

General

IBM Type I programming systems are described in this section. The descriptions are general and are not intended to be exhaustive. For more information, see the supporting Systems Reference Library (SRL) publications.

Program Identification

Each program is assigned a nine-character identification code. The first four digits identify the computer on which the program will run. The next two characters are a functional mnemonic describing the program class. The last three characters are a sequence number. That number may be three digits, or two digits plus an X, R, or L.

The System/360 four-digit identification code includes an alphabetic character which designates:

360A: All Type II Application Programs except Model 20	360H: Type I Extension
360B: Basic Operating System	360M: Tape Operating System
360C: Conversion	360N: Disk Operating System
360D: Type III Programs	360P: Basic Programming Support
360F: Model 44	360S: Operating System
360G: Model 67 Time Sharing System (TSS)	360T: Model 20 Card
	360U: Model 20 Tape
	360W: Model 20 Disk
	5731-: Type I Extensions

The functional mnemonics used in the program identification are:

- AD *Autochart*: Not used for new programs. See Documentor (DC).
- AL *ALGOL Compiler*
- AS *Assembler*: A program which prepares an object language program by producing absolutes or relocatable machine code from a source program of statements containing symbolic operation codes and symbolic operands.
- AT *Automatic Test*: Not used for new programs. See Program Test (PT).
- AU *Autocoder*: Not used for new programs. See Assembler (AS).
- CB *COBOL Compiler*: COBOL (COmmon Business Oriented Language) is a language primarily for commercial data processing. It is the result of work by the Conference on Data Systems Language (CODASYL), a voluntary cooperative effort by a number of users and manufacturers of data processing equipment.
- CT *Commercial Translator*: Not used for new programs.
- CC *Communications Input/Output*: Input/Output routines which include routines for communication devices or terminals.
- CL *Control Program*: A set of programs which provide the management functions necessary for continuous operation of a computing system.
- CV *Conversion*: Programs which facilitate the running of programs written for one type on another type or configuration.
- DC *Documentor*: A program which performs some or all of the functions of producing, maintaining, controlling, and distributing text, tabular and graphic information including flowcharts.
- DM *Data Management*: See IO: Input/Output.
- DN *Diagnostic*: A program which facilitates computer maintenance by detection and isolation of malfunctions or mistakes.
- ED *Editor*: Programs which create and maintain a system library (a collection of available programs, routines, and data which comprise an operating system), or which logically combine, replace, or interconnect modules or subsections of a program or operating system.
- EU *Emulator Program*: Used to designate the program part of an emulator. An emulator is a combination of a program and equipment adaptations which enables one system to emulate the functions of another. The emulator uses the same form of input data and can produce the same form of output data as the system being emulated.
- FO *FORTRAN Compiler*: FORTRAN (FORmula TRANslation) closely resembles the language of mathematics. FORTRAN permits people who are not trained programmers to prepare programs for a computer. FORTRAN is especially useful in scientific and technical fields where most problems are expressed in mathematical form.
- IO *Input/Output*: Input/Output routines. DM (Data Management) is an alternative code.
- LM *Library Material*: Supplementary programming developed for inclusion in a library (an organized collection of standard, checked out routines). An example is a mathematical function subroutine.
- LD *Loader*: A program which prepares instructions and data (often combining program segments and subprograms) to form a single executable machine language program.
- MI *Miscellaneous*
- OS *Operating System*: An integrated set of programs, routines, and communication conventions.
- PR *Processors*: Not used for new programs.
- PL *PL/I Compiler*: A program which compiler programs written in the PL/I Language.
- PT *Program Test*: A program which facilitates the testing and debugging of programs.
- RC *Remote Computing*: Programs which provide access to a computer from multiple remote terminals for immediate or batch processing of individual tasks.
- RG *Report Generator and Report Program Generator*: A program which constructs a report or report-writing program in accordance with input specifications of the data file and of the desired report.
- SI *Simulator*: A program which permits the running on the simulator machine of a program expressed in the machine language of the simulated machine.
- SL *System Librarian*: See ED, Editor.
- SM *Sort/Merge*
- SP *Symbolic Assembly Programs*: Not used for new programs.
- SV *Supervisor*: Programs (a set of routines) which control the execution and possibly the scheduling of other programs.
- TX *Type I Extension*
- UT *Utility*: A program or a set of programs which assist in the operation of a computer; e.g., storage clearing, intermediate data transmission, simple loaders, dump programs, file organization routines, etc.

Programming Services

The programs described in this section have one of three service classifications associated with them:

- A - Central and FE Programming Services
- B - Central Programming Services
- C - Local Programming Services available at a charge

The service classification for Type I programs, plus selected Type III programs, are on the following pages.

Program Name	Program Number/ Availability	Reference	Programming Service Classification
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System/7

Host Program Preparation Facilities I			
1130 (1130-SV-001)	Now	P 7.1	A
1800 (1800-SV-001)	Now	P 7.1	A
MSP/7 Host Preparation Facilities II			
Facilities II Macro Library/Basic			
OS (360A-TX-024)	Now	P 7.2	
DOS (360A-TX-014)	Now	P 7.2	
Facilities II Macro Library/Relocatable			
OS (360A-TX-026)	Now	P 7.3	
DOS (360A-TX-016)	Now	P 7.3	
Host Macro Assembler (ASM/7)			
OS (360A-TX-021)	Now	P 7.4	
DOS (360A-TX-011)	Now	P 7.4	
Host Linkage Editor (LINK/7)			
OS (360A-TX-025)	Now	P 7.5	
DOS (360A-TX-015)	Now	P 7.5	
Host Storage Load Formatting (FORMAT/7)			
OS (360A-TX-023)	Now	P 7.5	
DOS (360A-TX-013)	Now	P 7.5	
Host Source Preparation (PREP/7)			
OS (360A-TX-022)	Now	P 7.5	
DOS (360A-TX-012)	Now	P 7.5	
Distributed System Program (S/370 or S/360)			
(360A-TX-032)	Now	P 7.6	A
Distributed System Program (1130)			
(1130-SV-002)	Now	P 1130.6	A
Distributed System Program (1800)			
(1800-SV-003)	Now	P 1800.7	A

IBM System/360 Basic Operating System (BOS/360)

Assembler	360B-AS-309	P 360B.2	
Basic Control Program	360B-CL-302	P 360B.1	
IOCS			
Consecutive Processing Macros	360B-IO-303	P 360B.1	
Indexed Sequential File Management System (ISFMS)	360B-IO-304	P 360B.1	
Direct Access Method	360B-IO-305	P 360B.1	
STR Macros	360B-IO-310	P 360B.2	
Autotest	360B-PT-306	P 360B.3	
Report Program Generator (RPG)	360B-RG-307	P 360B.2	
Sort/Merge	360B-SM-308	P 360B.2	
Process Communication - 1070	360B-SV-032	P 360B.3	
Utilities - Group 1	360B-UT-300	P 360B.2	
Group 2	360B-UT-301	P 360B.2	
Binary Synchronous Communication Macros	360B-CQ-312	P 360B.1	
Remote Job Entry Work Station	360B-CQ-311	P 360B.2	
Basic Program Material and Ordering			
Instructions - Additional Program Material		P 360B.4	

System/360 Conversion/Service Programs

Emulator 1401/1460 32K Model 40	360C-EU-074	P 360C.1	C
Emulator 1410/7010 64K Model 40	360C-EU-728	P 360C.4	C
Emulator 1410/7010 Any Model 50	360C-EU-726	P 360C.3	C
Simulator 1410/7010	360C-SI-754	P 360C.7	C
Emulator 7070/7074 256K Model 50, 65	360C-EU-725	P 360C.1	C
Simulator 7070/7074	360C-SI-753	P 360C.6	C
Emulator 7080 256K Model 65	360C-EU-727	P 360C.3	C
Emulator 709/90/94 512K Model 65	360C-EU-729	P 360C.5	C
Simulator 7090/7094	360C-SI-750	P 360C.5	C
FORTRAN IV to PL/I (F) LCP	360C-CV-710	P 360C.8	C
ALGOL to PL/I (F) LCP	360C-CV-711	P 360C.8	C
COBOL to PL/I LCP	360C-CV-712	P 360C.8	C
COBOL to OS ANS COBOL LCP	360C-CV-713	P 360C.9	A
7094 Under OS Integrated Emulator for Mdl 85	360C-EU-734	P 360C.9	C
7094 Integrated Emulator - S/370			
Model 165 - OS	360C-EU-740	P 360C.13	A
7070/7074 Integrated Emulator -			
S/370 Model 165 - OS	360C-EU-739	P 360C.11	A
S/370 Model 155 - OS	360C-EU-741	P 360C.21	A
7080 Integrated Emulator - S/370			
Model 165 - OS	360C-EU-737	P 360C.12	A
1401/1440/1460 Integrated Emulator - S/370			
Models 155, 155II, 158 under OS	360C-EU-735	P 360C.10	A

Program Name	Program Number/ Availability	Reference	Programming Service Classification
<u>System/370 Conversion/Service Programs (Cont'd)</u>			
1410/7010 Integrated Emulator - S/370 Models 155, 155II, 158 under OS	360C-EU-736	P 360C.10	A
DOS Emulator Under OS - S/370 Models 135, 145 and 155 - OS	360C-EU-738	P 360C.11	A
1401/1440/1460 Emulator - S/370 Model 145 with Compatibility Feature Under OS	360C-EU-735	P 360C.18	A
1410/7010 Emulator - S/370 Model 145 with Compatibility Feature Under OS	360C-EU-736	P 360C.19	A
1401/1440/1460 Emulator - S/370 Model 135 with Compatibility Feature Under OS	360C-EU-735	P 360C.21	A
S/360 Model 20 Emulator - S/370 Model 135 - DOS	370N-IC-002	P 360C.23	A
1401/1440/1460 Integrated Emulator for S/370 Model 155 under DOS	370N-EU-490	P 360C.13	A
1410/7010 Integrated Emulator for S/370 Model 155 Under DOS	370N-EU-490	P 360C.15	A
Emulating the 1401/1440/1460 on the S/370 Model 145 Using DOS	370N-EU-490	P 360C.16	A
Emulating the 1410/7010 on the S/370 Model 145 Using DOS	370N-EU-490	P 360C.16	A
Emulating the 1401/1440/1460 on the Model 135 Using DOS	370N-EU-490	P 360C.19	A
1401/1440/1460 Emulator for S/370 Model 135 with Compatibility Feature Under OS	360C-EU-735	P 360C.22	A
7070/7074 Integrated Emulator for S/370 Models 155, 155II, 158		P 360C.22	A
Additional Program Material		P 360C.25	
<u>System/360 Type III Programs</u>			
2495 - Utility Program (OS)	360D-00.0.020	See	A
Houston Automatic Spooling Priority System (HASP-II) (OS)	360D-05.1.014	Catalog of	A
Conversational Remote Batch Entry (OS)	360D-05.1.016	Programs	C
Control Program Cambridge Monitor System (CP-67/CMS)	360D-05.2.005		A*
POWER II (Priority Output Writers, Execution Processors and Input Readers)	360D-05.2.006		A
IBM 1285/1287/1288 OCR Programming Support (OS)	360D-07.5.001		A
<u>System/360 Model 44</u>			
	360F-UT-606 thru 360F-UT-620	P 360F.2 and P 360F.3	C
Basic Program Material and Ordering Instructions		P 360F.3	
Additional Program Material		P 360F.3	
<u>IBM System/360 Model 67</u>			
Time Sharing System (TSS)	360G-CL-627	P 360G.1	C
Additional Program Material		P 360G.5	
<u>IBM System/360 Tape Operating System (TOS/360)</u>			
Control Program IOCS	360M-CL-405	P 360M.1	C
Optical Character Reader IOCS	360M-IO-404	P 360M.1	C
Assembler	360M-IO-417	P 360M.2	C
Report Program Generator	360M-AS-465	P 360M.3	C
COBOL	360M-RG-408	P 360M.3	C
FORTRAN IV	360M-CB-402	P 360M.3	C
Basic PL/I	360M-FO-409	P 360M.3	C
Sort/Merge	360M-PL-410	P 360M.3	C
Autotest	360M-SM-400	P 360M.4	C
Batch Utilities	360M-PT-407	P 360M.4	C
Supervisor (6K)	360M-UT-403	P 360M.4	C
Supervisor (8K)	360M-SV-413	P 360M.4	C
MPS Utility Macros	360M-SV-414	P 360M.4	C
Compiler I/O Modules	360M-UT-411	P 360M.4	C
On-Line Test Executive Program (OLTEP)	360M-IO-412	P 360M.4	C
	360M-DN-418	P 360M.4	C
Basic Program Material		P 360M.5	
Additional Program Material		P 360M.6	

Program Name	Program Number/ Availability	Reference	Programming Service Classification
<u>IBM Disk Operating System (DOS)</u>			
Supervisor	360N-SV-474	P 360N.2	C*
2301/2304	370N-SV-495	P 360N.2	A
2311/2314/3330	360N-CL-453	P 360N.2	C*
System Control and Basic IOCS	360N-IO-454	P 360N.3	C*
Direct Access Method IOCS Macros	360N-IO-455	P 360N.3	C*
Consecutive Disk IOCS Macros	360N-IO-456	P 360N.3	C*
Consecutive Tape IOCS Macros	360N-IO-458	P 360N.3	C*
Consecutive Paper Tape IOCS Macros			
Indexed Sequential File Management System			
IOCS Macros (ISFMS)	360N-IO-457	P 360N.3	C*
Compiler Input/Output Modules	360N-IO-476	P 360N.4	C*
MICR IOCS	360N-IO-477	P 360N.3	C*
Optical Character Reader IOCS	360N-IO-478	P 360N.3	C*
Basic Telecommunications Access Method IOCS Macros (BTAM)	360N-CQ-469	P 360N.6	C*
Queued Telecommunications Access Method IOCS Macros (QTAM)	360N-CQ-470	P 360N.6	C*
Multiprogramming Support Utility Macro	360N-UT-471	P 360N.11	C
Assembler D	360N-AS-465	P 360N.7	C*
Assembler F	360N-AS-466	P 360N.7	C
Report Program Generator (RPG)	360N-RG-460	P 360N.9	C
COBOL	360N-CB-452	P 360N.7	C
DASD Assembler Macros	360N-CB-468	P 360N.7	C
ANS COBOL V2	360N-CB-482	P 360N.7	C
Language Conversion Program	360N-CV-489	P 360N.7	A
Basic PL/I (Including DOS PL/I DASD Macros for 2311 ISFMS Files)	360N-PL-464	P 360N.8	C
FORTRAN IV	360N-FO-479	P 360N.8	A
FORTRAN IV Library Subprograms	360N-LM-480	P 360N.8	A
Basic FORTRAN IV	360N-FO-451	P 360N.8	C
Sort/Merge - Disk	360N-SM-450	P 360N.9	C
Sort/Merge - Tape (Disk Resident)	360N-SM-400	P 360N.9	C
Sort/Merge - Tape/Disk	360N-SM-483	P 360N.10	C
Autotest	360N-PT-459	P 360N.10	C
On-Line Test Executive Program	360N-DN-481	P 360N.10	C
Group 1 Utilities (Unit Record and Disk)	360N-UT-461	P 360N.10	C*
Group 2 Utilities (Magnetic Tape)	360N-UT-462	P 360N.10	C
Group 3 Utilities (Data Cell)	360N-UT-463	P 360N.10	C
System Utilities	370N-UT-491	P 360N.11	C
Vocabulary File Utility Program for 7772	360N-UT-472	P 360N.6	A
1401/1440/1460 Emulation - Compatibility Support			C
CS/30	360N-EU-484	P 360N.11	C
CS/40	360N-EU-485	P 360N.11	C
1401/40/60 - 1410/7010 Emulation - S/370	360N-EU-490	P 360N.13	C*
3735 Terminal Support	370N-CO-493	P 360N.6	A
Environmental Recording and Editing	360N-CO-493	P 360N.14	A
Program Material and Ordering Information	370N-UT-492	P 360N.15-18	

* DOS Version 4 (Release 27) has similar components: with 370N Program Identification Codes. These have programming service classification A.

Program Name	Program Number/ Availability	Reference	Programming Service Classification
<u>IBM System/360 Basic Programming Support (BPS/360)</u>			
<u>Basic Card Support</u>			
Basic Assembler	360P-AS-021	P 360P.1	C
Basic Utilities			
Input/Output Support Package	360P-UT-018	P 360P.1	
Absolute Loader	360P-UT-017	P 360P.2	
Relocating Loader	360P-UT-020	P 360P.2	
Dump Program	360P-UT-019	P 360P.2	
Report Program Generator (Card)	360P-RG-200	P 360P.2	
FORTRAN IV (16K Card)	360P-FO-205	P 360P.3	
<u>Basic Tape Support</u>			
Basic Tape System (8K)	360P-AS-091	P 360P.3	
1287 Models 3 and 4		268-59	
Report Program Generator (8K Tape)	360P-RG-201	P 360P.6	
FORTRAN IV (Tape)	360P-FO-031	P 360P.6	
Sort/Merge (8K Tape) (1 channel)	360P-SM-043	P 360P.7	
Sort/Merge (8K Tape) (2 channel)	360P-SM-044	P 360P.7	
Autotest (Tape)	360P-PT-045	P 360P.8	
<u>Card and Tape Utilities (Single-Transfer)</u>			
Card to Printer and/or Punch	360P-UT-050	P 360P.9	
Card to Tape	360P-UT-051	P 360P.9	
Tape to Printer	360P-UT-052	P 360P.9	
Tape to Card	360P-UT-053	P 360P.9	
Tape to Tape	360P-UT-054	P 360P.9	
<u>Card and Tape Utilities (Special Purpose)</u>			
Initialize Tape	360P-UT-057	P 360P.10	
Multiple Utility	360P-UT-055	P 360P.10	
Storage Print	360P-UT-056	P 360P.10	
Tape Compare	360P-UT-202	P 360P.10	
<u>DASD Utilities (Single Transfer)</u>			
Card to Disk	360P-UT-063	P 360P.11	
Disk to Card	360P-UT-064	P 360P.11	
Disk to Disk	360P-UT-067	P 360P.11	
Disk to Printer	360P-UT-073	P 360P.11	
Disk to Tape	360P-UT-065	P 360P.11	
Tape to Disk	360P-UT-066	P 360P.11	
<u>DASD Utilities (Special Purpose)</u>			
Alternate Track Assignment (2311)	360P-UT-098	P 360P.11	
Alternate Track Assignment (2321)	360P-UT-212	P 360P.12	
Clear Disk	360P-UT-068	P 360P.12	
Initialize Data Cell	360P-UT-204	P 360P.12	
Initialize Disk	360P-UT-069	P 360P.13	
Multiple Disk to Printer	360P-UT-203	P 360P.13	
Copy Disk to Tape and Restore Tape to Disk	360P-UT-061	P 360P.13	
Copy Disk to Card and Restore Card to Disk	360P-UT-062	P 360P.13	
Copy Data Cell to Tape and Restore Tape to Data Cell	360P-UT-071	P 360P.13	
Copy Disk to Disk	360P-UT-072	P 360P.13	
16K Initialize Disk	360P-UT-206	P 360P.13	
16K Alternate Track Assignment	360P-UT-207	P 360P.12	
Distribution Program	360P-UT-208	P 360P.17	
<u>Paper Document Support</u>			
Input/Output 1231 N1	360P-IO-060	P 360P.16	
Input/Output 1412/1419	360P-IO-058	P 360P.14	
Input/Output 1418/1428	360P-IO-059	P 360P.15	
<u>Miscellaneous Support</u>			
Universal Character Set Utility	360P-UT-048	P 360P.17	
S/360 Direct Access Stor Drive Initialization	360P-UT-213	Catalog	
Dump/Restore	360P-UT-214	of	
Recover/Replace	360P-UT-215	Programs	
Modular File Maintenance	360P-UT-219	P 360P.17	
RJE Work Station	360P-CQ-218	P 360P.17	
Basic Program Material and Ordering Instructions		P 360P.18	
Additional Program Material		P 360P.19	

Program Name	Program Number/ Availability	Reference	Programming Service Classification
<u>System/360 & System/370 Operating System (OS)</u>			
Primary Control Program (PCP)	360S-CI-566	P 360S.1	C
Multiprogramming with a Fixed Number of Tasks (MFT)	360S-CI-505	P 360S.1	A
Multiprogramming with a Variable Number of Tasks (MVT), with Priority Scheduler, Disk			
SYSIN	360S-CI-535	P 360S.1	
Time Sharing Option	360S-CI-555	P 360S.4	
MVT Model 65 Multiprocessing	360S-CI-535	P 360S.1	
Data Set Control - Primary Data Management	360S-DM-508	P 360S.2	
Access Methods			
Sequential and Partitioned	360S-DM-508	P 360S.2	
Direct (BDAM)	360S-DM-509	P 360S.3	
Indexed Sequential (BISAM, QISAM)	360S-IO-526	P 360S.3	
P 360S.3			
Telecommunications - Basic (BTAM)	360S-CQ-513	P 360S.3	
BTAM Extension	360S-OS-584	P 360S.3	
Telecommunications - Queued (QTAM)	360S-CQ-519	P 360S.3	C
Telecommunications - TCAM	360S-CQ-548	P 360S.3	A
Graphic Programming Services	360S-IO-523	P 360S.4	C
Graphic Programming Services for FORTRAN	360S-LM-537	P 360S.7	
Graphic Job Processor (MFT or MVT)	360S-RC-541	P 360S.10	
FORTRAN Subroutines for Data Transmission between a S/360 and 1130	360S-LM-542	P 360S.7	
Job Control from an 1130 to 2250 using Satellite Graphic Job Processor (SGJP) (MFT or MVT only)	360S-RC-543	P 360S.10	
<u>Language Translators</u>			
ALGOL F	360S-AL-531	P 360S.8	C
ALGOL F Library	360S-LM-532	P 360S.8	C
Assembler E (18K)	360S-AS-036	P 360S.8	C
Assembler F (44K)	360S-AS-037	P 360S.8	A
COBOL E (17K)	360S-CO-503	P 360S.7	C
COBOL E Library	360S-LM-504	P 360S.8	C
Full ANS COBOL V2 Library	360S-LM-546	P 360S.2	C
ANS COBOL V2	360S-CB-545	P 360S.8	C
FORTTRAN E (15K)	360S-FO-092	P 360S.7	C
FORTTRAN G (80K)	360S-FO-520	P 360S.7	C
FORTTRAN H Version II (150K)	360S-FO-500	P 360S.7	C
FORTTRAN Library (E, G, H)	360S-LM-501	P 360S.7	C
PL/I F (44K)	360S-NL-511	P 360S.6	C
PL/I Subroutine Library	360S-LM-512	P 360S.6	C
Report Program Generator (15K)	360S-RG-038	P 360S.8	C

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Program Name	Program Number/ Availability	Reference	Programming Service Classification
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System/360 Operating System (OS/360) (Cont'd)

Service Programs

Linkage Editor E (15K, 18K)	360S-ED-510	P 360S.9	C
Linkage Editor F Version 2 (44K, 88K, 128K)	360S-ED-521	P 360S.9	A
Loader	360S-LD-547	P 360S.9	A
Sort/Merge (16K minimum)	360S-SM-023	P 360S.9	C
TESTRAN	360S-PT-516	P 360S.10	C
Remote Job Entry	360S-RC-536	P 360S.9	A
Conversational Remote Job Entry	360S-RC-551	P 360S.10	
Starter System for 2311 Residence	360S-CI-514	P 360S.16	
Starter System for 2314/2319 Residence	360S-CI-534	P 360S.16	
Starter System for 3330 Residence	360S-CI-560	P 360S.16	
Independent Utilities	360S-UT-507	P 360S.10	C
OS/360 Utilities	360S-UT-506	P 360S.10	C
SERO, SERL, & EREP for Model 40,50,65,75	360S-DN-527	P 360S.11	A
Recovery Management Support for MFT and MVT - Models 65, 85, System/370	360S-DN-539	P 360S.11	
On-Line Test Executive	360S-DN-533	P 360S.11	
OS/360 Service Aids	360S-DN-554	P 360S.11	
FORTRAN Syntax Checker	360S-FO-550		C
PL/I Syntax Checker	360S-PL-552		C
2305 Additional Device Support	360S-OS-569		A
3330 Additional Device Support	360S-OS-570		
3211 Additional Device Support	360S-OS-571		
Model 145 Additional Device Support	360S-OS-572		
2800/Mdl 65 Additional Device Support	360S-OS-573		
TSO/DCB Parameters	360S-OS-586	P 360S.4	
System/370 Model 135 Additional Support	360S-OS-588		
System/370 Model 195 Additional Support	360S-OS-589		
3410 Additional Device Support	360S-OS-590	P 360S.12	
3505 Additional Device Support	360S-OS-591	P 360S.12	
3525 Additional Device Support	360S-OS-592	P 360S.12	
2996 Additional Device Support	360S-OS-593	P 360S.12	
3270 Additional DIDOCS Support	360S-OS-594	P 360S.12	
TCAM Additional Support for Releases 20.1, 20.6, and 20.7	360S-OS-577		
TCAM Additional Support for Release 21.0	360S-OS-599		
TCAM Maintenance for Release 21.6	360S-OS-595		
65MP/TSO Additional Support	360S-OS-598		
3735 FD Macros and Utility	360S-OS-596		
3270 BTAM	360S-OS-579		
Call/360 OS	360A-CX-42X	P 360S.19	C
Call-OS Basic	360A-CX-44X	P 360S.22	C
Call-OS PL/I	360A-CX-45X	P 360S.22	C
Call-OS FORTRAN	360A-CX-46X	P 360S.23	C
Real Time Monitor	360A-SV-001	P 360S.24	A
ASP - Asymmetric Multiprocessing System	360A-CX-15X	P 360S.25	A

Program Material and Ordering Instructions

P 360S.17

System/360 Model 20

Card

Basic Assembler 8K	360T-AS-110	P 360T.2	C
Basic Assembler	360T-AS-001	P 360T.2	
IOCS	360T-IO-002	P 360T.3	
Sterling Currency Processing Routines	360T-LM-015	P 360T.6	
Report Program Generator	360T-RG-010	P 360T.1	
Punched Card Utility Programs			
Programs I (Gangpunch/Reproduce, List/ Summary Punch)	360T-UT-100	P 360T.2	
Programs II (Collate, Merge Sort)	360T-UT-101	P 360T.2	
Basic Utility Programs			
Except Trace	360T-UT-102	P 360T.2	
Basic Trace (4K)	360T-UT-103	P 360T.2	
Basic Trace (8K)	360T-UT-104	P 360T.2	
Basic Trace (12K)	360T-UT-107	P 360T.2	
Basic Trace (16K)	360T-UT-105	P 360T.2	
Communications IOCS	360T-CQ-003	P 360T.4	
1419 I/O Program	360T-IO-029	P 360T.4	
Universal Character Set Utility	360T-UT-108	P 360T.7	
Remote Job Entry (RJE) Work Station	360T-CQ-113	P 360T.8	
IOCS for BSCA	360T-CQ-111	P 360T.8	
BSCA I/O Error Statistics Printout	360T-UT-112	P 360T.10	

Program Name	Program Number/ Availability	Reference	Programming Service Classification	
<u>System/360 Model 20</u>				
<u>Tape</u>				
TPS Basic Assembler	360U-AS-130	P 360T.3	C	
Basic Assembler 8K	360U-AS-153	P 360T.3		
TPS Control and Service Programs				
Core Image Service	360U-SL-155	P 360T.6		
Macro Service	360U-SL-156	P 360T.6		
Card-Resident Control	360U-CL-157	P 360T.6		
IPL Tape-Resident System	360U-CL-158	P 360T.6		
Tape-Resident Control	360U-CL-159	P 360T.6		
Load System Tape Program	360U-SL-142	P 360T.6		
Copy System Tape Program	360U-SL-143	P 360T.6		
Directory Service Program	360U-SL-144	P 360T.6		
Core-Image Maintenance Program	360U-SL-145	P 360T.6		
Macro Maintenance Program	360U-SL-146	P 360T.6		
Linkage Editor Program	360U-SL-147	P 360T.6		
TPS Report Program Generator	360U-RG-148	P 360T.1		
TPS Assembler	360U-AS-149	P 360T.3		
TPS Utility Programs				
Card to Tape	360U-UT-131	P 360T.2		
Tape to Card	360U-UT-132	P 360T.2		
Tape to Printer	360U-UT-133	P 360T.2		
Tape to Tape	360U-UT-134	P 360T.2		
Initialize Tape	360U-UT-135	P 360T.2		
TPS Sort/Merge	360U-SM-150	P 360T.5		
TPS Input/Output and Basic Monitor Macro Definitions	360U-IO-151	P 360T.4		
TPS I/O Macro Definitions for 1419/1259	360U-IO-152	P 360T.4		
Remote Job Entry (RJE) Work Station	360U-CQ-160	P 360T.8		
I/O Macro Definitions for BSCA	360U-CQ-154	P 350T.7		
<u>Disk (12K)</u>				
Control and Service				
Disk-Resident Control Programs	360W-CL-171	P 360T.6		
Load System Disk Program	360W-SL-172	P 360T.6		
Library Allocation Organization Program	360W-SL-173	P 360T.6		
Physical and Logical Unit Tables Service Program	360W-SL-174	P 360T.6		
Core Image Maintenance Program	360W-SL-175	P 360T.6		
Macro Maintenance Program	360W-SL-176	P 360T.6		
Library Service Programs	360W-SL-177	P 360T.6		
Distribution Package Retrieval Program	360W-SL-178	P 360T.6		
Linkage Editor Program	360W-SL-179	P 360T.6		
Copy System Program	360W-SL-205	P 360T.6		
Macro Library Service Program	360W-SL-206	P 360T.6		
Report Program Generator	360W-RG-180	P 360T.1		
Assembler	360W-AS-181	P 360T.3		
Disk Sort/Merge	360W-SM-182	P 360T.5		
Tape Sort/Merge	360W-SM-194	P 360T.5		
Disk Utility				
Initialize Disk	360W-UT-183	P 360T.2		
Alternate Track Assignment	360W-UT-184	P 360T.2		
Clear Disk	360W-UT-185	P 360T.2		
Disk-to-Disk	360W-UT-186	P 360T.2		
Disk-to-Tape	360W-UT-187	P 360T.2		
Tape-to-Disk	360W-UT-188	P 360T.2		
Disk-to-Card	360W-UT-189	P 360T.2		
Card-to-Disk	360W-UT-190	P 360T.2		
Disk-to-Printer	360W-UT-191	P 360T.2		
Tape-to-Tape	360W-UT-195	P 360T.2		
Tape-to-Card	360W-UT-196	P 360T.2		
Card-to-Tape	360W-UT-197	P 360T.2		
Tape-to-Printer	360W-UT-198	P 360T.2		
Initialized Tape	360W-UT-199	P 360T.2		
Disk Dump Program	360W-UT-204	P 360T.2		
Input/Output and Basic Monitor Macro Definitions	360W-IO-192	P 360T.4		
Input/Output Macro Definitions for 1419/1259	360W-IO-193	P 360T.3		
Monitor Generation Macro Def.	360W-IO-200	P 360T.6		
2152 Printer-KeyBoard Macro Def.	360W-IO-202	P 360T.7		
Remote Job Entry (RJE) Work Station	360W-CQ-203	P 360T.9		
BSCA IOCS	360W-CQ-201	P 360T.7		
PL/I	360W-PL-207	P 360T.9		
Basic Program Material		P 360T.11		
Additional Program Material		P 360T.11		

Program Name	Program Number/ Availability	Reference	Programming Service Classification
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1130 Computing System

Programming Systems

Card/Paper Tape Programming System Assembler	Card	1130-SP-001	P 1130.1	C	
	Paper Tape	1130-SP-002	P 1130.1		
FORTRAN Compiler	Card	1130-FO-001	P 1130.1		
Subroutine Library	Card	1130-LM-001	P 1130.1		
Utility Routines	Card	1130-UT-001	P 1130.2		
	Paper Tape	1130-UT-002	P 1130.2		
Disk Monitor System Version 2	Card	1130-OS-005	P 1130.2		A
	Paper Tape	1130-OS-006	P 1130.3		
1130/2250 Graphic Subroutine Pkg (GSP)		1130-LM-008	P 1130.4		C
Data Transmission Subroutines		1130-LM-011	P 1130.5		
Remote Job Entry - 1130 to S/360		1130-CQ-009	P 1130.5		
1130 Distributed System Program (DSP)		1130-SV-002	P 1130.6		
Satellite Graphic Job Processor PPG		1130-CQ-012	P 1130.5		
		1130-PC-007	P 1130.3		
			P 1130.7		
Additional Program Material					

1450 Bank Data Processing System Programs

Programming Systems

1401/1440/1460 Autocoder (on disk)		1401-AU-008		C
IOCS		1440-IO-010		
Communications IOCS (1026/DDC)		1440-IO-012	Catalog of Programs	
Report Program Generator (on disk)		1440-RG-020		
Sort 5		1440-SM-030		
Merge 5		1440-SM-031		
Disk File Organization Routines		1440-UT-040		
Disk Utility Programs (1311)		1440-UT-041		

1800 Programming System

Programming Systems

Assembler	Card	1800-AS-005	P 1800.1	C	
	Paper Tape	1800-AS-006	P 1800.1		
FORTRAN Compiler	Card	1800-FO-007	P 1800.1		
	Paper Tape	1800-FO-008	P 1800.1		
Subroutine Libraries	Card	1800-LM-003	P 1800.1		
	Paper Tape	1800-LM-004	P 1800.1		
Utility Routines	Card	1800-UT-001	P 1800.1		
	Paper Tape	1800-UT-002	P 1800.1		
Time Sharing Executive (TSX)		1800-OS-001	P 1800.3		A
TSX Non Reentrant Subroutines		1800-LM-009	P 1800.2		
Multiprogramming Executive System (MPX)		1800-OS-010	P 1800.3		A
MPX Spooling		1800-SV-002	P 1800.5		
1800 Distributed System Program (DSP)		1800-SV-003	P 1800.7	A	
Additional Program Material			P 1800.8		

3705 Communications Controller

System Support Program for OS		360H-TX-035	P 360H.1	A
System Support Program for DOS/360		360H-TX-036	P 360H.1	
Network Control Program Support Package		360H-TX-034	P 360H.2	
Emulation Program Support Package		360H-TX-033	P 360H.2	

The following programs, which are divided into two groups -- Programming Systems and Applications, are available from the Program Information Department.

Each program is listed in order number sequence, with the current version and modification numbers, and the date of the latest modification. If the modification number is zero, then no corrections have been issued since the announcement of the last version; in this case, the date given is the date of the last version.

Branch Offices should insure that customers have the latest available version and modification for all Programming Systems and Application Programs.

Program Name	Program Number	Reference	Programming Service Classification
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Programming Systems

1401/1311 Autotest 8K	1401-AT-081
Basic Autocoder 2K	1401-AU-005
1401/1440/1460 Autocoder	1401-AU-008
Autocoder Program	1401-AU-037
COBOL 4K	1401-CB-070
COBOL Conversion on 1401 /TO S/360/	1401-CB-701
1401/1440/1460 FORTRAN IV	1401-FO-051
1401/1440/1460 FORTRAN IV TAPE	1401-FO-052
FORTRAN II Language Conversion For 1401	1401-FO-702
IOCS	1401-IO-065
1401/1460 IOCS /ON DISK/	1401-IO-068
Card Systems Subroutine	1401-LM-007
Basic 4K RPG	1401-RG-022
1401/1460 RPG on Disk	1401-RG-032
FARGO	1401-RG-045
Report Program Generator	1401-RG-048
System/360 RPG Translator	1401-RG-700
Sort 7	1401-SM-060
Merge 7	1401-SM-061
1401/1311 Sort 6	1401-SM-062
Merge 6	1401-SM-063
Symbolic Programming System /SPS 2/	1401-SP-030
Card Systems Utility Programs	1401-UT-001
Tape Utility	1401-UT-025
Tape to Printer	1401-UT-026
Card to Tape Utility	1401-UT-027
Tape to Card Utility	1401-UT-028
1401/1311 File Organization	1401-UT-052
1401/1311 Disk Utilities	1401-UT-053
7040/44-1401 Periph.Ut.Pgm./See PR-154/	1401-UT-157
1401 Peripheral Util. Prog. /PR-130/	1401-UT-158
Input Program /7090-SI-162/	1401-UT-938
OS/1410/7010/ Autocoder Processor	1410-AU-968
COBOL Processor /PR-155/	1410-CB-969
OS/1410/7010/ FORTRAN Processor	1410-FO-970
Basic IOCS /See PR-155/	1410-IO-966
OS/1410/7010/ Random-Proc. Scheduler	1410-IO-967
OS/1410/7010/System Generation Programs	1410-MI-965
OS/1410/7010/File Organ. Sys. FOR	1410-MI-977
Sort/Merge 12	1410-SM-112
1410-1301 Disk/Sort	1410-SM-137
OS/1410/7010/Generalized Tape Sort. Prog	1410-SM-971
OS/1410/7010/Generalized Sort. Prog.	1410-SM-972
OS/1410/7010/Resident & Trans. Monit.	1410-SV-962
OS/1410/7010/Tele-Processing Supervisor	1410-SV-964
Card/Tape Utilities	1410-UT-106
1410/1301 Disk Utilities	1410-UT-126
Multiple Utility	1410-UT-147
OS/1410/7010/ Linkage Loader	1410-UT-963
Utility Programs /PR-155/	1410-UT-973
IOCS	1440-IO-010
1440 Communications IOCS #1026/DDC	1440-IO-012
1440 RPG On Disk	1440-RG-020
1440 Sort 5	1440-SM-030
Merge 5	1440-SM-031
1440 File Organization Routines	1440-UT-040
1440 Disk Utility	1440-UT-041

Catalog
of
Programs

C

Program Name	Program Number	Reference	Programming Service Classification
FORTTRAN with Format for Cards	1620-FO-004		C
FORTTRAN Pre-Compiler for Cards	1620-FO-006		
FORTTRAN II	1620-FO-019		
1620 FORTRAN w/Format for Printer	1620-FO-037		
1620 FORTRAN II with Auto Float	1620-FO-049		
Production Line Balancing	1620-IM-018		
GOTRAN For Cards	1620-PR-011		
1620 Monitor I	1620-PR-025		
Monitor II	1620-PR-029		
1620-1443 Monitor II Card	1620-PR-045		
1620-1311 Sort Merge Card	1620-SM-047		
SPS Two Pass for Cards	1620-SP-009		
SPS - 1620/1710 Card	1620-SP-020		
SPS III Card	1620-SP-027		
SPS III For Printer	1620-SP-035		
COBOL Compiler	7040-CB-816		
FORTTRAN IV Compiler	7040-FO-815		
8K FORTRAN	7040-FO-960		
OS/16/32K/ Input/Output Control System	7040-IO-952		
8K IOCS	7040-IO-957		
Subroutine Library	7040-LM-813		
Processor	7040-PR-954		
Report Program Gen.	7040-RG-961		
Generalized Sort	7040-SM-953		
Macro Assembly Library	7040-SP-814		
8K Assembly Program	7040-SP-959		
OS/16/32K Processor Monitor	7040-SV-811		
Loader	7040-SV-812		
System Monitor	7040-SV-951		
8K System Monitor	7040-SV-956		
OS/16/32K/ Debugging Processor	7040-TA-817		
OS/16/32K/ 7040/7044 Update Program	7040-UT-955		
8K Relocatable Loader	7040-UT-958		
8K System Editor	7040-UT-974		
Utility Programs	7040-UT-975		
COBOL/FOS Compiler	7070-CB-940		
SPOOL System	7070-IO-076		
7070/7300 Disk IOCS	7070-IO-905		
7080 IOCS Library	7080-IO-932		
7080 Processor Library	7080-LM-931		
7080 COBOL Processor Lib.	7080-LM-934		
7080 Processor	7080-PR-930		
IBCBC	7090-CB-806		
Comm. Translator	7090-CT-921		
IBFTC	7090-FO-805		
FORTTRAN II	7090-FO-928		
IOCS	7090-IO-919		
Restart Program	7090-IO-976		
IBLIB	7090-LM-803		
IBDLB	7090-PR-807		
9 PAC	7090-PR-924		
IBJOB	7090-PR-929		
Simulator /7090-SI-162/	7090-SI-937		
Sort	7090-SM-922		
IBMAP Macro Assembly	7090-SP-804		
Assembler /7090-SI-162/	7090-SP-936		
Monitor	7090-SV-801		
IBLDR	7090-SV-802		
IBSYS Basic Monitor	7090-SV-918		
Utility Package	7090-UT-927		
Update	7090-UT-978		

Catalog
of
Programs

HOST PROGRAM PREPARATION FACILITY I

1130 (1130-SV-001)
1800 (1800-SV-001)

MSP/7 provides System/7 instructions plus functional system control and input/output subroutines formatted as assembler/macro definitions to be added to host system Macro Libraries. These macro definitions added to the 1130/DM2 or 1800/MPX macro libraries allow assembly of System/7 programs. This establishes a support concept for System/7 that makes available, even to the user of the smallest System/7, the extended facilities and ease of use of macro level assemblers for program preparation.

The storage load is produced using the macro assembler and Output-Handler Facility. This storage load can be outputted as follows:

- Punching a System/7 loadable paper tape on a 1055 paper tape punch.
- Punching the load module to cards for later conversion to loadable paper tape. A 2770 system with a card reader and paper tape punch may be used for this conversion.
- Writing the load module to disk as a data set.

These macros are functionally grouped and are briefly summarized in the following paragraphs.

Specification Macros prepare environmental data and provide for specification of the physical and operational characteristics of the system.

System Macros provide for specification and inclusion, at assembly time, of subroutines to control System/7 facilities allowing the user to more easily utilize the capabilities of his specific configuration.

The macros provide:

- System Initialization. Start timers/prepare input/output modules for operation, etc.
- Program check out and debugging facilities providing storage dump, snapshot dump, and storage patch via printer keyboard or paper tape.
- Error recovery routines to handle machine check, power failure, and program check interrupts.
- Subroutines to control the functions of the Operator Station input/output. Included is interrupt handling and error recovery.
- Subroutines to allow control of the Sensor Based devices; analog input/output and digital input/output.
- Subroutines that control the functions of the two natively attached timers of the System/7. Available are time-of-day functions plus a subroutine to control the scheduling of various user tasks.
- 2790 Control Support
 - Subroutine allowing use of the System/7, with a 2790 control, as the system controller for 2790 system units. (Supports from one to four 2790 controls per System/7.)
 - Units supported include:

2791 Area Stations	2797 Data Entry Unit
2792 Remote Communications Controller	2798 Guidance Display Unit
2793 Area Stations	1053 Output Typewriter
2795 Data Entry Unit	1035 Badge Reader
2796 Data Entry Unit	

IBM maintenance of the System/7 and its associated I/O and terminals requires the use of the 5010 Processor Module by the FE, with resultant effect on system availability.

Asynchronous Communication Control Support

- Subroutine to initiate and control data transfer to and from the System/7 via the asynchronous communication adapter.
- A transparent data scheme to permit the transfer of load modules to the System/7 for execution or punching to paper tape.
- Using the line control discipline of a 2740 Model 1 (with record checking), the System/7 can send and receive data to and from a 360/370 host operating under control of DOS BTAM or QTAM, or OS BTAM, QTAM, or TCAM.
- Basic Disk Support Macros
 - Seek, Read, Write, and Write-Verify functions
 - Multiple Sector Operations, including cylinder overflow support
 - Multiple 5022 modules are supported (Seeks may be overlapped)
 - Error handling routines

Access Macros provide, at assembly time, for inclusion of and linkage to subroutines that perform data transfers between System/7 and input/output devices.

Instruction Macros which include the System/7 input/output instruction and its extended mnemonics, the stop instruction and the assembler instruction PEND.

Other Functional Macros including the IBM supplied data conversion, multiply, divide, and square root subroutines.

Using parameters to specify only the specific functions of the system control and I/O subroutines needed, the macro assemblers provide the modularity required to support the wide range of available System/7 application configurations.

Classification: Type I with programming service classification A.

Minimum System Requirements

For program preparation on a 1130 or 1800

Host preparation of System/7 storage loads is supported on the minimum machine configurations required for the macro assemblers under 1130 DM/2 (1130-05-005) and 1800/MPX (1800-05-010). However, the throughput of the macro assemblers and the size of the System/7 program which can be produced is highly dependent upon the system configuration and available disk space on the 1130 or 1800 host.

To maximize host preparation throughput:

- A line printer is highly recommended.
- Macro Assembler working storage should be allocated to a different disk from the operating system and MSP/7 macro library.

If all files must be allocated to a single disk, then the storage available for the incore symbol table should be as large as possible. This can be accomplished by increasing Vcore (1800) or upgrading core (1130).

The size of System/7 program which can be assembled is dependent upon the number of statements (including macro expansions) produced, the average statement length, and the number of symbols (including macro generated symbols). To maximize the size of program which can be assembled:

- A disk drive should be dedicated to working storage. If this is not possible, then files should be arranged to provide a maximum size working storage area on one disk drive.
- When assembling on a one-disk system, a special MSP/7 assembly pack should be built containing a minimum-sized operating monitor, the Macro Assembler, the MSP/7 macros required by the application, and the MSP/7 Output Handler. Remaining disk space should be allocated to working storage.

These and other host preparation techniques are documented in IBM System/7 MSP/7 Host Program Preparation Facilities 1130/1800 Macro Library: Programming Guide (GC34-0021).

For Program Execution

The System/7 programming support provides the (with the exception of systems having a 2790 Control #8195) capability of generating an object program to support the smallest announced (2K) configuration with the capability to allow for expansion to any future configuration.

Basic Program Material: 1130-SV-001 Host Program Preparation Facility

Documentation: One copy each of the Program Directory, IBM System/7 MSP/7 Host Program Preparation Facilities 1130/1800 Macro Library: Programming Guide (GC34-0021), and IBM System/7 MSP/7 Messages, Codes, and Operating Procedures (GC34-0023).

Machine Readable: Object code for 1130-MSP/7 Macro-Assembler, Supervisor, and two (2) subroutines; source code for Macro Library Extensions, Output Handler Facility, and sample programs.

Optional Program Material:

Documentation: None (Installation instructions for the optional material are included in the Program Directory)

Machine Readable: Source for 1130-MSP/7 Macro Assembler, Supervisor, and two (2) subroutines.

Ordering Information: Program Number 1130SV001

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	None	2315	58	01
Optional	None	DTR 9/800	28	None
		DTR 9/1600	29	None

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering specify: Group Code GJD1-1783.

Publications (available from Mechanicsburg): IBM System/7 Modular System Programs (MSP/7) Logic Manual (GY34-0003), and IBM System/7 MSP/7 Stand-Alone Assembler: Programming Guide (GC34-0022).

Basic Program Material: 1800-SV-001 Host Program Preparation Facility

Documentation: One copy each of the Program Directory, IBM System/7 MSP/7 Host Program Preparation Facilities 1130/1800 Macro Library: Programming Guide (GC34-0021), and IBM System/7 MSP/7 Messages, Codes, and Operating Procedures (GC34-0023).

Machine Readable: Source code for 1800 Macro Library Extensions, Output Handler Facility, and sample programs, plus 1 conversion routine in object form.

Optional Program Material: None

Ordering Information: Program Number 1800SV001

	Program Number	Distribution Medium	User Volume
	Extension	Type Code	
Basic	None	2315 58	01
		1316 52	01

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering specify: Group Code GJD1-1783.

Publications (available from Mechanicsburg): IBM System/7 Modular System Programs (MSP/7) Logic Manual (GY34-0003), and IBM System/7 MSP/7 Stand-Alone Assembler: Programming Guide (GC34-0022).

MSP/7 HOST PROGRAM PREPARATION FACILITY II

Facility II provides:

Macro Libraries with System/7 function system control and input/output subroutines formatted as assembler/macro definitions

- System/7 Host Macro Assemblers (ASM/7)
- System/7 Host Linkage Editors (LINK/7)
- System/7 Host Storage Load Formatting Program (FORMAT/7)
- System/7 Host Source Preparation Program (PREP/7)

This support concept for System/7 makes available to the user of System/7 the extended facilities and ease of use of macro level assemblers and Linkage Editors for program preparation.

SYSTEM/7 MACRO LIBRARY/BASIC

OS 360A-TX-024
DOS 360A-TX-014

Functions include:

- Specification Macros
 - Environmental characteristics
 - Physical and operational characteristics of the system.
- System Macros
 - System Initialization. Start timers, prepare feature modules for operation, etc.
 - Timer control functions that provide for program timers, time of day clocks, and scheduling of periodic program execution.
 - Two-way communication between operator and system through the Operator Station printer/keyboard.
 - Program check-out and debugging facilities providing storage dump, snapshot dump, and storage patch via printer/keyboard or paper tape.
 - Error recovery to handle machine check, power failure, and program check interrupts.
- Access Macros
 - Macros to control the functions of Digital, Analog, and Operator Station input/output. These include interrupt handling and error recovery routines.
 - 2790 Control Support
 - Macros allowing use of the System/7, with 2790 control, as the system controller for 2790 system units. (Supports from one to four 2790 controls per System/7.) Support for up to 16 2791 or 2793 Area Stations per System/7 is provided by MSP/7.
 - Macros for area station and attached device definition, building Transaction Control List, and Data Entry Unit List.
 - Units supported include: 2791 and 2793 Area Stations ... 2795, 2796, and 2797 Data Entry Units ... 2798 Guidance Display Unit ... 1053 Output Typewriter ... 1035 Badge Reader.
- Asynchronous Communication Control Support
 - Macros to initiate and control data transfer via the asynchronous communication adapter.
 - A data scheme to permit the transfer of load modules to the System/7 for execution or punching to paper tape.
 - Using the line control discipline of a 2740 Model 1 (with record checking), the System/7 can send and receive data to and from a 360/370 host operating under control of DOS BTAM or QTAM, or OS BTAM, QTAM, or TCAM.
- Other Function Macros
 - Data conversion macros.
 - Multiply-Divide.
 - Square Root.
- Basic Disk Support Macros
 - Seek, Read, Write, and Write-Verify functions.
 - Multiple sector operations, including cylinder overflow support.
 - Multiple 5022 Modules are supported. (Seeks may be overlapped.)
 - Disk Cycle Steal Feature 2664 is not supported.
 - Error Handling Routines.

Classification: Type I with Programming Service Classification A.

Basic Program Material - OS 360A-TX-024 Macro Library/Basic:

Documentation: One copy each of the Program Directory, IBM System/7 MSP/7 Host Program Preparation Facilities II Macro Library/Basic: Programming Guide (GC34-0019).

Machine Readable: 80-column card images on 9-track 800/1600 BPI magnetic tape. MSP/7 macros and the sample program in source form.

Optional Program Material: None

Ordering Information: Program Number 360ATX024

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	None	DTR 9/800	28	None
		DTR 9/1600	29	None

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify: Group Code GJD1-1784.

Publications (available from Mechanicsburg): IBM System/7 Modular System Programs (MSP/7) Logic Manual (GV34-0003).

Basic Program Material: DOS 360A-TX-014 Macro Library/Basic

Documentation: One copy each of the Program Directory, IBM System/7 MSP/7 Host Program Preparation Facilities II Macro Library Basic: Programming Guide (GC34-0019).

Machine Readable: 80-column card images on 9-track 800/1600 BPI magnetic tape. MSP/7 macros and the sample program in source form.

Optional Program Material: None

Ordering Information: Program Number 360ATX014

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	None	DTR 9/800	28	None
		DTR 9/1600	29	None

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify: Group Code GJD1-1784.

Publications (available from Mechanicsburg): IBM System/7 Modular System Programs (MSP/7) Logic Manual (GV34-0003).

SYSTEM/7 MACRO LIBRARY/RELOCATABLE

OS 360A-TX-026
DOS 360A-TX-016

Macro Library/Relocatable provides MSP/7 support macros that can operate in the Linkage Editor environment.

Functions include:

- Specification Macros
 - Environmental characteristics.
 - Physical and operational characteristics of the system.
- System Macros
 - System Initialization. Start timers, prepare feature modules for operation, etc.
 - Timer control functions that provide for program timers, time of day clocks, and scheduling of periodic program execution.
 - Two-way communication between operator and system through the Operator Station printer/keyboard.
 - Program check-out and debugging facilities providing storage dump, snapshot dump, and storage patch via printer/keyboard or paper tape.
 - Error recovery to handle machine check, power failure, and program check interrupts.
- Access Macros
 - Subroutines to control the functions of Digital, Analog, and Operator Station input/output. These include interrupt handling and error recovery routines.
 - 2790 Control Support

Macros allowing use of the System/7, with a 2790 control, as the system controller for 2790 system units. (Supports from one to four 2790 controls per System/7.) Support for a maximum of four 2792 model 1s (up to two per 2790 controls) or a maximum of sixty four 2791s/2792 model 1s/2793s is provided by MSP/7.

Provides for multiple input/output channels ... eight data input channels permitting concurrent operation of up to eight 2790 terminal devices, each operating at up to 100 characters per second. In addition, five output channels are available to permit printing of up to five 1053 Printers simultaneously.

System/7 Utilization/Productivity ... Multiple lobes require additional processing time on the System/7. MSP/7 utilization of the System/7 CPU is expressed below as a function of the number of lobes:

No. of 2790 Controls	MSP/7 CPU Utilization
1	10 - 16%
2	24 - 30%
3	33 - 40%
4	42 - 50%

- Macros for area station and attached device definition, building Transaction Control List, Data Entry Unit List, GDU transaction definition, Lobe Error Recovery procedure, and Lobe On-Line Diagnostics, Lobe Fault Isolation, and Lobe Error Display system routines.
- Units supported include: 2791 and 2793 Area Stations ... 2792 Remote Communications Controller ... 2795, 2796, and 2797 Data Entry Units ... 2798 Guidance Display Unit ... 1053 Output Typewriter ... 1035 Badge Reader.
- On-Line Diagnostics: For both area stations and 2792. Invokable from any local or remote area station or from 5028 for 2792. Prerequisite for systems with more than 16 area stations, with a 2792, more than 16 area stations, or where system availability is critical.

Asynchronous Communication Control Support

- Macros to initiate and control data transfer via the asynchronous communication adapter.
- A transparent data scheme to permit the transfer of load modules to the System/7 for execution or punching to paper tape.
- Using the line control discipline of a 2740 Model 1 (with record checking), the System/7 can send and receive data to and from a 360/370 host operating under control of DOS BTAM or QTAM, or OS BTAM, QTAM, or TCAM.

Binary Synchronous Communications Adapter Support

- Communications Access Method macros to initiate and control data transfer via the Binary Synchronous Communications Adapter.

The BSCA feature allows remote connection of a System/7 as a processor terminal to:

- System/370 Models 115, 125, and 135 (via the Integrated Communications Adapter).
- System/370 Models 115 or larger (via the 2701, 2703, 3704, or 3705)
- System/3 Model 6 or 10 or 15 (via the System/3 BSCA)
- Another System/7 (via the BSCA)

Both EBCDIC and ASCII transmission codes are supported under software control. Transparent mode is standard but allowed only with EBCDIC. Note: System/370 Model 135 ICA will not allow transparent and non-transparent code support on the same line.)

Communication may be over any two or four wire links on point-to-point (switched or non-switched) or multipoint configurations. In point-to-point configurations, the System/7 is supported as a processor terminal. In a multipoint configuration, System/7 is supported as a tributary station only with no multipoint central capability available. Transmission is half duplex and data transfers in and out of System/7 storage are by means of a direct storage access mechanism on a cycle stealing basis.

The System/7 BSCA provides the capability of remote initial program load (IPL) from another system. Initiation of the IPL is controlled by the remote system. A System/7 can be IPL'd from a remote system when it is configured as a processor terminal on a point-to-point switched line or as a tributary station in a multipoint configuration. The IPL message is transmitted in transparent EBCDIC only.

The System/7 BSCA is supported as a BSC terminal by: BTAM under DOS/VS; by BTAM and TCAM under OS/VS1 and OS/VS2; by 3704/3705 emulation mode, by System/3 Multiline/Multipoint (ML/MP), RPG II and Communication Control Program (CCP).

Other Function Macros

- Data conversion macros.
- Multiply-Divide.
- Square Root.
- Dynamic Buffer Management.
- Variable Length Character Manipulation.
- Double-Word Integer Arithmetic.
- Simultaneous Disk Services.

Basic Disk Support Macros

- Seek, Read, Write, and Write-Verify Functions.
- Multiple sector operations, including cylinder overflow support.
- Multiple 5022 Modules are supported. (Seeks may be overlapped.)
- Disk Cycle Steal Feature 2664 is supported when use with 5010 feature 2662.
- Error handling routines.

Symbolic File Support Macros

Supported disk file organization includes:

- System/3 compatible, Volume Table of Contents (VTOC).
- Directorized data sets with suballocation of data set space into subdata sets called members.
- Programs stored to disk as members of a directorized data set.
- Data sets comprised of one or more tracks, members comprised of one or more sectors.

Support Provides:

- Storage-resident and disk-resident versions.
- Access routines to load data sets or members.
- OPEN routine to locate data sets or members and make available for access.
- Dynamic Allocation and Deletion of members of directorized data sets.
- Access routines to SEEK, READ, WRITE, GET, PUT data set or member records.
- CLOSE routine to make data sets or members unavailable for access.
- Retrieval and execution of program members via @ FETCH macros.
- Routine to wait until a specific volume or any volume comes ready.

Access routines support:

- Basic Access Method - Access to data sets or members by relative sector number. One request allows read and write of multiple sectors across track and cylinder boundaries.
- Direct Access Method - Access to fixed length records of data sets or members randomly by relative record number. GET and PUT of records also provides for sequential input/output of records (record number is incremented by one after each access).
- Program Access Method - Supports the loading and retrieval of a program to a program member already defined under the Disk Support System.
- Variable Segment Access Method - Access to variable length records as if they were on a sequential device. Provides for backspace of records, rewind of data set, etc.
- Sequential Access Method - Provides device independent input and output for sequential devices. Support is provided for the 5028 Operator Station, 5022 Disk Storage Module, 129 or 5496 Data Recorder and 7431 Serial Printer.
- Communications Access Method - Provides support for Binary Synchronous Communications Adapter at the logical record (GET, PUT) level and the physical record (READ, WRITE) level.

The allocation of disk space and the use of the OPEN facility allows the user to reference a data area on disk by symbolic name rather than disk address. OPEN logically connects a disk data area to the symbolic name referenced in the application program and can be either within the program at assembly time or in conjunction with the Disk Support System at the time the program is loaded for execution.

NOTE: System/3 System/7 data interchange

System/3 to System/7

System/3 files (data sets) marked as Direct, Index Sequential, and Consecutive may be read on the System/7 using the Basic Access Method or the Direct Access Method.

System/3 files (data sets) marked as Variable Length Spanned Unblocked Sequential may be accessed on the System/7 using Basic Access Method or the Variable Segment Access Method. System/7 FORTRAN used VSAM and DAM.

System/7 to System/3

System/7 data sets marked as Direct (built by the Direct Access Method) may be opened by System/3 data management and accessed as a consecutive or direct file. System/7 data sets marked as variable sequential (loaded by the Variable Segment Access Method) may be accessed by System/3 data management as a variable consecutive file. System/3 FORTRAN uses both direct and variable sequential files. The System/7 directorized data sets and members of directorized data sets are not available to System/3 Support Facilities.

TASKING

MSP/7 Support Macros provide facility:

- To insure serial use of a nonreentrant program.
- To maintain registers and work area after program suspension and reactivation.

WAIT/POST Macros

A program WAITING for the completion of an event can relinquish control and free its interrupt level for other use. The WAIT/POST Macros:

- Save registers in dynamically allocated storage.
- Automatically restore register contents and reactivate the supported program when completion of the event is POSTED.
- Facilitates overlap of processing with input/output operations.

Classification: Type I with programming service classification A.

Basic Program Material: OS 360A-TX-026 Macro Library/Relocatable

Documentation: One copy each of Program Directory ... MSP/7 Macro Library/Relocatable: Coding the Input/Output Macros (GC34-0020) ... Coding the Processing Macros (GC34-0008) ... Coding the 2790 Control Macros (GC34-0024) ... MSP/7 Installation and Nucleus Generation Guide (GC34-0031) ... MSP/7 Control Blocks (GC34-0033).

Machine Readable: 80-column card images on 9-track 800/1600 magnetic tape, MSP/7 macros (commented and uncommented), 2790 On-Line Diagnostics, and the sample programs in source form.

Optional Program Material: None.

Ordering Information: Program Number OS 360ATX026

	Program Number Extension	Distribution Type	Medium Code	User Volume Requirement
Basic	None	MT 9/800	28	1 - 2400' reel
		MT 9/1600	29	1 - 2400' reel

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify Group Codes GJD1-1790 and GJD1-1794.

Publications (available from Mechanicsburg): IBM System/7 Symbolic File Support (SFS): Program Logic Manual (GY34-0018) ... Understanding MSP/7 (GC34-0027) ... MSP/7 Binary Synchronous Communication: Program Logic Manual (GY34-0012) ... IBM System/7 Macro Library/Relocatable: Program Logic Manual (GY34-0010).

Basic Program Material: DOS 360A-TX-016 Macro Library/Relocatable

Documentation: One copy each of Program Directory ... MSP/7 Macro Library/Relocatable: Coding the Input/Output Macros (GC34-0020) ... Coding the Processing Macros (GC34-0008) ... Coding the 2790 Control Macros (GC34-0024) ... MSP/7 Installation and Nucleus Generation Guide (GC34-0031) ... MSP/7 Control Blocks (GC34-0033).

Machine Readable: 80-column card images on 9-track 800/1600 bpi magnetic tape, MSP/7 macros (commented and uncommented), 2790 On-Line Diagnostics, and the sample programs in source form.

Optional Program Material: None.

Ordering Information: Program Number DOS 360ATX016

	Program Number Extension	Distribution Type	Medium Code	User Volume Requirement
Basic	None	MT 9/800	28	1 - 2400' reel
		MT 9/1600	29	1 - 2400' reel

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify Group Codes GJD1-1790 and GJD1-1794.

Publications (available from Mechanicsburg): IBM System/7 Symbolic File Support (SFS): Program Logic Manual (GY34-0018) ... Understanding MSP/7 (GC34-0027) ... MSP/7 Binary Synchronous Communication: Program Logic Manual (GY34-0012) ... IBM System/7 Macro Library/Relocatable: Program Logic Manual (GY34-0010).

SYSTEM/7 HOST MACRO ASSEMBLER (ASM/7)

OS 360A-TX-021
DOS 360A-TX-011

ASM/7 is a System/7 Language Translator that translates symbolic instructions into machine language instruction, assigns storage locations, and performs auxiliary functions necessary to produce executable machine language programs. ASM/7 is language compatible with the stand-alone ASM/7.

In addition, ASM/7:

- Produces listings of source and object programs.
- Produces object modules suitable for input to the storage load formatting program (FORMAT/7) or the Linkage Editor (LINK/7).
- Allows user macros.

Provides conditional assembly instructions.
Supports new instructions for System/7 Model E processor.

Minimum System Requirements for execution on a System/360 or System/370 operating under ...

Disk Operating System (DOS)

14K bytes of storage exclusive of System Control and Basic IOCS.

In addition, ASM/7 requires auxiliary storage as follows:

Three 2311, 2314/2319, or 3330 disk storage extents as work files or

Three 2400/3400 series magnetic tape units (either 7-track or 9-track) as work files or

Any combination of the above disks and tapes which provide the three required work files. (If 7-track magnetic tape is used, the data conversion feature is required.)

Operating System (OS)

44K bytes of storage exclusive of data management and supervisory service

In addition, ASM/7 requires space in auxiliary storage for the following data sets:

System Input... Three intermediate (work storage)... Macro Instruction Library (this requirement may be satisfied by DASD system residence or private library).

Print Output (selectable through JCL).

Object Module (selectable through JCL).

Punch Output (selectable through JCL).

Classification: Type I with programming service classification A.

SYSTEM/7 HOST LINKAGE EDITOR (LINK/7)

OS 360A-TX-025
DOS 360A-TX-015

The Linkage Editor combines separately assembler or compiled object modules into a load module suitable for input to FORMAT/7 and subsequent execution. It also combines previously edited load modules with each other or with object modules.

Highlights

In addition to its primary function of linking or combining host or stand-alone program modules, the Linkage Editor also:

- Incorporates program segments from a library into load modules, either automatically or upon request.
- Aids in construction of overlay program segments.
- Aids program modification by replacing program segments.

Minimum System Requirements for execution on a System/360 or System/370 operating under ...

Disk Operating System (DOS)

24K bytes of storage exclusive of system control and Basic IOCS.

Auxiliary storage for at least two intermediate work areas (DASD).

Operating System (OS)

44K bytes of storage exclusive of data management and supervisory services.

In addition to the standard system residence, the Linkage Editor requires space in auxiliary storage for at least the following data sets:

System Input.

One Intermediate (requires DASD).

Print Output (selectable through JCL).

Output Load Module (requires DASD).

Classification: Type I with programming service classification A.

SYSTEM/7 HOST STORAGE LOAD FORMATTING PROGRAM (FORMAT/7)

OS 360A-TX-023
DOS 360A-TX-013

FORMAT/7 allows the user to generate loadable System/7 storage loads from ASM/7 output. The output storage load can be directed to disk for transmission via the ACCA connection or to cards for later conversion. For the DOS user with a 1018 paper tape punch, the storage load can go directly to paper tape.

Minimum System Requirements for execution on a System/360 or System/370 operating under ...

Disk Operating System (DOS)

14K bytes of storage exclusive of System Control and Basic IOCS.

Operating System (OS)

44K bytes of storage exclusive of data management and supervisory services.

Classification: Type I with programming service classification A.

SYSTEM/7 HOST SOURCE PREPARATION PROGRAM (PREP/7)

OS 360A-TX-022
DOS 360A-TX-012

PREP/7 prepares Source Programs written in the syntax of the MSP/7 Host Program Preparation Facility I for input into ASM/7.

- Accepts source written for OS/DOS and 1800/1130 Facility I Macro Assemblers.
- Flags instructions that may need programmer intervention for correct conversion.
- Punches new source deck.

Minimum System Requirements for execution on a System/360 or System/370 operating under ...

Disk Operating System (DOS)

14K bytes of storage exclusive of System Control and Basic IOCS.

Operating System (OS)

44K bytes of storage exclusive of data management and supervisory services.

Classification: Type I with programming service classification A.

PUBLICATIONS

- IBM System/7 MSP/7 Host Program Preparation Facility II on System/360 or System/370: Introduction (GC34-0007)
- IBM System/7 MSP/7 Symbolic File Support Introduction (GC34-0017)

ORDERING PROCEDURES

MSP/7 HOST PROGRAM PREPARATION FACILITIES II - OS

Basic Program Material - OS 360A-TX-020:

360A-TX-020 is a group order number for the following programs:

ASM/7	360A-TX-021
PREP/7	360A-TX-022
FORMAT/7	360A-TX-023
LINK/7	360A-TX-025

When ordering from PID, the group order number must be used, not the individual program ID numbers.

Documentation: One copy each of IBM System/7 Macro Assemblers (GC34-0018) ... MSP/7 Messages, Codes, and Operating Procedures (GC34-0023) ... IBM System/7 Linkage Editors (GC34-0006).

Machine Readable: Teleprocessing service programs UTIPL and UZERO, and object code of ASM/7, PREP/7, LINK/7, and FORMAT/7 suitable for link editing into an OS library. Also included are the service programs UPIPL and UZERO in a form that can be punched out on paper tape (provides the functions of UTIPL and UZERO teleprocessing service programs for non-TP users).

Optional Program Material:

Documentation: None

Machine Readable: Source code of ASM/7, PREP/7, LINK/7 and FORMAT/7.

Ordering Information - Program Number 360ATX020

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Basic	None	DTR 9/800 28	None
		DTR 9/1600 29	None
Optional	None	MT 9/800 28	1 - 2400' reel
		MT 9/1600 29	1 - 2400' reel

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify Group Code GJD1-1786.

Publications (available from Mechanicsburg): IBM System/7 MSP/7 Host Preparation Facilities II on System/360 or System/370: Program Logic Manual (GY34-0006 and GY34-0008).

MSP/7 HOST PROGRAM PREPARATION FACILITIES II - DOS

Basic Program Material - DOS 360A-TX-010:

360A-TX-010 is a group order number for the following programs:

ASM/7	360A-TX-011
PREP/7	360A-TX-012
FORMAT/7	360A-TX-013
LINK/7	360A-TX-015

When ordering from PID, the group order number must be used, not the individual program ID numbers.

Documentation: One copy each of IBM System/7 Macro Assemblers (GC34-0018) ... MSP/7 Messages, Codes, and Operating Procedures (GC34-0023) ... IBM System/7 Linkage Editors (GC34-0006).

Machine Readable: 80-column cards or 80-column card images on 9-track 800/1600 bpi magnetic tape (number of cards is in excess of 3500). Object code of ASM/7, PREP/7, LINK/7, FORMAT/7, and teleprocessing service programs UTIPL and UZERO. Also includes the service programs UPIPL and UZERO in a form that can be punched out on paper tape (provides the functions of UTIPL and UZERO teleprocessing service programs for non-TP users).

Optional Program Material:

Documentation: None

Machine Readable: 80-column source card images on 800/1600 bpi 9-track magnetic tape.

Ordering Information: Program Number. 360ATX010

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Basic	None	DTR 9/800 28	None
		DTR 9/1600 29	None
		Cards 15	None
Optional	None	MT 9/800 28	1 - 2400' reel
		MT 9/1600 29	1 - 2400' reel

Additional Program Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify: Group Code GJD1-1787.

Publications (available from Mechanicsburg): IBM System/7 MSP/7 Host Program Preparation Facilities II on System/360 or System/370: Program Logic Manual (GY34-0007 and GY34-0009).

Distributed System Program (360A-TX-032):

To broaden the concept of distributed computing power, the small rapid response System/7 connected via a teleprocessing attachment to a host System/370* is supported at a higher level. The System/370 can continue to be used for local processing as well as for preparation of programs. The larger host computer provides large file and processing capabilities on a demand basis.

* The System/370 Distributed System Program operates under the MFT and MVT versions of the System/360 Operating System and supports both System/360 and System/370. All references to System/370 also apply to System/360 unless specifically indicated. All references to OS regions imply the optional use of OS MVT partitions.

Description: The System/370 Distributed System Program (S/370 DSP, 360A-TX-032), links a System/370 to one or more System/7s to operate as coupled components of an integrated system. Communication between the System/7s and the host System/370 is by a start/stop teleprocessing attachment using the Basic Telecommunications Access Method (BTAM). System/370 DSP provides support under OS MFT (with sub-tasking) or OS MVT and System/7 Modular System Programs (MSP/7). This attachment allows for the exchange of data, programs, and tasks. The facilities provided by System/370 DSP include:

- Application programs in the System/7 may initiate tasks and subtasks in the System/370 DSP region or OS batch jobs in other System/370 regions. System/370 programs may be initiated from a System/7 as:
 - a) Programs which execute in synchronism with the requesting application (as an extension of DSP)
 - b) Programs which execute asynchronously with the requesting application (as a sub-task of DSP)
 - c) OS Batch Jobs
- Programs in any region of the System/370 may initiate the execution of programs in the System/7 at user assigned priorities.
- Named data files in the DSP/OS data sets on the host disk may be defined and accessed by application programs residing in the System/7, the System/370 DSP region in the System/370, and the DSP users in other regions of OS in the System/370.
- A separate area of main storage (DSP COMMON in the System/370 and in the System/7) may be accessed by application programs in the System/7, the System/370 DSP region in System/370, or DSP users in other regions of OS in the System/370.

- The System/7 or System/370 application program can request that a program stored on the host disk be loaded into the System/7 storage.
- The System/7 can be initial program loaded by a request from the resident application program; a System/370 application program can request an initial program load on any System/7.

Application programs, written using the facilities of 1130 and 1800 Distributed System Programs and obeying their conventions, can be transferred with little modification to System/370 operating with System/370 DSP.

Highlights:

- Sensor-based application programs can use the facilities of both OS MFT (with subtasking) or OS MVT and the System/7 Modular System Programs.
- Multisystem support is compatible with both 1130 and 1800 Distributed System Programs.
- The System/370 DSP facilities described in this announcement are FORTRAN and PL/I callable by the System/370 user.
- S/370 DSP will asynchronously process multiple requests for exchanges of data, programs, and tasks made from multiple System/7s and regions.
- Existing teleprocessing applications utilizing BTAM facilities and existing user programs utilizing standard OS facilities are not restricted through the installation of System/370 DSP.
- Applications utilizing the facilities of other sub-systems (e.g., IMS) may also use the facilities of DSP.

Special Sales Information: System/370 DSP allows the support of a wide range of applications including Laboratory, Automation, Process Control, Data Acquisition, Manufacturing Testing, and Manufacturing Automation. Application programs written for 1130 DSP and 1800 DSP run with little modification under System/370 DSP, allowing for easy growth.

Use: System/370 DSP consists of subroutines which execute on the host and macros which execute on each System/7. To use the System/370-System/7 multisystem configuration, application programs must use System/370 DSP in the following manner:

- The System/370 DSP region is initiated as an OS job by using OS Job Control Language (JCL).
- The System/370 resident programs include calls to the System/370 DSP subroutines.
- The System/7 resident programs use the System/7 DSP macros.
- The System/370 DSP utility programs are invoked via OS functions or operator command from a console recognized by OS as the System/370 DSP console.

User Responsibilities: The following items must be arranged for or provided by the user:

- Teleprocessing lines and modems necessary to establish the required teleprocessing links between the System/370 and the System/7s.
- Proper generation of DSP to match his system configuration.
- Installation of the program elements provided with System/370 DSP in the proper OS/360 libraries, according to System/370 DSP generation procedures.
- A thorough knowledge of System/7 MSP/7 HPPF II, System/370 DSP, Operating System/360 Assembler, and/or FORTRAN or PL/I, in order to code his distributed system application.
- Sufficient System/370 direct access storage to contain his application programs and data files.
- Protection against accidental loss or misuse of his data.

Programming Systems

System/370 Programs: The System/370 resident programs of System/370 Distributed System Programs (S/370 DSPs) operate under the MFT Supervisor, 360S-CI-505, or the MVT Supervisor, 360S-CI-509. System/370 DSP requires the following access methods:

1. Direct Access Method (BDAM), 360S-DM-509
2. Sequential Access Method (BPAM, BSAM), 360S-DM-508
3. Basic Telecommunications Access Method (BTAM), 360S-CQ-513

The Multiple WAIT option must be included in the OS system generation.

All of the S/370 resident modules of S/370 DSP are written using S/360 Assembler Language.

System/7 Programs: The System/7 resident programs of System/370 DSP are written as macros. These macros utilize some of the facilities of the System/7 Modular System Program (MSP/7). The MSP/7 Macros and the System/7 Macros in System/370 DSP are written in System/370 DSP are assembled under the ASM/7 Assembler.

Compatibility with 1130 and 1800 Distributed System Programs (1130 DSP and 1800 DSP): To assure the 1130 and 1800 resident application programs written in 1130/1800 Basic FORTRAN IV Language will execute under System/370 DSP, they must avoid the use of FORTRAN facilities which are unique to the 1130 or 1800 operating systems. Since 1130 and 1800 programs must use the one word

integers control record, and this facility is not available in the System/370 FORTRAN, the 1130 and 1800 programs should not depend on this relationship between integer and real values.

System/7 application programs are compatible with either 1130 DSP, 1800 DSP, or System/370 DSP if communications to the host use only the DSP data, task, and program exchange facilities. No direct use of the MSP/7 communication macros is allowed in the System/7 resident user programs if compatibility is to be maintained.

Minimum Machine Configurations:

System/370 or System/360

3135 or 2040 or above	Central Processing Unit. As stated in the sales manual, the minimum configuration must be that required for the IBM Operating System.
2400 or 3400	One 9-track (800 or 1600 bpi) magnetic tape I/O device must be available for DSP distribution and maintenance purposes.
4640, 2701 or	Integrated Communications Adapter (3135 only) Data Adapter Unit
2702 or 2703	Transmission Control Unit

The Integrated Communications Adapter (for the 3135), the 270X or the 3705 above must be equipped with the minimum features for attachment of the 5010 at 134.5 or 600 bps as specified in the sales manual pages for these units. Additionally, the 3705 must be operated in 2701/2702/2703 Emulation mode.

Note: The 1200 bps (RPQ D08001) and 50KB bps (RPQ D08000) terminal configurations are supported by System/370,DSP.

DSP is written in a modular manner. This allows the user to customize his system according to the DSP functions required for his application.

A 60K region allows the user to utilize all of the DSP functions. Subsets of DSP functions can require a region of substantially less than 60K. The storage distribution of this region is approximately as follows:

(Reverse side is blank)

<u>Area</u>	<u>Storage required (bytes)</u>
DSP Control & Process Programs	30K
DSP User Defined Areas	
DSP COMMON	
DSP Buffer Areas	30K
Application program module execution space	(estimated average size)

Note: Algorithms for estimating DSP storage requirements are provided as an appendix to the System/370 DSP Operations Guide (GH20-9501).

If the standard OS data management routines used by DSP are not included in the OS system area, the storage required for these routines will have to be added to the DSP region size.

System/7

5010	Processor Module Model A06; includes 6144 words of storage with the Asynchronous Communications Control Adapter feature #1610
5026	Enclosure Model A02
5028	Operator Station with keyboard/printer and paper tape reader/punch

The System/370 DSP macros resident in the System/7 require approximately 600 words of System/7 storage. The prerequisite MSP/7 macros require approximately 2800 words of System/7 storage including the MSP/7 macros for interrupt handling, queueing, program interrupt, and Operator Station I/O Control. The System/7 storage available for the customer's application program is approximately 2700 words for the minimum System/7 configuration of 6144 words.

Programming service classification is A.

Market Support: Customer Announcement Letters (G320-7027), Customer Brochures (G520-2539), and the General Information Manual (GH20-1171) are available from Mechanicsburg.

Ordering Information:

Basic Program Material - OS 360A-TX-032

Documentation: One copy each of IBM System/370 Distributed System Program, Program Reference Manual (GH20-9500) and IBM System/370 Distributed System Program, Operations Guide (GH20-9501).

Machine Readable Material: One 9-track 800/1600 bpi magnetic tape reel containing source and object code required for System/370 DSP generation and one paper tape strip for initiating a dial-in System/7 teleprocessing connection.

To order the basic material, specify one of the following numbers:

<u>Specify Number</u>	<u>Track Density</u>	<u>Description</u>	<u>User Volume Requirement</u>
9027	9/800	Magnetic Tape	None (DTR)
9029	9/1600	Magnetic Tape	None (DTR)

Two programming systems are provided for the 1130 Computing System: (1) 1130 Card/Paper Tape Programming System ... (2) 1130 Disk Monitor System

Components of the Card/Paper Tape Programming System are:

1. Assembler
2. FORTRAN
3. Subroutine Library
4. Utility Routines

Components of the Disk Monitor System are:

1. Supervisor
2. Subroutine Library
3. Disk Utility Program
4. Assembler
5. FORTRAN
6. RPG (Disk Monitor Version 2 only)

IBM 1130 Card/Paper Tape Programming System

This Programming System is designed especially for use on an 1130 Computing System without disk storage.

Minimum system requirements: A 4K word 1131 mdl 1 ... 1442 Card Read Punch mdl 6 or 7, or 1134 Paper Tape Reader and 1055 Paper Tape Punch.

Machine features and units supported: An 1131 model 1A, 1B, 2A, 2B, 2C, 4A or 4B ... 1442 Card Read Punch model 6 or 7 ... 1134 Paper Tape Reader and 1055 Paper Tape Punch ... 1132 Printer ... 1627 Plotter model 1 or 2 ... Synchronous Communications Adapter.

The four components of the Card/Paper Tape Programming System are described below:

Assembler: The IBM 1130 Assembler provides the programmer a flexible and meaningful Symbolic language that is easier to code than a binary machine language.

Source programs are assembled by the processor in two passes. The Assembler automatically assigns and keeps a record of storage locations and checks for coding errors. By relieving the programmer of these burdensome tasks, the Assembler significantly reduces the amount of programming time and effort required to prepare a program.

A Compressor Program compresses symbolically assembled output into a form suitable for execution.

The Assembler and its compressor always use all of core storage available on an assembly machine. The programs determine memory size automatically at assembly time and adjust table parameters accordingly. Approximately 520 labels may be held in a 4K memory.

The Assembler provides for assembly of both absolute and relocatable mainline programs, and for assembly of relocatable subroutines. By means of ENT and CALL statements, provision is made for automatic symbolic cross-referencing between programs at load time. The Assembler can be used to generate subroutines and subprograms for FORTRAN main programs. Similarly, Assembler main programs can call FORTRAN subroutines or subprograms, as well as Subroutine Library and Utility Routines.

The Assembler also provides facilities for assembling interrupt processing subroutines which may be incorporated into the system as part of the IOCS.

At object time, the Relocating Loader normally occupies core storage locations 0000 through 0635. Instructions and data may not be loaded into this area, however, most of this area may be used as input/output buffers and working storage.

A Core Image Converter is provided which will convert the relocatable binary object decks of a mainline and all called subroutines, into a single core image binary deck. This deck may then be loaded with a Core Image Loader which has no relocating or cross-referencing abilities. This loader will occupy (approximately) core locations 0000 to 0220. Much of this area may be used as input/output buffers and working storage.

The assembly speeds for the card/paper tape assemblers and compressors is limited by the speed of the I/O devices, although for extremely large programs with many labels (e.g., a 700 label program being assembled on an 8K machine), a slight reduction on the order of 10% in the speed may be expected.

Throughput speed on an 1131 model 1A or 1B for assembly and compression (not counting processor load time --

Card System, with 1442 Model 6: 67-77 statements/minute

(The variation may be ascribed to varying numbers of comments statements which do not require punching.)

Card System, with 1442 Model 7: 90-100 statements/minute

Processor load times are as follows:

With 1442 Model 6, Assembler - 12 seconds, Compressor - 9 seconds

With 1442 Model 7, Assembler - 9 seconds, Compressor - 7 seconds

Paper Tape system with 1134 and 1055: 6-17 statements/minute

The variation may be ascribed to:

- a. The extent of remarks on the statements, which affect the tape length and

- hence the read/punch time, and
- b. Whether or not the optional typewriter listing is requested during the compression. This listing effectively reduces the read speed to 15 characters/second, the typewriter speed.

Minimum system requirements: For program generation and execution -- A 4K word 1131 mdl 1 or mdl 4 ... 1442 Card Read Punch mdl 6 or 7 or 1134 Paper Tape Reader and 1055 Paper Tape Punch.

Basic Program Material:

1130-SP-001 (Card)

SRL Publication -- IBM 1130 Card/Paper Tape Programming System - Operators Guide, C26-3629.

Documentation -- Program Material List ... Sample Assembly Program Attachment to Users.

Machine Readable -- Object Deck and Sample Program.

1130-SP-002 (Tape)

SRL Publication -- IBM 1130 Card/Paper Tape Programming System - Operators Guide, C26-3629.

Documentation -- Program Material List ... Sample Assembly Program.

Machine Readable -- One paper tape for each of the following - Sample Program ... Assembler ... Compressor.

FORTRAN Compiler: A coding system with a language that closely resembles the language of mathematics. It is a system primarily for scientific and engineering computations. Since this system is essentially problem-oriented rather than machine-oriented, it provides scientists and engineers with a method of communications that is more familiar, easier to learn, and easier to use than actual machine language.

The FORTRAN processor accepts source program statements as input from cards or paper tape and produces, as output, a machine language program. At object time, the system utilizes advanced techniques, such as relocatable subroutines, highly compressed formats, and flexible input and output command structures which facilitate data conversion operations. The FORTRAN Compiler provides a high level of language power and flexibility with minimal machine requirements. The units supported at execution time are the 1442 Card Read Punch mdl 6 or 7, Printer-Keyboard, 1132 Printer, 1134 Paper Tape Reader and 1055 Paper Tape Punch. The maximum number of words available on the computer can be utilized at both compile and execute time.

A source program written in the 1130 FORTRAN Language is processed by the FORTRAN Compiler to produce a 1130 machine language program. The 1130 System Loader, Input/Output Routines for I/O function, and the System Subprograms will be loaded with the compiled program prior to execution.

The compilation speed for the Card System includes the time required to: read in source program ... read in compiler phases ... and compile and punch card object deck, assuming: (1) 400 card/min. read and 160 col/punch on 1442 Model 7, (2) a 150 statement source program, (3) a 50 card object deck punched, (4) no listings required, the compilation will take approximately 2.75 minutes on an 1131 model 1A or 1B.

Object execution speed is dependent upon program type, size, I/O functions performed and other factors pertinent to program execution speed.

Available core varies with the number of System Subprograms and I/O routines used. In general, (1) core storage words 0000-0635 will be used by the 1130 System Loader, 580 of which may be used for storing mainline variables at execution time and (2) core storage words 0636-end of memory will be used for the mainline program and any subprograms called by it. If the object program is compressed, however, the System Loader will occupy the first 220 words (approximately) of core storage, of which 160 may be used for data storage.

Minimum system requirements: For compilation -- A 4K word 1131 mdl 1 or mdl 4 ... 1442 Card Read Punch mdl 6 or 7 or 1134 Paper Tape Reader and 1055 Paper Tape Punch.

Basic Program Material:

1130-FO-001 (Card)

SRL Publication -- IBM 1130 Card/Paper Tape Programming Systems Operators Guide, C26-3629.

Documentation -- Program Material List ... Sample FORTRAN Program ... Attachment to Users.

Machine Readable -- Object Deck and Sample Program.

Subroutine Library: The IBM 1130 Subroutine Library has arithmetic, functional, code conversion, I/O control and selective dump subroutines for use by object programs generated by the 1130 Assembler or the 1130 FORTRAN Compiler.

The floating-point subroutines in the 1130 Subroutine Library offer two ranges of precision: Standard Range and Extended Range. The Standard range provides 23 bits of precision; the Extended range provides up to 31 bits of precision.

The subroutines provided include Floating-Point, Fixed-Point, Special Function, Code Conversion, I/O Control and Selective Dump.

The subroutines are used by FORTRAN Compiler or Assembler object programs to perform floating-point, fixed-point arithmetic, and functional operations; the conversion of data from one I/O code to another; the control of I/O activity on the devices attached to the system; and the selective dumping of memory areas for debugging purposes.

Subroutines are provided to operate the Synchronous Communications Adapter in STR mode and BSC mode. The STR subroutines include line control and 4 of 8 code conversion. The BSC subroutines provide for point to point and multipoint transmission with the following basic line control functions provided for: Point to point, with contention ... Point to point switched network ... Multipoint, centralized with 1130 as slave ... Data set clocking or IBM clocking ... Inquiry and alternating acknowledgements ... Auto answer without identification ... Headers ... Normal Text (EBCDIC code) ... Full Transparent Text (EBCDIC control characters) ... Error checking (cyclic check) ... Disconnect. BSC with the 1130 is program supported on System/360 Models 30, 40, 50, 65, 67 (working in 65 mode) and 75 in DOS/BTAM and OS/BTAM ... See IBM System/360 Disk Operating System (DOS/360) and IBM Operating System/360 (OS/360).

Minimum system requirements: A 4K word 1131 mdl 1 or 4 ... applicable I/O equipment for execution of the subroutines.

Machine features and units supported: A 4K or 8K word 1131 ... 1442 Card Read Punch mdl 6 or 7 ... 1134 Paper Tape Reader and 1055 Paper Tape Punch ... Console Printer-KeyBoard ... 2315 Disk Cartridge ... 1132 Printer ... 1627 Plotter ... Synchronous Communications Adapter.

Basic Program Material:

1130-LM-001 (Card)

SRL Publications -- IBM 1130 Subroutine Library, C26-5929-1 ... TNLs to Subroutine Library, N26-0551 and N26-0553.
Documentation -- Program Material List ... Attachment to Users.
Machine Readable -- Object Deck.

Utility Routines: The IBM 1130 Utility Routines are part of the basic programming system to be used by all 1130 installations. These programs make it possible to program the 1130 in a wide range of general engineering applications.

The Utility Routines include: (1) an Input/Output routine which accepts data from one of two input media (card or paper tape) and outputs data to one or two of four output devices (card, paper tape, 1132 or console printer). When two output devices are required, one must be a print option (Console Printer or 1132 Printer). (2) Dump routines which permit the user to dump any area of memory; output can be obtained on cards, console printer or 1132 Printer. (3) Loader routines - Relocating Loader, Core Image Converter, and Core Image Loader.

These routines provide the programmer with a versatile tool for transferring data from one medium to another, and also for performing the repetitive utility functions needed daily for most data processing installations. They also include routines to aid the user in debugging his programs. In addition, they provide the facilities for: (1) loading compressed binary object program cards in either relocatable or core image format. (2) generating object program core maps.

Minimum system requirements: A 4K word 1131 mdl 1 ... 1442 Card Read Punch mdl 6 or 7 or 1134 Paper Tape Reader and 1055 Paper Tape Punch.

Basic Program Material:

1130-UT-001 (Card)

SRL Publication -- IBM 1130 Card/Paper Tape Programming Systems Operators Guide, C26-3629.
Documentation -- Program Material.
Machine Readable - Object Deck.

1130-UT-002 (Tape)

SRL Publication -- IBM 1130 Card/Paper Tape Programming Systems Operators

Guide, C26-3629.

Documentation -- Program Material.

Machine Readable -- One Paper Tape for each of the following - Relocating Loader ... Core Image Loader ... Core Image Converter - Core Map on Typewriter ... Core Image Converter - Core Map on Printer ... Dump and Console Utilities ... I/O Utilities ... Construct Paper Tape - a routine for compressing subroutines ... EOD 1 ... EOD 2 ... DPIR ... User Exit Special User EOD User Exit Overlay Record ... One Record Typewriter Dump ... Keyboard Routine.

1130/1800 Compatible Programs: Programs can be prepared on the IBM 1130 Computing System for execution on the IBM 1800 Data Acquisition and Control System.

Programs for the 1800 can be assembled and compressed or FORTRAN compiled on the 1130 using the 1130 Card/Paper Tape programming systems. These programs in relocatable card or paper tape form can be executed on the 1800 using the 1800 Re-locating Loader and 1800 Subroutine Library.

This compatibility applies only to relocatable object programs produced by the 1130 Card/Paper Tape programming systems. The compatibility does not apply to the programming systems themselves. The 1130 Card/Paper Tape programming systems contain differences in I/O operation such that they cannot generally be used on the 1800.

Reference Manual: IBM 1130 Card/Paper Tape Programming System Operator's Guide, C26-3629.

IBM 1130 Disk Monitor System

The 1130 Disk Monitor System enables the user to assemble, compile, and execute programs written in Assembler, FORTRAN or RPG. The system provides the ability to combine Assembler Language subprograms or FORTRAN subprograms into Assembled or FORTRAN compiled main programs in any combination. RPG mainline programs may use assembler-written subprograms. System programs, user programs, and data are stored on disk for direct accessibility and speed of operation. The system provides overlay capability, and the ability to call (LINK) one program from another, thus allowing the execution of programs that would not otherwise fit into core storage.

The Disk Monitor System provides for minimal set-up time and continuous execution of stacked jobs without operator intervention. Job input is in the form of either cards or paper tape. Job records identify jobs to be performed by the 1130 Monitor System. Monitor control records specify the functions to be performed, e.g., Assembly, RPG compilation, ... FORTRAN compilation, execute an assembled or compiled program, or call the Disk Utility Program. Control Records recognized by the function to be performed give further instructions regarding the subjob.

Monitor System, Version 2: The components of the 1130 Monitor System, Version 2, are described below:

Supervisor:

The Supervisor reads the monitor control records and causes the proper system functions to be brought into control. The time required to load a sample 8K core load (disk core image format) varies from 1.5 to 4.0 seconds, depending primarily on the length of the User Area.

Assembler:

The Disk Monitor Assembler performs the same functions as the Card/Paper Tape System Assembler. It can assemble in one pass of the source deck, however, and it produces an object program on the disk, as well as a listing. It allows labels to overflow onto disk if necessary, and provides more instruction types. The loading of object programs is covered in the description of the core load builder.

The approximate Assembler program speeds in statements per minute, assuming a 2.2 μ sec memory and that the monitor system and Working Storage are on different disk drives, are given in the following table:

List Device	Input Device				
	2501 Model A2	2501 Model A1	1442 Model 7	1442 Model 6	1134
1403 mdl 7	300	270	220	190	130
1403 mdl 6*	230	200	170	150	110
1132 mdl 1	72	68	65	62	54
Console Printer	14	14	14	14	17
No Listing	500	410	300	240	160

* Using Attachment 4424 for operation at 340 ipm maximum.

FORTRAN Compiler

The 1130 Disk Monitor System, Version 2, FORTRAN language contains all of the features defined in American National Standard Basic FORTRAN, X3.10-1966, with significant extensions beyond this standard. These extensions are listed in IBM 1130/1800 Basic FORTRAN IV Language, SRL C26-3715, Appendix B.

The Disk Monitor Compiler performs the same functions as the Card/Paper Tape System Compiler plus it provides the ability for an object program to read and write on the disk units. It produces an object program on the disk and utilizes up to 32K of core storage as available. The loading of object programs is covered in the description of the Core Load Builder.

The approximate time in minutes to compile on a single disk (3,6 user) 8K 1130 system a 150-statement FORTRAN source program is on an 1131-2B CPU system given in the following table:

List Device	Input Device				
	2501 Model A2	2501 Model A1	1442 Model 7	1442 Model 6	1134
1403 mdl 7	1.8	1.8	1.9	2.0	2.7
1403 mdl 6*	2.0	2.0	2.0	2.1	3.0
1132 mdl 1	3.8	3.8	3.8	3.8	3.8
Console Printer	7.2	7.2	7.2	7.2	7.2
No Listing	1.6	1.7	1.8	1.9	2.5

* Using Attachment 4424 for operation at 340 lpm maximum.

RPG

RPG is a commercial, problem-oriented, language designed to provide users with an efficient, easy-to-use technique for generating programs that can: obtain data records from single or multiple input files ... perform calculations on data taken from input records or RPG literals ... write printed reports ... do table lookup ... branch within calculations ... sequence check input records ... exit to internal RPG subroutines or external routines written in 1130 Assembler Language ... process disk Indexed Sequential files ... process disk Blocked Sequential files ... provide Sterling conversion and inverted print edit ... write records during calculations ... use of chain operation codes in calculations ... automatic page numbering ... use of edit codes on output format ... transfer to an RPG sub-routine.

A source program written in 1130 RPG Language is processed by the RPG compiler to produce an 1130 machine language program. Input/Output Routines for I/O functions, RPG subroutines, and System subroutines are loaded with the generated mainline program prior to execution. The RPG compiler operates in a stacked job environment under control of the 1130 Disk Monitor, Version 2.

The approximate time in seconds, assuming a 2.2u sec CPU, to compile a 52-statement RPG source program which reads card input and formats and prints an Accounts Receivable Register is shown below.

Basic Program Material: 1130-RG-007

Documentation: Program Directory

SRL Publications: One copy of IBM 1130 RPG Language (GC21-5002).

Machine Readable: Object decks and sample program available.

Optional Program Material:

Machine Readable: Source code for the compiler and subroutines.

Ordering Information: Program Number 1130 RG 007

	Program No. Extension	Distribution Medium Type Code	User Volume Requirement
Basic	None	Cards 15	None
Optional	None	MT 9/800 28	None
		MT 9/1600 29	None

Additional Program Material:

Program Logic Manual: IBM 1130 RPG Program Logic Manual (GY21-0010). Available from Mechanicsburg.

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering, specify microfiche listing.

Reference Publications:

IBM 1130 Disk Monitor System V2 Programmer's and Operator's Guide GC26-3717-9

IBM 1130 Subroutine Library GC26-5929-7

IBM 1130 Disk Monitor Programming System V2 PLM GN34-0068 (TNL to GY26-3714-3)

IBM 1130/1800 Basic FORTRAN IV Language GN34-0085 (TNL to GC26-3715-7)

List Device	Input Device			
	2501 Model A2	2501 Model A1	1442 Model 7	1442 Model 6
1403-M7	30	30 sec	30 sec	40
1403-M6	45	45	45	45
1132 mdl 1	95	95	95	95
Console Printer	500	500	500	500
No Listing	17	20	20 sec	30

Core Load Builder:

The Core Load Builder prepares object programs for execution or storage on disk. It performs a function similar to the Card/Paper Tape System Relocating Loader plus several additional functions, and the programs are stored on disk instead of cards or paper tape. One of the most important of its extra functions is that of creating overlays of parts of the core load. One class of overlays is specified by the user, whereas the other is automatically created by the Core Load Builder in order to make a FORTRAN core load fit into core storage when it would otherwise be too large.

Disk Utility Program:

The Disk Utility program assists the user in managing programs and data files stored on disk(s). It is used to perform the functions of addition, replacement, and deletion of programs and data files plus related functions.

System Library:

The System Library contains the Card/Paper Tape System Subroutine Library plus additional interrupt service (I/O) subroutines and conversion subroutines. It also includes dump programs for debugging. All programs in the System Library will operate in any core memory size or speed. DFCNV requires an 1130 System with at least one disk, 8K words of core, and a card reader.

Communications Subroutines:

The System Library contains subroutines to operate the Synchronous Communications Adapter in STR mode and BSC mode. The STR subroutines include line control and 4 of 8 code conversion. The BSC subroutines provide for point-to-point and multi-point transmission with the following basic line control functions provided for: Point-to-point, with contention ... Point-to-point switched network ... Multipoint, centralized with 1130 as slave ... Data Set Clocking or IBM Clocking ... inquiry and alternating acknowledgements ... Auto answer without identification ... Headers ... Normal Text (EBCDIC code) ... Full Transparent Text (EBCDIC control characters) ... Error checking (cyclic check) ... Disconnect. BSC with the 1130 is program supported on System/360 Models 30, 40, 50, 65, 67 (working in 65 mode) and 75 in DOS/BTAM and OS/BTAM ... See IBM System/360 Disk Operating System (DOS/360) and IBM Operating System/360 (OS/360).

Also supported are communications with S/360 Model 20 with BSCA-IOCS, 1800 Data Acquisition and Control System with 1800 Multi-programming Executive System Version 2 with BSCIO 2770 Data Communications System and 2780 Data Transmission Terminal.

Note: The 1130 Type I programming support will not include the Edit Macro for the 2770's Model 50 Magnetic Data Inscrber. Therefore, if communication with the 2770's Mdl 50 MDI is desired, the customer will have to supply his own edit routine.

Minimum system requirement. A 4K word 1131 Model 2 ... I/O devices same as for the Monitor System, Version 2 ... Synchronous Communications Adapter.

Reference Manual: IBM 1130 Synchronous Communications Adapter Subroutines, C26-3706.

Disk Data File Conversion Program (DFCNV):

Provides the capability for customers to convert their 1130 disk data files which have been created through the use of FORTRAN (or FORTRAN plus Commercial Subroutines) to an 1130 RPG compatible disk sequential format.

Designed as a general purpose program, it runs under control of 1130 Disk Monitor System, Version 2 (1130-OS-005). Conversion is from disk data file to disk data file, with an intermediate punched card stage as an option.

The program accepts as input a set of control cards which describe the format of the data file to be converted. This file may contain the following field types:

- one word integer
- two word integer
- Real numbers (standard or extended precision)
- FORTRAN's A1, A2, A3, A4, A5, or A6 format
- Commercial Subroutine's D1, D4, or A3 data format

Input of this program is always a disk data file record. Output of this program is always another disk data file record (on the same or a different drive) unless punched card output is specified. Output in all cases is to a sequential data file accessible by RPG-compiled user programs. A reverse conversion is not possible.

Provides 1130 user with a quick, easy conversion program to allow data interchange between FORTRAN-compiled and RPG-compiled programs. Allows selective field conversion and data rearrangement within converted records.

The program is used for the permanent conversion of FORTRAN-created data sets for use by RPG-compiled programs.

Customer Responsibilities - The user must reserve an area for the converted file in either the fixed or user area, by name, before running the utility. This function can be performed by the DUP STOREDATA function.

Programming Systems - The program is written in Assembler Language and runs under control of 1130 Disk Monitor, Version 2. It is included in the System Library.

Machine Configurations - Requires an 1130 system with at least one disk, 8K words of core, and a card reader. Supports all 1130 card I/O devices and 1130 printers. Input disk data file and output disk data file may be on separate disk drives or the same disk drive.

Utility Programs:

The Utility Programs are a group of special purpose programs stored on cards or paper tape. They include programs for dumping from core to printer, from disk to printer, for initializing disk cartridges, and for copying from one disk cartridge to another.

Minimum System Requirements: 1130-OS-006 - A 4K work 1131 with at least one disk and a 1134 Paper Tape Reader and 1055 Paper Tape Punch.

1130-OS-005 - A 4K work 1131 with at least one disk and one of the following:

- . A 1442 Card Read Punch Model 6 or 7, or
- . A 2501 Card Reader Model A1 or A2 and 1442 Card Punch Model 5, or
- . 1442 Card Read Punch Model 6 or 7.

Note: RPG required an 8K or larger 1131, disk, and a card reader.

Units and features utilized: All 1131 CPU models except 1A which are part of an 1130 system containing at least one disk drive (internal disk, 2310, or 2311) ... 1442 Card Read Punch Model 6 or 7 ... 1442 Card Punch Model 5 ... 1134 Paper Tape Reader and 1055 Paper Tape Punch ... Console Printer and Keyboard ... 2315 Disk Cartridges ... 1132 Printer Model 1 or 2 ... 1627 Plotter Model A1 or A2 ... 1403 Printer Model 6 or 7 ... 2310 Disk Storage Models B1 and B2 ... 1231 Optical Mark Page Reader ... Synchronous Communications Adapter, 2311 Disk Storage Model 11 or 12.

All 1130 card/paper tape and printer devices will function as principal I/O devices for the monitor system programs except for RPG, which will not function with paper tape input. In addition, the keyboard will function as an input device for all monitor system programs except RPG. All I/O devices will be available to FORTRAN and Assembler object programs except the 1231 and Synchronous Communications Adapter which will be available to Assembler object programs only.

Note: 2311 Models 11 and 12 Disk Storage Drives are supported by 1130-OS-005 only.

RPG supports the following I/O devices only:

1. 1442 Card Reader/Punch - Model 6 or 7
2. 1442 Card Punch - Model 5
3. 2501 Card Reader - Model A1 or A2
4. 1403 Printer - Model 6 or 7
5. 1132 Printer - Model 1 or 2
6. 2310 Disk - Model B1 or B2, up to 4 drives
7. Console printer as an output device
8. 2311 Disk Model 12, up to two drives

The Synchronous Communications Adapter, the 1231 Optical Mark Page Reader, Paper Tape I/O, the Console Keyboard at execution time, and all other I/O devices not listed above as specifically supported are not supported.

2311 Programming Notes:

This programming system supports the internal disk drive on 1131 Models 2 and 3 plus up to four additional drives housed in one or two 2310s, or up to two 2311 drives in place of the 2310s. The combinations supported are:

1131 Models	Internal Drives	2310	2311
2 or 3	Yes	No	No
2 or 3	Yes	1 to 4	No
2 or 3	Yes	No	1 or 2
1 or 5	No	1 to 4	No
1 or 5	No	No	1 or 2

Whenever a 2311-11 is part of a system, five 2315 disks are emulated on five platters of the 1316 disk pack. Whenever a 2311-12 is part of a system, three 2315 disks are emulated on three platters on a 1316 disk pack. Each 2315 cartridge has a four digit cartridge "ID". Each of the 1316 platters will also have a four digit "ID".

In the maximum system, the 1131 will have available to it a maximum of eleven logical disk drives - one internal disk plus five logical drives per 2311-11. For a single job, any five of these logical drives can be addressed. A user program can select any combination of five logical cartridges at the start of a job by means of parameters in the //JOB card. Programs coded in Assembler or FORTRAN can, by a call to the subroutine SYSUP, switch to any other logical cartridge during the job.

System Residence for Disk Monitor Version 2 (1130-OS-005) may be on any logical platter. IPL (cold start) may come from any platter.

Basic Program Material: 1130-OS-005

Documentation: Program Directory

SRL Publications*: One copy of IBM 1130 Disk Monitor System Version 2, Programmer's and Operator's Guide (GC26-3717).

Machine Readable: Object decks and sample programs are available on one 2315 Disk Cartridge or one 1316 Disk Pack.

Optional Program Material:

Machine Readable: Source assembler language coding for the DM2 system programs, system library and utilities.

Ordering Information: Program Number 1130 OS 005

	Program No. Extension	Distribution Medium Type Code	User Volume Requirement	
Basic	None	2315 Disk	58	1-2315 Disk
	None	1316 Disk	52	1-1316 Disk
Optional	None	MT 9/800	28	1-2400' reel
		MT 9/1600	29	1-2400' reel

* If only the basic form number copy of the publication is required, order them from the IBM Distribution Center, Mechanicsburg (SLSS) -- not from PID.

1130-OS-006 (Paper Tape)

Documentation -- Program Material List.

SRL Publication -- 1130 Disk Monitor System, Version 2, Programming and Operator's Guide (C26-3717).

Machine Readable -- One Paper Tape for each of the following -- System Loader, Part 1 ... System Loader, Part 2 ... Phase ID (PHID) Control Record ... Disk Utility Program ... FORTRAN Compiler ... Assembler ... Supervisor, Core Load Builder, System I/O, Core Image Loader ... End of System Tape Control Record ... Standard Precision LIBF and CALL Subroutines ... Extended Precision LIBF and CALL subroutines ... Common LIBF and CALL Subroutines ... ILS, ISS, Conversion and Utility Subroutines ... Plotter Subroutines ... SCA Subroutines ... Cold Start Paper Tape Record ... DCIP (Disk Cartridge Initialization Program) ... PTUTL (Paper Tape Utility Program) ... Paper Tape Reproducing Program ... 1132/1403 Printer Core Dump ... Console Printer Core Dump. Sample FORTRAN Program ... Sample Assembler Program.

The RPG compiler is not available for this system. It is available for the Card Equivalent system, 1130-OS-005 only. This system does not support 2311 disk drives.

Note: For system using CPU models 1B, 1C, 1D, 5B, 5C, or 5D and 2311 Model 12 disk, a card reader is required for adequate FE support.

1130/2250 Graphic Subroutine Package (GSP): A set of subroutines, operating within the 1130 Disk Monitor Version 2 environment, that aids

the FORTRAN or Assembler programmer in using the IBM 2250 Display Unit Model 4. The subroutines are accessed by means of the CALL statement, and provide these functions:

Image Generation:

Routines to generate basic display elements such as points, lines, and characters. Scissoring and scaling is performed as specified by the program.

Image Management:

Routines to manipulate image elements (called entities) by name for purposes of visibility (display/non-display), light pen control (detect/no detect) and modification (replace, delete, extend).

Attention Handling:

Routines to allow specification of attentions to be processed or ignored and to request available attention data for manipulation.

Operator-Program Communication:

Character Input -- Routines to automatically collect data from the Alphameric Keyboard to construct messages (Cursor functions are included).

Light Pen Tracking -- A sophisticated tracking capability allowing linear tracking (rubber banding), curve tracking (sketching) or discrete point definition.

Input/Output:

Routines to start and stop the display and light the programmed function keyboard indicators in any combination.

Assembler Language Support:

In addition to the GSP, the 1130 Assembler will include all the 2250 Model 4 order mnemonics.

Minimum system requirements: Programs using the GSP may be executed on any 1130 computing system having 8,192 words of core storage, disk and an attached IBM 2250

Display Unit Model 4. Although the programmer is not required to utilize the total Graphic Subroutine Package, it is anticipated that an effective graphic application will require 16K words of 1130 core storage.

Reference Manual

IBM 1130/2250 Graphic Subroutine Package, Preliminary Specification, C27-6934.

Basic Program Material ... 1130-LM-008

SRL Publication - IBM 1130/2250 Graphic Subroutine Package for Basic FORTRAN IV, C27-6934-1.

Documentation - Program Material List and an attachment to users.

Machine Readable - Object Decks provided in card form.

FORTRAN Subroutines for Data Transmission Between a System/360 and an 1130 System:

These routines provide for data transmission between a S/360 and a remote 1130 Computing System over established communication lines. The user, by means of FORTRAN CALL statements, can transmit control information and data between two programs, one in the 1130, and one in the S/360. These programs will normally be started in each processor by the Satellite Graphic Job Processor but can be started by any procedure.

Use of the transmission subroutines makes it possible for an 1130 program to use the high speed computational capability and large storage capacity of OS/360, thus increasing the flexibility and efficiency of the 1130 application.

The transmission subroutines use OS/360 BTAM facilities and a specialized synchronous communication adapter subroutine under the 1130 Monitor System, Version 2, to accomplish the actual data transmission. However, the FORTRAN programmer will be able to program the data communication with no knowledge of binary synchronous communications.

The transmission subroutines enable the OS/360 FORTRAN programmer to:

- Initialize the communications lines.
- Read and write data via the communications lines.
- Test and status of the previous request for a read or write operation.
- Activate a user-written synchronous routine in the 1130.
- Terminate the 1130 main-line program.
- Logically terminate the communications hookup.

Similar functions are performed by transmission subroutines available to the 1130 FORTRAN programmer, except that the 1130 does not have the facility to terminate an OS/360 program.

Conversion subroutines are provided to resolve FORTRAN differences between the internal data structure of the System/360 and the 1130. These subroutines (available to the OS/360 program only) perform the following conversions:

- 1130 integer format to OS/360 integer format, and vice versa.
- 1130 standard-precision real format to OS/360 standard length real format, and vice versa.
- 1130 extended-precision real format to OS/360 double-precision real format, and vice versa.

In addition, the conversion subroutines can be used to reverse the main storage position of elements when arrays containing alphanumeric data are transmitted from one system to the other. This preserves the readability of alphanumeric messages despite differences in the arrangement of array elements in the two systems.

System Requirements:

- Operating System/360 MFT-II, or MVT Model 65 Multiprocessing. While PCP can be used it is not a practical environment because it does not support multitasking or the Satellite Graphic Job Processor.
- A 2701 Data Adapter Unit or 2703 Transmission Control Unit capable of supporting Binary Synchronous Communications in half-duplex, point-to-point environment. The 2701 or 2703 must be designated for use with EBCDIC. Users of the Dual Code Feature on the 2701 must specify EBCDIC as Code A. Users of the Dual Communications Interface on the 2701 must specify the 1130 system line as Interface A.
- An IBM 1130 Computing System operating under the 1130 Monitor System, Version 2 with at least 8K of core storage and the Synchronous Communications Adapter.

Users who want to employ switched network data sets will be required to perform their own manual or program-controlled procedures to establish the point-to-point environment necessary for the data transmission subroutines.

Basic Program Package: 1130-LM-011

Documentation: IBM System/360 Operating Systems and 1130 Disk Monitor System: System/360-1130 Data Transmission for FORTRAN (C27-6937) ... Program Material List ... Attachment to Users.

Machine Readable: Object code.

Optional Program Package:

Documentation: Program Material List ... Attachment to Users ... Operating Instructions.

Machine Readable: Source modules.

Satellite Graphic Job Processor: 1130-CQ-012

The Satellite Graphic Job Processor (SGJP) permits OS/360 job definition and initiation from a 2250 Display Unit attached to a remote 1130 Computing System. SGJP enables the user who is unfamiliar with either the 1130 or OS/360 to define an OS/360 job to run in conjunction with a related 1130 program. OS/360 system messages are routed by SGJP to the 1130 for optional printing. The programming to transmit control information and data between the programs in each processor is not provided by SGJP and must be part of the application. FORTRAN Subroutines for Data Transmission between a System/360 and an 1130 system will normally be used for this purpose.

SGJP can also be used to specify and queue OS/360 jobs for normal batch processing under MFT-II or MVT from the 2250. Output from these jobs is produced as normal OS/360 output, and not routed to the originating 1130.

SGJP is an extension of the OS/360 Graphic Job Processor (GJP).

Up to 14 remote 1130/2250 systems can be attached to a System/360 for SGJP operations. If batch jobs are included in OS/360 and/or GJP is being used, the number of batch partitions or regions, plus the number of local 2250s (for GJP operations) plus the number of 1130/2250 systems (for SGJP operations) must not exceed 14.

SGJP facilitates the initiation of jobs by requesting OS/360 and the related 1130 job control information from a user through a series of displays. The user responds to the displays by entering requested information or by selecting appropriate options with the light pen or the alphanumeric keyboard. Job control information for an OS/360 job is transmitted to the OS/360, converted to Job Control Language, and used to initiate the desired job in a region or partition associated with the 1130/2250 subsystem. Information about an 1130 program is used to initiate that program in the 1130.

SGJP enables the remote 1130/2250 user to:

- Identify himself to the OS/360 (LOG ON)
- Define and start execution of an OS/360 procedure as a job (BEGIN PROCEDURE)
- Define an OS/360 program or cataloged procedure to be executed as a job step (SPECIFY JOB STEP)
- Define data sets to be used by the OS/360 program (DESCRIBE DATA)
- Define an 1130 program to run in conjunction with the OS/360 program (SPECIFY 1130 PROGRAM)
- Start execution of the specified OS/360 and 1130 programs (BEGIN JOB)
- Communicate with OS/360 operator (WRITE MESSAGE)
- Enter 80-character data records to be used by the OS/360 program (ENTER DATA)
- Delete a job he is currently defining, but has not yet initiated (CANCEL JOB)
- Re-examine previously completed job control operations (RECALL)
- Conclude his job definition and prepare the 2250 for the next user (LOG OFF)

System Requirements:

- An IBM 1130 Computing System including:
 - The 1130 Monitor System, Version 2 with at least 16K of core storage and the Synchronous Communications Adapter.
 - A 1132 Printer or 1403 Printer (If a Printed Record of Operations Performed is desired).
 - A 1442 Card Read/Punch, or a 2501 Card Reader and a 1442 Card Punch.
- A 2250 Display Unit Model 4 equipped with the light pen and alphanumeric keyboard.
- Operating System/360 MFT-II, MVT or MVT Model 65 Multiprogramming.
- A 2701 Data Adapter Unit or 2703 Transmission Control Unit capable of supporting Binary Synchronous Communications in half-duplex, point-to-point environment. The 2701 or 2703 must be designated for use with EBCDIC. Users of the Dual Control Feature on the 2701 must specify EBCDIC as Code A. Users of the Dual Communications Interface on the 2701 must specify the 1130/2250 subsystem line as Interface A.

Users who desire to employ switched network data sets will be required to perform their own manual or program controlled procedures to establish the point-to-point environment necessary for the data transmission.

Basic Program Package 1130-CQ-012

Documentation: IBM System/360 Operating System and 1130 Disk Monitor System: User's Guide for Job Control from an IBM 1130 System (C27-6938) ... Program Material List -- Attachment to Users.

Machine Readable: Object code.

Optional Program Package

Documentation: Program Material List ... Attachment to Users ... Operating Instructions.

Machine Readable: Symbolic modules.

Remote Job Entry Work Station: 1130-CQ-009

The 1130 Remote Job Entry Work Station Program, operating within the 1130 Disk Monitor Version 2 environment, has ability to enter OS/360 jobs from a remote 1130 to be executed on a central System/360 Model 50, 65, 67 (65 mode), 75, 85, 91 or 195. The program reads job input and RJE commands from an attached input device, transmits data to and receives data from the central processor, and writes output to an attached printer, punch or disk. As an option, disk output may be replaced by a user-written routine. 16K words of main storage is normally required if a user-written output routine is included. However, a limited user-written routine can be included in an 8K machine, depending on the configuration. The 1130 RJE program operates with Remote Job Entry under OS/360. Communication is in binary synchronous mode on a point-to-point leased line, a multipoint leased line, or on a point-to-point switched network.

Minimum System Requirements: An 8K word 1131 Model 2 or 5 ... 1442 Card Read Punch Model 6 or 7, or 2501 Card Reader Model A1 or A2 and 1442 Card Punch Model 5 or 1142 Card Read Punch Model 6 or 7 ... 1132 or 1403 Printer ... Synchronous Communications Adapter.

I/O Devices Utilized: 1442 Card Read Punch Model 6 or 7 ... 2501 Card Reader Model A1 or A2 ... 1442 Card Punch Model 5 ... Keyboard/Console Printer ... 1403 Printer Model 6 or 7 ... 1132 Printer Model 1 ... 2310 Disk Storage Models B1 and B2 and internal disk drives ... 2315 Disk Cartridges ... Synchronous Communications Adapter ... 2311 Disk Storage Models 11 and 12.

Reference Material: IBM 1130 Disk Monitor System, Version 2, Programming and Operators Guide, C26-3717.

Basic Program Material: (1130-CQ-009)

SRL Publication -- IBM System/360 Operating System, Remote Job Entry, C30-2006.

Documentation -- Program Material List ... Attachment to Users.

Machine Readable Material -- Available in card form.

1130 Macro Assembler and Macro Update Facility: An Enhancement to the IBM 1130 Disk Monitor System, Version 2 -- Available only under the IBM 1130 Disk Monitor System, Version 2. It is a direct extension of and a replacement to the existing DM2 assembler (ASM) and is entirely compatible in syntax and language usage. It is available at no charge.

Description

- Introduces high level language capability, specified by the customer.
- Decreases customer programming effort through the development of his own application or systems oriented macro libraries.
- Provides full library facilities for user macros.
- Enables your customer to create a language suitable to his unique environment.

Features
Macro Definition

MAC - Start user macro
 SMAC - Start system macro
 MEND - Macro end

Conditional Assemblies

AIF, AGO - Provide for conditionally or unconditionally passing over and not assembling blocks of code.

Symbol Redefinition

SET - Permits redefinition of a symbol without a multiple definition error occurring.

Library Purging

PURG - Removes macro name from the users library.

Macro Update Facility

MUP - Provides the following facilities for maintaining user macro libraries.

- initializes disk space for user macro libraries
- purge system macros and reclaim space
- insert or delete individual statements within macros rename a macro
- add new macros to library
- physically or logically join libraries
- obtain listing of macro libraries

Performance

The macro assembler performs as efficiently as the existing DM2 Assembler when used for assembling non-macro code.

Compatibility

The macro assembler is language compatible with the 1800 Macro Assembler, operating under MPX Version 2 announced in P69-79.

Object modules are not 1800 compatible.

The language is a superset of the present 1130 assembler language.

The macro capability of the 1130 Macro Assembler restricts the number of in-core symbols to 217 less than the number supported by the current Disk Monitor, Version 2 Assembler. This restriction applies only to systems with 8K core or above; the 4K core user will not be affected. For all users, overflow sectors in disk working storage for programs with large symbol tables may still be specified. (See "Assembler" section of SRL IBM 1130 Disk Monitor System, Version 2, Programming and Operator's Guide - C26-3717)

Disk Utilization Requirements

These programs require an additional 5 cylinders of disk space for residence over the space now required for the assembler program.

Programming Systems

These programs are written in assembler language, and run under control of the IBM 1130 Disk Monitor, Version 2.

Machine Configurations

These programs run on any 1130 disk configuration. However, 8K words of core (or more) are a requirement for the macro features.

1130 Distributed System Program (1130-SV-002): The 1130 Distributed System Program (1130 DSP), 1130-SV-002,

a Type I Extension, provides means for operating an 1130-System/7 multisystem configuration as a single system with distributed facilities. This program provides the capability to operate 1130-System/7 Multisystem Support programs in the foreground, concurrently with Disk Monitor batch programs in the background.

1130 DSP supports multisystem operation of the 1130 System coupled to the System/7 via the 1130 Storage Access channel. The facilities provided by 1130 DSP are:

- Support for the exchange of data, programs, and tasks between systems (Multisystem Support).
- Enhancements to the 1130 Disk Monitor Programming System which provide for background execution of batch programs concurrently with sensor-based System/7-related application programs in the foreground (Foreground/Background Support).

Multisystem support is provided to link the computers together so that each may communicate with and draw upon the resources of the other. Each computer may be assigned the tasks for which it is best suited, while providing the user with a convenient interface for application programming.

These facilities parallel those of the IBM 1800 Distributed System Program which supports the system comprising one or more System/7s coupled to an IBM 1800 Data Acquisition and Control System via a telecommunications link. Multisystem application programs that are written using the facilities of 1130 DSP can be transferred to an IBM 1800 System operating with 1800 DSP with little or no modification.

The 1130 Foreground/Background Support makes it possible to add sensor-based applications to an 1130 Computing System while maintaining the batch job processing environment of the Disk Monitor System. The 1130 DSP Foreground/Background Support permits the basic 1130-System/7 Multisystem support functions to be co-resident in the 1130 with Disk Monitor batch programs.

Under the Foreground/Background mode of operation, Multisystem Support functions are processed in the 1130 on a priority basis, responding to the demands of the System/7 program. The Foreground/Background Support will interrupt and restore Disk Monitor batch jobs, as required by System/7, in a manner which is transparent to the batch program. The user, writing batch programs for concurrent operation with Multisystem Support, need only be concerned with the foreground operation insofar as it affects the amount of 1130 core storage available for background programs. If sufficient 1130 core storage is available, many existing user-written batch programs will run under 1130 DSP Foreground/Background Support if the programs are recompiled.

Highlights:

- Concurrent operation of 1130-System/7 Multisystem Support with Disk Monitor batch jobs.
- Minimal batch program modification required to run with Foreground/Background Support.
- Data Acquisition and Control application programs can use the facilities of both the 1130 and the System/7.
- Multisystem support compatible with 1800 DSP.
- All 1130 DSP user subroutines in the 1130 are FORTRAN callable.

Special Sales Information: 1130 DSP Multisystem Support can be used in a wide range of sensor-based applications including Laboratory Automation, Process Control, Manufacturing Testing, and Manufacturing Automation. Application programs written for 1130 DSP run under 1800 DSP, allowing easy growth. 1130 DSP Foreground/Background Support makes it possible to connect a System/7 to an installed 1130 system and add sensor-based applications with minimal impact on the 1130 Disk Monitor batch processing environment.

Use: Data acquisition and control application programs written to use the 1130-System/7 multisystem configuration will include calls to the 1130 DSP subroutines in 1130 resident programs and DSP Macros for System/7 resident programs. 1130 Disk Monitor batch programs written for concurrent operation with 1130 - System/7 Multisystem Support can use only the 1130 core storage available after providing residence for the Foreground/Background Support.

Customer Responsibilities: The customer must arrange for the installation of the devices listed under minimum machine configuration.

The customer must generate the 1130 DSP system (using 1130 Disk Monitor System generation procedures), define disk-resident files used by the Submonitor, specify the size of the Distributed System Partition (DSPAR), and assemble and build core loads for this area. These core loads must include the DSP Submonitor and may include user-written routines.

The code which is to be resident in System/7 must be assembled using the 1130 Macro Assembler and storage load for the System/7 generated. The MSP/7 facilities to be used in this storage load must be specified by using the MSP/7 configuration macros.

The foreground/background support is specifically designed to provide System/7 users with additional functional capabilities by relocating certain elements of 1130 DMS Version 2. Most 1130 programs, not employing the use of absolute addressing, may be re-compiled to operate in the background under 1130 DSP. As a result of this relocation, careful review is required of 1130 Type II, III and IV programs, and program products planned for execution in the background; for example COBOL will not execute without modification.

As with other systems, the customer is responsible for providing protection against accidental loss or misuse of his data.

Programming Systems:

1130 Programs: The IBM 1130 Disk Monitor System, Version 2, with modifications necessary to provide Foreground/Background Support, is distributed as a part of the IBM 1130 Distributed System Program (1130 DSP). All of the standard programming features of the IBM 1130 Disk Monitor System, Version 2, (1130-05-005) are available under 1130 DSP (for background programs), except for the 1130/2250 Graphic Subroutine Package.

Careful review is required of all RPQ devices which may be attached to interrupt level 3. This level is used by the System/7 Storage Access Channel attachment which may pre-empt other devices and their servicing routines.

Because the modified Disk Monitor is distributed as a part of the 1130 DSP, an existing Disk Monitor System cannot be modified to include 1130 DSP facilities. When Disk Monitor facilities are to be used with 1130 DSP, the 1130 DSP must be ordered and installed.

All of the 1130 resident subroutines of 1130 DSP are written in 1130 Assembler Language. Some of the 1130 DSP Utility Programs are written in 1130 FORTRAN Language.

System/7 Programs: The 1130 DSP System/7 routines use the macros provided by System/7 Modular System Programs (MSP/7). The MSP/7 Macros and the DSP Macros are written in System/7 Language which is assembled under the 1130 Macro Assembler.

Compatibility with IBM 1800 Distributed System Program (1800 DSP): To maintain compatibility with 1800 DSP application programs should be written observing the following conventions:

1. 1130 resident application programs written in 1130/1800 Basic FORTRAN IV Language must avoid the use of FORTRAN facilities which are peculiar to the 1130 operating system. FORTRAN programs must use the *ONE WORD INTEGERS control record.
2. Do not use subroutines which are unavailable in the 1800.
3. Communications between systems must use only the data, task, and program exchange facilities of DSP; e.g., a user program call to the 1130 SAC I/O Control Routine, is not allowed.

System/7 application programs will be compatible with either 1130 DSP or 1800 DSP if communications to the host use only the DSP data, task, and program exchange facilities. No direct use of the MSP/7 communication macros is allowed if 1800 DSP compatibility is to be maintained. Reassembly will be required however, when changing from 1130 to 1800.

Minimum Machine Configuration:

1130 System

- 1131-2B Central Processing Unit with 8,192 words core storage, single internal disk storage drive, 1442 Model 6 or 7 Attachment (#4454), Storage Access Channel (#7490 or #7492).
- 1442-6 Card Read Punch

This program will not operate on an 1130 System utilizing an 1131 Model 1, 4 or 5.

This minimum configuration provides the necessary storage for many functional subsets of the full DSP system.

The 1130 Distributed System Program is a modular series of subroutines. This makes it possible for the user to incorporate into his system only those DSP functions required for his application. The selection of DSP modules is accomplished by using the *EQUAT feature of the 1130 Disk Monitor System, Version 2 to replace unneeded subroutines with a DSP provided dummy subroutine.

The major DSP functions not included in the minimum configuration are System/7 requests for executing programs in the 1130 at the foreground level, priority batch level, and System/7 batch level.

The minimum configuration is utilized as follows:

	Words
Resident Monitor (including DISKN and the Monitor Extension required for DSP)	1280
User's Area (Minimum size for operation of DUP, FORTRAN, and Assembler)	3616
DSP Submonitor (maximum size)	3296 8192

User-written programs operating in the User's Area must also include approximately 100 words for subroutine calls for 1130 initiated transactions and 200 words if logging and checkpointing of 1130 transactions is also specified.

The Macro Assembler and the Macro Update program require a User Area of 6912 words for operation. These programs can be run in an off-line mode in the minimum configuration or on-line in a larger configuration of 16,384 or 32,768 words.

Following are examples of storage assignments for two functional DSP subsets. These DSP subsets will execute in the minimum configuration DSP submonitor (with LOCALs).

EXAMPLE 1

System/7 Satellite System - Data Spooling to 1130 Disk Files

DSP functions supported are:

- 1130 originated DGETD and DPUTP
- System/7 originated DPUTD and DGETP
- IPL of System/7 from 1130 disk file
- Special data file, .COR in the System/7
- Named 1130 disk files

LOCALing of some DSP subroutines is required to support these functions in the minimum system configuration. The submonitor for this subset consists of the following:

	Words
DSPAR Fixed Area	62
DSPAR Communication Buffer	322
1130 DSP Subroutines including maintenance reserve	2146
ILS Routine, Transfer Vector and Core Load Header	134
LOCAL Table, FLIPR, LOCAL Area	632
	3296

Data is spooled to the 1130 disk from the System/7 at intervals controlled by timer interrupt, experiment parameters, etc. This data can later be reduced on-line as additional spooling is proceeding. During the spooling operation, all of the normal DUP, ASM, and FOR functions are available to run in the User's Area as well as user programs that will execute in 3616 words of storage.

EXAMPLE II

System/7 Satellite System - 1130 Initiated Transactions

DSP functions supported are:

- 1130 Originated DGETD, DPUTD, DPUTP, DXEQP
- IPL of System/7 from 1130 disk file
- Special data files .COR, .FOR, .COM
- Named disk files
- DSP COMMON in both the System/7 and 1130
- Transaction Logging
- Completion tasks in System/7

LOCALing of some DSP subroutines is required to support these functions in the minimum system configuration. The Submonitor for this subset consists of the following:

	Words
DSPAR Fixed Area	62
DSPAR Communication Buffer	322
DSP COMMON (100 words)	102
1130 DSP Subroutines including maintenance reserve	2004
ILS routine, Transfer Vector, and Core Load Header	144
LOCAL TABLE, FLIPR, LOCAL Area	662
	3296

For this configuration the 1130 makes all requests for data or task transfer. This type of operation can be used in the controlled experiment environment or any application where the 1130 controls the entire operation. During the Satellite operation, all normal DUP, ASM, and FOR functions are available to run in the User's Area. The Macro Assembler and the Macro Update program require a User's Area of 6912 words for operation. These programs can be run in an off-line mode in the minimum configuration or on-line in a larger configuration of 16,384 or 32,768 words.

A maximum DSP configuration which provides all of the DSP facilities and which makes no use of LOCALing, thereby providing minimum response time, can only be configured in a 16,384 word (or larger) 1130. The storage requirements for this DSP Submonitor are given below.

	Words
DSPAR Fixed Area	62
DSPAR Communication Buffer	322
DSPAR COMMON (100 words)	102*
DSPAR Queues (10 entries each - three queues)	96*
In-Core FLET Table (10 entries)	44*
1130 DSP Subroutines resident in DSPAR (including maintenance reserve)	5725
ILS Routine, Transfer Vector, and Core Load Header	158
	6509

*Size may be user defined.

A DSP configuration which provides all of the DSP facilities but makes use of maximum LOCALing of DSP subroutines, can only be configured in a 16,384 word (or larger) 1130. The storage requirements for this DSP Submonitor are given below.

	Words
DSP Fixed Area	62
DSPAR Communication Buffer	322
DSPAR COMMON (100 words)	102*
DSPAR Queues (10 entries each - three queues)	96*
In-Core FLET Table (10 entries)	44*
1130 DSP Subroutines (including maintenance reserve)	4210
ILS Routine, Transfer Vector, and Core Load Header	160
LOCAL Table, FLIPR, LOCAL Area	650
	5646

In the above two configurations, User's Areas of approximately 8600 and 9450 words respectively are provided for operation of user programs and 1130 Disk Monitor System programs in a 16,384 word 1130 System.

Any program which required all of an 8192 word 1130 under the 1130 Disk Monitor System, Version 2, will require a 16,384 word 1130 when run with 1130 DSP.

System/7:

5026	Enclosure, Model A02
5010	Processor Module, Model B04 (with 4,096 words of storage, 1130 attachment, and Operator Station Adapter)
5028	Operator Station
	One I/O Module (such as 5014 or 5012)

Following are the System/7 storage requirements for code generated by DSP and the prerequisite MSP/7 Macros for the minimum configuration.

	Words
DSP Macros	600
MSP/7 Macros (including Interrupt Handling Queueing, Program Interrupt, and Operator Station I/O Control)	1200
	1800

This allows approximately 2300 words for the user's application program in the minimum System/7 configuration of 4096 words.

Disk Storage Requirements:

Following are disk storage requirements for the components of 1130 DSP:

	Sectors
Modified 1130 Disk Monitor System	708
1130 DSP Subroutines and Utilities	105
1130 DSP Save Areas, System/7 Storage Dump Area, and Transaction Log Area	128*
Sample Problem	89**
DSP Macro Library	40
MSP/7 Macro Library, Output Handler and Required Subroutines	406

*The size of these areas, except the transaction log area, can be set by the user for his configuration. The default sizes received with the system are as follows: (1) The transaction log is one sector, (2) The save areas are 32 sectors each and are designed to save an 8K or smaller User's Area, and (3) The System/7 dump area is 52 sectors, large enough for a 16K System/7 storage dump. These areas are configured in a 16 cylinder Fixed Area (128 sectors).

**The sample problem can be deleted making this area available after the problem is run. The total disk requirements for the modified Disk Monitor System, DSP subroutines and utilities, save, dump, and log areas, DSP macro library, and MSP/7 macro library and output handler are 1387 sectors of the 1600 sectors available.

With this configuration, 213 sectors are initially available for working storage (if the sample problem has been removed). As user programs are stored to the disk, the size of working storage decreases. If the working storage required to assemble System/7 storage loads exceeds that available on the disk, a two drive system may be required.

If the MSP/7 macro library is to be kept on a separate MSP/7 cartridge along with the DSP macro library, the disk storage requirements for the DSP cartridge are 941 sectors, and the requirements for the MSP/7 cartridge are increased by 40 sectors for the DSP macro library.

Users will not be able to interchange disk cartridges (in order to execute programs that are resident on another disk) while the system is on line because the User's Area may have been saved on the disk and must be available to be restored. Users with limited space for storage of programs, will require two disk drives to allow access to all programs at any one time.

Programming Service Classification: A

Basic Material:

Documentation: Program Directory ... One copy each of IBM 1130 Distributed System Program, Program Reference Manual (GH20-1144) and IBM 1130 Distributed System Program Operations Guide (GH20-1145).

Machine Readable Material: Object decks and sample program are available on two 2315 Disk Cartridges, or on 80-column cards.

Optional Program Material:

Machine Readable Material: Source assembler language coding for the DSP system programs, subroutines, and macros.

Ordering Information: Program Number 1130SV002 (use form Z120-1957).

	Program No. Extension	Distribution Type	Medium Code	User Volume Requirement
Basic †	None	2315 Disk	58	2 - 2315 Disks
	None	Cards	15	None
Optional	None	MT 9/800	28	1 - 2400' reel
	None	MT 9/1600	29	1 - 2400' reel

Additional Program Material: IBM Distributed System Program General Information Manual (GH20-0080-3).

† May be ordered on cards only if 1130 system configuration does not include a 2310 Disk Drive, or the Single Disk Drive in the 1131 CPU.

ORDERING INFORMATION

	<u>Program Number Extension</u>	<u>Distribution Medium Type</u>	<u>Code</u>	<u>User Volume Requirement</u>
1130S006 Basic Optional	none Same as 1130S005	PT	05	none
1130LM008 Basic Optional	none none	Cards MT 9/800 DTR 9/1600	15 28 29	none 01 none
1130LM011, 1130CQ009 and 1130CQ012 Basic Optional	none none	Cards DTR 9/800 DTR 9/1600	15 28 29	none none none
1130F0001 Basic Optional	none See 1130UT002	Cards	15	none
1130LM001 Basic Optional	none See 1130UT002	Cards	15	none
1130RG007 Basic Optional	none none	Cards MT 9/800 MT 9/1600	15 28 29	none 01 01
1130SP001 Basic Optional	none See 1130UT002	Cards	15	none
1130SP002 Basic Optional	none See 1130UT002	PT	05	none
1130UT001 Basic Optional	none See 1130UT002	Cards	15	none
1130UT002 Basic	none	PT	05	none
1130 SV002 Basic Optional	none none	2315 MT 9/800 MT 9/1600	58 28 29	02 02 01

OPTIONAL PROGRAM PACKAGE

Documentation - Program material list, Operating Instructions, and attachment.
Machine Readable - Source modules are available on the programs listed below:

1130 Disk Monitor Version 2 Card	1130-OS-005
Paper Tape	1130-OS-006
Satellite Graphic Job Processor	1130-CQ-012
1130/2250 Graphic Subroutine Package	1130-LM-008
FORTRAN IV Subroutines for Data Trans- mission between S/360 and 1130	1130-LM-011
1130 Remote Job Entry Work Station	1130-CQ-009
FORTRAN Compiler (Card)	1130-FO-001
FORTRAN Compiler (Paper Tape)	1130-FO-002
Subroutine Library (Card)	1130-LM-001
Subroutine Library (Paper Tape)	1130-LM-002
Card System Error-Detection Aids	1130-SP-001
Assembler Program	1130-SP-002
Utility Routines (Card)	1130-UT-001
Utility Routines (Paper Tape)	1130-UT-002
1130 RPG Computer	1130-RG-007
1130 Distributed System Program (1130 DSP)	1130-SV-002

ADDITIONAL PROGRAM MATERIAL

Program Logic Manuals

1130 Disk Monitor Programming System	GY26-3714
1130/1800 Programming Systems, Card/Paper Tape	GY26-3620
1130/2250 Graphic Subroutine Package	GY27-7174
1130 Remote Job Entry Work Station	GY30-1001
1130 RPG	GY21-0010
1130 DSP	GY30-0786

Program Listings: Listings are available on microfiche from -- IBM Distribution Center, Publication Order Department, Mechanicsburg, Pa. Specify order supply number.

Order supply number	GJD1-3000 for 1130 Card/Paper Tape System
	GJD1-3040 for 1130 Disk Monitor System, Ver- sion 2
	GJD1-3050 for 1130/2250 Graphic Subroutine Package
	GJD1-3060 for 1130 Remote Job Entry Work Station
	GYB0-0791 for DSP

Optional Machine Readable Material - Source Code for the following 1130 programs is available on one functional volume:

FORTRAN Compiler (Paper Tape)	1130-FO-002
Subroutine Library (Card)	1130-LM-001
Subroutine Library (Paper Tape)	1130-LM-002
Card System Error-Detection Aids	1130-SP-001
Assembler Program	1130-SP-002
Utility Routines (Card)	1130-UT-001
Utility Routines (Paper Tape)	1130-UT-002

Ordering Information = System Number 1130

Note: The Optional Machine Readable Material for the above 1130 programs is ordered by specifying a "System Line" (columns 1-7, 15-24) and "Component Lines" (columns 8-12) of the program order form. Enter a separate component line for each component desired. Also, specify program number extension "OPT1".

(Reverse side is blank)

	<u>Program Number Extension</u>	<u>Distribution Medium Type</u>	<u>Code</u>	<u>User Volume Requirement</u>
Optional	OPT1	MT	9/800 28	01
		MT	9/1600 29	01

1800 Assembler Language: The IBM 1800 Assembler Language provides the programmer a flexible and meaningful symbolic language that is easier to code than a binary machine language.

Source programs are assembled by the processor in two passes. The Assembler automatically assigns and keeps a record of storage locations and checks for coding errors. By relieving the programmer of these burdensome tasks, the Assembler significantly reduces the amount of programming time and effort required to prepare a program.

A Compressor Program is provided with the Assembler to compress symbolically assembled output into a form suitable for execution.

The Assembler and its compressor always use all of core storage available on an assembly machine. The programs determine memory size automatically at assembly time and adjust table parameters accordingly.

The Assembler provides for assembly of both absolute and relocatable mainline programs, and for assembly of relocatable subroutines. By means of ENT and CALL statements, provision is made for automatic symbolic cross-referencing between programs at load time. The Assembler may be used to generate subroutines and subprograms for FORTRAN main programs. Similarly, Assembler main programs may call FORTRAN subroutines or subprograms, as well as Subroutine Library and Utility Routines.

A Core Image Converter is provided which will convert the relocatable binary object decks of a mainline and all called subroutines into a single core image binary deck. This deck may then be loaded with a Core Image Loader which has no relocating or cross-referencing abilities.

Minimum system requirements: For program generation and execution: A 4096 word 1801 or 1802 Processor-Controller ... 1442 Card Read Punch mdls 6 or 7 or 1054 Paper Tape Reader and 1055 Paper Tape Punch.

Processor-Controller supported: an 1801 or 1802 with 4, 8, 16 or 32K words of core storage (Note: 24K is not supported).

Basic Program Material:

SRL Publication -- 1800 Card/Paper Tape Programming System, Operator's Guide, C26-3751.

Documentation -- Program Material List.

Machine Readable -

1800-AS-005 (Card)

Deck No. 1	Assembler
2	Compressor
3	Sample Program

1800-AS-006 (Paper Tape)

Tape No. 1	Assembler (unedited)
2	Compressor (unedited)
3	Assembler Sample Program

1800 FORTRAN Language: The IBM 1800 FORTRAN Language is a coding system with a language that closely resembles the language of mathematics. It is a system designed primarily for scientific and engineering computations. Since this system is essentially problem-oriented rather than machine-oriented, it provides scientists and engineers with a method of communication that is more familiar, easier to learn, and easier to use than actual machine language.

The FORTRAN processor accepts source program statements as input from cards or paper tape and produces, as output, a machine language program. At object time, the system utilizes advanced techniques, such as relocatable subroutines, highly compressed formats, and flexible input and output command structures which facilitate data conversion operations. The FORTRAN Language optimizes redundant subscript calculations to produce an efficient object program. The FORTRAN Language provides a high level of language power and flexibility with minimal machine requirements. The machine features supported at execution time are the 1442 Card Read Punch mdl 6 or 7, 1816 Printer-Keyboard, 1053 Printer, 1443 Printer mdl 1 or 2, 1054 Paper Tape Reader and 1055 Paper Tape Punch, 2401/2402 Magnetic Tape Units mdl 1, 2, or 3, Analog Output, Analog Input, Contact Sense, and Contact Operate. The maximum number of words available on the computer can be utilized at both compile and execute time.

A source program written in the 1800 FORTRAN Language is processed by the FORTRAN Compiler to produce an 1800 System machine language program. The 1800 System Loader, Input/Output Routines for I/O function, and the System Subprograms will be loaded with the compiled program prior to execution.

The 1800 FORTRAN language encompasses American Standard Basic FORTRAN, X31-1966, with extension beyond this standard. These extensions are shown in C26-3715, IBM 1130/1800 Basic FORTRAN IV Language.

Minimum system requirements: For compilation: A 4096 word 1800 System Processor-Controller ... 1816 Printer-Keyboard or 1053 Printer or 1443 Printer ... 1442 Card Read Punch mdl 6 or 7 or 1054 Paper Tape Reader and ... 1055 Paper Tape Punch.

Processor-Controller supported: an 1801 or 1802 with 4, 8, 16 or 32K words of core storage (Note: 24K is not supported).

Basic Program Material:

SRL Publication -- 1800 Card/Paper Tape Programming System, Operator's Guide,

C26-3751.

Documentation -- Program Material List.

Machine Readable -

1800-F0-007 (Card)

Deck No. 1	Compiler (unedited)
2	FORTTRAN Compiler Editor
3	FORTTRAN Sample Program

1800-F0-008 (Paper Tape)

Tape No. 1	FORTTRAN Input Phase for 1816/1053 (unedited)
2	FORTTRAN Input Phase for 1443 (unedited)
3	Part 2 of FORTRAN Compiler for 1816/1053
4	Part 2 of FORTRAN Compiler for 1443
5	FORTTRAN Compiler Editor
6	FORTTRAN Sample Program

1800 Subroutine Library: The 1800 Subroutine Library provides arithmetic, functional, code conversion, I/O control and selective dump subroutines for use by object programs generated by the 1800 Assembler of the 1800 FORTRAN Language.

The floating-point subroutines in the 1800 Subroutine Library offer two ranges of precision: Standard Range and Extended Range. The Standard range provides 23 bits of precision; the Extended range provides up to 31 bits of precision.

The subroutines provided include Floating-Point Fixed Point, Special Function, Code Conversion, I/O Control, and Selective Dump.

The subroutines are used by FORTRAN Language or Assembler object programs to perform floating-point, fixed-point arithmetic, and functional operations; the conversion of data from one I/O code to another; the control of I/O activity on the devices attached to the system; and the selective dumping of memory areas for debugging purposes.

Minimum system requirements: An 1800 System with an 1801 or 1802 Processor-Controller with 4096 words of core storage and applicable I/O equipment is required for execution of the subroutines.

Machine features and units supported: An 1801 or 1802 Processor-Controller with 4, 8, 16, or 32K words of core storage (Note: 24K is not supported) ... 1442 Card Read Punch mdls 6 and 7 ... 1054/1055 Paper Tape Attachment ... 1816 Printer-Keyboard ... 1053 Printer ... 1810 Disk Storage Drive mdls A1, A2, A3, B1, B2, and B3 ... 1443 Printer mdls 1 and 2 ... 1627 Plotter mdls 1 and 2 ... 2401/2402 Magnetic Tape Units mdls 1, 2, and 3 ... Analog Input Basic for 1800 with all features ... Digital/Analog Output Feature ... Digital Input Feature.

Basic Program Material:

SRL Publication -- 1800 Card/Paper Tape Programming System Operator's Guide, C26-3751.

Documentation -- Program Material List.

Machine Readable -

1800-LM-003 (Card)

Deck No. 1A	Standard Precision (Calls)
1B	Extended Precision (Calls)
2	Common 2 Word Calls
3	Dump 80 Utility Program (unedited)
4	EOD1 Cards
5A	Standard Precision (LIBFs)
5B	Extended Precision (LIBFs)
6	Common LIBFs
7	ISS Routines (unedited)
8	Common LIBFs and Conversion Routines which must Follow ISS Routines
9	EOD2 Cards
10	Editor for Subroutine Deck 3 and 7

1800-LM-004 (Paper Tape)

Tape No. 1A	Standard Precision (Calls)
1B	Extended Precision (Calls)
2	Common Calls
3	Dump 80 Subroutines (unedited)
4	EOD1 Cards
5A	Standard Precision (LIBFs)
5B	Extended Precision (LIBFs)
6	Common LIBFs
7	ISS Routines with EOD2 Records (unedited)
8	Common LIBFs and Conversion Routines
9	EOD2 Records
10	Editor Subroutine for Tapes 3 and 7

1800 Utility Routines: The 1800 System Utility Routines are part of the basic programming system to be used by all 1800 installations. These programs will make it possible to program the 1800 in a wide range of data acquisition and real-time control applications.

The Utility Routines include: [1] An Input/Output routine which accepts data from one

of three input media (card, paper tape, magnetic tape) and outputs data to one or two of five output devices (card, paper tape, magnetic tape, typewriter and printer). When two output devices are required, one must be a print option (1043 or 1443 Printer). [2] Dump routines which permit the user to dump any area of memory; output can be obtained on cards, typewriter, printer or magnetic tape. [3] Loader routines - Relocating Loader, Core Image Converter, and Core Image Loader.

These routines provide the programmer with a versatile tool for transferring data from one medium to another, and also for performing the repetitive utility functions needed daily for most data processing installations. They also include routines to aid the user in debugging his programs. In addition, they provide the facilities for: Loading compressed binary object program cards in either relocatable or core image format ... generating object program core maps.

Minimum system requirements: A 4096 word 1800 System Processor-Controller ... 1053 Printer ... 1442 Card Read Punch mdl 6 or 7 or 1055 Paper Tape Reader and 1055 Paper Tape Punch.

Processor-Controller supported: an 1801 or 1802 with 4, 8, 16 or 32K words of core storage (Note: 24K is not supported).

Basic Program Material:

SRL Publications -- 1800 Card/Paper Tape Programming System Operator's Guide, C26-3751.

Documentation -- Program Material List

Machine Readable -

1800-UT-001 (Card Utility)

Deck No. 1	Relocating Loader
2	Core Image Loader
3	Core Image Converter/1443
4	Core Image Converter/1816
5	I/O Utility - Phase 1
6	I/O Utility - Phase 2
7	Users Exit Special User EOD Cards
8	Users Exit Overlay Cards
9	Dump Between Limits - Cards
10	Dump Between Limits - Console Printer
11	Dump Between Limits - Magnetic Tape
12	Core Dump - 1443
13	Relocatable Core Dump
14	One Card Dump on Console Printer
15	Keyboard to Paper Tape
16	Keyboard to Cards
17	Card Reproducing Routine
18	I/O Utility Edit Cards
19	DPIR

1800-UT-002 (Paper Tape)

Tape No. 1	Relocating Loader
2	Core Image Loader
3	Core Image Converter with 1443 Map
4	Core Image Converter with 1816/1053 Map
5	I/O Utility - Phase 1
6	I/O Utility - Phase 2
7	Users Exit Special User EOD Record
8	Users Exit Overlay Record
9	Dump Between Limits - 1816/1053
10	Dump Between Limits - Magnetic Tape
11	Core Dump - 1443 Printer
12	Relocatable Core Dump - 1443
13	Core Dump - 1816/1053
14	Keyboard to Paper Tape
15	I/O Utility Edit Record
16	DPIR
17	Construct
18	Paper Tape Reproducer

1800 Time-Sharing Executive System: The IBM 1800 TSX is a real-time programming system that affords the user a convenient means of generating and using a complete process control or data acquisition system. The system programs provided are:

Assembler Program

A one-for-one symbolic assembly program that produces object programs that can be used with the 1800 TSX from symbolic card input.

FORTRAN Compiler Program

Accepts 1800 FORTRAN language input in card form and produces object programs that can be used with the 1800 TSX. Both the FORTRAN written and Assembler written programs call on subroutines to perform various arithmetic and input-output functions.

Disk Utility Program (DUP)

The 1800 DUP is a group of generalized utility and maintenance routines that are necessary in the day to day operation of the TSX. These routines store user programs on disk, delete programs from disk, dump programs from disk and perform numerous other functions of a utility nature.

Nonprocess Supervisor

The Nonprocess Supervisor recognizes certain system control cards and transfers control to the system program specified. It also initializes the nonprocess system when a job control card is recognized.

Subroutine Library

A set of reentrant arithmetic, functional, and conversion subroutines are supplied with the 1800 TSX. A set of non-reentrant subroutines for use with TSX can be ordered separately [1800-LM-009].

The non-reentrant arithmetic, functional and conversion subroutines are the same in number and function as those reentrant subroutines provided by the 1800 TSX. These routines offer those users of the 1800 TSX system who do not need reentrant coded subroutines faster execution of their programs.

Simulator Program

The Simulator executes a program in a controlled environment for the purpose of debugging.

Process Supervisor

The Process Supervisor controls execution of process programs. It consists of the Skeleton Executive, error decision programs, and certain other on-line special purpose start-up and analysis routines. The Skeleton Executive is built up from routines the user has assembled or compiled. Many different options may be specified using equivalence statements when these routines are assembled. The user may include frequently called subroutines and high priority interrupt routines in the Skeleton. The control of timers and the scheduling of core loads and interrupt routines are handled by routines supplied by IBM and that the user assembles.

Efficiency

The efficiencies listed in the following sections vary depending on the machine configuration, disk and core layout, and the user program size and type. Execution times are based on large programs.

Approximate core storage and execution times:

Assembler

Core Storage Minimum 3692 at the high end of core

Disk Storage 48 Sectors

Speed

With 1442 Model 7 - No listing	320 cds/min
- 1443 (Mod 1) listing (52 char. set)	103 cds/min
- 1443 (Mod 2) listing (52 char. set)	140 cds/min
- 1053	17 cds/min
With 1442 Model 6 - No listing	250 cds/min
- 1443 (Mod 1) listing (52 char. set)	95 cds/min
- 1443 (Mod 2) listing (52 char. set)	125 cds/min
- 1053	16 cds/min

FORTRAN Compiler

Core Storage Minimum 3692 at the high end of core

Disk Storage 103 Sectors

Speed

Assuming a 150 statement program:	
Without punching	47 Statements/min.
With punching (assume 50 cds pch)	38 Statements/min

Disk Utility Program

Core Storage 3692 at the high end of core

Disk Storage 68 Sectors

Speed

The STORE operation varies in speed depending on the size of the program and the number and distance of the disk arm movements needed. This can vary from about 15 seconds to read in and execute the STORE routine for a short program to many hundreds of seconds to store the program under worst case conditions. Normally an assembled program will be stored in 15 or 20 seconds after the STORE control card is read by DUP.

Other DUP operations will not be performed often in most 1800 installations, so the time they require is not significant to the total use of the 1800.

Nonprocess Supervisor (with Core Load Builder)

Core Storage 3692 at the high end of core

Disk Storage 21 Sectors

Speed

The control card analyzer operates at card read speed for most control cards. The Core Load Builder requires from several seconds to about thirty seconds under the worst conditions. The normal time for an 8K core load is 7 or 8 seconds.

Simulator

Core Storage 3692 at the high end of core

Disk Storage 95 Sectors
Speed 150 to 1, ratio of Sim. speed to Exe. speed
Process Supervisor
Core Storage Minimum system (8K) must provide 4500 words for the in-core Skeleton if that Skeleton is to be used off-line with the Nonprocess Monitor. (This means that 3692 words will be available above the Skeleton for the Nonprocess Monitor.)
 If a separate Skeleton is used for off-line work, the on-line Skeleton may be 6392 words. (This leaves 1800 words for error decision programs at the high end of core storage.)
 The maximum size of the Skeleton is always determined by the balance of core storage above the Skeleton -- 3692 minimum for Nonprocess Monitor use or 1800 minimum for error decision program use.

Disk Storage 46 to 131 Sectors
Speed The speed of the execution of process core loads is dependent on what they have been programmed to do. The reading of core loads by the Supervisor is done with disk addresses that are in core when the new core load is called, for minimum delay. All process core loads are in core image and are obtained at disk read speed.
 Interrupts may be permanently in the Skeleton in core, on disk as interrupt core loads, or with mainline core loads. The in-core routines are entered most quickly, the routines with the mainline equally quickly if the mainline containing the interrupt routine is in core when the interrupt occurs, and the interrupt core loads least quickly since they must be read into core after saving the current contents on disk.
 Error decision programs are read into core after saving the 1800 words that they must occupy. If a dump to disk is included as an error decision option, the dump will write all of core to disk. These operations proceed at disk read-write speed.

Minimum System Configuration: The system requires an 1801 or 1802 Processor Controller with 8K of core storage ... a 1810 Disk Storage Drive model A1 or model B1 ... a 1053 Printer or 1443 Printer or 1816 Printer-KeyBoard ... and a 1442 Card Read Punch.

Additional Hardware Supported

Process Controller with 16, 24, or 32K words of core storage ... Up to eight 1053 Printers ... 1810 Disk Storage Drives models A2, A3, B2, or B3 ... 1442 Card Read Punch ... 1443 Printer.

The following are supported for the user but not for system generation

2401/2402 Magnetic Tape Unit ... 1627 Plotter ... 1054 Paper Tape Reader ... 1055 Paper Tape Punch ... Analog Input ... Digital Input ... Analog/Digital Output.

Reference Material: Microfiche Listings GJ1-3030 1800 Reference Summary System, Reference Data, GX26-5624; 1800 TSX System Program Logic Manual GY26-3702; 1800 Data Acquisition and Control System Functional Characteristics GA26-5918; 1130/1800 Plotter Subroutines GC26-3755. 1800 Time-Sharing Executive Concepts and Techniques GC26-3703; 1130/1800 Basic FORTRAN IV Language GC26-3715; 1800 Time-Sharing Executive System Subroutine Library GC26-3723; 1800 Assembler Language GC26-5882.

Basic Program Material: 1800-OS-001

SRL Publications -- 1800 Time-Sharing Executive System Operating Procedure, GC26-3754.

Documentation -- Program Material List.

Machine Readable -- Twenty-eight object decks and three source decks (one of which is a sample problem deck), available in card form.

Multiprogramming Executive System (MPX): The IBM 1800 Multiprogramming Executive Operating System is a partitioned, FORTRAN-oriented,

disk-based operating system intended for process control and data acquisition applications which have high system usage requirements.

Multiprogramming is regulated on the basis of I/O operation. When an I/O operation is initiated in one core storage partition, that partition can be placed in a suspended state until the I/O function is completed. Concurrently with this, a program loaded into a lower priority partition can also be executed. A programmed interrupt technique is used by the system to direct the levels of operation, thereby controlling the execution of any one of the areas at any moment in time.

The MPX system also provides for queueing of I/O operations as well as the ability to achieve overlap of I/O and computing. In addition, interrupt programs may be queued and executed on interrupt levels within a hierarchy of priority levels chosen by the user. Queueing and I/O overlap as used in the MPX system are designed to take advantage of the 15 cycle-stealing data channels and 24 interrupt levels.

In MPX main storage is allocated as follows:

- . The System Executive, which is always core resident.
- . Up to 23 partitions. Programs executed in these partitions are executed on an interrupt level. Special (SPAR) coreloads, which enable the user to modify his

high-priority interrupt subroutines in real-time, may reside in these partitions.

Variable core (VCORE), in which background processing can take place. This could contain a process coreload, a batch processing monitor program, or an interrupt coreload. When a program that is being executed in VCORE is interrupted by a higher priority VCORE program, the lower-priority program is saved on disk and the higher priority program is fetched and executed. All compilations, assemblies, etc. take place in VCORE.

Among the services provided by MPX to allow concurrent operation are: Loading programs into main storage ... Scheduling the use of programs for execution in main storage ... Switching control of the processor-controller from one function to another, based on I/O operation ... Controlling the execution of the various functions in accordance with a flexible hierarchy of priorities.

MPX also includes the 1800/2790 MPX Data Communications System, which supports the 1800/2790 Data Communications System. The following programs are a part of this system.

- . 1800/2790 Loop Adapter Input Output Control Routine (IOCR)
- . Data Control Program (DCP)
- . Message Assembly Director (MAD)

The 1800/2790 MPX Communications System will support two 2790 adapters, each with a maximum of 100 area stations, (IBM 2791 and IBM 2793 in any combination). The inclusion of the 1800/2790 MPX Communications System will be a user option exercised at the time the user generates his MPX System.

All 2790 input and output is controlled by the 2790 Adapter Input/Output Control Routine (2790 IOCR). This program controls the sending and receiving of all data to and from the adapter.

After data has been received from a device on the loop via the 2790 IOCR, the data is acted upon by the Data Control Program. The action to be taken by the Data Control Program on this data is defined by the user in the form of a Transaction Control List (TCL). The TCL consists of a set of defined procedures by which data is collected, inspected, routed, or rejected. Once data for a particular transaction has been collected by the DCP under the direction of the TCL, the data is passed on to the Message Assembly Director (MAD).

MAD routes the collected data to one of 30 selected output files. These files are defined by the user. After verifying that the data was transferred to the selected file, MAD releases the user's medium from the 2790 device.

Advantages: High throughput ... Fast response ... Efficient use of processor-controller time ... Ease in time-scheduling program execution ... Ability to modify IBM system programs in real-time ... Ability for the IBM Customer Engineer to run on-line diagnostics for the 1442 Card Read Punch, 1443 Printer, 1810 Disk Storage Unit, 2311 Disk Storage Unit, Communications Adapter, 1053 Printer, 1800/2790 Communications System, and analog input ... Processing of multiple foreground (process) and background (batch processing) operations ... System Residence on either the 1810 or the 2311 Disk Storage Unit ... Ability to update System/360 data banks through shared 2311 files ... Ability to provide real time process information to interconnected processors through the Communications Adapter (System/360, 1130, 2770, 2780, other 1800s) ... Disk input to the FORTRAN compiler and the macro assembler ... Keyboard input to the supervisor and DMP ... Up to 32 software timers, the number of which is customer selectable to provide minimum system overhead ... Ability for the user to define frequently used routines as macros and include them in the macro assembler library.

MPX consists of a System Executive, through which data acquisition and process control applications are serviced in real-time, and a Batch Processing Monitor, by which data processing is performed. Batch processing is done under control of BOM (Basic Operating Monitor) and process control under control of the System Executive. Listed below are the main components of MPX.

1. System Executive - that portion of the system that resides in core during the execution of various disk resident programs. It includes such functions as handling of interrupts, controlling user-specified sequence of execution of process control programs, and controlling the operation of batch processing in VCORE.
2. Batch Processing Monitor - provides various batch processing functions and operates under the control of BOM when control of the system is not held by the System Executive. The Batch Processing Monitor subcomponents are:
 - a. Batch Processing Supervisor - The Batch Processing Supervisor recognizes certain system control records and transfers to the system program specified. It also initializes the batch processing system when a job control record is recognized.
 - b. Disk Management Program (DMP) - The Disk Management Program is a group of generalized utility and maintenance programs that perform such tasks as storing user programs on disk, deleting programs from disk, dumping programs from disk, and installing system maintenance modifications.
 - c. Macro Assembler - Accepts 1800 Macro Assembler language input from either cards or disk and produces object programs that can be executed under MPX.
 - d. FORTRAN Compiler - Accepts 1800 FORTRAN language input from either cards or disk and produces programs that can be executed under 1800 MPX system.
 Programs written in both FORTRAN and the Macro Assembler language call on subroutines in the Subroutine Library to perform various arithmetic and input-output functions.
 - e. Builder - Builds coreloads and the System Executive.

3. BOM (Basic Operating Monitor) - controls the system generation process, provides for the definition of the system to the system generation process, and controls the batch processing operations.
4. Subroutine Library - consists of input/output, data conversion, arithmetic, functional, selective dump, and various machine function and real-time system subroutines.

Efficiency: The efficiencies listed in the following sections vary depending on the machine configuration, disk and core layout, and the user program size and type. Execution times are based on large programs and a 2 usec memory.

Approximate storage requirements and execution times:

Assembler

Core Storage	Minimum 5140 words at the high end of core	
Disk Storage	56 sectors	
Speed, Card Input		
With 1442 Model 7	- No listing	320 cds/min
	- 1443 (Mod. 1) listing (52 char. set)	103 cds/min
	- 1443 (Mod. 2) listing (52 char. set)	140 cds/min
With 1442 Model 6	- No listing	250 cds/min
	- 1443 (Mod. 1) listing (52 char. set)	95 cds/min
	- 1443 (Mod. 2) listing (52 char. set)	125 cds/min
	- 1053	16 cds/min
Speed, Disk Input		
With 1810-A2		
Source file not on Drive 0, no listing	1000 cds/min	
Source file on Drive 0, no listing	285 cds/min	
With 1810-B2		
Source file not on Drive 0, no listing	1050 cds/min	
Source file on Drive 0, no listing	900 cds/min	

Disk Storage
Speed

FORTRAN Compiler

Core Storage	Minimum 5140 at the high end of core	
Disk Storage	97 sectors	
Speed	Assuming a 150 statement program:	
With punching	47 statements/min	
With punching (assume 50 cols/cd)	38 statements/min	

Disk Management Program

Core Storage	5140 words at the high end of core
Disk Storage	166 sectors
Speed	The STORE operation varies in speed depending on the size of the program and the number and distance of the disk arm movements needed. This can vary from about 15 seconds to one minute to execute the STORE program for a short program under worst case conditions. Normally an assembled program will be stored in 35 or 40 seconds after the STORE control record is read by DMP.

However, depending on whether the assembled subroutine is reentrant makes a considerable difference in time to complete the STORE function. A reentrant subroutine causes the moving of all the non-reentrant subroutines in compliance with the system design of having all reentrant subroutines in one area and all non-reentrant subroutines in a separate area.

Since other DMP operations will not be performed as often in most 1800 installations, the time they require is not significant to the total use of the 1800.

Batch Processing Supervisor (with Builder)

Core Storage	5140 words at the high end of core
Disk Storage	44 Sectors
Speed	The control card analyzer operates at card read speed for most control cards. The Builder requires from several seconds to about two minutes to build a coreload under the worst conditions. The normal time for an 8K core load is 30 to 40 seconds.

System Executive

Core Storage	Following are examples of minimum System Executives:
	1. A single partition system. System Executive size, approximately 6550 words. Variable Core (VCORE) size, minimum 5140 words. The remainder of core storage can be added to VCORE or the System Executive. This system supports: One 1810 Disk Storage Unit Model A1 or B1 ... One 1442 Card Read Punch ... One 1053 Printer ... Analog Input ... Digital/Analog

Output ... Four interrupt levels ... Nine ILSW bits ... Sixteen PISW bits ... First-in-first-out queueing ... Batch processing

2. A system that provides multiprogramming and Batch processing System Executive size, approximately 7620 words; Partition 1 size, minimum 320 words; Partition 2 (VCORE) size, minimum 5140 words. The remainder of core storage could be allocated to any of the above partitions or to the System Executive. This system supports those features mentioned in example 1, and in addition:

1. Multiprogramming
2. Two partitions, one of which is VCORE
3. Interrupt level queueing

Partition 1 may be used for SPAR coreloads. If there are no other SPAR coreloads, the size of the System Executive can be reduced by exercising a system generation option that deletes the unneeded code.

3. A system that provides multiprogramming only. System Executive size, approximately 7520 words; Partition 1 size, minimum 320 words; Partition 2 size, minimum 320 words; The remainder of core storage could be allocated to any of the above partitions or to the System Executive. This system supports all of the features mentioned in example 2 except for batch processing.

24 to 87 sectors

The speed of the execution of process coreloads is dependent on what they have been programmed to do. For minimum delay the fetching of coreloads by the System Executive is done with disk addresses that are in core when the new coreload is called. All process coreloads are in core image format and are obtained at disk read speed.

Interrupt servicing subroutines may be part of the System Executive on disk as interrupt coreloads, or in SPAR coreloads. Interrupts may also be serviced by programs queued to partitions. The subroutines in the System Executive are entered most quickly, those in the current SPAR coreload almost as quickly, those interrupts serviced by queued programs much more slowly since they must be read into core from disk, and the interrupt coreloads least quickly since they must be read into core after saving the current contents on disk.

Approximate time to service various interrupts, assuming the interrupt is not masked and no cycle stealing is occurring are:

1. Time to execute first user instructions for an in-core system executive ISS Subroutine is 115 usec.
2. Time to execute first user instruction in a process interrupt subroutine that is in the System Executive is 343 usec.
3. Time to execute first user instruction of a process interrupt subroutine that is in a SPAR coreload core-resident is 343 usec.

Minimum System Requirements (without 2790): The IBM 1800 Multiprogramming Executive System requires at least: one 1801/1802 Processor-Controller with a minimum of 16,384 words of core storage ... one 1053 Printer or one 1816 Printer-Keyboard or one 1443 Printer ... one 1442 Card Read Punch ... one 1810 Disk Storage Unit, Model A1 or B1, or one 2311 Disk Storage Unit (attached via 2841 Storage Control Unit).

Minimum System Requirements (with 2790): One 1801/1802 Processor-Controller with a minimum of 24,576 words of core storage ... one 1053 Printer or one 1816 Printer-Keyboard or one 1443 Printer ... One 1442 Card Read Punch ... one 1810 Disk Storage Unit, Model A2 or B2, or one 2311 Disk Storage Unit (attached via 2841 Storage Control Unit) ... one 2790 Adapter ... one 2791 or one 2793 Area Station.

Machine Features Supported: In addition to the above, the optional machine units and features supported by the MPX system are: Process-Controller with up to 65,538 words of core storage ... up to eight 1053 Printers ... up to two 2401 Magnetic

IBM 1800 Data Acquisition and Control System

ape Units ... 1627 Plotter ... 1054 Paper Tape Reader ... 1055 Paper Tape
unch ... Analog Input ... Digital Input ... Analog/Digital Output ... a second
1442 Card Read Punch ... all models of the 1810 Disk Storage Unit ... up to
eight 2311 Disk Storage Units (attached to a 2841 Storage Control Unit) ... up to
four Communications Adapters, each with one or two lines ... up to two 1800/2790
Adapters ... for each 1800/2790 Adapter, up to 100 2791/2793 Area Stations,
1024 2795/2796 Data Entry Units, 100 1053 Printers, and 300 1035 Badge
Readers, and up to 1024 pulse counters.

Reference Material: Microfiche Listings, GJD1-3070 ... MPX System Introduction,
GC26-3718 ... 1800 Reference Summary System Reference Data, GX26-5624 ...
1800 Reference Summary, MPX Control Statements, GX26-1594 ... 1130/1800
Assembler Language Statements Summary, GX26-3780 ... 1800 MPX System Program
Logic Manual, GY26-3726 ... 1800 Data Acquisition and Control System
Functional Characteristics, GA26-5918 ... 1130/1800 Plotter Subroutine, GC26-
3755 ... 1800 Multiprogramming Operating System, Subroutine Library, GC26-
3724 ... 1130/1800 Assembler Language, GC26-3778 ... 1130/1800 Basic
FORTRAN IV Language, GC26-3715 ... 1800 Multiprogramming Operating System
Communications Adapter Programming, GC26-3757 ... 1800/2790 Multiprogram-
ming Executive Operating System, Data Communications System Programming, GC26-
3732.

Basic Program Material:

SRL Publications* -- 1800 Multiprogramming Executive Operating System, Program-
mer's Guide, GC26-3720-4; 1800 Multiprogramming Executive Operating
System, Operating Procedures, GC26-3725-2; 1800 Multiprogramming Executive
Operating System, Error Messages and Recovery Procedures, GC26-3727-2.

Documentation -- Program Material List ... Attachment to Users.

Machine Readable -- MPX is available on either one 1316 Disk Pack (2311 users),
two or three 2315 Disk Cartridges (1810 users), or one 2400 foot reel of magnetic
tape which can be restored to a 1316 Disk Pack. Both 2311 and 1810 users will
also receive a small deck of cards to assist cold start in addition to the disk distri-
bution. The Communications Adapter and 2790 Adapter Support for 1810 users are
contained on the third 2315.

The program number extension OPT1 is for the 2311 user. The complete MPX sys-
tem is available on one 1316 Disk Pack.

The program number extension OPT2 is for the 1810 user. The MPX system, except
for the Communications Adapter and 2790 Adapter Support, is available on two 2315
Disk Cartridges.

The program number extension OPT3 is for the 1810 user requiring the Communications
Adapter and 2790 Adapter Support. This package is available on one separate 2315
Disk Cartridge.

1810 users requiring the entire MPX system, including the Communications Adapter
and 2790 Adapter Support, must order both the OPT2 and the OPT3 packages.

Current users will receive a preprinted program order form and a letter announcing the
availability of Version 3 Modification Level 2. The letter instructs them to order the
version through the branch office using the preprinted order form. Complete ordering
instructions are provided in the letter to users.

MPX SPOOLING (1800-SV-002): MPX Spooling (1800-SV-002) augments
MPX. It provides additional functions which
facilitate the application of the IBM 1800 to
those environments in which multiple, isolated, asynchronous users require con-
current service. The functions implemented under MPX SPOOLING are:

1. **Dynamic File Allocation:** Files are assigned on as-needed basis by the user at
execution time. This allows disk storage to be minimized in a non-static environ-
ment.
2. **Buffering of 1443 Printer Output on disk:** Significant increases in throughput
are possible in installations with heavy assembly or compilation listings or com-
putation printing burdens. The 1443 can be used by both process mainline and
non-process programs executed in variable core.
3. **Buffering of 1627 Plotter output to disk for users requiring large amounts of
plotter output.** Again both process mainline and non-process programs executed
in variable core may make use of the plotter independently of each other.

The above features are completely independent. Analog data logging requires the
dynamic file allocation feature. A user whose needs are answered by any of the
above facilities may readily implement only the function desired.

4. **Logging of analog data to disk at equal time increments.** Time increment for
various devices which may operate concurrently need not be equal. Users
acquiring analog data from multiple devices would find this feature very helpful.

The program is specifically suited to dynamic installations in which an efficient
utilization of disk, analog features and printer and/or plotter resources will greatly
increase system throughput and availability of variable core for computational
purposes.

Description: The IBM 1800 Data Acquisition and Control System provides a large
number of features, e.g., data channels and priority interrupt structure, which allow
the computer to execute multiple tasks concurrently. For example, several peripheral
devices can run simultaneously while the central processing unit is doing a calculation
completely unrelated to the I/O operations.

MPX SPOOLING utilizes this capability for the line printer, the plotter and the
analog-to-digital converter in a manner which allows them to be easily shared by
multiple, isolated programs.

Open-ended file routines are provided to allow a user to process variable length, dis-
cretely addressable disk data files. Data may be formatted on the disk in one word
integer, single precision or extended precision format. The user must specify the name,
size (maximum of 32,767 words) and drive when it is necessary to create a file.
Files may be deleted or modified as required. Files are automatically expanded if
the file size is exceeded when attempting to write to the file. The user determines
what size file "pool" he wants on each drive and files are then created, modified and
deleted dynamically. Reference may be made to other "permanent" files by referring to
the file name and thereafter using the same file read and write subroutines.

Printer and plotter routines allow the user to concentrate on using variable core for
extensive data analysis calculation rather than tying up the machine with large amounts
of line printer/plotter output. Printer and plotter output is spooled directly to disk and
then printed/plotted using a separate coreload area avoiding "bottlenecks". Printer
and plotter spooling are restricted to variable core Basic Level program use.

Analog data logging routines are provided to allow the user to collect data at a desired
rate (up to a maximum of 60 points/sec.) with a minimum of programming effort.

The customer interfaces his instrument to the Analog Input Features via Multiplexer/S
(solid state switched input) or Multiplexer/R (mercury wetted contact switched input)
after suitable filtering and signal conditioning. Readings are initiated by a timer.
Multiple instrument readings are obtained by linking analog input sequential tables.
A basic requirement of the system is thus Analog Input Data Channel Adapter 1 (#1233)
and Data Channel (standard or #3222).

Three methods of acquiring analog data may be used:

A sequential read method of up to six points per instrument. The user specifies
the rate and number of points to be accumulated.

A range-selection method for Multiplexer/R where the program selects the range
giving maximum resolution. A maximum of four ranges are possible. A typical
use would be for Gas Chromatograph Instruments.

A "catting" (Computed Average Transients) method where a number of individual
scans are repeated to improve the signal-to-noise ratio. Corresponding points
in scans are added together and divided by the total number of scans at the end
of the experiment. A typical use would be for a Nuclear Magnetic Resonance
(NMR) instrument.

Input data is buffered and logged to a disk data file defined by the user at execution
time.

Highlights: Use of printer and/or plotter spooling may significantly increase the system
throughput in some systems with heavy printing and/or plotting output requirements.
Throughput is defined as the ratio of the time required to process a job stack through
the card reader without spooling, divided by the time required with spooling.

Use of Analog Input Data Channel Adapter 1 to link Analog Input sequential tables
allows reading multiple instrument addresses with one call. It also allows intermixing
Multiplexer/S and Multiplexer/R tables.

Using four Multiplexer/R ranges (10mV, 50mV, 500mV, and 5V for example) allows
meeting the wide dynamic range requirements of such instruments as gas chromatog-
raphs.

Use: Printer spooling requires no programming effort on the part of the user. Plotter spooling necessitates adding certain FORTRAN calls to the plotter programs. Run initialization and data analysis programs, written by the user, are implemented largely through calls to system subroutines provided for open-ended files and analog data acquisition.

Customer Requirements: The customer is responsible for performing the following functions:

1. Generating a suitable MPX operating system and properly defining system equates and the desired system parameters.
2. Allocating disk storage for open-ended files.
3. Allocating disk storage for 1443 and/or 1627 spooling.
4. Assembling or compiling the programs supplied in source form and building the core loads.
5. Providing low noise, low impedance analog signals to the 1800. For specific requirements, see IBM 1800 Installation Manual - Physical Planning, Form GA26-5922.
6. Installing appropriate instrument stations with lights, buttons and switches at each instrument and cabling to the 1800.
7. Writing the necessary FORTRAN programs to initialize the analog data acquisition program, analyze the data collected and generate reports.
8. As with other systems the customer is responsible for providing adequate protection against accidental loss or misuse of his data.

There are three possible options in the manner in which the user may set up the instrument stations. The following items are always located at each instrument:

- . START/STOP pushbutton for starting or terminating a run.
- . RUN light indicating that data acquisition is in progress for this instrument.

Option A

If there are no other instruments in the immediate vicinity the station would also include:

- . REQ/ABORT pushbutton for requesting or aborting a run.
- . READY light to indicate the computer is ready for run initiation on this instrument.
- . Data entry switches for entry of run parameter information.

Option B

If instruments are closely located then there would be a common (user-supplied) console consisting of:

- . REQ/ABORT pushbuttons (one per instrument).
- . READY lights (one per instrument).
- . 16 data entry switches.

This option requires one set of data switches for the entire group of instruments.

Option C

If the instruments are in the vicinity of the IBM 1800 then the common console would consist of:

- . REQ/ABORT pushbuttons (one per instrument).
- . READY lights (one per instrument).

The data switches on the IBM 1800 console would serve the purpose of the data entry switches.

A combination of the above options may also be used.

Programming Systems: MPX SPOOLING is written largely in 1800 Assembler Language, with some Utility and test programs in IBM 1130/1800 Basic FORTRAN IV. It operates under the IBM 1800 Multiprogramming Executive (MPX) Operating System. Generation of MPX SPOOLING requires the capabilities of assembling and compiling from disk and the use of the DMP SRFLC function, all standard facilities of MPX at its current version.

Minimum Machine Configuration: The minimum machine requirements for MPX SPOOLING incorporating the Analog data logging and open-ended file features are:

- . 1801 Processor-Controller 24K, 2 microsecond (2CB), or 4 microsecond (1CB)
- . One of the following:
One 1810 Disk Storage Model B2 or,
One 1810 Disk Storage Model B1 and one 1810 mapped 2311 Disk Storage Drive or,
One 1810 mapped 2311 Disk Storage Drive

NOTE: The 1810 Model A2 or A3 may be used but a substantial reduction in throughput can result if the transaction processing times are limited by disk seek speed. Also, the 2-microsecond Processor-Controller is required for 2311 Disk Storage.

- . One 1442 Card Read Punch, Model 6 or 7
- . One 1816 Printer-Keyboard
- . Analog Input Features with Analog Input Data Channel Adapter 1 (#1233) and 1 group Multiplexer/S and/or Multiplexer/R

For each instrument wired to the system, the following is necessary.

- . Two points of Process Interrupt Contact (#5715) or
Process Interrupt Voltage (#5716) for REQ/ABORT and START/STOP pushbuttons
- . Two points of Electronic Contact Operate (#3612) for READY and RUN lights
- . One group of Digital Input Contact (#3285) or Digital Input Voltage (#3286) for data entry switches

Note: If instruments are concentrated in one location, one group of digital input may be used per group of instruments.

For Analog Data logging, it is desirable to have multiple 1053s if instruments are widely separated. If the instruments are closely located to the computer the console switches may be used (see Item 6 of Customer Requirements).

To utilize only the 1443/1627 spooling features of MPX SPOOLING, the minimum configuration is:

- . 1801 Processor Controller 24K, 2 microsecond (2CB) or 4 microsecond (1CB) microsecond
- . One of the following:
One 1810 Disk Storage Model B2 or,
One 1810 Disk Storage Model B1 and one 1800 mapped 2311 Disk Storage Drive or,
one 1810 mapped 2311 Disk Storage Drive

NOTE: The 1810 Model A2 or A3 may be used but a substantial reduction in throughput can result if the transaction processing times are limited by disk seek speed. Also, the 2-microsecond Processor-Controller is required for 2311 Disk Storage.

- . One 1442 Card Read Punch - Model 6 or 7
- . One 1443 Printer Model 1 or 2 and/or one 1627 Plotter Model 1 or 2
- . One 1816 Printer-Keyboard

To incorporate all four modules of MPX spooling requires:

- . 1810 Processor-Controller 32K, 2 microsecond (2D) or 4 microsecond (1D) and the above mentioned peripheral devices.

Core Requirement: The following subroutines and their core requirements are required for the corresponding MPX SPOOLING modules to be incorporated. These routines are to be incorporated into the System Executive.

	Subroutine	No. of Storage Locations
For 1443 Printer spooling:	CASE1	806 (2 buffers)
	LEVEL	132
For 1627 Plotter spooling:	PHSE1	784 (2 buffers)
	PLOTX	277
	LEVEL	132
For Open-Ended Files:	GTFAD, DSKOP	98
	GTPAR	34
For Analog data logging	LNKSP	164
	CANCL	138
	REPET	348
	AINSN	424
	ABRTQ	46

Partition requirements are as follows:

Analog Data Logging	ADAS	2978
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Note: Actual size depends on buffer allocations.

For 1443 Printer Spooling	CASE2 or PRPH2	686
	CASE3 or PRPH3	598
For 1627 Plotter Spooling:	PHSE2	734
	PHSE3	622
For 1443/1627 Spooling:	CASE2 or PRPH2 or PHSE2	734

(continued)

CASE3 or PRPH3	598
PHSE3	622

The user should make his partitions somewhat larger than the above requirements to allow for future corrections which may be required.

A sample core map implementing open-ended files and Analog data logging follows:

*Executive I/O (2 disks, 1816, 1053, 1442)	7931
INSKEL COMMON	50
***EXDIR	3958
GTFAD, DSKOP, GTPAR	132
LNKSP	164
AISN, CANCL, REPET, ABRTQ	956
Patch Area	409
Total for System Executive	13600
Area 1 (ADAS)	3500
**Variable Core	7476

A sample core map implementing the Printer and Plotter spooling features follows:

*Executive I/O (2 disks, 1816, 1053, 1442, 1443, 1627)	8422
INSKEL COMMON	50
***EXDIR	3958
CASE1	806
PHSE1	784
PLOTX	277
LEVEL	132
Patch Area	371
Total for System Executive	14800
Partition 1 CASE2, PRPH2, PHSE2	800
Partition 2 CASE3, PRPH3	650
Partition 3 PHSE3	700
**Variable Core	7626

A sample core map for a 32K system with Printer spooling, Plotter spooling, and Analog data acquisition follows:

*Executive I/O (3 disks, 1816, 1053, 1442, 1443, 1627)	8532
INSKEL COMMON	50
***EXDIR	3958
GTFAD, DSKOP, GTPAR	132
CASE1	806
PHSE1	784
LNKSP	164
LEVEL	132
PLOTX	277
AISN, CANCL, RE&PET, ABRTQ	956
Patch area	309
Total for System Executive	16100
Area 1 (ADAS)	3500
Area 2 CASE2, PRPH2, PHSE2	750
Area 3	650
Area 4 PHSE3	650
**Variable Core	11017

*Includes all BOM Utilities (858 words additional)

**Minimum 5400 words. To minimize the use of locals and linking core loads a variable core size of at least 6000 words is recommended.

***Single priority queues.

Disk Requirements: Following are the disk requirements for MPX SPOOLING on Drive 0:

Reload Core Load RMPXP	2
System Definition Macro PLUS	10
Open-Ended File Core Loads	224
LINKC Core Load (1443 and/or 1627)	8
1442 Spooling Core Loads	11
1627 Spooling Core Loads	24
Analog Data Acquisition Core Loads	112
OEFE0 Open-Ended File Drive 0	33
	424 sectors

The LET requirements for MPX SPOOLING on drive 0 are:

Reload subroutine RPLUS	9
Open-ended file subroutines	141
1443 SPOOLING subroutines	21
1627 SPOOLING subroutines	35
Analog data acquisition subroutines	145
	351 disk blocks

Process working storage for SPOOLING may be estimated as follows:

For 1443 spooling, a minimum of 100 sectors is suggested. For 1627 spooling, a minimum of 200 sectors is recommended.

Programming Service Classification: B.

Basic Program Package:

Documentation: One copy each of the Application Directory, Program Description Manual (GH20-0977), and Operations Manual (GH20-0984).

Machine Readable: Source programs.

Optional Program Package:

Documentation: None

Machine Readable: None

Related Documentation: (Available only from Mechanicsburg).

Systems Manual (GY20-0668)

Reference Material:

Promotional Flyer (G520-2442)
General Information Manual (GH20-0884-1)

1800 Distributed System Program (1800-SV-003): Provides means for operating a multisystem configuration comprised of 1800s, System/7s, and 2740 terminals as a single Distributed System. Equipment can be placed at the optimum physical location and yet take advantage of all the facilities of the central 1800.

The IBM 1800 Distributed System Program provides for operating an interconnected system of IBM 1800s, IBM System/7s and IBM 2740s as a single Distributed System. Communications between the systems use start/stop teleprocessing links. The facilities provided may be categorized as:

1. Support for the exchange of data, programs and tasks between systems (Multisystem support).
2. Support for setting up and entering jobs into the batch process queue of the 1800 from remote terminals (Conversational Remote Job Entry).
3. Support for communication between an 1800, operating under the Multiprogramming Executive System (MPX), and a remote terminal or computing system (Communications support).

The facilities provided in the first category (item 1 above) parallel those of the IBM 1130 Distributed System Program, which supports a System/7 coupled to an IBM 1130 Computing System. Application programs that are written using the facilities of 1130 DSP and obeying its conventions, can be transferred to an 1800 System Operating with 1800 DSP with little or no modification.

Highlights:

- Users located at either the 1800 or the System/7 have access to facilities of both machines.
- System/7, 2740, and 1816 can be used as Conversational Remote Job Entry Terminals.
- Multisystem support compatible with IBM 1130 Distributed System Program.
- Terminals may be point-to-point, dial up, or multipoint.
- Data sets, tasks, and programs may be exchanged between 1800 and System/7 computers.
- All 1800 DSP user subroutines in the 1800 are FORTRAN callable.

IBM 1800 Data Acquisition and Control System

Use: Data, task, and program exchange are initiated by calls to subroutines in the 1800, or by calls to macros in System/7. CRJE facilities are used directly from terminals.

Customer Responsibilities: The customer must establish configuration parameters specifying for example, the number of terminals and number of active CRJE users. Some 1800 DSP programs must be assembled or compiled, and included in an MPX System Generation. The System/7 macros must be assembled as part of the System/7 Storage load. Application programs that use the subroutines and macros for multisystem support must be supplied by the customer.

The customer must obtain the compatible modems and telephone links to connect the IBM 1800 and the terminals.

The CRJE functions of the 1800 DSP contain the following security provisions:

1. Terminal users must identify themselves using a combination of letters defined by an operator at the IBM 1800.
2. A terminal user has read/write access to data sets containing his own user ID. Access to another user's data sets is on a read-only basis.
3. Data sets in the fixed area must be defined using standard operations of the MPX Disk Management Program.

As with other systems, the customer is responsible for providing adequate protection against accidental loss or misuse of his data. This includes an adequate review of the system's security provisions by the customer.

Programming Systems: Most of the subroutines of DSP that are used in the 1800 are written in 1800 Assembler language. Some utility coreloads are written in FORTRAN. The System/7 macros are written in the System/7 Assembler language.

The 1800 programs operate under control of the IBM 1800 Multiprogramming Executive System (1800-OS-010 Version 3 Modification 2 or later). The System/7 macros utilize the macros provided by the System/7 Modular System Programs (MSP/7) in either Host Program Preparation Facilities I for the 1800, or Host Program Preparation Facilities II, Macro Library/Basic for the System/360 or System/370.

Compatibility with 1130 Distributed System Program: Application programs written for operation under 1800 DSP will operate under 1130 DSP without modification of the source instructions if the following restrictions are observed:

1800 Programs:

1. are written in 1130/1800 Basic FORTRAN IV, using the *ONE WORD INTEGERS control card and avoiding the use of FORTRAN facilities peculiar to MPX, such as the COMMON/INSKEL/Specification statement.
2. do not directly reference the communication facilities TPIOC, and DLIOS.
3. do not use subroutines that are unavailable in the 1130.

System/7 Programs:

The communication macros of the System/7 Modular System Programs should not be directly invoked.

Minimum Machine Configurations:

1800

The minimum machine configuration for the 1800 Data Acquisition and Control System is:

1. 1801 Processor-Controller Model 1D or 2D (32K); Model 1CB or 2CB (24K) may be used if the CRJE facility is deleted.
2. One of the following :
One 1810 Disk Storage Model B2 or,
One 1810 Disk Storage Model B1 and one 1810 mapped 2311 Disk Storage Drive or,
One 1810 mapped 2311 Disk Storage Drive
NOTE: The 1810 Model A2 or A3 may be used but a substantial reduction in throughput can result if the transaction processing times are limited by disk seek speed. Also, the 2-microsecond Processor-Controller is required for 2311 Disk Storage.
3. 1442 Card Read/Punch, Model 6 or 7
4. 1816 Printer-Keyboard or 1053 Printer, Model 3

Additional devices that are supported by DSP include additional disk drives, an additional 1816 Printer-Keyboard or 1053 Model 3 printers, and an IBM 1443 Printer Model 1 or 2. Up to 15 teleprocessing lines may be used. If 1800 MSP 7 is to be used on the system, it is advisable to consider the advantages of an additional disk drive. Refer to the DISK REQUIREMENTS section.

Core Requirements: The minimum Executive core size can be estimated by computing the length of the following components:

- | | |
|-----------------------|---|
| 1. Executive I/O | 4. MPX subroutine LEVEL |
| 2. Executive Director | 5. Patch area |
| 3. Executive Tables | 6. DSLOC, TRING, and TPDTL |
| | 7. DSCOM, the 1800 DSP communication area |

The procedures for computing the core requirements for components 1, 2, and 3 are described in the manual IBM 1800 Multiprogramming Executive Operating System, Programmer's Guide (GC26-3720). Component 4 requires approximately 132 words.

Component 6 consists of DSLOC, TPDTL, and TRING. DSLOC is a subroutine which locates the entry point to DSCOM. DSCOM is a core-resident area used by the DSP which consists of tables and operation complete routines.

TRING is the Interrupt Servicing Subroutine (ISS) for the start/stop communications adapter. The user has the option as to whether to incorporate DSCOM in the System Executive or preferably, a SPAR area (DSPAR).

The size of DSCOM depends on a number of user parameters.

Two subroutines are provided to support communication between IBM 1800-resident programs and terminal devices. The DLICS subroutine provides communication without concern for the structure of the physical device.

The Start I/O portions of the TPIOC (TPSIO) and DLIOS (DLSIO) subroutines may be located in the Executive or, preferably, in a SPAR area. The call sections of these functions are reentrant, and may be included in the Executive.

Miscellaneous TP support routines DIOST, DIOVR, TPQSW, TPTIM and ABRTF are required for TP operation and will normally appear in a SPAR area.

The following example will assume DSCOM to be in the SPAR area.

Example 1 - Multisystem only

For a system with two disk drives, no IBM 1443 Printer, one teleprocessing line (not dialup) and two terminals, components 1, 2, and 3 might require 12,400 words; thus, the total executive core size might be:

Component	Size
1, 2, and 3	12,400
4	132
5	177
6	91
7	---
	12,800

A possible DSCOM size might require about 1,807 words.

The DSPAR area incorporating DSCOM might require about 5,024 words.

For a 24K machine the core map might be:

Executive	12,800
SPAR	5,250
Variable Core	6,526
	24,576

The subroutine names DGETD, DPUTD, DXEQP, and DPUTP are entry points in a single reentrant subroutine which requires 311 words. An additional 31 words should be added if multiple word integers are to be used. Transactions are processed by an interrupt core load DSICL which requires 4,600 words.

Example 2 - CRJE only

For a system with two disk drives, an IBM 1443 Printer, one teleprocessing line and three terminals, components 1, 2, and 3 might require 12,800 words; thus, the total executive core size might be:

Component	Size
1, 2, and 3	12,800
4	132
5	177
6	91
7	---
	13,200

Possible DSCOM and DSPAR sizes are as follows:

DSCOM	1,957 words
DSPAR	5,222 words

The following assumptions were made:

- two simultaneous CRJE users
- 100-word line buffer
- two disk buffers in pool
- buffered 2740 terminals
- five RJE input tables
- five RJE output tables

For a 32K machine the core map might be:

Executive	13,200
SPAR	5,400
RJE area	2,500
CRJE area	3,200
Variable Core	8,468
	32,768

The remote job execution and the CRJE service program operate in separate coreload areas.

This allows CRJE operation and remote job execution to occur simultaneously.

The user may execute the CRJE service program in variable core if desired and eliminate the CRJE area (3,200 words) leaving a variable core size of 11,668 words.

Example 3 - Multisystem and CRJE

For a system with two disk drives, an IBM 1443 Printer, two teleprocessing lines, two System/7s and two buffered 2740s, components 1, 2, and 3 might require 12,800 words, thus the total Executive core size might be:

Component	Size
1, 2, and 3	12,800
4	132
5	177
6	91
7	--
	<u>13,200</u>

The DSCOM and DSPAR values might be as follows:

DSCOM	3,478 words
DSPAR	6,743 words

The following assumptions were made:

- two simultaneous CRJE users
- two simultaneous multisystem transactions
- four disk buffers in pool
- five RJE input tables
- five RJE output tables
- 100-word line buffer and 160-word line buffer.

Using the sample configuration above for a 32K machine the core map would be:

Executive	13,200
SPAR	7,000
RJE area	2,500
Variable Core	<u>10,068</u>
	32,768

If a separate area is used for the CRJE coreload the net variable core size would be 6,868 words. Note that the variable factor in the DSPAR area is DSCOM. The other factors are fairly constant.

DISK REQUIREMENTS

LET Entries	Number of Disk Blocks	Used By
DINIT	21	Coldstart
DOPEN	7	Coldstart
LOPEN	18	Coldstart
LCLOS,TCLOS	10	Coldstart
TOPEN	12	Coldstart
DGETD, DPUTD, DPUTP, DXEQP	24	Multisystem
DTRON, DTROP	16	Multisystem
DCKRS	5	Multisystem
DGETS, DFRS	23	Multisystem
DCLRS	5	Multisystem
DPCNN, DGCHN	11	Multisystem
DTBAD	4	Multisystem
DTLON,DTLOP	8	CRJE
DTBON,DTBOF	8	User

PLET Entries	Number of Sectors	Used By
DERLP**	1 minimum	All
DSCPR*	21	DSP Utility
DPKUP	5	All
DNPPC*	20	DSP Utility
DSPAR**	23	All
DCTST*	9	DSP Utility
DCOLD**	11	All
DRLOH**	2 minimum	All
DTPBL	2	All
DRJTH	25	CRJE
DJXSP	12	CRJE
DRJH4	19	CRJE
DRJH5	22	CRJE
DRJH6	24	CRJE
DJINT	2	CRJE
DRJTA	1	CRJE
PCRJE***	18	CRJE
MCRJE****	18	CRJE

TPIPL	2	Multisystem
UZERO	2	Multisystem
DSICL	12	Multisystem
DTALF**	1 minimum	Multisystem
DTRLG*	20	Multisystem Utility
PUT18*(Optional)	13	Multisystem Utility
D1836(Optional)	14	Multisystem Utility
DCKPF	1	Multisystem
TSTS7(Sample program (temp.))	23	Multisystem
D7TAB,D7PRI,D7TRP(add to MSP/7)	26	Multisystem

- **May be loaded from cards
- **User-defined
- ***If point-to-point System/7s used for CRJE
- ****If multi-point System/7s used for CRJE

For Multisystem System/7 applications, the MSP/7 macro library and the edit program are required. Approximate sizes are 315 and 40 sectors, respectively.

One disk sector is required for each 19 CRJE user IDs. The space required by each active user depends on the size of the CRJE jobs created and the amount of output produced. On the average, one sector can store 14-20 assembler cards or 10-15 lines of an assembly listing. No sector may be used simultaneously by more than one user.

System/7

The minimum machine configuration for the System/7 is:

- One Enclosure Model A02
- One Processor Module A04 (4K)
 - a. Asynchronous Communications Control Adapter or 50K bps Communications Adapter (RPQ D08000)
 - b. Operator Station

Normally user application programs will require the use of at least one I/O module (such as 5012 or 5014). CRJE and Multisystem are mutually exclusive and require separate storage loads. Multiprocessor Support size is based on the inclusion of the following modules:

	Size
1. Fixed core used for IPL	128
2. CE Error tables	50
3. Interrupt branch tables	72
4. Interrupt level work area	64
5. Initialize, \$INIT	96
6. System error recovery, \$ERP	187
7. Set programmed interrupt, \$SPT	87
8. Queue handling \$QUE	101
9. Null interrupt handler, \$NINT	31
10. Telecommunication interface, \$TNLK	164
11. Telecommunication transmission, \$TXMT	324
12. Telecommunication reception, \$TREC	316
13. Operator Station Support, \$OPR	437
Total for Multiprocessor Support	2,057
14. DSP Multisystem routine D7TRP (note 1)	600
Total	2,657

Note 1: Actual size = 505 + DSP COMMON size + 3* (number entries in D7PRI) + number entries in D7TAB.

The user must add to this minimum requirement those MSP/7 routines required for his application together with the actual user requirements.

CRJE requires a storage load of 3,600 words.

COMMUNICATION FACILITIES

The communications interface to the IBM 1800 is the Start/Stop Communications Adapter which provides for the attachment of a single start/stop communications line. Up to 15 adapters are supported. All adapters must be assigned to the same interrupt level. Compatible modems supplied by IBM or other manufacturers are required to connect the adapter to the communication lines.

Installation and operation of the adapter are described in the Start/Stop Teleprocessing Adapter, General Information Manual (GL26-2112). The following adapter installation options are normally required:

number of bits per character	=	7
number of stop bits	=	1
vertical redundancy check (VRC)	=	yes
VRC generate	=	yes
VRC type	=	odd
End-of-block (EOB) character	=	bits 10, 11, 12, 13, 15
End-of-transmission (EOT) character	=	bits 11, 12, 13, 14, 15
Negative reply (NAK) character	=	bit 9

The carrier detect option is determined by the type of data set used, and the full duplex option is not applicable.

DSP operation requires the adapter to be jumpered to transmit PAD characters.

The communications facilities which may be used include Common Carrier Switched Telephone Networks, Common Carrier Leased Private Line Telephone Service (two- or four-wire facility), or equivalent privately-owned facilities.

The communications mode on a given line may be point-to-point over a switched network (dial up), point-to-point over non-switched leased or private facilities, or multi-point over non-switched leased or private facilities. When operating in multipoint mode, up to 16 terminals may be multiplexed from a single line.

Supported terminal configurations include:

System/7 with Asynchronous Communications Control or 50K bps Communications Adapter (RPQ D08000)

- Programmed to emulate an IBM 2740 Model 1 or 2
- 134.5 bits per second multipoint, point-to-point, or dial-up mode
- 600 bps multipoint or point-to-point mode

IBM 2740 Model 1

- 134.5 bps line speed
- Dial-up mode on switched network
- Dial-up adapter required
- Automatic EOB feature optional
- Checking feature required

IBM 2740 Model 1

- 134.5 bps line speed
- Point-to-point or multipoint mode
- Checking feature required
- Station control feature required for multipoint
- Automatic EOB feature optional

IBM 2740 Model 2 (buffered)

- 600 bps line speed
- Multipoint mode
- Record checking feature required
- Buffer receive feature required
- Speed base feature required
- Buffer expansion feature optional
- Header control feature optional
- Edit feature optional

IBM 2740 Model 2 (buffered)

- 134.5 bps line speed
- Multipoint mode
- Record checking feature required
- Buffer expansion feature optional
- Header control feature optional
- Edit feature optional

All terminals on a given line must be of the same line speed and addressing mode.

Programming Service Classification is A.

Basic Program Material:

One copy each of the Program Reference Manual (GH20-1143-0) and Operations Guide (GH20-1142-0). One copy of the machine readable material containing source program modules, object program modules, and sample programs, shipped on one IBM 2315 or one 1316 Disk Cartridge.

Optional Program Material:

The Logic Manual and additional copies of the Program Reference Manual (GH20-1143) and Operations Guide (GH20-1142), may be ordered from the IBM Distribution Center as billable customer requisition; customer will be billed through AOO. One copy of the machine readable material containing in source form those program modules which come in object form on the basic machine readable material.

General Documentation: Additional documentation consists of the General Information Manual (GH20-0881) which is available from the IBM Distribution Center at no charge.

Additional Program Material

Program Logic Manuals

1130/1800 Programming Systems, Card/Paper Tape	Y26-3620
1800 Time-Sharing Executive System	Y26-3702
1800 Multiprogramming Executive Operating System	Y26-3726

Program Listings: Listings are available on microfiche from --

Group Code 3010 for 1800 Card/Paper Tape System
3030 for 1800 Time-Sharing Executive System
3070 for 1800 Multiprogramming Executive System

Optional Program Material (Symbolic Modules): The optional program components are available on magnetic tape (2400). One reel of tape is required for each program group (each program group is bracketed below).

Distribution will be made on S/360 9-track magnetic tape (800 bpi or 1600 bpi). The requester must forward or order one reel of magnetic tape,

The external tape label must show one of the program numbers listed below, as well as the information required under the current procedures.

If either 9-track 800 bpi or 1600 bpi is not specified on the order form, 9-track 800 bpi will be supplied.

<u>Program Component Name</u>	<u>Program Number</u>	
1800 Card Utilities	1800-UT-001	} one reel
Paper Tape Utilities	1800-UT-002	
Card Subroutines	1800-LM-001	
Paper Tape Subroutines	1800-LM-002	
Card Assembler	1800-AS-005	} one reel
Paper Tape Assembler	1800-AS-006	
Card FORTRAN	1800-FO-007	
Paper Tape FORTRAN	1800-FO-008	
Time-Sharing Executive System	1800-OS-001	} one reel
1800 Multiprogramming Executive System	1800-OS-010	

BOS/360

BOS/360 is a Disk Resident System designed to provide operating system capabilities for 8K and larger System/360 configurations. This system is provided specifically for 2311 Disk Drive configurations. Configurations above 8K requiring a disk oriented stack job operation but not requiring the expanded functions of DOS/360 or OS/360 will also benefit from this system.

Minimum system requirements: 8,192 bytes of main core storage ... Standard Instruction Set ... either one multiplexer or one selector channel ... one 2311 Disk Drive* ... one card reader** ... one card punch** ... one printer.**

*The system resident device (2311 Disk Drive) may be used by processing programs for intermediate or permanent storage.

**See the control program I/O chart for specific devices and possible alternatives.

Note: The 1052 Keyboard-Printer is required for efficient systems communication.

The Basic Operating System/360 is composed of two types of programs: Control Programs and Processing Programs. Users may tailor the system according to their installation configurations and processing requirements.

Control Programs

The Control Program, 360B-CL-302, constitutes the basic framework of the Basic Operating System/360. It is a prerequisite to any program executed in the BOS/360 environment.

Control Program input/output functions are:

- System Resident: System resident unit
- System Reader: Unit used for Job Control cards
- System Input: Main system input for control programs
- System List: System printer unit for control programs
- System Punch: Main system output for control programs
- System Log: Medium for operator communication

Control components and functions:

Initial Program Load (IPL)-- loads supervisor into main storage when system operation is initiated.

Supervisor -- provides main storage resident control functions (in a minimum of 4,096 bytes) such as: interrupt handling ... scheduling of I/O operations on the multiplexer and one or two selector channels ... common physical I/O interface for all channel programs ... operator communication via the operating console or 1052 Printer-Keyboard ... Job-to-Job communication via a communication region ... systems loader for program fetching ... a transient area for functions such as -- error recovery, file management (open, close, end-of-volume, end-of-job), checkpoint restart, storage print.

Job Control -- brought into main storage between jobs by the supervisor to provide: job-to-job transition; e.g., compile and execute ... symbolic device assignment within device dependent environment ... entry of additional information such as -file limits, label checking data, current data, program switches.

Linkage Editor -- for linking and relocating separate program sections from the relocatable library and/or from a system input unit. These programs may be permanently placed in the system (core image library), requiring only control cards to call them for execution, or they can be stored temporarily, executed, and then overlaid in the core image library by new programs.

Librarian -- A group of programs, used for maintaining and reorganizing the disk library areas and providing printed and punched output from these libraries.

Core Image Library (required). All programs are loaded for execution from this library by the System Loader routine of the supervisor.

Macro Library (optional) - used to store IBM-supplied and user-defined macro routines.

Relocatable Library (optional) - required for compile-and-execute operations, certain utilities, and for Autotest. It can be used to store assembled object modules for subsequent linkage with other program sections when editing programs into the core image library.

Load System Program -- Operates as an independent program (loaded from cards, with its own IPL program, Supervisor, and Job Control), the Load System program builds a disk resident system from cards. This program can be used to

build minimum systems for specialized applications. If two disk drives are available, the librarian can be used instead of the Load Systems program to build specialized systems.

IOCS -- The Consecutive Processing Macros, ISFMS Macros, DAM Macros, and Tele-processing Macros for Synchronous Transmitter-Receiver terminals (STR), together constitute the logical IOCS facilities of BOS/360.

Consecutive Processing Macros, 360B-IO-303 -- Used to read, process, and write successive records in a logical file. These routines apply to all files in serial-type I/O devices. They can also be used for the 2311 disk file records to be processed in a serial manner.

Indexed Sequential File Management System (ISFMS), 360B-IO-304 -- These routines provide a comprehensive method for establishing and maintaining logical files in a manner which allows random and sequential processing in the same 2311 disk file.

Direct Access Method (DAM), 360B-IO-305 -- The Direct Access Method macro instructions can be used to create and maintain logical files in random order in 2311 disk files.

Tele-processing Input/Output Support for STR 360B-IO-310 -- Input/Output macro level Tele-processing support for 2701 with Synchronous Data Adapter Type I communicating with Synchronous Transmitter-Receiver (STR) terminals: Using BOS/360 system, STR applications will probably require 16K, however, utility type applications requiring minimum processing and code conversion are supported in an 8K environment. STR applications using facility will require a 16K of core storage.

Macros will be provided to: Handle transmission and reception of data in the STR mode ... assist the programmer in the processing of STR records.

Tele-processing Input/Output Support for Binary Synchronous Communication 360B-CQ-312 Binary Synchronous Communication Macros are provided for an IBM System/360* via a 2701 equipped with a SDA-Type II adapter to another System/360* via (a) a 2701 equipped with a SDA-Type II adapter, (b) a 2703 equipped with Binary Synchronous features. This support is for point-to-point non switched and switched lines. Included within this support are the 2701 Error Recovery Procedures and Error Counts. Available for S/360 Model 25 via its integrated communication attachments.

Macros will be provided to handle the following Binary Synchronous Line Control functions:

- Contention (point to point)
- Headers and normal text,
- Inquiry and alternating replies
- WABT (optional)
- Full Transparent text,
- Dial with and without identification
- Disconnect and Conversational

EBCDIC will be supported as the transmission code. The minimum core storage requirement is 16K bytes.

BOS/360 Binary Synchronous Communication support communicate with other System/360s using DOS BTAM, OS BTAM and BOS/BPS/360 Binary Synchronous Communication support.

* Model 25, 30, 40, 50, 65, 67 (65 mode) or 75, System/370 Model 165.

Note: 2701 Support on a selector channel is limited to non-switched. (leased or private direct connection)

It is recommended that a 1052 console be used in order to facilitate the printing of error messages and error counts as the result of a persistent error condition. This facility will aid in system repair and preventive maintenance.

Processing Programs

Include customer programs and IBM supplied programs that provide both language and service functions. All processing programs, customer and IBM, utilize the functions provided by the control programs.

The Basic Operating Systems may be generated and regenerated by the customer to include those languages, service and problem program functions that he desires in system residence.

Language Functions: Available within the Basic Operating System/360 at a 4,096 design level. A design level is the minimum main storage requirement in which the processor is designed to operate.

Assembler, 360B-AS-309 -- Provides a convenient means of solving problems by offering the full flexibility of the powerful System/360 instruction set. This easy-to-use symbolic language is machine oriented and applicable to both commercial and scientific problems. The Assembler Language includes a complete set of macro instructions for all I/O and other Supervisor functions. Also, the user can define frequently used routines as macros. The actual problem coding is done with symbolic instructions that are translated, one for one, to machine instructions. All storage references can be made through symbolic names. Data constants can be defined in several different ways, either as explicit constants or as literals coded directly into the operand of an instruction.

Report Program Generator (RPG), 360B-RG-307 -- RPG is a problem-oriented language designed to provide users with an efficient, easy-to-use technique for generating programs that can: obtain data records from single or multiple input files ... perform calculations on data taken from input records or RPG literals ... write printed reports ... use table lookup ... exit to a user's subroutine written in a language other than RPG ... branch within calculations ... and sequence-check input records.

Note: The Decimal Arithmetic feature #3237 is required by RPG.

Control Program Input/Output:

Units Supported	Residence	Reader	Input	Work	Punch	List	Log
1052							x
2540		x	x		x		
1403						x	x
1404*						x	x
1442 N1		x	x		x		
1442 N2					x		
1443						x	x
2501		x	x				
2520 B1		x	x		x		
2520 B2, B3					x		
2311	x			x			
2400 (1)			x		x**	x**	
2400 Dual Density			x		x**	x**	

* Continuous Forms Only
** Assembler Only

Input/Output Support for Object Programs:

I/O Units	RPG	Assembler
2540	x	x
1403	x	x
1404 Continuous Forms	x	x
1442	x	x
1443	x	x
1445	x	x
2501	x	x
2520	x	x
2400 (1) 7- or 9-track	x	x
2311 Consecutive	x	x
2311 Direct Access Method (DAM)	x	x
2311 Indexed Sequential (ISFMS)	x	x
1052		x
2671		x
1285		x
2701		x**
1070 and 1050 or 1030		x**

** 2701 with SDA-I communicating with: 1009, 1013, 7701/02, 7711, 1974 (mdl 2), 1978 (mdls 1, 2, and 3) 360 Model 20 with Communication Adaptor (Feature #2073), 360 Model 25, 30, 40, 50, 65, and 75 with 2701 and SDA-1.
*** Available with Process Control System (PCS).

IBM System/360 * via a 2701 equipped with an SDA-Type II adapter, or an IBM System/360 Model 25 via the Integrated Communications Attachment to another S/360 * via a 2701 equipped with an SDA Type-II adapter or via a 2703 with a Synchronous Base, or an S/360 Model 25 via the Integrated Communications Attachment.

* Model 25, 30, 40, 50, 65, 67 (working in 65 mode) or 75, System/370 Model 165.

Service Functions: (1)

Sort/Merge, 360B-SM-308 -- The Sort/Merge program enables the user to sort a file of records into one sequential file. The control data information can be contained in as many as twelve fields in each record. The program assumes that input records for a sort operation are in random sequence. Records can be sorted or merged into ascending or descending sequence, and an individual sequence can be specified for each control-data field. The output sequence for a merge-only operation must be the same as the input sequence. Files to be sorted can be read by the program from 2311 Disk Storage (except ISFMS), 2400 series Magnetic

(1) 2420 Model 7 is not supported.

Tape, or from cards read through any of the card readers listed under Minimum Machine Requirements. Output files can be written on disk storage or magnetic tape. An option provided by the program is a list of disk storage addresses that reflects the sorted output file.

Utilities, Group 1, 360B-UT-300 (BOS/360)

Clear Disk - Clears one or more areas of 2311 Disk Storage, and establishes a preformatted track containing an indicated base throughout the area cleared.

Card to Disk - Transfers binary or EBCDIC data from cards to disk with or without key fields.

Disk to Card - Transfers data from disk to cards. The disk file may or may not have key fields. Data may be punched in either EBCDIC or binary.

Disk to Printer - Prints a disk file in either the data display format or the data list format. Both formats are explained under the tape to printer program. Disk records may or may not contain key fields.

Disk to Disk - Transfers the data from one disk file to another. The input and/or output file may or may not contain key fields. The disk file may be copied, reblocked, field selected, or reblocked and field selected.

Card to Printer and/or Punch - Transfers binary or EBCDIC data from cards to a printer and/or a card punch.

VTOC Display - Displays the labels in the volume table of contents from either a system pack of a data pack.

Utilities, Group 2, 360B-UT-301 (BOS/360)

Card to Tape - Transfers binary or EBCDIC data from cards to magnetic tape.

Tape to Printer - Prints a tape file in one of two formats:

Data Display - prints all, in a series of lines, of the tape block using 100 print positions for the data (with top and bottom scale line, and page numbering). Twenty positions of the printer line are used for block size, block number, and record number. Field selection of data is not available with this option.

Data List - prints one line for each data record. The data, if larger than the print span, would usually be edited to printer size by using the "Field Select" feature of the utility program.

Some other options for the user include page numbering, heading lines, and spacing control.

Tape to Card - Transfers data from magnetic tape to cards. Data may be punched in either EBCDIC or binary.

Tape to Tape - Transfers the data from one tape to another. The tape file data may be simply copied, block by block; or reorganized by altering the number of records in the block (reblocking); or reorganized by deleting or re-positioning the fields within the record (Field Select) as well as reblocking.

Disk to Tape - Transfers data from a disk file to a tape file. The disk file may or may not contain key fields. The disk file may be copied, reblocked, field selected, or reblocked and field selected.

Tape to Disk - Transfers data from a tape file to a disk file. The disk file may or may not contain key fields. The tape file may be copied, reblocked, field selected, or reblocked and field selected.

Tape Compare - Compares two files from two or more tape reels to ensure that the files are identical. The number of reels in each file need not be equal.

Files containing fixed, variable, or undefined record lengths may be compared. Physical records which do not compare are documented along with an index indicating the bytes that do not match, and the physical record number. A user routine may be supplied for user processing on unequal compares.

A compare may be terminated and a new compare initiated at any time.

Remote Job Entry Work Station Program 360B-CQ-311 (BOS/360) -- This program works in conjunction with the OS Remote Job Entry (RJE) system to provide a convenient means of entering OS jobs to a central computing system from a remote location equipped with a System/360. It accepts OS jobs and RJE control statements and commands from a card reader or 1052 printer-keyboard, transmits this data to the Central (OS) processor via high-speed communication lines, receives data from the central system, and outputs this data to an attached output device (printer, punch or console printer), or passes it to a

(BOS/360)

user-written routine. The console printer-keyboard cannot be used for input and output of jobs.

Without the inclusion of user-written routines, a System/360 with at least 16K of main storage, a 2701 Data Adapter Unit or Integrated Communications Attachment equipped for binary synchronous communication in EBCDIC transparency mode, a card reader, a printer, a 1052 Printer-KeyBoard, and a card punch are required for RJE operation. If user-written routines are included, a System/360 with at least 24K bytes of main storage is required. BOS/360 minimum device requirements apply.

Autotest, 360B-PT-306 (BOS/360)-- Autotest is the debugging aid for object programs that have been assembled by the Assembler. Using Autotest, runs can be planned to proceed with a minimum of operator intervention. (For use on systems with at least 16K bytes of main storage.)

Autotest resides on disk (SYSRES) during testing. It controls testing and:

Allows the exchange, addition, or deletion of instructions without reassembly. Allows replacement of constants.

Provides the dump of all or any portion of main storage, permanent storage assignments, and/or general registers/floating registers whenever a designated address is reached during object program execution. Such test request output can be regulated even within user program loops.

Symbolic debugging features are available. End-of-job main storage printouts can reflect user assembled labels associated with the appropriate main storage locations. Also, address for test requests and patches can be referenced symbolically.

Will print out main storage at abnormal end-of-job, and optionally at normal end-of-job.

Pre-scan loading of the object program and clears unused main storage.

Allows execution of BOS/360 Utilities or User utilities to be run prior to or following execution of the user test program.

A card to tape utility is supplied to generate variable length tape records.

Allows assembly and immediate test capability.

1070 Process Communication Supervisor 360B-SV-032

The 1070 PCS consists of the following components:

Executive Routine ... Conversion Subroutine ... Delta Limit Check Subroutine ... Contact Sense Subroutine ... Thermocouple Subroutine ... Pulse Counter Subroutine ... Binary to Decimal String Routine ... Decimal to Binary Subroutine ... Decimal to Binary String Routine ... Diagnostic Write Routine.

The 1070 PCS is used with the Supervisor (8K Disk) at object program time, and uses the Assembler (8K Disk) for program assembly.

The PCS macro definitions are inserted in the BOS macro library by a MMAINT run and the Subroutines are inserted in the BOS relocatable library by a RMAINT run.

The PCS provides the facility to communicate with 1070 Process Communication Terminals, 1030 Data Collection Terminals and 1050 Data Communication Terminals, through a 2701 Data Adapter Unit or a 2702 Transmission Control. In addition, all IOCS facilities provided by the Basic Operating System (8K Disk) may be used.

[See next page for Basic Program Package and Ordering Information]

BASIC PROGRAM PACKAGE

Documentation -- Material List and an attachment ... The following SRL publications appropriate to the components ordered are shipped with each initial BOS/360 order.

Assembler with Input/Output Macros Specifications, TNLs GN33-8564, 8571, <u>8608</u> , <u>8633</u>	GC24-3361-6
Programs and Assembler Operating Guide TNLs GN33-8533, 8566, 8577	GC24-3450-3
Programmer's Guide TNLs GN24-5336, 5328; GN33-8531, 8544, 8565, 8572, <u>8605</u> , <u>8634</u>	GC24-3372-6
Operating Guide, Operator Messages TNLs GN33-8537, 8563, 8578, <u>8609</u> , <u>8635</u>	GC24-5024-3
System Generation and Maintenance TNLs GN33-8532, 8545, 8567, 8579, <u>8632</u>	GC24-5060-2
Utility Programs Specifications and Operating Guide TNL GN28-2338	GC24-3409-3
1070 Process Communication Supervisor	GC26-5996-1
1070 Process Communications Supervisor, Operating Guide	GC26-3627-1
Autotest (8K Disk) Specifications TNLs GN21-5011, 5041, 5070; GN33-8583,	GC24-3378-2
Note: SRL GC24-3378-1 plus TNLs GN24-5015, GN21-5011, 5041, and 5070 may be used in lieu of the SRL GC24-3378-2 plus TNLs GN21-5011, 5041, 5070, GN33-8583.	
Report Program Generator (8K Disk) Specifications,	<u>GC24-3387-5</u>
Sort/Merge Program (8K Disk) Specifications TNL GN28-2389	GC24-3321-4
Note: SRL GC24-3321-3 plus TNLs GN21-5045 and GN28-2389 may be used in lieu of SRL GC24-3321-4 plus GN28-2389.	
Macro Definition Language 8K Disk/Tape TNL GN33- <u>8639</u>	GC24-3364-3

Form numbers which have changed since previous release are underlined.

Machine Readable -- Program components may be selected from the following list.
Each component for which program documentation and maintenance material is required must appear on the order form.

Assembler	360B-AS-309
Basic Control Program	CL-302
Consecutive Processing MACROS	IO-303
IFMS - Indexed Seq. File MGT. SYSTEM MACROS	IO-304
DAM - Direct Access Method MACROS	IO-305
Synchronous Transmitter Receiver MACROS	IO-310
Autotest	PT-306
Report Program Generator	RG-307
Sort/Merge	SM-308
Group 1 Utilities	UT-300
Group 2 Utilities	UT-301
1070 PCS	SV-032
BCS	CQ-312
Remote Job Entry	CQ-311

OPTIONAL PROGRAM PACKAGE

Documentation - Material List - Optional Material instructions. The dumped disk pack data on the tape will be preceded by an initialize 2311 Utility Program and a tape to disk program. The operating instructions for creating a system pack from the tape are provided with the material list.

Machine Readable

1070 PCS	360B-SV-032
Utilities Group 1	UT-300
Utilities Group 2	UT-301
Basic Control Programs	CL-302
Autotest	PT-306
RPG - Report Program Generator	RG-307
Sort/Merge	SM-308
Assembler	AS-309

System Number 360B (specify each component desired).

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	MT 7DC/800	26	01
		DTR 9/800	28	None
		DTR 9/1600	29	None
		1316	52	01
Optional	none	MT 7DC/800	26	01
		MT 9/800	28	01
		MT 9/1600	29	01
		1316	52	01

ADDITIONAL PROGRAM MATERIAL

Program Logic Manuals

BOS/360 Control Program	Y24-5002
IOCS	Y24-5003
Autotest	Y24-5004
Report Program Generator	Y24-5005
Sort/Merge	Y24-5001
Assembler	Y24-5000
1070 PCS	Y24-5006
RJE Work Station	Y30-2006

Program Listings: The BOS/360 listing (including the Control Program) is available on microfiche
Pennsylvania.

The Control Program listing is also available on hard copy. Specify Group Code 2010 for the microfiche and/or Group Code 2011 for the hard copy. The listings are equivalent to the output listings produced by assembling the symbolic modules indicated below.

Program Component Name	Program Number
Basic Control Program	360B-CL-302
Utilities, Group 1	UT-300
Sort/Merge	SM-308
1070 PCS	SV-032
Assembler	AS-309
Utilities	UT-301
Autotest	PT-306
Report Program Generator	RG-307

CURRENT USERS

Current users will receive a pre-printed Program Order Form and a letter announcing the availability of Release 19/20 instructing them to order the new Release through the branch office using this pre-printed Program Order Form. Complete ordering instructions are provided in the letter to users.

To order the maintenance package for System Release 19/20, the user must specify M for Maintenance Package with one of the appropriate Distribution Medium codes on the Program Order Form. User Volume Requirements for either the total replacement or the maintenance package is 1. The maintenance package will be available for 60 days from the date of announcement. Disk only users must order a complete Replacement of BOS.

Users who no longer require this program should be instructed to return the pre-printed order form to PID with a "D" in columns 14 of section 1, line 1.

Current users may also modify their profile by adding or deleting components.

1401/1460 Emulator Program for use with the 1401/Compatibility Feature #4457 on System/360 Model 40: 1460 Emulator Program is a

stand-alone program that executes 1401/1460 programs when used on a System/360 Model 40 equipped with the 1401/1460 Compatibility Feature (#4457). The Compatibility Feature, which executes 1401 instructions at an average internal speed of approximately 4.5 times the 1401 system excluding I/O and edit instructions. Currently operating non time-dependent 1401/1460 programs can be executed without modification, although certain special and custom features are not emulated.

The basic 1401/1460 configuration being emulated may include 6 tape units, unit record equipment, 5 disk units, and the

1407/1447 Console. The emulator appears to the 1401/1460 program as a 16K 1401/1460 with all basic features and the following optional features: Advanced Programming (#1060) ... Bit Test (#1470) ... Column Binary (#1990) ... Expanded Print-Edit (#3835) ... 51-Column Interchangeable Read-Feed (#4150) ...

High-Low-Equal Compare (#4575) ... Multiply-Divide (#5275) ... Print Storage (#5585) ... Additional Print Control (#5540) ... Processing Overlap (#5730) ... Punch-Feed Read (#5890) ... Read-Punch Release (#6040) ... Space Suppression (#7246) ... Sense Switches (#7600) ... Binary Transfer - 1460 (#1468) ... Indexing and Store Address Register - 1460 (#4631) ... Scan Disk (#6396) ... Direct Seek - 1311 (#3281, #3282, #3283) ... Track-Record 1311 (#8011).

By eliminating the requirement to convert all 1401/1460 programs before installing System/360, the emulator allows the user to apply most of his programming resources towards developing new applications and redesigning existing applications to take full advantage of System/360 facilities. Use of the emulator also allows immediate production runs upon installation, allows time for user education in System/360 concepts, and eases the pressure of program testing.

In addition to 1401/1460 Compatibility Feature #4457 and at least 32,768 bytes of main storage (Model E), the System/360 Model 40 must have: Decimal Arithmetic (#3237) ... one 1052 Printer-Keybaord and 1052 Adapter (#7920) ... one 2540 Card Read Punch or 2400 series Magnetic Tape Unit for initial program loading ... for disk systems only - minimum of 65,536 bytes of main storage and Disk Compatibility (#9710).

If the emulator program is to be loaded from a 2400 series tape unit equipped with the 7-track Read-Write Head (#9557), the 7-track Compatibility Feature (#7125, #7126, #7127), and the Data Conversion Feature (#3228 or #3236) must be installed on the associated Tape Control Unit. After the emulator program has been loaded, the load device is available as a 1401/1460 corresponding device (see below). After initial program loading, the emulator program can be loaded from a 2540 Card Read Punch, a 2400 series Magnetic Tape Unit, or a 2311 Disk Storage Drive.

Input/Output Device Correspondence is as follows:

<u>1401/1460 Input/Output Device</u>	<u>System/360 Input/Output Device*</u>
1402 Card Read Punch, Model 1 or 3	2540 Card Read Punch and 2821 Control Unit with 1400 Compatibility Feature #8065
1403 Printer, Model 1, 2, or 3	1403 Printer, Model 2 or N1 or 1404 Printer Model 2 (continuous forms operations only)
729 II, IV, V, VI Tape Unit or 7330 Magnetic Tape Unit	2401, 2402, 2403, or 2415 Tape Units, Mdl 1, 2, 3, 4, 5, or 6; and 2420 Model 5 or 2404 Mdls 1-3 2401 Model 8 (7-track only) 3420 Models 3,5
1407/1447 Console Station Inquiry	1052 Printer-Keybaord, Model 7, with PPTC/ERCD code printing element
1311 Disk Storage Drive, Mdls 1, 2, or 4	2311 Disk Storage Drive** Mdl 1

*Magnetic Tape Units must be on Selector Channel 1 for emulation. All other units must be on the Multiplexor Channel.

**The 2311 Disk Storage Drive does not accept solid-hub 1316 Disk Packs.

Input/Output Feature Correspondence is as follows:

<u>1401/1460 Input/Output Feature</u>	<u>System/360 Input/Output Features</u>
1402 Punch Feed Read and Control Unit, Feature #5890 and #5895	2540 Punch Feed Read, Feature #5890; Punch Feed Read Control, Feature #5895, on the 2821 Control Unit

Column Binary Feature, #1990 Binary Transfer Feature, #1468 Column Binary Feature, #1990 must be installed on the 2821 Control Unit

1402 51-Column Interchangeable Read Feed, and Feed Adapter, Feature #4150 and #1013 2540 51-Column Interchangeable Read Feed,* Feature #4151

1403 Preferred Character Set and Adapter, Feature #5523, #5524; 1416 Interchangeable Train Cartridge, equipped with Preferred Character Set print train 1403 Universal Character Set Feature #8641 for Model 2, #8640 for Model N1, with prerequisite Interchangeable Chain Cartridge Adapter or Interchangeable Train Cartridge, and the appropriate Universal Character Set Adapter on the 2821 Control Unit

1311 Scan Disk Feature #6396 2841 File Scan Feature #4385

*This feature reduces the 2540 read speed from 1000 cpm to 800 cpm.

Basic Program Material 360C-EU-074

SRL Publications -- IBM System/360 Model 40 Emulation of the IBM 1401/1460 Data Processing System, C28-6561-3 and TNL N27-1250

Documentation -- Program Material List ... Sample Problem Operating Instructions.

Machine Readable -- Sample Problem Deck ... Absolute Loader ... Object Deck ... Disk Loader Object Deck are available in card form or on one 9-track (800 or 1600 bpi) or 7-track (800 cpi) DTR (Data Conversion feature required) For disk systems, a disk initialization program is required and must be ordered separately. A suitable initialization program is the Initialize Disk (2311) Program, 360P-UT-069.

7074 Emulator Program for System/360 Models 50 and 65: The 7074 Emulator Program operates on a

System/360 Model H50, 150, #65, 165, or J65 equipped with the 7070/7074 Compatibility Feature (#7117). The Emulator Program and Compatibility Feature together constitute the Emulator. Currently operating non time-dependent 7070/7074 programs can be executed without modification, although certain special and custom features are not emulated.

By eliminating the requirement to convert all 7070/7074 programs before installing System/360, the Emulator allows the user to better allocate his programming resources toward developing new applications and redesigning existing applications to take full advantage of System/360 facilities. Use of the Emulator also permits continued running of the critical production workload during the early period of installation when there are normally large testing requirements for new programs.

S/360 Model 50 Internal Performance

The average internal speed of the Emulator on System/360 Model 50 is approximately 2.4 times that of the 7070, or approximately .5 times that of the 7074. Actual speeds vary by application.

S/360 Model 65 Internal Performance

The average internal speed of the Emulator on System/360 Model 65 is approximately 8.4 times that of the 7070, or approximately 1.8 times that of the 7074. Actual speeds vary by application.

The basic 7070/7074 configuration being emulated may include up to ten tape units on each of three channels for the Model 50 or four channels for the Model 65, card readers and punches, printers, and the 7150 Console Typewriter.

Minimum System Requirements: In addition to the 7070/7074 Compatibility Feature, System/360 Model 50 or 65 with 262K bytes of main storage (Model H) ... one 1052 Printer-Keybaord ... one selector channel for each tape channel of the system being emulated ... one 2400 series Magnetic Tape unit, for each 729 Tape Unit to be emulated ... one 2400 series Magnetic Tape Unit for initial loading of the Emulator Program (subsequent program loading is accomplished by either a 2400 series Magnetic Tape Unit or 2311 Disk Storage Drive).

If the Emulator Program is to be loaded from a magnetic tape unit equipped with the 7-track Read/Write Head (#9557), the 7-track Compatibility Feature (#7125, #7126, or #7127), and the Data Conversion Feature (#3228 or #3236) must be installed on the associated tape control unit. After the Emulator Program has been loaded, the load device is available as a 7070/7074 corresponding device.

Input/Output device correspondence is as follows:

<u>7070/7074 I/O Devices</u>	<u>System/360 Model 50 or 65 I/O Devices</u>
7500 Card Reader	1442 Card Read Punch Model N1 or 2501 Card Reader Model B1 or B2 or 2520 Card Read Punch Model B1 or 2540 Card Read Punch Model 1
7501 Console Card Reader	1442 Card Read Punch Model N1 or 2501 Card Reader Model B1 or B2 or 2520 Card Read Punch Model B1 or 2540 Card Read Punch Model 1
7550 Card Punch	1442 Card Read Punch Model N1 or 2520 Card Read Punch Model B1 or 2520 Card Punch Model B2 or B3 or 2540 Card Read Punch Model 1
7400 Printer	1403 Printer Model 2, 3, 7, or N1 or 1443 Printer Model N1
7150 Console Typewriter 729 II, IV, V, and VI Magnetic Tape Units	1052 Printer-Keyboard Model 7 2401, 2402, 2403 Magnetic Tape Units Model 1, 2, 3, 4, 5, 6, or 2404 Magnetic Tape Units Model 1, 2, or 3, or 2415* Magnetic Tape Unit and Control Model 1, 2, 3,4,5, or 6; 2420** Models 5 and 7, 3420** Models 3, 5 and 7 2401 Model 8 (7-track only)
*2415 Magnetic Tape Unit and Control available only with the System/360 Model 50.	

**2420 Model 7 and 3420 Model 7 on 65 only, 2420 Model 5 and 3420 Models 3 and 5 on Model 50. 3420 Model 7 on Model 50 is not supported at 1600 bpi nine-track; on the Model 50 during simultaneous operations, the combined data rate on the system cannot exceed 400KB; on the Model 65 during simultaneous tape operations, the combined data rate on the system cannot exceed 640KB. Use of the 3420s requires Version 4 Mod Level 1 of 360C-EU-725.

Note: Data transfer operations during emulation are restricted to the simultaneous operation of 2420-7s on two channels.

Basic Program Material 360C-EU-725

SRL Publications -- Conversion Aids, 7074 Emulator Program for System/360 Models 50 and 65, C27-6908-3 and TNLS N27-1323, 1340, 1361

Documentation -- Program Material List ... Sample Problem Operating Instructions.

Machine Readable -- Sample Problem Card Deck ... one 9-track (800 or 1600 bpi) DTR or one 7-track (800 cpi) DTR (Data Conversion feature required) containing the 7074 Emulator Object Deck.

System/360 Model 50 1410/7010 Emulator Program for use with Compatibility Feature #4478:

The 1410/7010 Emulator Program is a stand-alone program that executes 1410/7010 programs when used on a System/360 Model 50 equipped with the 1410/7010 Compatibility Feature (#4478). The Emulator consists of the Compatibility Feature and the Emulator Program. Currently operating non time-dependent 1410/7010 programs can be executed without modification, although certain special and custom features are not emulated.

By eliminating the requirement to convert all 1410/7010 programs before installing System/360, the Emulator allows the user to apply most of his programming resources towards developing new applications and redesigning existing applications to take full advantage of System/360 facilities. Use of the Emulator also allows immediate production runs upon installation, allows time for user education in System/360 concepts, and eases the pressure of program testing.

The average internal speed of the Emulator when executing non-I/O instructions (except Move Characters and Edit, and Move Characters and Suppress Zeros) is approximately three times that of the 1410. Emulator performance for an individual job is greatly dependent on the mixture of instructions and the comparative performance of I/O devices. WITH equivalent I/O devices, throughput for most jobs which are not I/O bound will be approximately that of the 7010 system, or up to two times 1410 system throughput. I/O bound jobs will run at approximately the same speed as on the emulated system. Timing information which may be used to estimate throughput is presented in the SRL publication, IBM System/360 Model 50, Emulation of the 1410/7010 Data Processing Systems, C28-6568.

Note: The specified performance can be attained for disk systems only if EC413140 is installed on 2841 Storage Control Units.

The basic 1410/7010 configuration being emulated may include disk modules on each of three channels, tape units on each of three channels, unit record equipment on channel one, and the 1415 Console Printer. The Emulator appears to the 1410/7010 program as a 1410/7010 system of any standard memory size with the following features:

- 1410/7010 Processing Overlap
- 1410/7010 Priority Processing
- 1410 Dual Synchronizer Adapter
- 7010 Second and Third Data Channels
- 7010 Store and Restore Status Instructions

In addition to the 1410/7010 Compatibility Feature (#4478), the System/360 requirements are -- Model F50 for 1410/7010 core storage up to 20K, or Model G50 or larger for 1410/7010 core storage up to 100K ... one 1052 Printer-Keyboard Model 7, and 1052 Adapter (#7920) ... one 2540 Card Read Punch, 1442 Card Read Punch, Model N1, or one 2400 series Magnetic Tape Unit from which to load the Emulator program.

If the Emulator Program is to be loaded from a magnetic tape unit equipped with the 7-track Read/Write Head (#9557) and the 7-track Compatibility Feature (#7125, #7126, #7127), the Data Conversion Feature (#3228 or #3236) must be installed on the associated Tape Control Unit. After the Emulator Program has been loaded, the load device is available as a 1410/7010 corresponding device (see below).

Engineering Change Levels: The following EC levels are required for proper functioning of the System/360, Model 50 1410/7010 Emulator Program with phase encoded tape drives. EC 257246 on the 1410/7010 Compatibility feature ... EC 730969 on the 2803 Tape Control Unit model 2 ... EC 730966 on the 2804 Tape Control Unit model 2 ... EC 730969 on the 2403 Model 4, 5, and 6. Version 3 Modification Level 0 does not require the above EC's for Models 1, 2, and 3 tape drives.

The following REAs are required for proper functioning of the System/360 Model 50 1410/7010 Emulator Program with the 2314 Direct Access Storage Facility, REA 02-40-425 and REA 02-40-497 on the 1410/7010 compatibility feature.

- REA 02-40-425 is in EC #257246
- REA 02-40-497 will be in EC #257929

Input/Output Device Correspondence is as follows:

<u>1410/7010 I/O Devices</u>	<u>Equivalent System/360, Model 50 -- I/O Devices</u>
1402 Card Read Punch, Mdl 2*	2540 Card Read Punch
1442 Card Reader, Mdl 3*	1442 Card Read Punch, Mdl N1
1403 Printer, Mdl 1, 2, or 3*	1403 Printer, Mdl 2 or N1 1404 Printer, Mdl 2
729 II, IV, V, or VI Magnetic Tape Units	2401, 2402, 2403, 2404, 2420 Mdl 5, or 2415 Magnetic Tape Units Mdl 1,2,3,4,5, or 6, 7-track or 9-track or 3420 Models 3, 5 or 7**

7330 Magnetic Tape Units Sares as for the 729 Magnetic Tape Units

1415 Console Printer 1052 Printer-Keyboard, M41 7, with printing element #9572

1301 Disk Storage 2302 Disk or 2314 Direct Access Storage Facility ***

Model Correspondence as follows for 2302:

Two Model 1	One Model 3
One Model 2	One Model 3
Four Model 1	One Model 4
Two Model 2	One Model 4
Two Model 1 and One Model 2	One Model 4

Model Correspondence as follows for 2314:

1301 Mdl 1 ... DASF ***
 1301 Mdl 2 ... DASF ***

- * Emulated punched card equipment must previously have been assigned to 1410/7010 Channel 1.
- ** 3420 Model 7 is not supported at 1600 bpi nine-track; during simultaneous operations, the combined data rate on the system cannot exceed 600KB.

Input/Output Feature Correspondence is as follows:

<u>1410/7010 Feature</u>	<u>Model 50 Feature</u>
1402 51-Column Interchangeable Read Feed, Feature #1013 and #4150	2540 50-Column Interchangeable Read Feed, Feature #4151

Input/Output Feature Correspondence is as follows:

2302 Disk Storage Model correspondence as follows:	2314 DASF***
One 2302 Model 1	DASF ***
One 2302 Model 2	DASF ***

Disk initialization may be performed using System/360 Direct Access Storage Device Initialization Program, 360P-UT-213.

*** Three 2314 disk units are needed to emulate one 1301/2302 access arm. Unused 2314 disk units are available for any other desired operation.

Basic Program Material 360C-EU-726

SRL Publications -- System/360 Basic Programming Support, Operating Guide for Basic Assembler and Utilities, C28-6557-3 ... System/360 Model 50, Emulation of the 1410/7010 Data Processing System, C28-6568-1, and TNL N27-1245.

Documentation -- Program Material List ... Sample Problem Operating Instructions.

Machine Readable -- Absolute Loader, Emulator Object Deck, Sample Problem and Disk Loader available on one 4-track (800 or 1600 bpi) or one 7-track (800 cpi) DTR (Data Conversion feature required).

System/360 -- 7080 Emulator Program: The 7080 Emulator Program is a stand-alone program that executes currently operating 7080 programs when used on System/360 Model 65 equipped with the 7080 Compatibility Feature (#7118). The Emulator Program and the Compatibility Feature together constitute the Emulator. Programs for 705 I/II and 705 III can be run if they are compatible with the 7080. This usually requires running these programs in conjunction with INT580. However, 705 III programs that can be run without INT580 on the 7080 will run on the Emulator within the restraints of the Emulator support.

By eliminating the requirement to convert all 7080 programs before installing the System/360, the Emulator allows the user to better allocate his programming resources toward developing new applications and redesigning existing applications to take full advantage of System/360 facilities. Use of the Emulator also permits continued running of the critical production workload during the early period of installation when there are normally large testing requirements for new programs.

Most currently operating non-time-dependent 7080 programs can be executed without modification, although certain special and custom features are not emulated.

The performance of the Emulator will vary according to the combination of instructions used and the activity of the I/O in support of the emulated 7080 program. The average internal speed of the Emulator on System/360 Model 65 is approximately equal to that of the 7080.

Throughput performance of the 7080 Emulator is dependent upon the mixture of instructions executed and the comparative performance of equivalent I/O devices used in the support of a given application. However, experience with the 7080 Emulator indicates that throughput time for most Emulator jobs will be approximately equal to the job time on the 7080.

The 7080 configuration being emulated may include ten tape units on each of four channels, a 7153 Console and a 7502 Console Card Reader.

In addition to the 7080 Compatibility Feature, System/360 requirements are:

At least 262K bytes of main storage (Model H) for the emulation of a 7080 with 80,000 characters of memory. 524K bytes of main storage (Model I) is the minimum requirement to emulate a 7080 with a 160,000 character memory.

One 1052 Printer-Keyboard.

One selector channel for each communication channel of the 7080 being emulated.

One 2400 series Magnetic Tape Unit for each 729 Tape Unit being emulated.

If the Emulator Program is to be loaded from a magnetic tape unit equipped with the 7-track Read/Write Head (#9557), the 7-track Compatibility Feature (#7125, #7126, #7127) and the Data Conversion Feature (#3228 or #3236) must be installed on the associated tape control unit. After the program has been loaded, the load device is available as a 7080 corresponding device.

Input/Output device correspondence is:

I/O Device Correspondence Table for 7080 Emulator

7080 Units	Model	System/360 Units	Model
7153 Console Control Unit	1	Console Typewriter (choice of direct 1052 or 2150/1052)	
		2150 Console with 1052 Printer-Keyboard	1 7
		or 1052 Printer-Keyboard via #7920	7
7621 Tape Control	2,4	2403 Magnetic Tape Unit and Control, or 2803 Tape Control, and 2816 Switching Unit	1-6 1,2,3 1
		or 2404 Magnetic Tape Unit and Control, or 2804 Tape Control	1,2,3 1,2
729 Magnetic Tape Units	2,4,5,6	2401, 2402, 2403 Magnetic Tape Units or 2404 Magnetic Tape Unit or 2420 Magnetic Tape Unit or 3420 Magnetic Tape Unit	1-6,8 1-6 1-3 5-7 3,5,7
7502 Console Card Reader	1	1442 Card Read Punch, or N1 2501 Card Reader, or 2520 Card Read Punch, or B1 2540 Card Read Punch	N1 B1,B2 B1

Note: Tape drives must be emulated on a drive-for-drive-per channel basis ... as many tape control units are required on the System/360 as are necessary for the tape drives required. Use of 3420s requires Version 4 Mod Level 1 of 360C-EU-727.

System/360 Unit Record Devices can be attached to either or both Selector and Multiplexer Channels contained in the same system.

Conversion / Service

Basic Program Material 360C-EU-727

SRL Publications -- System/360 Conversion Aids: The 7080 Emulator Program for System/360 Model 65, C27-6911-1 and TNLs N27-1249, 1357.

Documentation -- Program Material List ... Sample Problem Operating Instructions.

Machine Readable -- One 9-track (800 or 1600 bpi) or 7-track (800 cpi) DTR (Data Conversion feature required) containing the self-loading emulator program, followed by the sample program.

System/360 Model 40 1410/7010 Emulator Program: The 1410/7010 Emulator Program is a stand-alone program that executes 1410/7010 programs when used on a System/360 Model 40 equipped with the 1410/7010 Compatibility Feature (#4478). The Emulator consists of the Compatibility Feature and the Emulator Program. Currently operating non time-dependent 1410/7010 programs can be executed without modification, although certain special and customer features are not emulated.

By eliminating the requirement to convert all 1410/7010 programs before installing System/360, the Emulator allows the user to apply most of his programming resources towards developing new applications and redesigning existing applications to take full advantage of System/360 facilities. Use of the Emulator also allows immediate production runs upon installation, allows time for user education in System/360 concepts, and eases the pressure of program testing.

The average internal speed of the Emulator when executing non-I/O instructions (except Move Characters and Edit, and Move Characters and Suppress Zeros) is approximately twice that of the 1410. Throughput performance depends on the mixture of instructions and the comparative performance of I/O devices. However, throughput for most jobs will be equal to or better than 1410 system throughput.

The basic 1410/7010 configuration being emulated may include ten disk modules on each of two channels, tape units on each of two channels, unit record equipment on channel one, and the 1415 Console Printer. The Emulator makes the Model 40 appear to the 1410/7010 program as a 40K or 80K 1410/7010 with the following features:

- 1410/7010 Processing Overlap
- 1410/7010 Priority
- 1410 Dual Synchronizer Adapter
- 7010 Second Data Channel
- 7010 Store and Restore Status instructions

In addition to the 1410/7010 Compatibility Feature (#4478), the System/360 requirements are: Model 40F for 40K positions of 1410/7010 core storage ... Model 40G or larger for 80K positions of 1410/7010 core storage ... Decimal Arithmetic Feature (#3237) ... one 1052 Printer-keyboard Model 7, and 1052 Adapter (#7920) ... one program-load device for the Emulator Program as distributed by IBM. This device can be a 2540 Card Read Punch ... 1442 Card Read Punch, Model N1 ... 2501 Card Reader, Model B1 or B2 ... 2520 Card Read Punch, Model B1 ... or 2400-series Magnetic Tape Unit. Subsequent loads can be accomplished with any of the aforementioned devices or with 2302 Disk Storage or a 2311 Disk Storage Drive or a 2314 Direct Access Storage Facility.

If the Emulator Program is to be loaded from a magnetic tape unit equipped with the 7-track Read-write Head (#9557), the 7-track Compatibility Feature (#7125, #7126, #7127), and the Data Conversion Feature (#3228 or #3236) must be installed on the associated Tape Control Unit. After the Emulator Program has been loaded, the load device (except for 2311 Disk Storage Drive) is available as a 1410/7010 corresponding device (see below). 360C-EU-7281

Disk initialization can be performed using S/360 Direct Access Storage Device Initialization Program, 360P-UT-213.

Engineering Change Levels REA 02-06-177 on the 1410 compatibility feature is required for proper functioning of System/360 Model 40 1410/7010 Emulator Program with the 2314 Direct Access Storage Facility. This REA is in EC #258013.

Input/Output Device Correspondence is as follows:

<u>1410/7010 I/O Devices</u>	<u>Equivalent System/360 Model 40 I/O Devices</u>
1402 Card Read Punch Model 2*	2540 Card Read Punch
1442 Card Reader Model 3*	1442 Card Read Punch Mdl N1 2501 Card Reader Mdl B1 or B2 2520 Card Read Punch Mdl B1
1403 Printer Mdl 1,2, or 3	1403 Printer Mdl 2 or N1 1404 Printer Mdl 2
729 II, IV, V, and VI Magnetic Tape Units	2401, 2402, 2403, or 2404 Magnetic Tape Units, Mdl 1, 2, 3, 4, 5, or 6, 8** or 2420 Mdl 5** or 2415 Magnetic Tape Units Mdl 1,2,3,4,5, or 6, 7-track or 9-track or 3420† Models 3 and 5**
7330 Magnetic Tape Units	Same as for the 729 Magnetic Tape Units
1415 Console Printer	1052 Printer-keyboard Mdl 7, with printing element #9572
1301 Disk Storage	2302 Disk Storage or 2314 Direct Access Storage Facility ***

Model correspondence as follows for 2302:

Two 1301 Model 1	One 2302 Model 3
One 1301 Model 2	One 2302 Model 3
Two 1301 Model 2	One 2302 Model 4
Four 1301 Model 1	One 2302 Model 4
Two 1301 Model 1 and One 1301 Model 2	One 2302 Model 4
One 2314 DASF***	
Two 2314s DASF***	
2314 DASF***	
Two 2314s DASF***	
Three 2314s DASF***	

* Emulated unit-record equipment must previously have been assigned to 1410/7010 channel 1.

** 2401/2402/2403 Model 6's 2420 Model 5, or 3420 Model 5 may be used on either selector channel 1 or 2, but not both simultaneously.

*** Three 2314 disk units are needed to emulate one 1301/2302 access arm. Unused 2314 disk units are available for any other desired operation.

† When emulating on a two-channel System/360, the combined data rate of the two channels cannot exceed 300 KB. Therefore, only 3420 Model 3's can be used on both channels when emulating the 1410/7010.

Input/Output Feature Correspondence is as follows:

<u>1410/7010 Feature</u>	<u>Model 40 Feature</u>
1402 51-Column Interchangeable Read Feed, Feature #1013, #4150	2540 51-Column Interchangeable Read Feed, Feature #4151

Basic Program Material 360C-EU-728

SRL Publications -- System/360 Conversion Aids: The 1410/7010 Emulator Program for System/360 Model 40, C28-6563-2, and TNL N27-1247 ... System/360 Basic Programming Support, Operating Guide for Basic Assembler and Utilities, C28-6557-2, and TNL N24-5136.

Documentation -- program material list ... operating instructions for sample problem.

Machine Readable -- one distribution tape reel (DTR) either 9-track (800 or 1600 bpi) or 7-track (800 cpi), containing the Emulator object program, absolute loader, sample program and disk loader. Data Conversion feature required for 7-track users.

Conversion/Service

System/360 Model 65 Emulator Program for 7097/7090/7094/7094II:

A stand-alone program which, when used on a System/360 Model 65 equipped with the 7090

Compatibility Feature, executes 709, 7090, 7094, and 7094II programs. The Emulator Program and Compatibility Feature are referred to as the Emulator.

By eliminating the requirement to convert all 7090 series programs before installing the System/360, the Emulator allows the user to apply his programming resources toward developing new applications, and redesigning existing applications to take full advantage of System/360 facilities. Use of the Emulator also allows immediate production runs upon installation and eases the pressure of program testing.

Most currently-operating, non-time-dependent, 7090 series programs can be executed without modification; however, certain devices and special features are not emulated.

Performance of the 7090 Emulator varies according to the instructions used and the I/O activity of the emulated 7090 series program. The average internal speed of the Emulator when it is executing non-I/O instructions is approximately twice that of the 7090 on the Model 65.

Throughput performance is highly dependent upon the mixture of instructions and the comparative performance of equivalent I/O devices used for a given application. However, on the Model 65 throughput time for most jobs will be approximately equal to the job time on the 7094 Model 1. Timing information that may be used to estimate throughput is presented in the SRL publication, System/360 Conversion Aids: The 709/7090/7094/7094II Emulator Program for System/360 Model 65, C28-6565.

Minimum machine requirements: System/360 Model 165 (524,288 bytes of main storage) ... 7090 Compatibility Feature (#7119) ... one 1052 Printer-Keyboard Model 7 with 1052 Adapter (#7920) or with 2150 Console ... one 2400 series Magnetic Tape Unit (9-track, or 7-track with the Data Conversion Feature) ... two additional units of initialization from the following -- 2400-series Magnetic Tape Unit, 2501 Card Reader or 1442, 2520, or 2540 Card Read Punch.

Data transfer operations during emulation are restricted to the simultaneous operation of 2420 Model 7's on two channels.

Matching requirements are as follows:

709/7090/7094/7094 II	Model	System/360	Model
7108 Processing Unit (7090)	1	2065 Processing Unit	1, IH, J
7110 Processing Unit (7094)	1	With 709/7040/7044/7090/7094/7094 II Compatibility	
7111 Processing Unit (7094 II)	1		
7109 Arithmetic Sequencer Unit	1	Functions provided by 2065	
7302 Core Storage	1,3	2365 Processor Storage I	2
		2365 Processor Storage III	3
		2365 Processor Storage J	2
7607 Data Channel(s) (channels A thru D supported)	1,2,3,4,5	2860 Selector Channel(s)	1,2,3
729 Tape Unit	2,4,5,6	2401,2402,2403 magnetic tape units	1,2,3,4,5,6,8
		2404 magnetic tape units	1,2,3
		2420	5 and 7
		3420 ***	3,5,7
711 Card Reader	2	2540 Card Read Punch	1
		1442 Card Read Punch*	N1
		2420 Card Read Punch*	B1
		2501 Card Reader	B1,B2
		2400/3400 Series Magnetic Tape Unit**	B1,B2
716 Printer	1	1052 Printer-Keyboard	7
		1403 Printer	2,3,7, N1
		1443 Printer	N1
		2400/3400 Series Magnetic Tape Unit**	
721 Card Punch	1	2540 Card Read Punch	1
		1442 Card Read Punch*	N1
		1442 Card Punch	N2
		2520 Card Read Punch*	B1
		2520 Card Punch	B2,B3
		2400/3400 Series Magnetic Tape Unit**	

* The 1442 and 2520 can be used to emulate either a reader or a punch, but not both at the same time.

** 2401, 2402, 2403, 2404, and 2420-5, and 3420-3,5,7 magnetic tape units. Use of 3420s requires Version 3 Mod Level 1 of 360C-FU-72J.

*** During simultaneous operations, the combined data rate on the system cannot exceed 640KB.

Basic Program Material [360C-EU-729]

SRL Publications -- System/360 Conversion Aids: The 709/7090/7094/7094II Emulator Program for System/360 Model 65, C28-6565-3 ... System/360 Conversion Aids: Sample Problems for System/360 Emulator Programs, C27-6929.

Documentation -- Program Material List

Machine Readable -- The Emulator Object Program, the Emulator Initialization Deck, the sample program, and the Emulator Initialization Object Program are available on one 9-track (800 or 1600 bpi) or one 7-track (800 cpi), DTR Data Conversion feature required.

IBM System/360 Simulator of the System/360 Simulator IBM 7090/7094 Data Processing System: of the 7090/94 is a stand-alone System/360 program that, without additional hardware, enables programs that have been operating on a 7090/94 to be executed on any System/360 having a suitable configuration.

By providing program "compatibility," the simulator relieves reprogramming schedules, and can eliminate the need to convert infrequently used programs.

All standard 7090/7094 instructions and features are simulated, and in addition to 7090/7094 programs the simulator executes 709 programs and 704 programs designed for 8K or 16K running under the 704/709/7090 Input/Output Compatibility Program. The functions of 7090/7094 input/output devices are performed by corresponding System/360 devices.

[Note: Simulation of the 704/709/7090 I/O Compatibility Program is provided to the users who retained an operational copy. This program is withdrawn and will not be provided.]

The simulator uses the System/360 Standard Instruction Set, Floating Point Arithmetic, and the Interval Timer. It also requires: a minimum of 262,144 bytes of main storage (Model H) ... one 1052 Printer-Keyboard ... one device for input of the simulator program (2400 Magnetic Tape Unit, 9-track or 7-track with Data Conversion Feature ... one device for simulator control information input ... for each device simulated, one of the devices shown for it in the following table:

7090/7094 Device	System/360 Device
7151 Console	1052 Printer-Keyboard, any model compatible with the system
711 Card Reader	1442 Card Read Punch, Mdl N1, equipped with card-image option; or 2540 Card Read Punch; or 2501 Card Reader, Mdl B1 or B2; or 2520 Card Read Punch, Mdl B1; or 2400 Magnetic Tape Unit, Mdl 1, 2, or 3 (7- or 9-track), 4, 5, or 6 (9-track).
716 Printer	1443 Printer, Mdl N1; or 1403 Printer; or 1052 Printer-Keyboard; or 2400 Magnetic Tape Unit, Mdl 1, 2, or 3 (7- or 9-track), 4, 5, or 6, (9-track).
721 Card Punch	1442 Card Read Punch, Mdl N1 equipped with card-image option; or 2540 Card Read Punch; or 1442 Card Punch, Mdl N2;

Conversion/Service

or 2520 Card Read Punch, Mdl B1; or 2520 Card Punch, Mdl B2 or B3; or 2400 Magnetic Tape Unit, Mdl 1, 2, or 3 (7- or 9-track) 4, 5, or 6 (9-track).

729 Magnetic Tape Unit 2400 Magnetic Tape Unit, Mdl 1, 2, or 3 (7- or 9-track), 4, 5, or 6 (9-track) or 8 (7-track)

(Note that Models 4, 5, and 6 of 2400-Series Magnetic Tape Units will be written at 1600 bpi density).

Card Read Punch devices must be equipped with the Card Image feature (1442), the Column Binary feature (2540), (#1532) or with Data Mode 2 (2501, 2520).

In some cases, the simulator program input, and the control information input, can be handled by the same devices as those used for simulated-device functions.

The Simulator produces correct results only for programs that work properly on the original system, and may produce incorrect results for time-dependent programs.

Restrictions and Limitations: Before a 7090 program is run under control of the Simulator, the following restrictions and limitations must be considered.

- . There are limitations on the length of magnetic tape records which can be directly accepted by the Simulator. These are explained in detail in the SRL.
- . Variable Length Multiply (VLM), Variable Length Divide or Halt (VDH), and Variable Length Divide or Proceed (VDP) instructions in which the count field is greater than 35 are treated as invalid.
- . The difference in timing of the 7090 and the System/360 may cause programs not protected by the Load Channel, Store Channel, or Channel Busy Test instructions to produce inconsistent results. Therefore, programs which rely upon 7090 internal timing to overlap I/O and CPU operations may produce incorrect results.
- . The point within a program run under Simulator control at which an I/O interruption occurs will not necessarily coincide with the corresponding interruption point when that program is run on a 7090.
- . A maximum of four 7607 Data Channels may be simulated.
- . No more than one 711, one 716, or one 721 can be simulated.

Basic Program Material [360C-SI-750]

SRL Publications -- IBM System/360 Conversion Aids: The 7090/7094 Simulator Program for IBM System/360, C28-6532-2. -- Program Material List.

Machine Readable -- The 7090/7094 Simulator Program Object Deck and Sample Program is available on one 9-track DTR (800 or 1600 bpi) or 7-track DTR (800 cpi) Data Conversion Feature is required.

Reference Material

IBM System/360 System Summary, A22-6810 ... IBM System/360 Principles of Operation, A22-6821 ... IBM 7090 Principles of Operation, A22-6528 ... IBM 7094 Principles of Operation, A22-6703.

IBM System/360 Simulator of the IBM 7070/7074 Data Processing System: The System/360 Simulator of the 7070/7074 is a stand-alone System/360 program that, without additional hardware, enables programs that have been operating on a 7070/7074 to be executed on any System/360 having a suitable configuration.

By providing program "compatibility", the simulator relieves reprogramming schedules, and can eliminate the need to convert infrequently used programs.

7070/7074 core storage capacities from 5,000 to 30,000 words are simulated, as well as all standard features, Floating Decimal Point (Option #4420), and Additional Storage (Option #1017). The functions of 7070/7074 input/output devices are performed by corresponding System/360 devices.

The Simulator uses the System/360 Standard Instruction Set and the Decimal Arithmetic option. It also requires:

- . Main Storage
 - 131,072 bytes (Mdl G) if simulated system is 5K or 10K
 - 262,144 bytes (Mdl H) if simulated system is 15K to 30K
- . One 1052 Printer-Keyboard
- . One device for input of the 7070/7074 program.
- . One device for simulator control information input.
- . For each device simulated, one of the devices shown for it in the following table:

<u>7070/7074 Device</u>	<u>System/360 Device</u>
7150 Console Typewriter	1052 Printer-Keyboard, any model compatible with the system
7501 Console Card Reader	1442 Card Read Punch, Model N1 2501 Card Reader, Model B1 or B2 2520 Card Read Punch, Model B1 2540 Card Read Punch
7500 Card Reader	1442 Card Read Punch, Model N1 2501 Card Reader, Model B1 or B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (9-track only)
7550 Card Punch	1442 Card Read Punch, Model N1 2520 Card Read Punch, Mdl B1 1442 Card Punch, Model N2 2520 Card Punch, Mdl B2 or B3 2540 Card Read Punch 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (9-track only)
7400 Printer	1403 Printer, Model 2 1443 Printer, Model N1 2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (9-track only)
729 Magnetic Tape Unit (any model)	2401 - 2403 Magnetic Tape Unit, Model 1, 2, or 3 (7-track or 9-track) or 8 (9-track)

(Note that Models 4, 5, and 6 of 2400-series tape units cannot be used.)

In some cases, the program input, control information input, and simulated-device functions can be handled by the same device.

The Simulator produces correct results only for programs that work properly on the original system, and may produce incorrect results for time-dependent programs.

The following are not simulated:
 7907 Data Channel ... 1301 Disk Storage ... 7340 Hypertape Drive ... 1414 Input/Output Synchronizer, Mdl 6 ... Interval Timer Feature ... Read Binary Tape Feature ... Diagnostic Operation Codes +08/-08 and +09/-09 - treated as NOP ... Unit Record Signal (US) - treated as NOP ... Tape No-Op Select (TSEL) - treated as NOP.

The following may impose a limitation for certain programs:

- . Tape Read Alpha (TRA) replaces Delta characters with the alphanumeric code 29 if the record is not in simulator internal format.
- . Address Stop is simulated only if it results from an instruction address.
- . Use of the simulated Stop key during execution of a branch operation places the branch address into the simulated instruction counter.
- . The Program Register is not simulated; when simulated execution is stopped by a programmed halt, the stop key, or an error condition, the current 7070/74 instruction and the contents of the instruction counter are printed.
- . Maximum BCD input/output tape record length is 20,000 bytes.
- . Bit representations of invalid characters are not typed; blanks or System/360 characters are typed instead.

Basic Program Material - [360C-SI-753]

Documentation - Program Material List ... Conversion Aids for the 7070/7074 Simulator Manual, C28-6530.

Machine Readable - The object programs ... all simulator functions and supporting functions ... and the sample program may be obtained on one 9-track or 7-track

If 9-track or 7-track is not specified, 9-track will be forwarded. No tape submittal is required.

IBM System/360 1410/7010 Simulator Program: The 1410/7010 Simulator Program is a stand-alone System/360 program that enables programs that have been operating on a 1410/7010 to be executed on a System/360 having a suitable configuration. By providing program "compatibility," the simulator relieves reprogramming schedules, and can eliminate the need to convert infrequently used programs.

The Simulator produces correct results only for programs that work properly on the original system, and may produce incorrect results for time-dependent programs.

The System/360 must be equipped with the devices needed to service the simulator, as well as those required to provide a configuration corresponding to that of the original system.

The Simulator requires:

- . One 1052 Printer-Keyboard.
- . One device for program input
- . One device for simulator control information input.
- . One corresponding device for each simulated device.

In some cases, the program input, control, and simulated-device functions can be handled by the same device.

Performance under simulation depends largely on the balance of CPU and I/O operations.

The 1410/7010 simulator handles all standard features and the following optional features of the simulated system:

- . Floating point arithmetic.
- . Processing overlap (#5730).
- . Priority processing (#5620).
- . Inverted Print-Edit (comma-period).
- . One to four channels.

The main restrictions and limitations are:

- . 1401 compatibility is not simulated.
- . Programs which rely on 1410/7010 internal machine timing to overlap I/O and CPU operations may produce incorrect results.
- . No more than 25 I/O devices can be simulated simultaneously.
- . Only the main console functions are simulated.
- . The length of records is limited to the size of the I/O buffers (5K to 120K characters, depending on the main storage capacity of the System/360 and on that of the 1410/7010 and the number of channels simulated).

Minimum system requirements: The simulator operates with the Standard Instruction set and the Decimal Arithmetic option. Main storage requirements depend on the 1410 or 7010 core storage being simulated as follows -

1410 Core Storage (Characters)	7010 Core Storage (Characters)	System/360 Main Storage (bytes)
10,000		65,536 (Model F)
20,000		65,536 (Model F)
40,000	40,000	131,072 (Model G)
60,000	60,000	131,072 (Model G)
80,000	80,000 (2 channels)	131,072 (Model G)
	80,000 (4 channels)	262,144 (Model H)
	100,000	262,144 (Model H)

A System/360 device corresponding to each 1410/7010 device to be simulated is required as follows:

1410/7010 Device	System/360 Device
1415 Console	1052 Printer-Keyboard, any model compatible with the System/360 configuration.
1402 Card Read Punch Model 2	2540 Card Read Punch
1442 Card Reader, Mdl 3	1442 Card Read Punch, Mdl N1 2501 Card Reader, Mdl B1 or B2 2520 Card Read Punch, Mdl B1
1403 Printer, Mdl 1,2, or 3	1403 Printer, Mdl 2 1443 Printer, Mdl N1
729 Magnetic Tape Unit Mdl's II, IV, V, VI	2401, 2402, 2403 Magnetic Tape Mdl's 1, 2, 3, or 8 (7-track)
7330 Magnetic Tape Unit	

Note: 2400 series tape units models 4, 5, and 6 at 1600 bpi cannot be used.

Simulation of the 1402 Card Read Punch, Model 2, with 51-column Interchangeable Read Feed feature (#4150) requires a 2540 Card Read Punch with 51-column Interchangeable Read Feed feature (#4151).

Simulation of the 1402 Card Read Punch, Model 2, with Read and Punch Column Binary feature (#6025) requires a Column Binary - Data Mode 2 feature on the 2821 Control Unit (#1990).

Any 2400-series Magnetic Tape Unit used to read or write 7-track tapes must be equipped with the 7-track Compatibility feature (#7125) and a 7-track Read/Write Head (#9557). The 7-track Compatibility feature must be installed on the associated tape control unit. Information on simulation limitations and performances under simulation can be found in the SRL publication, System/360 Conversion Aids: The 1410/7010 Simulator for System/360, C28-6528-1, and in the Programming section of the DP Sales Manual. [360C-SI-754]

Basic Program Material - [360C-SI-754]

Documentation - Program Material List ... IBM System/360 Conversion Aids - 1410/7010 Simulator for IBM System/360 Manual, C28-6528.

Machine Readable - 9-track or 7-track (Data Conversion Feature required) DTR containing - Common programs, SIM 10, PREP 10, UPDATE 10, SVSINEND and sample program.

If 9-track or 7-track DTR is not specified, 9-track DTR will be supplied. No tape submittal is required.

ALGOL-to-PL/I (F) Language Conversion Program The ALGOL-to-PL/I (F) Language Conversion Program (LCP) assists customers in the transition from OS/360 ALGOL-to-PL/I (F). The LCP itself, intended for operation within the System/360 Operating System, is written in PL/I (F). It is distributed in object module form on disk or on tape.

Minimum System Requirements -- The machine requirements depend on the type of run to be made: a conversion run or a link-editing run for creating the LCP load module. For a conversion run by the LCP:

One System/360 Model 40 with 128K bytes of main storage. The LCP itself needs a minimum of 54K bytes to operate in a PCP or MFT environment. The 54K bytes include the Data Management Routines and buffers. To use the LCP with MVT, it is suggested that 6K be added to the SIZE chosen so as to obtain the REGION specification.

Standard instruction set

Decimal Arithmetic feature

Floating Point Arithmetic feature

Minimum peripheral equipment required by the Operating System

The Logical data sets used by the LCP are shown in Table 1. Note that when these data sets are on DASD, they may be placed on the same volume as the system residence.

Logical Data Sets Required by the LCP for a Conversion Run

DATA SET	FUNCTION	DEVICE OPTIONS
SYSIN	Source Input	Magnetic Tape Unit, Card Reader, Direct Access Storage Device (DASD)
SYSRNT	Listing Output	Magnetic Tape Unit, Printer, DASD
SYSUT1	Auxiliary Storage	DASD
SYSUT2	Auxiliary Storage	DASD
SYSPCH ¹	Deck Output	Magnetic Tape Unit, Card Punch, DASD

¹ SYSPCH is required only for punched-card output (or card image on magnetic tape or DASD) of the converted program.

For creation of the LCP load module, an additional 2311 Disk Storage Drive or magnetic tape unit is required to run the distributed program. In order to create the LCP load module and/or execute a conversion run, the Operating System must include the modules for the PL/I (F) compiler and its library.

Performance -- On a System/360 Model 40 with 128K bytes of main storage, the average conversion time (T) for an ALGOL program containing N cards is given in the following formula (in seconds):

$$T = 65 + 0.65N$$

The time given is that which is applicable when the user has specified the options SOURCE and DECK in his EXEC card, thus requiring the source program to be listed on SYSRNT and the target program to be punched on SYSPCH. The devices to be used are as follows:

2540	Card Read Punch for SYSIN
1403	Printer for SYSRNT
2540	Card Read Punch for SYSPCH

When SYSIN, SYSRNT and SYSPCH are 2401 Magnetic Tapes Units (Model III):

$$T = 65 + 0.50xN$$

Basic Program Material: ALGOL LCP, 360C-CV-711.

Documentation -- Program Material List

SRL publications -- IBM System/360 Conversion Aids: ALGOL-to-PL/I Language Conversion Program for IBM System/360 Operating System C33-2000-1 ... with TNLS N33-7002 and N33-7004...N33-7001 and N33-7003.

Machine Readable Material -- Language Conversion Program in object deck form is available on one 9-track DTR (800 or 1600 bpi), or one 7-track DTR (800 cpi Data Conversion feature required) or one 1316 Disk Pack.

FORTRAN IV-to-PL/I (F) Language Conversion Program The FORTRAN IV-to-PL/I (F) Language Conversion Program (LCP) assists customers in the transition from FORTRAN IV-to-PL/I (F). The LCP itself, intended for operation within the OS/360 is written principally in PL/I (F), though it includes certain routines written in assembler language. These latter perform table look-up and special types of conversion. It is distributed in object module form on disk or on tape.

Minimum System Requirements -- Requirements depend on the type of run to be made: a conversion run or a link-editing run for generating the LCP load module. For a conversion run by the LCP:

One System/360 Model 40 with 128K bytes of main storage. The LCP itself needs a minimum of 70K bytes to operate in a PCP or MFT environment. The 70K bytes include the Data Management Routines and buffers. To use the LCP with MVT, it is suggested that 6K be added to the SIZE chosen so as to obtain the REGION specification.

Standard instruction set

Decimal Arithmetic feature

Floating Point Arithmetic Feature

Minimum peripheral equipment required by the Operating System

The Logical data sets used by the LCP are shown in table below. Note that when these data sets are on DASD, they may be placed on the same volume as the system residence.

Logical Data Sets Required by the LCP for a Conversion Run

DATA SET	FUNCTION	DEVICE OPTIONS
SYSIN	Source Input	Magnetic Tape Unit, Card Reader, Direct Access Storage Device (DASD)
SYSRNT	Listing Output	Magnetic Tape Unit, Printer, DASD
SYSUT1	Auxiliary Storage	DASD
SYSUT2	Auxiliary Storage	DASD
SYSPCH ¹	Deck Output	Magnetic Tape Unit, Card Punch, DASD

¹ SYSPCH is required only for punched-card output (or card image on magnetic tape or DASD) of the converted program.

For creation of the LCP load module, and additional 2311 Disk Storage Drive or magnetic tape unit is required to run the distributed program. In order to create the LCP load module and/or execute a conversion run, the Operating System must include the modules for the PL/I (F) compiler and its library.

Performance -- On a System/360 Model 50 with 128K bytes of main storage, the average conversion time (T) for a FORTRAN program containing N cards is given in the following formula (in seconds):

$$T: 55 + 37 \times S + 0.75 \times N$$

S: being the number of subprograms

The time given is that which is applicable when the user has specified the options SOURCE and DECK in his EXEC card, thus requiring the source program to be listed on SYSRNT and the target program to be punched on SYSPCH. The devices to be used are as follows:

2450	Card Read Punch for SYSIN
1403	Printer for SYSRNT
2540	Card Read Punch for SYSPCH

When SYSIN, SYSRNT and SYSPCH are 2401 Magnetic tapes units (Model III):

$$T = 55 + 37 \times S + 0.60 \times N$$

Basic Program Material: FORTRAN LCP, 360C-CV-710 ...

Documentation -- Program Material List

SRL publications -- IBM System/360 Conversion Aids: FORTRAN IV-to-PL/I Language Conversion Program for IBM System/360 Operating System, C33-2002-1.

Machine Readable Material -- Language Conversion Program in object deck form is available on one 9-track DTR (800 or 1600 bpi), or one 7-track DTR (800 cpi Data Conversion feature required) or one 1316 Disk Pack.

COBOL (E/F)-to-PL/I (F) Language Conversion Program -- The COBOL (E/F)-to-PL/I (F) Language Conversion Program (LCP) (360C-CV-712) assists customers in the transition from OS/360 COBOL (E/F)-to-PL/I (F). The LCP itself, intended for operation within the System/360 Operating System, is written in PL/I (F). It is distributed in object module form on disk or on tape.

Minimum System Requirements -- The machine requirements depend on the type of run to be made: a conversion run or a link-editing run for creating the LCP load module.

For conversion run by the LCP:

One System/360 Model 40 with 128K bytes of main storage. The LCP itself needs a minimum of 80K bytes to operate in a PCP or MFT environment. The 80K bytes include the Data Management routines and buffers. To use the LCP with MVT, it is suggested that 6K be added to the SIZE chosen so as to obtain the REGION specification.

Standard instruction set.

Decimal Arithmetic feature.

Floating Point Arithmetic feature.

Minimum peripheral equipment required by the Operating System.

The logical data sets used by the LCP are shown in Table below. Note that when these data sets are on DASD, they may be placed on the same volume as the system residence.

Logical Data Sets Required by the LCP for a Conversion Run

DATA SET	FUNCTION	DEVICE OPTIONS
SYSIN	Source Input	Magnetic Tape Unit, Card Reader, Direct Access Storage Device (DASD)
SYSPRINT	Listing Output	Magnetic Tape Unit, Printer DASD
SYSUT1	Auxiliary Storage	DASD
SYSUT2	Auxiliary Storage	DASD
SYSUT3	Auxiliary Storage	DASD
SYSUT4	Auxiliary Storage	DASD
SYSPCH ¹	Deck Output	Magnetic Tape Unit, Card Punch, DASD

SYSPCH is required only for punched-card Output (or card image on magnetic tape or DASD) of the converted program.

For creation of the LCP load module, an additional 2311 Disk Storage Drive or magnetic tape unit is required to run the distributed program.

In order to create the LCP load module, and/or to execute a conversion run, the Operating System must include the modules for the PL/I (F) compiler and its library.

Performance -- On a System/360 Model 50 with 128K bytes of main storage and using the minimum partition size (80K), the conversion speed ranged from 55 to 65 cards per minute. This speed applies when the SOURCE and DECK options are specified on the EXEC card, producing a source program listing on SYSPRINT and a punched target program on SYSPCH.

The machine configuration is as follows:

- One 2540 Card Read Punch for SYSIN and SYSPCH
- One 1403 Printer for SYSPRINT
- One 2311 Disk Storage Drive for SYSUT1, SYSUT2, SYSUT3, SYSUT4,
- One DASD for system residence

When SYSIN, SYSPCH and SYSPRINT are assigned to a 2401 Magnetic Tape Unit, model 3, the range of conversion speed was from 60 to 75 cards per minute.

Object Program -- As a general guideline to facilitate installation planning, it is estimated that the sample programs, when translated and compiled by the PL/I F Compiler will take between one and one third and one and two thirds times as long to execute as the original COBOL programs and will occupy up to 3 times as much core storage. Note that the programs tested are not necessarily representative of all COBOL programs and the above information is presented as a guideline only.

COBOL-to-ANS COBOL Language Conversion Program:

This Language Conversion Program (LCP) operates under OS/360 and assists users in the transition from COBOL E or COBOL F to OS/360 ANS COBOL, 360C-CV-713.

Minimum System Requirements - For conversion: One System/360 Model 30 with 64K bytes of main storage. The LCP itself requires a minimum of 26K bytes to operate in a PCP or MFT environment. To use the LCP with MVT, it is suggested that 4K be added to the SIZE chosen to obtain the REGION specification.

Standard instruction set
Decimal Arithmetic feature
Minimum OS/360 peripheral equipment requirements.

Logical Data Sets used by the LCP in conversion:

DATA SET	FUNCTION	DEVICE OPTIONS
SYSIN	Source Input	Magnetic Tape Unit, Card Reader, DASD
SYSPT	Listing Output	Magnetic Tape Unit, Printer, DASD
*SYSPCH	Deck Output	Magnetic Tape Unit, Card Punch, DASD
SYSUT 1	Auxiliary Storage	DASD
SYSUT 2	Auxiliary Storage	Magnetic Tape Unit, DASD
SYSUT 3	Auxiliary Storage	Magnetic Tape Unit, DASD
*SYSUT 4	NEWLIB output	DASD
*SYSUT 5	Auxiliary Storage for NEWLIB	Magnetic Tape Unit, DASD

*Optional

For creation of the LCP: minimum OS/360 requirement, plus the following: one Card Reader ... one Card Punch ... one Magnetic Tape Unit.

Basic Program Package 360C-CV-713

Documentation - Program Material List Publication, IBM System/360 Conversion Aids, C28-6400-0 with TNL N28-0262.

Machine Readable - Object code.

Optional Program Package

Documentation - Program Material List, LCP Creation Procedure.

Machine Readable - Source modules and sample control cards.

7094 Integrated Emulator for the System/360 Model 85 under Operating System/360:

An integrated emulator program that executes as a problem program under the System/

360 Operating System, MFT or MVT version, in conjunction with the 7094 Compatibility Feature (#7119). The integrated emulator program and the Compatibility Feature, referred to as the Integrated Emulator, executes 709, 7090, 7094, and 7094II programs.

The Integrated Emulator takes advantage of the multiprogramming facilities of the System/360 Operating System. Other problem programs, such as compilers, utility programs, user jobs, real-time applications, or other 7094 integrated emulators, can be executed concurrently in main storage. It allows the user to apply his programming resources toward developing new applications, and redesigning existing applications to take advantage of System/360 facilities. Both 7094 and System/360 jobs can be placed in a single input job stream for processing, provided the input does not contain binary data. If the MVT Automatic SYSIN Batching reader is used, binary cards may be read in SYSIN.

Most currently-operating, non-time-dependent 7090 series programs can be executed without modification; however, certain devices and special features are not emulated.

Performance of the Integrated Emulator varies according to the instructions used and the I/O activity of the emulated 7090 series program. The average internal speed of the Integrated Emulator when it is executing non-I/O instructions is approximately twice that of the 7094II.

System Requirements: The 7094 Integrated Emulator Program requires any System/360 Model 85, the 7090 Compatibility Feature (#7119), devices required for the operating system, and one System/360 device for each emulated 7094 device. All card read punch units used to read in binary data must be equipped with the Card Image Feature, and all tape drives used for 7094 compatible tapes, (i.e., readable by the 7094 system) must be equipped with the Seven-Track Compatibility Feature.

Equivalent system requirements are as follows:

709/7090/7094/7094II	Model	System/360	Model
7108 Processing Unit (7090)	1	2085 Processor Unit	Any
7110 Processing Unit (7094)	1	With 709/7090/7094/7094II Compatibility	
7111 Processing Unit (7094II)	1		
7109 Arithmetic Sequencer Unit	1	Functions provided by 2085	
7302 Core Storage	1, 3	2365 Processor Storage	5
		2385 Processor Storage	1,2
7607 Data Channel(s) (Channels A thru H supported)	1,2,3, 4,5	2860 Selector Channel(s)	
		2870 Multiplexer Channel(s)	
729 Tape Unit	2,4,5, 6	Any tape unit supported by the operating system basic sequential access method	
711 Card Reader	2	Any card reader with Card Image Feature or SYSIN device supported by the operating system queued sequential access method if SYSIN is used for binary cards, the Automatic SYSIN batching reader must be used (MVT only)	
716 Printer	1	Any printer or SYSOUT device supported by the operating system sequential access method	
721 Card Punch	1	Any card punch with Card Image Feature or SYSOUT device supported by the operating system sequential access method. If SYSOUT is used, the user must write his own SYSOUT writer to punch binary data.	

Any 7094 feature or device not listed is not emulated, 704 Mode is not emulated.

Basic Program Material: 360C-EU-734

Documentation: Basic Program Material List with attachment; IBM System/360 Operating System Emulator Program to Emulate the IBM 709, 7090, 7094, 7094 II on the System/360 Model 85, (GC27-6944).

Machine Readable Material: Load Modules, emulator generation macro definition and sample problem.

Optional Program Material:

Documentation: Optional Program Material List

Machine Readable Material: Source statements and macros

1401/1440/1460 Integrated Emulator Program for the IBM System/370 Model 155, 155 II, 158 Under OS: 360C-EU-735

The Operating System, (MFT or MVT) using the 1401/40/60, 1410/7010 Compatibility Feature (#3950). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440, or 1460 Data Processing Systems to be executed on the Model 155, 155 II, 158. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit ... Inverted Print Edit ... High-Low-Equal Compare ... Multiply-Divide ... Processing Overlap ... Sense Switches ... Advanced Programming/ Indexing ... Bit Test ... Print Storage ... Additional Print Control ... Space Suppression ... Scan Disk (in load mode) ... Selective Stacker.

The following features and operations are not emulated: Column Binary ... Binary Transfer ... 51-column Card ... Punch-Feed Read ... Read-Punch Release ... Card Image (on 1442) ... Selective Tape Listing (on 1403) ... Compressed Tapes.

The following input/output devices are not emulated: 1404 Printer ... 1444 Card Punch ... 1445 Printer ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Optical Readers ... Magnetic Character Readers ... Teleprocessing Devices.

The 1401 Model G is not emulated.

Internal speed - Model 155 only - (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately 1.75 times that of the 1401/1460 standalone emulator for the IBM System/360 Model 40. Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator program), input/output operations (executed by the emulator program), and the amount of interference from higher-priority partitions or regions.

The emulator program takes advantage of the multiprogramming facilities of the Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/360 or System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1401/1440/1460 system or an emulator program must be dumped onto tape using a 1401/1440/1460 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires the Model 155, 155 II, 158, the 1401/40/60, 1410/7010 Compatibility Feature (#3950), enough main storage for the operating system under which the emulator program is run (MFT or MVT), the emulator functions required for the system being emulated (emulator program and buffers), the 1401/1440/1460 program; and enough Model 155, 155 II, 158 devices to correspond to the emulated 1401/1440/1460 devices, in addition to the devices required for the operating system.

Input/Output Device Correspondence is as follows:

1401/1440/1460 I/O Device*	System/370 Model 155, 155 II, 158
1401 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the operating system.
1442 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the operating system.
1403 Printer	Any printer supported by the queued sequential access method of the operating system.
1443 Printer	Any printer supported by the queued sequential access method of the operating system.
729 II, IV, V, VI Tape Unit, or 7330 Magnetic Tape Unit, or 7335 Magnetic Tape Unit	Any tape unit supported by the basic sequential access method of the operating system.
1407 Console Inquiry Station, or 1447 Console	Any operator's console supported by the operating system.
1301 Disk Storage, or 1311 Disk Storage Drive, or 1405 Disk Storage, Model 1 or 2	Any direct access storage device supported by the basic direct access method of the operating system.**

Basic Program Material:

Documentation: Basic Program Material List; 1401/1440/1460 Emulator on Models 135, 145, 155 (GC33-2008).

Machine Readable: Load modules, emulator generation macro definition and sample program.

Optional Program Material:

Documentation: Optional Program Material List.

Machine Readable: Source statements and macros.

Ordering Information: See the last page in this section (Conversion/Service).

Additional copies of the form numbered manual should be ordered from Mechanicsburg -- not from PID.

Additional Program Support Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering use Group Code GJD1-2100.

Publication: 1401/1440/1460 Emulator on Models 135, 145, 155 Logic (GY33-7011). Available only from Mechanicsburg.

1410/7010 Integrated Emulator Program for the IBM System/370 Model 155, 155 II, 158 Under OS: 360C-EU-736

The 1410/7010 Emulator Program executes as a problem program under the Operating System (MFT or MVT) using the 1401/40/60, 1410/7010 Compatibility Feature (#3950). The combination of the program and the compatibility feature enables programs written for the 1410 or 7010 Data Processing Systems to be executed on the Model 155, 155 II, 158. Most 1410/7010 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Emulation is provided for 1410/7010 systems with main storage sizes from 10,000 to 100,000 positions of core storage.

All basic features are emulated, along with the following optional features: Processing Overlap ... Priority Processing ... Two Channels on 1410 ... Inverted Print Edit ... 7010 Second, Third, and Fourth Data Channels ... 7010 Store and Restore Status ... 7010 Floating Point Arithmetic Feature.

The following features and operations are not emulated: 1401/1410 Compatibility Mode ... Column Binary ... 51-Column Card ... Selective Stacker ... 1410/7010 Diagnostic Instruction Branch on Tape Indicate J(I) K ... 7010 Diagnostic Instruction Branch on C Bit ... 7010 Program Relocation and Storage Protection ... 7010 Interval Timer ... Write Disk Check Operations ... Disk CE Track Operations (i.e., operation with CE switch on).

The following input/output devices are not emulated: 1311 Disk Storage Drive ... 1405 Disk Storage ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Magnetic Character Readers ... Teleprocessing Devices ... Optical Readers.

Internal speed - Model 155 only - (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately 1.1 times that of the 1410/7010 standalone emulator for the IBM System/360 Model 50. Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator program), input/output operations (executed by the emulator program), and the amount of interference from higher-priority partitions or regions.

Continued

Notes:

*Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

**If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

The emulator program takes advantage of the multiprogramming facilities of the Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator programs can be executed concurrently.

The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/360 or System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1410/7010 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1410/7010 system or a stand-alone emulator program must be dumped onto tape using a 1410/7010 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires a Model 155, 155 II, 158, the 1401/7070, 1410/7010 Compatibility Feature (#3950), enough main storage for the operating system under which the emulator program is run (MFT or MVT), the emulator functions required for the system being emulated (emulator program and buffers), and the 1410/7010 program; and enough Model 155, 155 II, 158 devices to correspond to the emulated 1410/7010 devices, in addition to the devices required for the operating system.

Input/Output Device Correspondence is as follows:

1410/7010 I/O Device*	System/370 Model 155, 155 II, 158 I/O Device
1402 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the operating system.
1403 Printer	Any printer supported by the queued sequential access method of the operating system.
729 II, IV, V, VI Tape Unit, or 7330 Magnetic Tape Unit	Any tape unit supported by the basic sequential access method of the operating system.
1415 Console Printer	Any operator's console supported by the operating system.
1301 Disk Storage, Model 1 or 2, 1302 Disk Storage, Model 1 or 2, 2302 Disk Storage, Model 1 or 2	Any direct access storage device supported by the basic direct access method of the operating system. **

Notes:

- * Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.
- ** If more than one System/370 direct access storage device is required to correspond to the 1410/7010 disk storage device being emulated, all corresponding System/370 devices must be the same type of direct access storage device.

Basic Program Material:

Documentation: Basic Program Material List with attachment; 1410/7010 Emulator on Models 145/155 (GC33-2009).

Machine Readable: Load modules, emulator generation macro definition and sample program.

Optional Program Material:

Documentation: Optional Program Material List.
Machine Readable: Source statements and macros.

Ordering Information: See the last page in this section (Conversion/Service).

Additional copies of the form numbered manual should be ordered from Mechanicsburg -- not from PID.

Additional Program Support Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering use Group Code GJD1-2150.

Publication: 1410/7010 Emulator on Models 145/155 Logic (GY33-7012). Available only from Mechanicsburg.

DOS Emulator Under OS

The DOS Emulator eases the transition for DOS user migrating to OS (MFT) and the System/370 Models 135, 145 and 155, 155 II, 158 or OS MVT on the Models 145 and 155, 155 II, 158. The Emulator program integrates the facilities of the DOS system into the operating environment of OS. It receives DOS jobs as input and produces output in the same format as found in DOS.

Highlights: Emulation enables the new OS user to execute his DOS programs without having to rewrite them. . . No re-SYSGEN or linkage edit is required for DOS. . . The emulator supports the DOS multiprogramming environment. . . The emulator does not dedicate OS to emulating DOS, as normal OS processing occurs concurrently.

Restrictions: The following IBM units and features supported by DOS are not supported by the emulator:

- 2260 or 3270 local
- 1270, 1275 optical reader, sorter
- 1259, 1412, and 1419 magnetic character readers.
- 1287, 1288 optical character reader in document mode, when: response times are required for pocket selection, (1287 only); PCI bit in the CCW is used, or the CCW string is modified between the READ and WAITF macros.
- Model-dependent functions such as CS30, CS40, and the DIAGNOSE instruction.

The following programming items, permissible in the DOS environment, cannot be handled by the emulator:

The emulator programs for 1401/40/60 and 1410/7010 under DOS. Modification, use, or storing of information in user CCW's between EXCP and WAIT. Storage protection under DOS may be specified but is not effective.

QTAM and AUTOTEST.

Programs that:

- Depend upon the HIO, RDD, WDD, and DIAGNOSE instructions for their operation.
- Require more than 2 bytes of sense information.
- Rely on known timing relationships of DOS.
- Use PCI bit.

Minimum System Requirements: The minimum main storage required by the emulator program without the staged I/O facility is 22K bytes. The addition of the staged I/O facility requires 4K bytes more. An additional 6K is required for MVT because of the way MVT manages main storage.

The OS partition or region must be large enough to contain the emulator program plus the Disk Operating System being emulated. The Disk Operating System includes the DOS Control Program and the DOS partitions.

There must be enough devices available to support both the Disk Operating System being emulated and the host Operating System. Since devices must be dedicated to the Disk Operating System, device sharing is not provided.

The System/370 Model 155 requires logic EC level 260-448 and DOS Compatibility Feature (5450) EC level 260-715.

Basic Program Material:

Documentation: Basic Program Material List. SRL Emulating DOS under OS for IBM System/370 (GC26-3777).

Machine Readable: SYSIN tape containing Linkage Edit of DOS Emulator and sample job.

Optional Program Material:

Documentation: Optional Program Material List.

Machine Readable: Source Statements.

Ordering Information: Program Number 360C-EU-738

	Program No. Extension	Distribution Type	Medium Code	User Volume Requirement
Basic	None	DTR 7	DC/800 26	None
		DTR 9	800 28	None
		DTR 9	1600 29	None
Optional	None	DTR 7	DC/800 26	None
		DTR 9	800 28	None
		DTR 9	1600 29	None

System/370 Model 165, 165 II, 168 Integrated Emulator Program for the 7070/7074: (360C-EU-739)

The 7070/7074 Emulator Program executes as a problem

program under the MFT or MVT version of OS/360 on a Model 165, 165 II, 168 equipped with the 7070/7074 Compatibility Feature (#7117). The 7070/7074 Integrated Emulator Program and the Compatibility Feature enable the Model 165, 165 II, 168 to execute, under the Operating System, programs written for an IBM 7070/7074 Data Processing System with the Floating Point feature and 10,000 words of storage. Most 7070/7074 programs that are debugged and are not time-dependent can be executed without modification. Certain devices and features of the 7070/7074 system are not emulated, however.

The Integrated Emulator Program takes advantage of the multiprogramming facilities of OS/360. Other problem programs such as: user jobs, utility programs, compilers, or additional 7070/7074 Integrated Emulator Programs can be executed concurrently in

main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System, thereby achieving device independence and the automatic allocation of system resources.

The internal speed - Model 165 only - (that is, the speed for performing 7070/7074 CPU instructions, weighted by frequency of use) for the emulator is approximately three times the speed of the IBM 7074 Data Processing System. Throughput depends upon the 7070/7074 program being emulated, as determined by the following factors: the mix of 7070/7074 CPU operations executed by the compatibility feature, the 7070/7074 CPU and input/output operations simulated by the emulator program, and the amount of interruption from higher priority tasks of the Operating System.

Tape formatting programs are provided with the Emulator to assist the user in converting 7070/7074 tape files before emulation, so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation, so that they can be used on the original system. Native mode tape files must be preprocessed using the tape formatting program if record lengths exceed 32,755 bytes or if the complete range of data management facilities of the operating system are to be used.

The following CPU features are not emulated: Additional Storage and associated instructions ... Interval Time Instructions ... Customer Engineering Diagnostic Instructions ... Optional Feature Instructions (except Floating Point).

The following input/output devices are not emulated: 7907 Data Channel ... 7900 Inquiry Station ... 7300 Disk Storage ... 7500 Card Reader ... 7550 Card Punch ... 7400 Printer ... 7603 Input/Output Synchronizer.

The following input/output features are not emulated: Tape Read All Alpha (treated as tape read) ... Read Binary Tape ... Tape Read/Write from 7074 locations 9990-9999 ... 729 Tape Switching Feature ... Unit Record Priority Interrupts ... Unit Record Signal.

System Requirements: The 7070/7074 Emulator Program requires a System/370 Model 165, 165 II, 168 equipped with the 7070/7074 Compatibility Feature; it requires enough Model 165, 165 II, 168 devices to correspond to the 7070/7074 devices on the system being emulated (in addition to devices required by the Operating System); it requires enough main storage for the version of the Operating System being used (MFT or MVT), for the emulator functions needed for the 7070/7074 system being emulated, and for the 7070/7074 program being executed.

Input/output device correspondence is as follows:

<u>7070/7074 Device</u>	<u>System/370 Device</u>
7150 Console	3066 Systems Console
7501 Console Card Reader	Any card reader or SYSIN device supported by the Operating System Queued Sequential Access Method.
729 II/IV/V/VI Magnetic Tape Unit	2400 Series Magnetic Tape Units Models 1 - 6 and 8 (7-track) or 2420 Magnetic Tape Unit Models 5 or 7 or 3420 Magnetic Tape Unit Models 3, 4, 5, 6, 7, or 8 or any other tape unit supported by the Basic Sequential Access Method of the Operating System* or direct access devices.**

*All seven-track tape drives used for 7070/7074 compatible tapes must have the Seven-Track Compatibility Feature.

**A 7074 tape in spanned variable-length format may be kept on any Model 165 direct access device supported by BSAM. The file will appear to be a tape to the 7070/7074 program, which can access it only through tape commands.

Basic Program Material:

Documentation: Basic Program Material List with attachment; Emulating the IBM 7074 on the IBM System/370 Models 155 and 165 using OS/360 (GC27-6948) and TNLGN27-1365 and GN27-1372.

Machine Readable: Emulator generation macro definition, load modules and sample program.

Optional Program Material:

Documentation: Optional Program Material List.

Machine Readable: Source program and source macros.

Ordering Information: See page P 360C.23.

Additional Program Support Material: See page P 360C.23.

System/370 Model 165, 165 II, 168 Integrated Emulator Program for the 7080: (360C-EU-737)

The 7080 Integrated Emulator Program executes as a problem

program under the MFT or MVT version of OS/360 on a Model 165, 165 II, 168 equipped with the 7080 Compatibility Feature (#7118). The 7080 Integrated Emulator Program and the Compatibility Feature enable the Model 165, 165 II, 168 to execute, under the Operating System, programs written for an IBM 7080 Data Processing System. Most 7080 programs that are debugged and are not time-dependent can be executed without modification. Certain devices and features of the 7080 system are not emulated, however.

The 7080 Emulator takes advantage of the multiprogramming facilities of OS/360. Other problem programs, such as user jobs, utility programs, compilers, or additional 7080 Integrated Emulator Programs, can be executed concurrently in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System, thereby achieving device independence and the automatic allocation of system resources.

The internal speed - Model 165 only - (that is, the speed for performing 7080 CPU instructions, weighted by frequency of use) of the Emulator is approximately two times the speed of the IBM 7080 Data Processing System. Throughput depends upon the 7080 program being emulated, as determined by the following factors: mix of 7080 CPU operations executed by the compatibility feature, the 7080 CPU and I/O operations simulated by the emulator program, and the amount of interruption from higher priority tasks of the Operating System.

Tape formatting programs are provided with the Emulator to assist user in converting 7080 tape files before emulation, so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation, so that they can be used on the original system.

Specifically excluded from support are the following items:

- The IBM 7622 Signal Control, associated units and related instructions.
- The IBM 7908 Data Channel, associated devices and features (including control storage bank 4) and related instructions, specifically ENABLE COMPARE BACKWARD.
- All 7080 RPQ (Request for Price Quotation) features and related instructions.

System Requirements: The 7080 Emulator Program requires a System/370 Model 165, 165 II, 168 equipped with the 7080 Compatibility Feature (#7118); it requires enough Model 165, 165 II, 168 devices to correspond to the 7080 devices on the system being emulated (in addition to devices required by the Operating System); it requires enough main storage for the version of the Operating System being used (MFT or MVT), for the emulator functions needed for the 7080 system being emulated, and for the 7080 program being executed.

Input/output device correspondence is as follows:

<u>7080 Device</u>	<u>System/370 Device</u>
7153 Console	3066 Systems Console
7502 Console Card Reader	Any card reader or SYSIN device supported by the Operating System Queued Sequential Access Method.
729 II/IV/V/VI Magnetic Tape Unit	2400 Series Magnetic Tape Units Models 1 - 6 and 8 (7-track) or 2420 Magnetic Tape Unit Models 5 or 7 or 3420 Magnetic Tape Unit Models 3, 4, 5, 6, 7, or 8 or any other tape unit supported by the Basic Sequential Access Method of the Operating System* or direct access devices.**

*All seven-track tape drives used for 7080 compatible tapes must have the Seven-Track Compatibility Feature.

**A 7080 tape in spanned variable-length format may be kept on any Model 165, 165 II, 168 direct access device supported by BSAM. The file will appear to be a tape to the 7080 program, which can access it only through tape commands.

7080 devices not listed are not supported.

Basic Program Material:

Documentation: Basic Program Material List; Emulating the IBM 7080 on the IBM System/370 Model 165, 165 II, 168 using OS (GC27-6952).

Machine Readable: Load modules, emulator generation macro definition and sample program.

Optional Program Material:

Documentation: Optional Program Material List.

Machine Readable: Source statements and macros.

Ordering Information: Same as 360CEU740 from next page applies.

Additional Program Support Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering use microfiche listing form number GJD1 - 1642.

Publication: Program to Emulate the IBM 7080 on the IBM System/370 Model 165 using OS Program Logic Manual (GY27-7229). (Available only from Mechanicsburg.)

7094 Integrated Emulator System/370 Model 165, 165 II, 168 - OS (360C-EU-740):

MFT or MVT version of OS/360 on a Model 165, 165 II, 168 equipped with the 709/7090/7094/7094 II Compatibility Feature (#7119). The 7094 Integrated Emulator Program and the Compatibility Feature enable the Model 165, 165 II, 168 to execute, under the Operating System, programs written for a 709/7090/7094/7094 II Data Processing System. Most 7090/7094 programs that are debugged and are not time-dependent can be executed without modification. Certain devices and features of the 7090/7094 system are not emulated, however.

The 7094 Emulator takes advantage of the multiprogramming facilities of OS/360. Other problem programs, such as user jobs, utility programs, compilers, or additional 7090/7094 Integrated Emulator Programs, can be executed concurrently in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System, thereby achieving device independence and the automatic allocation of system resources.

The internal speed - Model 165 only - (that is, the speed for performing CPU instructions, weighted by frequency of use) of the Emulator is approximately 1.5 times the speed of the IBM 7094 II Data Processing System. Throughput depends upon the 7090/7094 program being emulated, as determined by the following factors: mix of 7090/7094 CPU operations executed by the compatibility feature, the 7090/7094 CPU and I/O operations simulated by the emulator program, and the amount of interruption from higher priority tasks of the Operating System.

System Requirements: The 7094 Integrated Emulator Program requires a System/370 Model 165, 165 II, 168, the 709/7090/7094/7094 II Compatibility Feature (#7119), devices required for the operating system, and one device or direct access data set for each emulated 7094 device. All card read punch units used to read or punch binary data must be equipped with the Card Image Feature, and all tape drives used for 7094 compatible tapes must be equipped with the Seven-track Compatibility Feature. Column binary card input data must be accepted in the SYSIN jobstream through the MVT ASB reader.

Input/output device correspondence is as follows:

709/7090/7094/7094 II	Model	System/370
7108 Processing Unit (7090)	1	Model 165, 165 II, 168
7110 Processing Unit (7094)	1	Processing Unit with 709/7090/7094/7094 II Compatibility
7111 Processing Unit (7094 II)	1	
7109 Arithmetic Sequencer Unit	1	Functions provided by Model 165, 165 II, 168
7302 Core Storage	1	Functions provided by Model 165, 165 II, 168
7607 Data Channel(s) (Channels A through H supported)	1,2,3,4,5	2860 Selector Channel(s) 2870 Multiplexer Channel(s) 2880 Block Multiplexer Channel(s)
729 Tape Unit	2,4,5,6	Any tape unit supported by the operating system sequential access method or sufficient space on a direct access device supported by the Basic Sequential Access Method.
711 Card Reader	2	Any card reader with Card Image feature or SYSIN device supported by the operating system Queued Sequential Access Method. If SYSIN is used for binary cards the Automatic SYSIN batching reader must be used (MVT only).
721 Card Punch	1	Any card punch with Card Image feature or SYSOUT device supported by the operating system Queued Sequential Access Method. If SYSOUT is used the user must write his own SYSOUT writer to punch binary data.
716 Printer	1	Any printer or SYSOUT device supported by the operating system Queued Sequential Access Method.

Any 7094 features or devices not listed are not emulated. 704 Mode is not emulated.

Basic Program Material:

Documentation: Basic Program Material List with attachment; Emulating the IBM 7094 on the IBM System/370 Model 165 using OS (GC27-6951).

Machine Readable: Load modules, emulator generation macro definition and sample program.

Optional Program Material:

Documentation: Optional Program Material List.

Machine Readable: Source statements and macros.

Ordering Information: Program Number 360CEU740 (Also applies to 360CEU737 from preceding page.)

	Prg. Nbr. Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	2311	DTR 7DC/800	26	None
		DTR 9/800	28	None
		DTR 9/1600	29	None
	2314	DTR 7DC/800	26	None
		DTR 9/800	28	None
		DTR 9/1600	29	None
3330	MT 7DC/800	26	01	
	DTR 9/800	28	None	
	DTR 9/1600	29	None	
Optional	None	MT 7DC/800	26	01
		DTR 9/800	28	None
		DTR 9/1600	29	None

Additional copies of the form numbered manual should be ordered from Mechanicsburg -- not from PID.

Additional Program Support Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. When ordering use Group Code GJD1-1640.

Publication: IBM System/360 Operating System Emulator Program to Emulate the IBM 7094 on the System/370 Model 165 Program Logic Manual (GY27-7187). (Available only from Mechanicsburg.)

1401/1440/1460 Integrated Emulator Program for the IBM S/370 Model 155 under DOS: (370N-EU-490)

The 1401/1440/1460 Emulator Program is a Type I Program that is

executed as a problem program under the Disk Operating System, using the 1401/40/60, 1410/7010 Compatibility Feature (#3950). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440, or 1460 Data Processing Systems to be executed on the Model 155. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit ... Inverted Print Edit ... High-Low-Equal Compare ... Multiply-Divide ... Processing Overlap ... Sense Switches ... Advanced Programming/Indexing ... Bit Test ... Print Storage ... Additional Print Control ... Space Suppression ... Column Binary ... Binary Transfer ... 51-Column Card ... Punch-Feed Read ... Card Image (on 1442) ... Selective Stacker ... Scan Disk.

The following features and operations are not emulated:

Selective Tape Listing (on 1403) ... Compressed Tapes Read Compare feature (on 1404)

The following input/output devices are not emulated:

1445 Printer ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Optical Readers ... Magnetic Character Readers ... Teleprocessing Devices ... Audio Response Units.

The 1401 Model G is emulated.

Internal speed (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately 1.75 times that of the 1401/1460 stand-alone emulator for the IBM System/360 Model 40. Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator program), input/output operations (executed by the emulator program), and the amount of interference from higher-priority partitions.

The emulator program takes advantage of the multiprogramming facilities of the Disk Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated.

Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system.

Disk files created by the 1401/1440/1460 system must be copies on a tape using a 1401/1440/1460 utility program on a 1401/1440/1460 system and then restored to disk by emulating the 1401/1440/1460 utility program on a Model 155.

Disk files created by emulator program (CS/30 and CS/40) can be used without conversion or they can be converted by using the technique described above. Converted files are processed more efficiently.

System Requirements:

For emulation, the Model 155 must be equipped with the 1401/40/60, 1410/7010 Compatibility Feature (#3950). 1401/1440/1460 devices are emulated by corresponding Model 155 input/output devices. There must be sufficient main storage for the version of the operating system used, for the emulator functions required for the emulated system, and for the 1401/1440/1460 program being emulated.

Input/output device correspondence between a 1401, 1440, or 1460 system and a Model 155 is described in the following table:

1400 Unit Record Devices	Model 155 Unit Record Devices
1402 Card Read Punch Model 1 (1401 Models A, B, C, E, F) Model 3 (1460) Model 6 (1401 Model H3) Models 4, 5 (1401 Model G)	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader, Models B1, B2 3525 Card Punch, Models P1, P2, P3
1442 Card Read Punch Model 1 (1440-one stacker) Model 2 (1440-two stackers)	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader, Models B1, B2 3525 Card Punch, Models P1, P2, P3
1442 Card Reader Model 4 (1440-two stackers)	1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader, Models B1, B2 3525 Card Punch Models P1, P2, P3 (with Card Read Feature)
1444 Card Punch (1440)	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 2540 Card Read Punch 3525 Card Punch, Models P1, P2, P3
1407 Console Inquiry Station (all 1401 models except 1401 Model A)	3215 or 3210 Console Printer-Keyboard
1447 Console Model 1 Console (1440, 1460) Model 2 Inquiry Printer and Keyboard (1440, 1460) Model 3 Inquiry Printer and Keyboard (1401) Model 4 Inquiry Printer and Keyboard and Control (1440, 1460)	3215 or 3210 Console Printer-Keyboard
1400 Magnetic Tape Units	System/370 Mdl 155 Magnetic Tape Units
729 Magnetic Tape Units Models II, IV, V, VI (1401, 1460) 7330 Magnetic Tape Unit (1401, 1460) 7335 Magnetic Tape Unit (except 1440 Model A2)	2401 Magnetic Tape Unit 2402 Magnetic Tape Unit 2403 Magnetic Tape Unit and Control 2404 Magnetic Tape Unit and Control Models 1, 2, 3 (seven-track) Models 1 - 6 (9-track), 8 (7-track) 2415 Magnetic Tape Unit and Control Models 1, 2, 3, 4, 5, 6 (seven- track or nine-track) 2420 Magnetic Tape Unit Models 5, 7 (nine-track) 3410 Magnetic Tape Unit Models 1, 2, 3 3411 Magnetic Tape Unit and Control Models 1, 2, 3 3420 Magnetic Tape Unit Models 3, 4, 5, 6, 7, 8
1400 Disk Storage Devices	Model 155 Disk Storage Devices
1301 Disk Storage Models 11, 12 (1440, 1460) 1311 Disk Storage Drive Model 1 (1440, 1460) Model 2 (1401, 1440, 1460) Model 4 (1401)	2311 Disk Storage Drive, Model 1 2314 DASF
1405 Disk Storage Models 1, 2 (1401)	2311 Disk Storage Drive, Model 1 2314 DASF 2319 Disk Storage Facility 3330 Series Disk Storage

1403 Printer
Model 1 (1401 Models A, B, E, F)
Model 2 (1401 Models A, B, C, D,
E, and F, 1440 1460)
Model 3 (1440, 1460)
Model 5 (1440)
Model 6 (1401 Model H3, 1440)
Model 4 (1401 Model G)

1403 Printer, Models 2, 3, 7, N1
1443 Printer, Model N1
3211 Printer

1404 Printer
Model 2 (all 1401 models except
1401 Models A, D, H)
(continuous forms only)

1403 Printer, Models 2, 3, 7, N1
1443 Printer, Model N1
3211 Printer

1443 Printer
Models 1, 2 (1440)

1403 Printer, Models 2, 3, 7, N1
1443 Printer, Model N1
3211 Printer

Notes:

Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

Input/Output feature correspondence between a 1401, 1440 or 1460 system and a Model 155 is described in the following table:

1400 Device Feature	System/370 Mdl 155 Device Feature
Column Binary (#1990) for 1402 Card Read Punch, Model 1	Column Binary (#1990) for 2540 Card Read Punch
Card Image (#1531) for 1442 Card Read Punch, Model N2	Card Image (#1531) for 1442 Card Punch, Model N2 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2520 Card Punch, Models B2, B3
Card Image (#1531) for 1442 Card Reader, Model 4	Card Image (#1532) for 1442 Card Read Punch, Model N1 Card Image (standard) on 3505 Card Reader, Models B1, B2
Card Image (#1531) for 1442 Card Read Punch, Models 1, 2	Column Binary (#1990) for 2540 Card Read Punch
Card Image (#1531) for 1442 Card Reader, Model 4	Card Image (#1531) for 1442 Card Punch, Model N2 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2520 Card Punch, Models B2, B3
Binary Transfer (#1468) for 1402 Card Read Punch, Model 3	Card Image (#1532) for 1442 Card Read Punch, Model N1 Card Image (standard) on 3505 Card Reader, Models B1, B2
51-Column Interchangeable Read Feed (#4150) for 1402 Card Read Punch, Mdl 1, 3, 6	Column Binary (#1990) for 2540 Card Read Punch
Punch Feed Read (#5890) for 1402 Card Read Punch, Mdl 1, 3, 6 Model 4, 5 for 1401 Model G Note: This feature is required to execute the Read Punch Feed instruction (4R) of the 1401.	Card Image (#1531) for 1442 Card Punch, Model N2 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2520 Card Punch, Models B2, B3 Card Image (standard) on 3505 Card Reader, Models B1, B2 51/80-Column Interchangeable Read Feed for 2540 Card Read Punch (#4151)
Punch Column Skip (#5880) for 1442 Card Read Punch, Mdl 1, 2	Not available on other card devices Punch Feed Read (#5890) for 2540 Card Read Punch Card Read for 3525 Card Punch, Models P1, P2, P3
	The 1440 instruction M%Gn nnn C is emulated without using a special feature.

Selective Stacker (#6406) for
1442 Card Read Punch, Mdl 1

Stacker 2 (standard) for
2520 Card Punch, Mdls B2, B3
2520 Card Read Punch, Mdl B1
Stackers R2 and RP3 for reading,
P2 and RP3 for punching (all
standard) for
2540 Card Read Punch
Selective Stacker (#6555) for
3505 Card Reader, Models B1, B2
Stackers 1 and 2 (standard) on
3525 Card Punch, Models P1, P2, P3

Alternate Stacker (standard) for
1444 Card Punch

Stacker 2 (standard) for
2520 Card Punch, Mdls B2, B3
2520 Card Read Punch, Mdl B1
Stackers P2 and RP3 (both standard)
for
2540 Card Read Punch
Stackers 1 and 2 (standard) on
3525 Card Punch, Models P1, P2, P3

Stackers 1 and 2 (both standard) for
1402 Card Read Punch

Stacker 2 (standard) for
2520 Card Read Punch, Mdl B1
Stackers R2 and RP3 (both standard)
for
2540 Card Read Punch

Stackers 4 and 8 (both standard) for
1402 Card Read Punch

Selective Stacker (#6555) for
3505 Card Reader, Models B1, B2

Stacker 2 (standard) for
2520 Card Punch, Mdls B2, B3
2520 Card Read Punch, Mdl B1
Stackers P2 and RP3 (both standard)
for
2540 Card Read Punch

Stackers 1 and 2 (standard) on
3525 Card Punch, Models P1, P2, P3

Numerical Print feature (#5381) for
1403 Printer Models 1, 2

Numerical Print feature (#5381) for
1403 Printer, Model 2

**1410/7010 Integrated Emulator Program for the IBM
System/370 Model 155 Under DOS: 370N-EU-490**

The 1410/7010 Emulator
Program is a Type I Pro-
gram that is executed as a

problem program under the Disk Operating System using the 1401/40/60, 1410/
7010 Compatibility Feature (#3950). The combination of the program and the com-
patibility feature enables programs written for the 1410 or 7010 Data Processing
Systems to be executed on the Model 155. Most 1410/7010 programs require no
changes for execution under the emulator, although certain special custom features
are not emulated. Emulation is provided for 1410/7010 systems with main storage
sizes from 10K to 100K positions of core storage.

All basic features are emulated, along with the following optional features: Processing
Overlap ... Priority Processing ... Two Channels on 1410 ... Inverted Print Edit
... 7010 Second, Third, and Fourth Data Channels ... 7010 Store and Restore
Status ... 7010 Floating Point Arithmetic Feature.

The following features and operations are not emulated: 1401/1410 Compatibility
Mode ... Column Binary ... 51-Column Card ... 1410/7010 Diagnostic Instruc-
tion Branch on C Bit ... 7010 Program Relocation and Storage Protection ... 7010
Interval Timer.

The following input/output devices are not emulated: 1311 Disk Storage Drive ...
1405 Disk Storage ... 7340 and 7641 Hypertape Drives ... 1011 Paper Tape
Reader ... 1012 Paper Tape Punch ... Magnetic Character Readers ... Teleproc-
essing Devices ... Optical Readers ... Audio Response Units.

Internal speed (performance of CPU instructions only and weighted by frequency of
use) of the integrated emulator is approximately 1.1 times that of the 1410/7010
stand-alone emulator for the IBM System/360 Model 50.

Throughput under emulation is not determined as much by the emulator as it is by the
1400 program being executed. Throughput of 1400 jobs is affected by the mix of
CPU operations (executed by the compatibility feature and/or the emulator program),
input/output operations (executed by the emulator program), and the amount of inter-
ference from higher-priority partitions or regions.

The emulator program takes advantage of the multiprogramming facilities of the Disk
Operating System. Other problem programs, such as utility programs, user jobs,
compilers, and more than one "integrated" emulator program can be executed con-
currently.

The emulator program uses the data management services of the operating system, and
takes advantage of the device independence achieved by these services. The operating
system error recovery procedures are also used. Both emulator jobs and System/370
jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by
the 1410/7010 system or by other emulator programs, and mixed parity tapes, are
emulated. Disk files must be converted before they can be used by the emulator pro-
gram. Two tape formatting programs are provided with the emulator program: (1) to
assist the user in converting his tape files before emulation so they can be used more
efficiently by the emulator program, and (2) to convert tape files produced during
emulation back to the 1410/7010 format so they can be used on the original system.

Disk files created by the 1410/7010 system or a stand-alone emulator program must
be copied on a tape using a 1410/7010 utility program on a 1410/7010 system and
then restored to disk by emulating the 1410/7010 utility program on a Model 155.

Input/Output Device Correspondence is as follows:

1400 Unit Record Devices	System/370 Mdl 155 Unit Record Devices
1402 Card Read Punch, Mdl 2	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2520 Card Punch, Models B2, B3 2540 Card Read Punch 3505 Card Reader Models B1, B2 3525 Card Punch Models P1, P2, P3
1442 Card Reader, Mdl 3	1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader Models B1, B2 3525 Card Punch Models P1, P2, P3 (with Card Read Feature)
1415 Console Unit	3215 or 3210 Console Printer-Keyboard Model 1
1403 Printer, Mdls 1, 2, 3	1403 Printer, Models 2, 3, 7, N1 1443 Printer, Model N1 3211 Printer

1400 Magnetic Tape Units	System/370 Mdl 155 Magnetic Tape Units
729 Magnetic Tape Unit Mdls II, IV, V, VI	2401 Magnetic Tape Unit 2402 Magnetic Tape Unit
7330 Magnetic Tape Unit	2403 Magnetic Tape Unit & Control 2404 Magnetic Tape Unit & Control Models 1, 2, 3 (seven-track) Models 1 - 6 (9-track), 8 (7-track) 2415 Magnetic Tape Unit & Control Models 1, 2, 3, 4, 5, 6 (seven- track or nine-track)
	2420 Magnetic Tape Unit Models 5, 7 (nine-track)
	3410 Magnetic Tape Unit Models 1, 2, 3
	3411 Magnetic Tape Unit and Control Models 1, 2, 3
	3420 Magnetic Tape Unit Models 3, 4, 5, 6, 7, 8

1400 Disk Storage Devices	Model 155 Disk Storage Devices
1301 Disk Storage, Mdls 1, 2	2311 Disk Storage Drive, Model 1 2314 DASF 2319 Disk Storage 3330 Series Disk Storage
1302 Disk Storage, Mdls 1, 2	2314 DASF 2319 Disk Storage 3330 Series Disk Storage

Note:

Programmed reading on more than one reader, printing on more than one printer, or
punching on more than one punch is not supported.

If more than one System/370 direct access storage device is required to corres-
pond to the 1410/7010 disk storage device being emulated, all corresponding
System/370 devices must be the same type of direct access storage device.

Printer feature correspondence is as follows:

1400 Printer Feature	System/370 Mdl 155 Printer Feature
Numerical Print feature (#5381) for 1403 Printer, Mdls 1, 2	Numerical Print feature (#5381) for 1403 Printer, Model 2
Interchangeable Chain Cartridge Adapter (#4740) for 1403 Printer, Mdls 1, 2	Interchangeable Chain Cartridge Adapter (#4740) for 1403 Printer, Models 2, 7

Emulating the 1401/1440/1460 on the IBM System/370 Model 145 Using DOS: 370N-EU-490

The 1401/1440/1460 Emulator Program is a Type I program that is executed as a problem program under the System/360 Disk Operating System, using the IBM Compatibility Feature (#4457 or #4458). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440 or 1460 Data Processing Systems to be executed on the Model 145. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 1,400 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiply-Divide, Processing Overlap, Sense Switches, Advanced Programming/Indexing, Bit Test, Print Storage, Additional Print Control, Space Suppression, Column Binary, Binary Transfer, 51-Column Card, Punch-Feed Read, Card Image (on 1442), Selective Stacker.

The following features and operations are not emulated: Selective Tape Listing (on 1403), Compressed Tapes, Read Compare (1404).

The following input/output devices are not emulated: 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices, Audio Response Units, and 1404 printer in cut card mode.

The 1401 Model G is emulated.

Internal speed (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately 4.9 times that of the 1401 and 1.1 times the CS40 1401 emulator. Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator program), input/output operations (executed by the emulator program), and the amount of interference from higher priority partitions. A precise performance statement cannot be given.

The emulator program takes advantage of the multiprogramming facilities of the Disk Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and it takes advantage of the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes used and produced by the 1401/1440/1460 system or by other emulated programs, and mixed parity tapes, are emulated.

Two-tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system.

Disk files created by the 1401/1440/1460 System must be copied on a tape using a 1401/1440/1460 utility program on a 1401/1440/1460 System and then restored to disk by emulating the 1401/1440/1460 utility program on a Model 145.

Disk files created by emulator program (CS/30 and CS/40) can be used without conversion or they can be converted by using the technique described above. Converted files are processed more efficiently.

System Requirements: For emulation, the Model 145 must be equipped with the IBM Compatibility Feature (#4457 or #4458). 1401/1440/1460 devices are emulated by corresponding Model 145 input/output devices. There must be sufficient main storage for the version of the operating system used, for the emulator functions required for the emulated system, and for the 1401/1440/1460 program being emulated.

Input/output device correspondence between a 1401, 1440, or 1460 System and a Model 145 is described in the table following the 1410/7010 Emulator Model 145 write-up below.

Emulating the IBM 1410/7010 on the IBM System/370 Model 145 Using DOS: 370N-EU-490

The 1410/7010 Emulator Program is a Type I Program that is executed as a problem program under the Disk Operating System using the 1401/1440/1460, 1410/7010 Compatibility Feature (#4458). The combination of the program and the compatibility feature enables programs written for the 1410 or 7010 Data Processing Systems to be executed on the Model 145. Most 1410/7010 programs require no changes for execution under the emulator, although certain special custom features are not emulated. Emulation is provided for 1410/7010 systems with main storage sizes from 10,000 to 100,000 positions of core storage.

All basic features are emulated, along with the following optional features: Processing Overlap, Priority Processing, Two Channels on 1410, Inverted Print Edit, 7010 Second-Third-and Fourth Data Channels, 7010 Store and Restore Status, 7010 Floating Point Arithmetic Feature.

The following features and operations are not emulated: 1401/1410 Compatibility Mode, Column Binary, 51-Column Card, 1410/7010 Diagnostic Instruction Branch on C Bit,

7010 Program Relocation and Storage Protection, 7010 Interval Timer, Stacker select.

The following input/output devices are not emulated: 1311 Disk Storage Drive, 1405 Disk Storage, 7340 and 7641 Hypertape Drives, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Magnetic Character Readers, Teleprocessing Devices, Optical Readers, Audio Response Units.

Internal speed (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately two times that of the 1410 and approximately 0.67 times that of the 7010.

Throughput under emulation is not determined as much by the emulator as it is by the 1410/7010 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator program), input/output operations (executed by the emulator program), and the amount of interference from higher priority partitions or regions. A precise performance estimate cannot be given.

The emulator program takes advantage of the multiprogramming facilities of the Disk Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently.

The emulator program uses the data management services of the operating system, and it takes advantage of the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1410/7010 System or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two-tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so they can be used on the original system.

Disk files created by the 1410/7010 system or a stand-alone emulator program must be copied on a tape using a 1410/7010 utility program on a 1410/7010 system and then restored to disk by emulating the 1410/7010 utility program on a Model 145.

Input/output device correspondence is as follows:

<u>1401/1440/1460 I/O DEVICES</u>	<u>SYSTEM/370 MODEL 145 I/O DEVICES</u>
1402 Card Read Punch Model 1 (1401 Models A,B,C,E,F) Model 3 (1460) Model 6 (1401 Model H3) Models 4, 5 (1401 Model G)	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader Models B1, B2 3525 Card Punch Models P1, P2, P3
1442 Card Read Punch Model 1 (1401 - One stacker) Model 2 (1440 - Two stackers)	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader Models B1, B2 3525 Card Punch Models P1, P2, P3
1442 Card Reader Model 4 (1440 - Two stackers)	1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader Models B1, B2 3525 Card Punch Models P1, P2, P3 (with Card Read Feature)
1444 Card Punch (1440)	1442 Card Punch, Model N2 1442 Card Read Punch, Model N1 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 2540 Card Read Punch 3525 Card Punch Models P1, P2, P3
1407 Console Inquiry Station (all 1401 Models except 1401 Model A)	3215 or 3210 Console Printer/Keyboard
1447 Console Model 1 Console (1440, 1460) Model 2 Inquiry Printer and Keyboard (1440, 1460) Model 3 Inquiry Printer and Keyboard and Control (1440, 1460)	3215 or 3210 Console Printer/Keyboard

1400 MAGNETIC TAPE UNITS

729 Magnetic Tape Units
Models II, IV, V, VI (1401, 1460)
7330 Magnetic Tape Unit (1401, 1460)
7335 Magnetic Tape Unit (except 1440 Model A2)

1400 DISK STORAGE DEVICES

1301 Disk Storage
Models 11, 12 (1440, 1460)

1311 Disk Storage Drive
Model 1 (1440, 1460)
Model 2 (1401, 1440, 1460)
Model 4 (1401)

1405 Disk Storage
Models 1, 2 (1401)

1400 PRINTERS

1403 Printer
Model 1 (1401 Models A, B, E, F)
Model 2 (1401 Models A, B, C, D, E, and F, 1440, 1460)
Model 3 (1440, 1460)
Model 5 (1440)
Model 6 (1401 Model H3, 1440)
Model 4 (1401 Model G)

1404 Printer
Model 2 (all 1401 models except 1401 Models A, D, H)
Continuous form only

1443 Printer
Models 1, 2 (1440)

Notes:

Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

Input/Output feature correspondence between 1401, 1440, or 1460 System and a Model 145 is described in the following table:

1400 DEVICE FEATURE

Column Binary (#1990) for
1402 Card Read Punch, Model 1

Card Image (#1531) for
1442 Card Read Punch, Models 1, 2

MODEL 145 MAGNETIC TAPE UNITS

2401 Magnetic Tape Unit
2402 Magnetic Tape Unit
2403 Magnetic Tape Unit and Control
2404 Magnetic Tape Unit and Control
Models 1, 2, 3 (7-track)
Models 1, 6 (9-track)
2415 Magnetic Tape Unit and Control
Models 1, 6 (7 or 9-track)
2420 Magnetic Tape Unit Models
5, 7 (9-track)
3410 Magnetic Tape Unit Models
1, 2, 3
3411 Magnetic Tape Unit and Control
Models 1, 2, 3
3420 Magnetic Tape Unit Models 3,
5, 7 (7- or 9-track) Models 4, 6, 8
(9-track)

MODEL 145 DISK STORAGE DEVICES

2311 Disk Storage Drive, Model 1
2314 Direct Access Storage Facility
Model 1 & A Series
2319 Disk Storage Facility
3330 Series Disk Storage

2319 Disk Storage Facility
2311 Disk Storage Drive, Model 1
2314 Direct Access Storage Facility
Model 1 & A Series
3330 Series Disk Storage

MODEL 145 PRINTERS

1403 Printer, Models 2, 3, 7, N1

1443 Printer, Model N1

3211 Printer

1403 Printer, Models 2, 3, 7, N1

1443 Printer, Model N1
3211 Printer

1403 Printer, Models 2, 3, 7, N1

1443 Printer, Model N1

3211 Printer

MODEL 145 DEVICE FEATURE

Column Binary (#1990) for
2540 Card Read Punch
Card Image (#1531) for
1442 Card Punch, Model N2
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3

Card Image (#1532) for
1442 Card Read Punch, Model N1
Card Image (standard) on
3505 Card Reader Models B1, B2

Column Binary (#1990) for
2540 Card Read Punch

Card Image (#1531) for
1442 Card Reader, Model 4

Binary Transfer (#1468) for
1402 Card Read Punch, Model 3

51-Column Interchangeable Read Feed
(#4150) for 1402 Card Read Punch,
Models 1, 3, 6

Punch Feed Read (#5890) for
1402 Card Read Punch,
Models 1, 3, 6
Models 4, 5 for 1401
Model G

Note: This feature is required to execute
the Read Punch Feed Instruction (4R) of
the 1401

Punch Column Skip (#5880) for
1442 Card Read Punch, Models 1, 2

Selective Stacker (#6406) for
1442 Card Read Punch, Model 1

Alternate Stacker (standard) for
1444 Card Punch

Stackers 1 and 2 (both standard) for
1402 Card Read Punch

Stackers 4 and 8 (both standard) for
1402 Card Read Punch

Numerical Print Feature (#5381) for
1403 Printer, Models 1, 2

1410/7010 I/O DEVICES

1402 Card Read Punch, Model 2

Card Image (#1531) for
1442 Card Punch, Model N2
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3

Card Image (#1532) for
1442 Card Read Punch, Model N1
Card Image (standard) on
3505 Card Reader Models B1, B2

Column Binary (#1990) for
2540 Card Read Punch

Card Image (#1531) for
1442 Card Punch, Model N2
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3
Card Image (standard) on
3505 Card Reader Models B1, B2

51/80-Column Interchangeable Read Feed
2540 Card Read Punch (#4151)
3505-B2 Card Reader (#3921)
(Not available on other card devices)

Punch Feed Read (#5890) for
2540 Card Read Punch
Card Read (#1533) for
3525 Card Punch, Models P1, P2, P3

The 1440 instruction M%Gn nnn C is emulated
without using a special feature.

Stacker 2 (standard) for
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1

Stackers R2 and RP3 for reading,
P2 and RP3 for punching (all standard)
for 2540 Card Read Punch
Selective Stacker (#6555) for
3505 Card Reader, Models B1, B2
Stackers 1 and 2 (standard) on
3525 Card Punch, Models P1, P2, P3

Stacker 2 (standard) for
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1

Stackers P2 and RP3 (both standard) for
2540 Card Read Punch
Stackers 1 and 2 (standard) on
3525 Card Punch, Models P1, P2, P3

Stacker 2 (standard) for
2520 Card Read Punch, Model B1
Stackers R2 and RP3 (both standard) for
2540 Card Read Punch
Selective Stacker (6555) for
3505 Card Reader, Models B1, B2

Stacker 2 (standard) for
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1

Stackers P2 and RP3 (both standard) for
2540 Card Read Punch
Stackers 1 and 2 (standard) on
3525 Card Punch, Models P1, P2, P3

Numerical Print Feature (#5381) for
1403 Printer, Model 2

SYSTEM/370 MODEL 145 I/O DEVICES

1442 Card Punch, Model N2
1442 Card Read Punch, Model N1
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3
2540 Card Read Punch
3505 Card Reader, Models B1, B2
3525 Card Punch, Models P1, P2, P3

cont'd

Conversion/Service

1442 Card Reader, Model 3	1442 Card Read Punch, Model N1 2501 Card Reader, Models B1, B2 2520 Card Read Punch, Model B1 2540 Card Read Punch 3505 Card Reader, Models B1, B2 3525 Card Punch, Models P1, P2, P3 (with Card Read Feature)
1415 Console Unit	3215 or 145 Console Printer/Keyboard Model 1
1403 Printer, Models 1, 2, 3	1403 Printer, Models 2, 3, 7, N1 1443 Printer, Model N1 3211 Printer

Notes:

- * Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.
- ** If more than one System/370 direct access storage device is required to correspond to the 1410/7010 disk storage device being emulated, all corresponding System/370 devices must be the same type of direct access storage device.

1400 MAGNETIC TAPE UNITS

729 Magnetic Tape Unit
Models II, IV, V, VI
7330 Magnetic Tape Unit

MODEL 145 MAGNETIC TAPE UNITS

2401 Magnetic Tape Unit
2402 Magnetic Tape Unit
2403 Magnetic Tape Unit and Control
Models 1, 2, 3 (7-track)
Models 1, 6 (9-track)
2415 Magnetic Tape Unit and Control
Models 1, 6 (7 or 9-track)
2420 Magnetic Tape Unit
Models 5, 7 (9-track)
3420 Magnetic Tape Unit
Models 3, 5, 7 (7- or 9-track)
Models 4, 6, 8 (9-track)

1400 DISK STORAGE DEVICES

1301 Disk Storage, models 1, 2

MODEL 145 DISK STORAGE DEVICES

2311 Disk Storage Drive, Model 1
2314 Direct Access Storage Facility
Model 1 & A Series
2319 Disk Storage Device
3330 Series Disk Storage

1302 Disk Storage, Models 1, 2
2302 Disk Storage, Models 1, 2

2314 Direct Access Storage Facility
Model 1 & A Series
2319 Disk Storage Device
3330 Series Disk Storage

Printer feature correspondence is as follows:

1400 PRINTER FEATURE

Numerical Print Feature (#5381)
for 1403 Printer, Models 1, 2

Interchangeable Chain Cartridge
Adapter (#4740) for
1403 Printer, Models 1, 2

MODEL 145 PRINTER FEATURE

Numerical Print Feature (#5381)
for 1403 Printer, Model 2

Interchangeable Chain Cartridge
Adapter (#4740) for
1403 Printer, Models 2, 7

1401/1440/1460 Emulator Program for the System/370
Model 145 with Compatibility Feature (#4457 or #4458)
Under OS: 360C-EU-735

The 1401/1440/
1460 Emulator
Program executes as
a problem program

under the Operating System, MFT or MVT version, using the IBM Compatibility feature (#4457 or #4458). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440, or 1460 Data Processing Systems to be executed on the Model 145. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiple-Divide Processing, Overlap, Sense Switches, Advanced Programming/Indexing, Bit Test, Print Storage, Additional Print Control, Space Suppression, Selective Stacker.

The following features and operations are not emulated: Column Binary, Binary Transfer, 51-column Card, Punch-Feed Read, Read-Punch Release, Card Image (on 1442), Selective Tape Listing (on 1403), Compressed Tapes.

The following input/output devices are not emulated: 1404 Printer, 1444 Card Punch, 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices.

Internal speed (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately 4.9 times that of the 1401 and 1.1 times the CS40 1401 emulator. Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher priority partitions or regions. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the CPU and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator program takes advantage of the multiprogramming facilities of the Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator programs' jobs and System/360 or System/370 jobs can be placed in a single input job stream for processing.

The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program; (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1401/1440/1460 system or a stand-alone emulator program must be dumped onto tape using a 1401/1440/1460 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires the Model 145, the Compatibility Feature (#4457 or #4458), enough main storage for the operating system under which the emulator program is run (MFT or MVT), the emulator functions required for the system being emulated (emulator program and buffers), the 1401/1440/1460 program, and enough Model 145 devices to correspond to the emulated 1401/1440/1460 devices, in addition to the devices required for the operating system.

Input/Output Device Correspondence is as follows:

<u>1401/1440/1460 I/O Device †</u>	<u>Model 145 I/O Device</u>
1401 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the Operating System.
1442 Card Read Punch	
1403 Printer	Any printer supported by the queued sequential access method of the Operating System.
1443 Printer	
729 II, IV, V, VI Tape Unit or 7330 Magnetic Tape Unit, or 7335 Magnetic Tape Unit	Any tape unit or direct access storage device supported by the basic sequential access method of the Operating System.
1407 Console Inquiry Station or 1447 Console	Any operator's console supported by the Operating System.
1301 Disk Storage, or 1311 Disk Storage Drive, or 1405 Disk Storage, Model 1 or 2	Any direct access storage device supported by the basic direct access method of the Operating System. ††

SRL Publication: IBM Operating System: 1410/1440/1460 Emulator on Models 135/145/155 (GC33-2008).

† Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

†† If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

1410/7010 Emulator Program for the System/370 Model 145 with Compatibility Feature (#4458) Under OS: 360C-EU-736

The 1410/7010 Emulator Program executes

as a problem program under the Operating System, MFT or MVT version, using the IBM 1401/1440/1460, 1410/7010 Compatibility Feature (#4458). The combination of the program and the compatibility feature enables programs written for the 1410 or 7010 Data Processing Systems to be executed on the Model 145. Most 1410/7010 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Emulation is provided for 1410/7010 systems with main storage sizes from 10,000 to 100,000 positions of core storage.

All basic features are emulated, along with the following optional features: Processing Overlap, Priority Processing, Two Channels on 1410, Inverted Print Edit, 7010 Second, Third, and Fourth Data Channels, 7010 Store and Restore Status, 7010 Floating Point Arithmetic feature.

The following features and operations are not emulated: 1401/1410 Compatibility Mode, Column Binary, Stacker Select, 51-column Card, 1410/7010 Diagnostic Instruction Branch on Tape Indicate J (I) K, 7010 Diagnostic Instruction Branch on C Bit, 7010 Program Relocation and Storage Protection, 7010 Interval Timer, Disk CE Track Operations (i.e., Operation with CE Switch On).

The following input/output devices are not emulated: 1311 Disk Storage Drive, 1405 Disk Storage, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Magnetic Character Readers, Teleprocessing Devices, Optical Readers, 1442 Card Reader,* Model 3.

Internal speed (performance of CPU instructions only and weighted by frequency of use) of the integrated emulator is approximately two times that of the 1410, and approximately 0.67 times that of the 7010. Throughput under emulation is not determined as much by the emulator as it is by the 1410/7010 program being executed. Throughput of 1410/7010 jobs is affected by the mix of CPU operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher priority partitions or regions. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the CPU and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator program takes advantage of the multiprogramming facilities of the Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently.

The emulator program uses the data management services of the operating system, and it takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator program jobs, System/360 jobs and System/370 jobs can be placed in a single input job stream for processing. The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes used and produced by the 1410/7010 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1410/7010 system or a stand-alone emulator program must be dumped onto tape using a 1410/7010 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires a Model 145, the Compatibility Feature (#4458), enough main storage for the operating system under which the emulator program is run (MFT or MVT), the emulator functions required for the system being emulated (emulator program and buffers), and the 1410/7010 program; and enough Model 145 devices to correspond to the emulated 1410/7010 devices, in addition to the devices required for the operating system.

Input/Output Device Correspondence is as follows:

1410/7010 I/O Device**

Model 145 I/O Device

1402 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the operating system.
1403 Printer	Any printer supported by the queued sequential access method of the operating system.
729 II, IV, V, VI Tape Unit or 7330 Magnetic Tape Unit	Any tape unit or direct access storage device supported by the basic sequential access method of the operating system.
1415 Console Printer	Any operator's console supported by the operating system.

1301 Disk Storage, Model 1 or 2, 1302 Disk Storage, Model 1 or 2, 2302 Disk Storage, Model 1 or 2 Any direct access storage device supported by the basic direct access method of the operating system.***

SRL Publication: IBM Operating System: 1410/7010 Emulator on Models 145/155 (GC33-2009).

* Can be emulated if running on 1402 mode.

** Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

***If more than one System/370 direct access storage device is required to correspond to the 1410/7010 disk storage device being emulated, all corresponding System/370 devices must be the same type of direct access storage device.

Emulating the 1401/1440/1460 on the IBM System/370 Model 135 Using DOS: 370N-EU-490

The 1401/1440/1460 Emulator Program

is a Type I program that is executed as a problem program under the Disk Operating System, using the IBM Compatibility Feature (#4457). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440 or 1460 Data Processing Systems to be executed on the Model 135. Most 1410/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are emulated. Emulation is provided for 1410/1440/1460 systems with main storage sizes from 1,400 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiply-Divide, Processing Overlap, Sense Switches, Advanced Programming/Indexing, Bit Test, Print Storage, Additional Print Control, Space Suppression, Column Binary, Binary Transfer, 51-Column Card, Punch-Feed Read, Card Image (on 1442), Selective Stacker.

The following features and operations are not emulated: Selective Tape Listing (on 1403), Compressed Tapes, Read Compare (1404).

The following input/output devices are not emulated: 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices, Audio Response Units, and 1404 printer in cut card mode.

The 1401 Model G is emulated.

Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator program), input/output operations (executed by the emulator program), and the amount of interference from higher priority partitions. A precise performance statement cannot be given.

The emulator program takes advantage of the multiprogramming facilities of the Disk Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and it takes advantage of the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes used and produced by the 1401/1440/1460 system or by other emulated programs, and mixed parity tapes, are emulated.

Two-tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system.

Disk files created by the 1401/1440/1460 System must be copied on a tape using a 1401/1440/1460 utility program on a 1401/1440/1460 System and then restored to disk by emulating the 1401/1440/1460 utility program on a Model 135.

Disk files created by emulator program (CS/30 and CS/40) can be used without conversion or they can be converted by using the technique described above. Converted files are processed more efficiently.

System Requirements: For emulation, the Model 135 must be equipped with the IBM Compatibility Feature (#4457). 1401/1440/1460 devices are emulated by corresponding Model 135 input/output devices. There must be sufficient main storage for the version of the operating system used, for the emulator functions required for the emulated system, and for the 1401/1440/1460 program being emulated.

Input/output device correspondence between a 1401, 1440, or 1460 System and a Model 135 is described in the following table:

1401/1440/1460 I/O DEVICES

1402 Card Read Punch
Model 1 (1401 Models A,B,C,E,F)
Model 3 (1460)
Model 6 (1401 Model H3)
Models 4, 5 (1401 Model G)

1442 Card Read Punch
Model 1 (1440 - One stacker)
Model 2 (1440 - Two stackers)

1442 Card Reader
Model 4 (1440 - Two stackers)

1444 Card Punch (1440)

1407 Console Inquiry Station
(all 1401 Models except 1401 Model A)

1447 Console
Model 1 Console (1440, 1460)
Model 2 Inquiry Printer and Keyboard (1440, 1460)
Model 3 Inquiry Printer and Keyboard and Control (1440, 1460)

1400 MAGNETIC TAPE UNITS

729 Magnetic Tape Units
Models II, IV, V, VI (1401, 1460)
7330 Magnetic Tape Unit (1401, 1460)
7335 Magnetic Tape Unit (except 1440 Model A2)

1400 DISK STORAGE DEVICES

1301 Disk Storage
Models 11, 12 (1440, 1460)

1311 Disk Storage Drive
Model 1 (1440, 1460)
Model 2 (1401, 1440, 1460)
Model 4 (1401)

1405 Disk Storage
Models 1, 2 (1401).

1400 PRINTERS

1403 Printer
Model 1 (1401 Models A,B,E,F)

SYSTEM/370 MODEL 135 I/O DEVICES

1442 Card Punch, Model N2
1442 Card Read Punch, Model N1
2501 Card Reader, Models B1, B2
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1
2540 Card Read Punch
3505 Card Reader Models B1, B2
3525 Card Punch Models P1, P2, P3

1442 Card Punch, Model N2
1442 Card Read Punch, Model N1
2501 Card Reader, Models B1, B2
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1
2540 Card Read Punch
3525 Card Punch, Models P1, P2, P3

1442 Card Read Punch, Model N1
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2540 Card Read Punch
3505 Card Reader Models B1, B2
3525 Card Punch Models P1, P2, P3
(with Card Read Feature)

1442 Card Punch, Model N2
1442 Card Read Punch, Model N1
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1
2540 Card Read Punch
3525 Card Punch, Models P1, P2, P3

3215 or 3210 Console
Printer/Keyboard

3215 or 3210 Console
Printer/Keyboard

MODEL 135 MAGNETIC TAPE UNITS

2401 Magnetic Tape Unit
2402 Magnetic Tape Unit
2403 Magnetic Tape Unit and Control
2404 Magnetic Tape Unit and Control
Models 1, 2, 3 (seven track)
Models 1, 2, 3, 4, 5, 6 (nine track)
2415 Magnetic Tape Unit and Control
Models 1, 2, 3, 4, 5, 6 (seven track or nine track)
2420 Magnetic Tape Unit Models
5, 7 (nine-track)
3410 Magnetic Tape Unit Models
1, 2, 3
3411 Magnetic Tape Unit and Control
Models 1, 2, 3
3420 Magnetic Tape Unit Models
3, 5, 7 (7- or 9-track)

MODEL 135 DISK STORAGE DEVICES

2311 Disk Storage Drive, Model 1
2314 Direct Access Storage Facility
Model 1 & A Series
2319 Disk Storage Facility
3330 Series Disk Storage

2319 Disk Storage Facility
2311 Disk Storage Drive, Model 1
2314 Direct Access Storage Facility
Model 1 & A Series
3330 Series Disk Storage

MODEL 135 PRINTERS

1403 Printer, Models 2, 3, 7, N1

Model 2 (1401 Models A,B,C,D,E, and F, 1440, 1460)
Model 3 (1440, 1460)
Model 5 (1440)
Model 6 (1401 Model H3, 1440)
Model 4 (1401 Model G)

1404 Printer
Model 2 (all 1401 models except 1401 Models A,D,H)
Continuous form only

1443 Printer
Models 1, 2 (1440)

Notes:

Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

Input/Output feature correspondence between 1401, 1440, or 1460 System and a Model 135 is described in the following table:

1400 DEVICE FEATURE

Column Binary (#1990) for
1402 Card Read Punch, Model 1

Card Image (#1531) for
1442 Card Read Punch, Models 1, 2

Card Image (#1531) for
1442 Card Reader, Model 4

Binary Transfer (#1468) for
1402 Card Read Punch, Model 3

51-Column-Interchangeable Read Feed (#4150) for 1402 Card Read Punch, Models 1, 3, 6

Punch Feed Read (#5890) for
1402 Card Read Punch,
Models 1, 3, 6
Models 4, 5 for 1401
Model G

Note: This feature is required to execute the Read Punch Feed Instruction (4R) of the 1401

Punch Column Skip (#5880) for
1442 Card Read Punch, Models 1, 2

Selective Stacker (#6406) for
1442 Card Read Punch, Model 1

1443 Printer Model N1
3211 Printer

1403 Printer, Models 2, 3, 7, N1

1443 Printer, Model N1
3211 Printer

1403 Printer, Models 2, 3, 7, N1

1443 Printer, Model N1
3211 Printer

MODEL 135 DEVICE FEATURE

Column Binary (#1990) for
2540 Card Read Punch

Card Image (#1531) for
1442 Card Punch, Model N2
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3

Card Image (#1532) for
1442 Card Read Punch, Model N1
Card Image (Standard) on
3505 Card Reader Models B1, B2

Column Binary (#1990) for
2540 Card Read Punch

Card Image (#1531) for
1442 Card Punch, Model N2
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3

Card Image (#1532) for
1442 Card Read Punch, Model N1
Card Image (Standard) on
3505 Card Reader Models B1, B2

Column Binary (#1990) for
2540 Card Read Punch

Card Image (#1531) for
1442 Card Punch, Model N2
2501 Card Reader, Models B1, B2
2520 Card Read Punch, Model B1
2520 Card Punch, Models B2, B3
Card Image (Standard) on
3505 Card Reader Models B1, B2

51/80-Column Interchangeable Read Feed for 2540 Card Read Punch (#4151)
3505-B2 Card Reader (#3921)
(Not available on other card devices)

Punch Feed Read (#5890) for
2540 Card Read Punch

The 1440 instruction M%Gn nnn C is emulated without using a special feature.

Stacker 2 (standard) for
2520 Card Punch, Models B2, B3
2520 Card Read Punch, Model B1

Stackers R2 and RP3 for reading,

	P2 and RP3 for punching (all standard) for 2540 Card Read Punch Stackers 1 and 2 (Standard) on 3525 Card Punch Models P1,P2,P3
Alternate Stacker (standard) for 1444 Card Punch	Stacker 2 (standard) for 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 Stackers P2 and RP3 (both standard) for 2540 Card Read Punch Stackers 1 and 2 (Standard) on 3525 Card Punch Models P1,P2,P3
Stackers 1 and 2 (both standard) for 1402 Card Read Punch	Stacker 2 (standard) for 2520 Card Read Punch, Model B1 Stackers R2 and RP3 (both standard) for 2540 Card Read Punch
Stackers 4 and 8 (both standard) for 1402 Card Read Punch	Stacker 2 (standard) for 2520 Card Punch, Models B2, B3 2520 Card Read Punch, Model B1 Stackers P2 and RP3 (both standard) for 2540 Card Read Punch Stackers 1 and 2 (Standard) on 3525 Card Punch Models P1,P2,P3
Numerical Print Feature (#5381) for 1403 Printer, Models 1, 2	Numerical Print Feature (#5381) for 1403 Printer, Model 2 Selective Stacker (#6555) for 3505 Card Reader Models B1, B2

1401/1440/1460 Emulator Program for the System/370 Model 135 with Compatibility Feature (#4457) Under OS: 360C-EU-735

Operating System, MFT or MVT version, using the IBM Compatibility feature (#4457). The combination of the program and the compatibility feature enables programs written for the IBM 1401, 1440, or 1460 Data Processing Systems to be executed on the Model 135. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiple-Divide Processing Overlap, Sense Switches, Advanced Programming/Indexing, Bit Test, Print Storage, Additional Print Control, Space Suppression, Selective Stacker.

The following features and operations are not emulated: Column Binary, Binary Transfer, 51-column Card, Punch-Feed Read, Read-Punch Release, Card Image (on 1442), Selective Tape Listing (on 1403), Compressed Tapes.

The following input/output devices are not emulated: 1404 Printer, 1444 Card Punch, 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices.

Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature and/or the emulator programs), input/output operations (executed by the emulator program), and the amount of interference from higher priority partitions or regions. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the CPU and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator program takes advantage of the multiprogramming facilities of the MFT options of S/370. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator programs' jobs and System/360 jobs or System/370 jobs can be placed in a single input job stream for processing.

The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 135 facilities.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1401/1440/1460 system or a stand-alone emulator program must be dumped onto tape using a 1401/1440/1460 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires the Model 135, the Compatibility Feature (#4457), enough main storage for the MFT option of the operating system, additional control storage (Control Storage Requirements) the emulator functions required for the system being emulated (emulator program and buffers), the 1401/1440/1460 program, and enough Model 135 devices to correspond to the emulated 1401/1440/1460 devices, in addition to the devices required for the operating system.

Input/Output Device Correspondence is as follows:

1401/1440/1460 I/O Device †	Model 135 I/O Device
1401 Card Read Punch	Any card reader or card read punch supported by the queued sequential access method of the Operating System.
1442 Card Read Punch	
1403 Printer	Any printer supported by the queued sequential access method of the Operating System.
1443 Printer	
729 II, IV, V, VI Tape Unit or 7330 Magnetic Tape Unit, or 7335 Magnetic Tape Unit	Any tape unit or direct access storage device supported by the basic sequential access method of the Operating System.

† Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

The 1401/1440/1460 Emulator Program executes as a problem program under the

1407 Console Inquiry Station or 1447 Console

Any operator's console supported by the Operating System.

1301 Disk Storage, or 1311 Disk Storage Drive, or 1405 Disk Storage, Model 1 or 2

Any direct access storage device supported by the basic direct access method of the Operating System. ††

†† If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

OS-7070/7074 Integrated Emulator for System/370 Model 155, 155 II, 158:

The 707X Emulator executes as a problem program under the MFT or MVT option of OS on a System/370 Model 155, 155 II, 158 equipped with the 7070/7074 Compatibility Feature #7117. The 707X Emulator enables the Model 155, 155 II, 158 to execute, under the Operating System, programs written for an IBM 707X Data Processing System with 10,000 words of storage. Most 707X programs that are not time-dependent can be executed without modification. Certain devices and features of the 707X system are not emulated.

Problem programs such as user jobs, utility programs, compilers, or teleprocessing can be executed concurrent with the 707X Emulator in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System, thereby achieving device independence and the automatic allocation of system resources.

Performance: The internal speed (that is, the speed for performing 707X CPU instructions, weighted by frequency of use) of the Emulator is up to 1.1 times for Model 155 and 1.2 times for Model 158 the internal speed of the IBM 7070/7074 Stand-Alone Emulator for System/360 Model 50 or up to 2.75 times for Model 155 and 3.0 times for Model 158 the IBM 7070. Throughput depends upon the following factors: the mix of 707X CPU operations part of those being CPU operations executed by the compatibility feature, the 707X CPU and input/output operations simulated by the Emulator Program, and the amount of interruption from higher priority partitions or regions and from the Operating System.

Two tape formatting programs are provided with the Emulator to assist the user in converting 707X tape files before emulation so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation so that they can be used on the original system.

The following CPU features are not emulated: Additional Storage and associated instructions ... Interval Timer Instructions ... Customer Engineer Diagnostic Instructions ... Optional Feature Instructions (except Floating Point which is emulated).

The following input/output devices are not emulated: 7907 Data Channel ... 7900 Inquiry station ... 7300 Disk Storage ... 7500 Card Reader ... 7550 Card Punch ... 7400 Printer ... 7603 Input/Output Synchronizer.

The following input/output features are not emulated: Tape Read all Alpha ... Read Binary Tape ... Tape Read/Write from 707X locations 9990-9999 ... 720 Tape Switching Feature ... Unit Record Priority Interrupts ... Unit Record Signal.

System Requirements: The 707X Emulator requires a System/370 Model 155, 155 II, 158 equipped with the 7070/7074 Compatibility Feature; it requires enough System/370 devices to correspond to the 707X devices on the system being emulated in addition to devices required by the Operating System; it requires enough main storage for the option of the Operating System being used (MFT or MVT); the emulator functions needed for the 707X system being emulated, and the 707X program being executed.

Excluded Feature: The Model 155, 155 II, 7070/7074 compatibility feature 7117 cannot be installed with the Extended Floating Point Feature 3700.

Input/output device correspondence is as follows:

707X Device	System/370 Device
7150 Console	Model 155 Console
7501 Console Card Reader	1442 Card Read Punch, 2501 Card Reader, 2520 Card Read Punch, 2540 Card Read Punch with 2821 Control Unit, or any other SYSIN devices supported by the Queued Sequential Access Method of the Operating System
729 II/IV/V/VI Magnetic Tape Unit	2400 Series Magnetic Tape Units (Models 1, 2, 3, 4, 5 or 6) or 2420 Magnetic Tape Unit (Models 5 or 7) or any other tape unit supported by the Basic Sequential Access Method of the Operating System* or direct access devices.**

* All seven-track tape drives used for 707X - compatible tapes must have the Seven-Track Compatibility Feature.

** A 707X tape in spanned variable-length format may be kept on any System/370 direct access device supported by BSAM. The file will appear to be a tape to the 707X program which can access it only through tape commands.

SRL Publications: 7074 OS Emulator on System/370 (GC27-6948).

Basic Program Material:

Documentation: Basic Program Material List ... User's information SRL: Emulating the 7074 on the System/370 Models 155 and 165 using OS (GC27-6948 and TNLs GN27-1365 and 1372).

Machine Readable: load module, emulator generation macro definition, User SYSOUT Writer, and sample program are available on a 2400 magnetic tape 9-track (800 or 1600 bpi).

Optional Program Material:

Documentation: Optional Program Material list, PLM: Program to emulate the 7074 on the System/370 Model 155 using OS (GY27-7238).

Machine Readable: source statements and macros are available on a 9-track 2400 magnetic tape (800 bpi).

Program Listings: are available on microfiche from Mechanicsburg (GJD1-1643-0).

Ordering Information: Program Number 360C-EU-741

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	2311	DTR 7DC/800	26	none
		DTR 9/800	28	none
		DTR 9/1600	29	none
	2314	DTR 7DC/800	26	none
		DTR 9/800	28	none
		DTR 9/1600	29	none
	3330	DTR 7DC/800	26	none
		DTR 9/800	28	none
		DTR 9/1600	29	none
Optional	none	MT 7DC/800	26	1
		DTR 9/800	28	none
		DTR 9/1600	29	none

Additional copies of the form numbered manual should be ordered from Mechanicsburg - not from PID.

System/360 Model 20 Emulator on System/370 Model 135 under DOS (370N-IC-002): It allows the user to run Model 20 programs under the Disk Operating System using the Model 20 Compatibility Feature #7520 of the System/370 Model 135.

It allows Model 20 programs to be run in a stacked-job environment mixed with System/370 jobs. It takes advantages of the multiprogramming facilities of DOS.

If SYSRDR is assigned to a magnetic tape or a disk unit, that device must input all of the DOS control cards that normally are included in the job stream.

The Model 20 CPU instructions are executed by the Compatibility Feature, except the Halt and Proceed (HPR) set PSW (SPSW), and all SS-format instructions which are executed by the emulator program. The emulator program uses the physical IOCS capabilities of DOS to emulate the Model 20 I/O instructions.

Card, Tape and Disk programs are executed. Cards and Tapes used and produced by the System/360 Model 20 or by the System/360 Model 25 in Mode 20 can be used by the emulator program without changes, except 7-track tapes in mixed parity or density which are not accepted by the emulator. Disk volumes created by the System/360 Model 20 or by the System/360 Model 25 in Model 20 mode must be copied on a tape by running a Model 20 utility program on their original system, and then restored to disk by emulating the Model 20 utility program on a Model 135. Each Model 20 disk volume is converted into a DOS DAM file. Three 2311 Model 11 volumes can be emulated by one module of an IBM 2319.

Restrictions:

Model 20 devices and features/functions not emulated are:

- 1419, 1255, and 1259 Magnetic Character Readers
- 1270 Optical Reader Sorter
- 2560 Sort/Merge, and only one punch path
- Binary Synchronous Communications Adapter
- Communications Adapter Special Features
- 1401/1440 Compatibility Feature for S/360 Model 20 Submodel 5
- Dual Feed Carriage Feature of the 2203 Printer
- Selective Tape Listing Feature of the 1403 Printer

Programs that cannot be executed using the emulator are:

- Time-dependent programs
- Programs using mixed parity or mixed density on 7-track tape
- Programs using ASCII Code
- Programs using the DIAGNOSE instruction
- Programs using the two commands for the Universal Character Set Feature of the IBM 1403 Printer

The emulated Model 20 error condition will always be that of the Model 20 Submodel 5

Minimum System Requirements: To emulate System/360 Model 20, the System/370 Model 135 must have:

- The Model 20 Compatibility Feature #7520
- For control storage requirements, refer to page M 3135.1 of the sales manual
- Enough main storage for the routines needed to emulate the Model 20, for emulated Model 20 core storage, and for the DOS supervisor
- System/370 input/output devices that correspond to the System/360 Model 20 input/output devices being emulated.
- The I/O device required by DOS.

Main Storage Requirements: The System/370 Model 135 main storage illustrated below includes the emulator routines and emulated Model 20 core storage. It does not include the main storage occupied by the DOS supervisor.

MAIN STORAGE REQUIRED (In K Bytes)

Model 20 Core Storage	Model 20 Card System *	Model 20 Card & Tape System	Model 20 Card & Disk System	Model 20 Card, Tape & Disk System
4	12	-	-	-
8	16	19	-	-
12	20	23	27	29
16	24	27	31	33
24	32	35	39	41
32	-	43	47	49

* Card devices include the IBM 2501, the IBM 2520 or 2560, the IBM 1442 and the IBM 1403 or 2203.

Auxiliary Storage Required (On a 2316)

Source Statement Library: 2261 blocks
Relocatable Library: 173 blocks
Core Image Library: 19 blocks

See SRL GC24-5036 - Disk Operating System System Control and System Service Program.

Input/Output device correspondence is as follows:

Model 20 Devices	Emulated By:
2415 Magnetic Tape Unit, Models 1 to 6	2401 Magnetic Tape Unit, Models 1 to 6 and 8 attached to the 2803 or 2804 Control Unit
2401 Magnetic Tape Unit and Control, Models 1, 2, 4	2415 Magnetic Tape Unit and Control Models 1 to 6
	2420 Magnetic Tape Unit, Models 5 and 7 attached to the 2803 Control Unit
	3420 Magnetic Tape Unit, Models 3, 5 and 7 attached to the 3803 Control Unit
2311 Disk Storage Drive, Models 11 and 12	2311 Disk Storage Drive, Model 1 attached to the 2841 Control Unit
	2312 Disk Storage Model A1
	2313 Disk Storage Model A1
	2314 Direct Access Storage Facility Models 1, A1, B1
	2318 Disk Storage Model A1
	2319 Disk Storage Models A1, A2, B1, B2
	3330 Series Disk Storage
1259 Magnetic Character Reader	Not emulated
1255 Magnetic Character Reader	Not emulated
1419 Magnetic Character Reader	Not emulated
1270 Optical Reader Sorter Models 1, 2, 3, 21, 22, 23	Not emulated
Binary Synchronous Communications Adapter	Not emulated
2152 Printer-KeyBoard	3210 Console Printer Model 1 3215 Console Printer
2501 Card Reader, Models A1 and A2 (3) (4)	2501 Card Reader, Models B1 and B2 2520 Card Read Punch, Model B1 2540 Card Read Punch attached to the 2821 Control Unit
	3505 Card Reader, Models B1 and B2 3525 Card Punch, Models P1, P2, and P3 (1)

- 2520 Card Read Punch, Model A1 (3) (4)
- 2520 Card Punch, Models A2 and A3 (4)
- 1442 Card Punch, Model 5 (3) (4)
- 2560 Multi-Function Card Machine, Models A1 and A2 (Model A1 with one of the Optional Card Print feature) (4)
- Sort and merge capabilities are not emulated
- 1403 Printer, Models 2, 7, and N1 (4) or
- 2203 Printer, Models A1 and A2 (4)
- Selective Tape Listing Feature of the 1403 and Dual Feed Carriage Features of the 2203 are not emulated

- 2520 Card Read Punch, Model B1
- 3525 Card Punch, Models P1, P2, and P3 (1)
- 2520 Card Read Punch, Model B1
- 2520 Card Punch, Models B2 and B3
- 2540 Card Read Punch attached to the 2821 Control Unit
- 3525 Card Punch, Models P1, P2, and P3 (1) or (2) with or without Card Read feature
- 2520 Card Read Punch, Model B1
- 2520 Card Punch, Models B2 and B3
- 2540 Card Read Punch attached to the 2821 Control Unit
- 3525 Card Punch, Models P1, P2, and P3 (1) or (2)
- 3505 Card Reader, Models B1 and B2, and
- 3525 Card Punch, Models P1, P2, and P3 with one of the Card Print feature (optional) (1)
- 1403 Printer, Models 2, 3, 7 and N1
- 1443 Printer, Model N1
- 3211 Printer attached to the 3811 Printer Control Unit

- (1) The 3505 Card Reader must be equipped with the 3525 Read/Punch Adapter feature #8105; the 3525 Card Punch must be equipped with the Card Read feature #1533.
- (2) The 3505 Card Reader must be equipped with the 3525 Punch Adapter feature #8103.
- (3) The System/370 2520 Card Read Punch, Model B1, or the 3525 Card Punch cannot emulate more than one of the following devices at a time:
 - 2501 Card Reader, Models A1, A2
 - 2520 Card Read Punch, Model A1 or 2520 Card Punch Models A2, A3
 - 1442 Card Punch, Model 5
- (4) When device independence is used, add the System/370 Magnetic Tapes and Disk Storage in the list of corresponding System/370 devices.

Device Independence: This option allows faster S/370 I/O devices such as disks or tapes to be used to replace unit record devices when emulating Model 20 programs. This is particularly advantageous when emulating Model 20 programs which make use of intermediate card files, since tape and disk devices transfer data at much higher speeds than do unit record devices. Also, in a multiprogramming environment, unit record devices no longer need to be dedicated to the emulator partition.

The additional storage required by this option is 6K plus buffer areas.

Model 20 features and instructions not emulated when using Device Independence are:

- Stacker selection for input files
- Optional Card Print feature on the 2520 MFCM, Model A1
- Punch Feed Read instruction
- Read Column Binary cards on the 2501 Card Reader, the 2520 Card Read Punch, and the 2560 MFCM

In addition:

- The Sort/Merge program for the 2560 MFCM cannot be run
- Only the selection of two stackers is emulated for 2560 MFCM
- Primary and secondary feeds have no interaction when emulating the 2560 MFCM
- Data files that contain /& cards cannot be read.

Model 20 DOS/VS Disk Data Interchange Function: During the conversion period the user may want a newly-written DOS/VS application program to have access to data stored in his files by Model 20 application programs running under emulation.

Since the data organizations on disk used by DPS and DOS/VS are not compatible, a file conversion aid known as Model 20 DOS/VS disk data interchange, part of the emulator program, provides this and the reverse capability.

Conversion is provided for Sequential, Indexed Sequential and Direct Access files.

Conversion from Model 20 DPS emulated format to DOS/VS format is provided, as is reverse conversion from DOS/VS format to Model 20 DPS emulated format.

Both Sequential and Indexed Sequential files can have a different blocking factor on the DOS/VS copy of the file from that used on the DPS copy. This enables the user to take advantage of the different physical characteristics of the System/370 Direct Access devices.

The Data Interchange function operates as a job in a DOS/VS jobstream. When the conversion function is no longer required the control cards invoking this function are merely removed from the jobstream. Thus no special provisions need be made in newly written DOS/VS application programs to allow for the file conversion process.

Restriction: The blocksize used by the DOS/VS copy of the file should not exceed a single track capacity.

When a DOS/VS originated file is copied into DPS emulated format, the disk extents used must be initialized by a DPS program running under control of the emulator.

Machine Requirements: The Disk Data Interchange function runs on any model (supported by DOS/VS) of System/370 in any partition since it is not dependent on the System/360 Model 20 compatibility feature (FC7520). The program including 2K buffers for an average blocksize of 1K runs in a 20K partition.

For best performance, it is suggested that the files are copied from one DASD pack to another DASD pack. In this case one DASD volume supported by the Model 20 Emulator (for the Model 20 file in emulated format), and one DASD volume supported by DOS/VS (for the DOS/VS file) must be provided.

Basic Program Material:

Documentation: One copy each of Model 20 Emulator on System/370 using DOS and DOS/VS (GC33-2006), basic program material list.

Machine Readable: One copy of machine readable material containing Generation macro definitions, object modules, phase modules for CIL and sample program.

Optional Program Material:

Documentation: Optional material list.

Machine Readable: One copy of machine readable material containing source modules of the Model 20 Emulator.

Ordering Information: Program Number 370NIC002

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	None	DTR 7DC/800	26	None
		DTR 9/800	28	None
		DTR 9/1600	29	None
		Disk 1316	52	1
		Disk 2316	57	1
Optional	None	DTR 7DC/800	26	None
		DTR 9/800	28	None
		DTR 9/1600	29	None
		Disk 1316	52	1
		Disk 2316	57	1

Additional Program Support Material:

Program Listings: Available on microfiche from IBM Corporation, Microfiche Distribution, Mechanicsburg. Order Number: GJDI-4601

Program Logic Manual: Model 20 Emulator on System/370 using DOS (SY 33-7010).

OPTIONAL PROGRAM PACKAGE

Machine Readable: Source modules are available and distributed as indicated below.

ORDERING INFORMATION

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
360CEU074, or 360CEU726, or 360CEU728, or				
Basic	none	DTR	7DC/800 9/800 9/1600	26 28 29 none none none
Optional	none	DTR	7DC/800 9/800 9/1600	26 28 29 none none none
360CEU725, 360CEU727, 360CEU729, 360CSI750				
Basic	none	DTR	7DC/800 9/800 9/1600	26 28 29 none none none
Optional	none	MT	7DC/800 9/800 9/1600	26 28 29 01 01 01
360CSI752				
Basic	none	DTR		00 none
Optional	none	DTR	7DC/800 9/800 9/1600	26 28 29 none none none
360CCV710, or 360CCV711				
Basic	none	DTR	7DC/800 9/800 9/1600 1316	26 28 29 52 01 01 01
Optional	none	DTR	7DC/800 9/800 9/1600	26 28 29 01 01 01
360CCV712				
Basic	none	DTR	7DC/800 9/800 9/1600 1316	26 28 29 52 01 01 01
Optional	none	MT	7DC/800 9/800 9/1600	26 28 29 01 01 01
360CCV713, or 360CSI754				
Basic	none	DTR	7DC/800 9/800 9/1600	26 28 29 none none none
Optional	none	MT	7DC/800 9/800 9/1600	26 28 29 01 01 01
360CSI753				
Basic	none	DTR	7DC/800 9/800 9/1600	26 28 29 none none none
Optional	none	MT	7DC/800 9/800 9/1600	26 28 29 02 02 02
360CEU734				
Basic	2311	DTR	9/800 9/1600	28 29 none none
	2314	DTR	9/800 9/1600	28 29 none none
Optional	None	DTR	9/800 9/1600	28 29 none none

360CEU735, or 360CEU736

Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic 2311	MT	7DC/800	26
	DTR	9/800	28
	DTR	9/1600	29
2314	MT	7DC/800	26
	DTR	9/800	28
	DTR	9/1600	29
3330	MT	7DC/800	26
	MT	9/800	28
	MT	9/1600	29
Optional none	MT	7DC/800	26
	DTR	9/800	28
	DTR	9/1600	29
360CEU739			
Basic 2311	SDTR	7DC/800	26
	SDTR	9/800	28
	SDTR	9/1600	29
2314	MT	7DC/800	26
	LDTR	9/800	28
	LDTR	9/1600	29
3330	MT	7DC/800	26
	LDTR	9/800	28
	LDTR	9/1600	29
Optional none	MT	7DC/800	26
	LDTR	9/800	28
	SDTR	9/1600	29

ADDITIONAL PROGRAM MATERIAL

Program Logic Manuals

1401/1460 Emulator for S/360	GY27-7103
7074 Emulator for S/360 Models 50 & 65	GY27-7111
7080 Emulator for S/360 Model 65	GY27-7112
7074 Emulator for S/360 Models 50 & 65	GY27-7129
1410/7010 Emulator for S/360 Model 40	GY27-7127
7040/7044 Emulator for S/360 Model 65	GY27-7147
1410/7010 Emulator for S/360 Model 40	GY28-6564
709/7090/7094 Emulator for S/360	GY28-6566
ALGOL to PL/I LCP	GY33-7006
FORTRAN IV to PL/I LCP	GY33-7000
1410/7010 Simulator	GY27-7115
7070/7074 Simulator	GY27-7117
7090/7094 Simulator	GY27-7119
COBOL-to-ANS COBOL LCP	GY28-6397
COBOL-to-(E/F) to PL/I LCP	GY33-7007
7094 Integrated Emulator Model 85 under OS/360	GY27-7187
1401/1440/1460 OS Emulator on Models 135/145/155	GY33-1011
1410/7010 OS Emulator on Models 145/155	GY33-1012

Program Listings:

Group Code	When ordering specify --
1310	for the 1410/7010 Simulator
1321	1620 Simulator S/360
1370	7070/7074 Simulator
1390	7090/7094 Simulator
1400	1401/1460 Emulator
1410	1410/7010 Emulator
1500	1410/7010 Emulator, Model 50
1510	7074 Emulator, Models 50 & 65
1620	7080 Emulator, Model 65
1630	709/7090/7094/7094 II Emulator, Mdl 65
4600	ALGOL to PL/I LCP
4610	FORTRAN IV to PL/I LCP
4620	COBOL to PL/I LCP
9000	COBOL-to-ANS COBOL LCP for OS/360
1420	7094 Integrated Emulator Model 85 under OS/360
GJD1-2100	1401/1440/1460 Integrated Emulator for Model 155 - OS
GJD1-2150	1410/7010 Integrated Emulator for Model 155 - OS
GJD1-1641	7070/7074 on Model 165

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Programming support for the System/360 Model 44 is tailored for the intermediate scientific user. It is provided by

System/360 Model 44 Programming System ... disk resident programs requiring a minimum of 64K (65,536) bytes of core storage.

System/360 Model 44 Programming System (44 PS)

The Model 44 Programming System consists of a FORTRAN compiler, an assembler, a supervisor, and system support programs. It provides FORTRAN and assembler language processing and program execution in a monitored environment, with automatic job-to-job transition, interruption handling, and input/output supervision. The system has facilities for the creation and maintenance of libraries and the manipulation of their contents. It also provides extensive job control and modular programming capabilities for flexibility and versatility in the preparation of programs for execution. It will utilize all available core storage. Programs utilizing direct data channel, direct word, or priority interruption features cannot be executed under the supervisor.

System Components

44 PS Supervisor	360F-10-613
44 PS Job Control	360F-CL-614
44 PS Linkage Editor	360F-ED-615
44 PS Assembler	360F-AS-616
44 PS Utilities	360F-UT-617
44 PS FORTRAN Compiler	360F-F0-618
44 PS FORTRAN Library	360F-LM-619
44 PS System Editor	360F-UT-620

The system resides on either a 2315 or a 1316 Disk Cartridge. It includes a supervisor, a set of support programs that perform system-related and utility functions, and two language processors: a full FORTRAN IV compiler and an assembler. It also includes seven stand-alone (i.e., not operating under system control) programs that are not resident on the 2315/1316 Disk Cartridge: a program to construct the executable programming system from the distributed tape/card decks; a loader for loading system-produced programs that are in absolute form; and are to be executed independently of system control; two disk initialization programs (2315 and 1316); a save/restore program for saving the contents of a disk on tape and later restoring the disk; a special purpose program for printing, punching, or updating the IBM-distributed system; and a self-loading core dump program. The system requires 16,896 bytes to be permanently resident in core storage, and 110 tracks on the Systems Residence Volume. Additional space must be reserved on the DSSK when the system is initially created for system scratch areas and user additions to the phase and module libraries. 814 bytes in the Resident Supervisor are the FE Diagnostics required to support this system.

Supervisor

The supervisor controls the entire system and provides a common interface to all processing programs, including the FORTRAN compiler, the assembler, the system support programs, and user-written programs. Specifically, the supervisor

- Manages the use of system resources.
- Loads the appropriate execution phases from the phase library (i.e., the library of programs in absolute form, ready for execution).
- Handles all standard label checking, input/output requirements, and input/output error recovery procedures. The NO LABEL option is provided for unlabeled tapes.
- Services interruptions and passes control to the appropriate system or user routine for interruption processing.
- Schedules channel use to effect overlap of processing with input/output operations.
- Provides for communication with the console operator.

System Support Programs

The system support programs provide a wide range of capabilities for use by both the system and the programmer.

- Job Control provides for sequential job processing with automatic job-to-job transition.
- Linkage Editor edits the compiler and assembler relocatable output modules into absolute form, automatically combining these modules with modules from the module library (one of the system libraries) where necessary.
- Utility Programs. These programs provide data set transmission and external storage initialization and maintenance functions. In addition, there are DUMP facilities which can be invoked by either the problem program or the operator.
- The System Editor allows for modification of program stored in either the phase or module library.

Assembler

The assembler translates System/360 assembler language programs to relocatable object program modules. The assembler language consists of all System/360 Model 44 instruction mnemonics, literals, and a set of assembler instructions that direct the assembly process. It includes an optional UPDATE facility.

Compatibility. Observing the qualifications listed below, programs written for the Model 44 Assembler may be assembled by the TOS/DOS Assemblers and the OS Assembler. Similarly, programs written for the BPS Assemblers may be assembled by the Model 44 Assembler.

The Model 44 Assembler will only assemble instructions included in the Model 44 Instruction Set. There are four special instructions unique to the Model 44 that cannot be assembled on other System/360 assemblers.

In addition, the Assembler's UPDATE instructions are unique to the Model 44 and cannot be processed by any other assembler.

If variable symbols are used, care must be taken prior to assembly in other systems to ensure that LCLA declaration exists for all variable symbols.

The user must ensure that each program observes the subroutine linkages and supervisor calls appropriate to the system that the program will run under.

FORTRAN IV

The FORTRAN IV compiler translates programs written in the FORTRAN language to relocatable object program modules. The compiler accepts programs written in the full FORTRAN IV language. No debug facilities are available however. Programs may be written in either BCD or EBCDIC. The compiler tests for usages of official FORTRAN library routine names to ensure correspondence with respect to the number and type of arguments used. The FORTRAN language manual warns against the declaration of COMMON and EQUIVALENCE data in such a way as to cause data to be improperly aligned, e.g., double precision data not on double word boundaries. If such a condition is detected, a warning message will be printed at compile time but execution will be allowed to begin. If a specification condition occurs at execution time, a fix-up routine will be loaded automatically into main storage and the data adjusted so that execution can continue. A facility is provided in the FORTRAN Library for CALLing the Fetch and Load Supervisor facilities of the 44 PS.

Compatibility. The Model 44 FORTRAN IV is compatible with and encompasses the U.S.A. Standard (USA) FORTRAN. Programs written in BPS, TOS, DOS FORTRAN or OS E Level FORTRAN may be compiled by the Model 44 FORTRAN IV. OS/360 FORTRAN IV G and H are compatible with Model 44 FORTRAN IV. (See System/360 FORTRAN IV Language Manual (C28-6515), which describes the common language).

Performance: Estimated performance of the Model 44 Programming System Assembler and FORTRAN IV, illustrated with three typical configurations, can be calculated with the information below, assuming no labels. I/O is unblocked with the exception of intermediate data sets. Assembler and FORTRAN IV figures include output of a listing and an executable program in the Phase Library for each compilation and are based on typical source program decks. Additional core storage will be used for symbol tables.

Configuration A is for a card environment, configuration B a tape/disk, and configuration C an all-tape environment. The following table shows the units required for each configuration. In configuration A, the card reader is the 2540 Card Read/Punch, and SDSD refers to the single disk storage drive. In B and C, the 2400 Tape is the Model 3 (90KC) tape.

All configurations include the Model 44F with a 2315 or 1316 Disk Cartridge for systems residence, the console printer-keyboard, and high speed general purpose registers. In addition, configurations B and C require a multiplexer channel as a second channel.

	Configuration		
	A	B	C
Source input	2540	2400 tape	2400 tape
Output listing	1403 N1	2400 tape	2400 tape
Linkage Editor input	SDSD	2400 tape	2400 tape
Scratch file	SDSD	SDSD	2400 tape

The estimates are made assuming that assembly/compilation options are set to give a listing, no deck, and to perform linkage editing. Also it is assumed that units are assigned to give optimum channel utilization.

Assembler

Up to 2100 symbols can be assembled in a Model 44F. This is increased by 2,000 for each additional 32K bytes of core storage available.

The assembler has a cross-reference feature which is optionally callable. The performance is significantly different with cross-reference than without, so several of the entries below provide two timing estimates.

(Time in seconds)	Configuration		
	A	B	C
System factor to be applied once per job	4.5	4.0	4.0
System and Assembler factor to be applied once per assembly			
a. without cross-reference	6.3	4.5	4.5
b. 2311 Residence, without cross-reference	5.2	3.7	3.7
c. with cross-reference*	12.3	9.8	7.0
Assemble factor per source card			
a. without cross-reference	0.133	0.044	0.030
b. with cross-reference	0.145	0.049	0.032
System factor to be applied once per linkage editor step			
a. SDDS Residence	4.3	3.6	3.6
b. 2311 Residence	3.5	2.4	2.4
Linkage Editor factor to be applied once per source card	0.003	0.003	0.003

*These estimates are made assuming that the symbol table is 2000 entries long. These times become proportionately less if the user specifies that the symbol table is shorter. For example, a symbol table of 500 entries under configuration A would reduce this figure by about 4.5 seconds.

FORTRAN IV

Both compiler and object programs require the Standard Instruction Set and the Floating Point option. In a Model 44F, about 1000 statements may be compiled. At execution time, approximately 33,000 bytes of core storage are available for object code and data space. In any given compilation, it is unusual for the number of bytes of executable code generated to be more than 60 per statement. To improve multiple compilation performance, compilations may be batched between a single //EXEC card and a /* card. The options on the //EXEC card follow throughout all compilations in the batch. The second and subsequent compilations follow directly behind the END statement of the preceding compilation.

	Configuration		
	A	B	C
System factor to be applied once per job	4.5	4.0	4.0
System and Compiler factor to be applied once per batch of compilations			
a. SDDS Residence	4.0	2.5	2.5
b. 2311 Residence	2.2	2.0	2.0
System and Compiler factor to be applied once per compilation			
a. SDDS Residence	4.5	4.5	4.5
b. 2311 Residence	3.7	3.0	3.0
Compile factor per source card	0.10	0.05	0.05
System and Linkage Editor factor to be applied once per job step			
a. SDDS Residence	11.8	10.0	9.6
b. 2311 Residence	8.3	6.3	6.3
System and Linkage Editor factor to be applied once per source card	0.04	0.03	0.02

Stand Alone Programs

2315 Disk Initialization	360F-UT-607
2311 Disk Initialization	360F-UT-608
Save/Restore (Stand Alone Utility)	360F-UT-609
System Maintenance (Stand Alone Utility)	360F-UT-610
Absolute Loader (Stand Alone Utility)	360F-UT-611
System Construction	360F-UT-612

System Construction -- Each system can be tailored to the specific system-function requirements and input/output configuration of the installation. The installation may modify the IBM-supplied configuration, deleting functions not required by the installation and adding installation-created functions and programs.

A stand-alone program is provided that constructs a system (on a 2315 or a 1316 Disk Cartridge) from the executable phases and the relocatable modules the installation elects to include in its system. All the announced support will be included in the distributed decks. As part of the initial program load (IPL) procedure, the operator may define alterations in the generated device-channel configuration and unit assignment. (For additional comments, see "Notes on Configuration," paragraph 2). These changes may be temporary or by using the FIX parameter of the SET statement they may be made on the resident volume so that they will hold through successive IPLs. Alternatively, the 44 PS is available on tape. In this case, a minimum system requires a card reader, and a tape drive.

Loader. This loader can be used to load absolute decks for execution

independent of system control. Object modules may also be loaded provided they are in absolute form. That is, they do not contain any external references or address constants which require relocation.

- **Disk Initialization.** Two programs (for 2315 and 1316) are included for surface analysis, initialization, and alternate track allocation.
- **Save/Restore.** This program saves the contents of a disk on tape or restores a disk from a "Save" tape.
- **System Maintenance.** This program prints or punches selected files of the tape containing the IBM-distributed system.
- **Core Dump.** This program dumps core, the 16 standard registers, and the floating point registers, if they exist.

Minimum Machine Configuration

- 2044 Processing Unit with its Console Printer-Keyboard, Single Disk Storage Drive, and at least 65,536 bytes of main storage.
- One Multiplexer Channel (#5248 or #4598).
- One 2315 Disk Cartridge (used for Systems Residence).
- One of the following input units: 1442 Mdl N1 Card Read/Punch ... 2501 Mdl B1 or B2 Card Reader ... 2520 Mdl B1 Card Read/Punch ... 2540 Mdl 1 Card Read/Punch ... 2401 or 2402 Mdl 1, 2, 3, 4, 5, 6, or 8 (7-track) Magnetic Tape Unit ... 2420 Mdl 5 ... 2403 Mdl 1, 2, 3, 4, 5, or 6 Magnetic Tape Unit Control ... 2404 Mdl 1, 2, or 3 Magnetic Tape Unit and Control ... 2311 Disk Storage Drive.
- One of the following output listing units: 1403 Mdl 2, 3, 7 or N1 Printer ... 1443 Mdl N1 Printer ... any of the magnetic tape units listed above ... 2311 Disk Storage Drive.
- One of the following output punching units: 1442 Mdl N2 Punch ... 2520 Mdl B2 or B3 Punch ... any of the card read/punches listed above ... any of the magnetic tape units listed above ... 2311 Disk Storage Drive.

Notes on Configurations:

1. In addition to the above requirements, the system supports the attachment of -- a second Single Disk Storage Drive (with 2315 Cartridge), which, alternatively, may be used for Systems Residence ... additional 2311 Disk Storage Drives (with 1316 Disk Pack), which also may be used for system residence ... additional magnetic tape units (any of the modules listed above) ... additional multiplexer channels to a maximum of 3.
2. A system-residence 2315/1316 Disk Cartridge can be created using the minimum machine configuration, provided the input device is a card reader. Assembly is not required in this procedure. However, if it is desired to assemble the source language version of the IBM-supplied components of the system, at least one magnetic tape drive is required. If re-assembly is desired, a second disk drive and a second magnetic tape drive should be included for optimum system editing.
3. If more than 65,536 bytes of main storage are available, the system will take advantage of their availability.
4. The FORTRAN compiler requires that the 2044 be equipped with the Floating-point Arithmetic feature (#4427). The assembler also requires this feature if it is desired to assemble floating-point constants.
5. The user may modify the supervisor to include input/output routines for additional devices (provided these devices have start, device end, and channel end characteristics similar to those of the supported devices). These characteristics are detailed in System/360 Principles of Operation, A22-6821, and the appropriate unit manuals.
6. The Read-Backward feature of the 2400 Series Magnetic Tape Units is not supported.

EC Level

Release 3 will function correctly on any level 2044 Processing Unit from EC 390147 (ECA 31).

Publications

IBM System/360 Model 44 Programming System	
• Concepts and Facilities	C28-6810
• Assembler Language	C28-6811
IBM System/360	
FORTRAN IV Language	C28-6515
Technical Newsletter for C28-6515-4	N28-0210
FORTRAN IV Library Subprograms	C28-6596

Basic Program Material:

SRL Publications --

System/360 Model 44 Programming System	
Guide to System Use	C28-6812
Guide to System Use for FORTRAN Programmers	C28-6813
Systems Programmer's Guide	C28-6814
Operator's Guide	C28-6815

Documentation -- Program Material List.

Machine Readable Material - The Absolute Component Program Decks and the Relocatable FORTRAN Library are available on either 9-track DTR (800 or 1600 bpi) or 7-track DTR (800 cpi, Data Conversion feature required) or in card form. Directions for using the Sample Program Input Deck are contained within the basic publication, System/360 Model 44 Programming System, Systems Programmers' Guide, C28-6814-1.

Core Dump 360F-UT-606

A stand alone utility that provides for dumping core sizes of 64K or greater, the 16 standard registers and floating-point registers, if they exist.

Additional Program Material:

Program Logic Manuals

Assembler	Y28-6811
Supervisor and Job Control Processor	Y28-6812
Linkage Editor	Y28-6813
Utilities and Stand-alone Programs	Y28-6814
FORTRAN IV Compiler	Y28-6815

Program Listings: Available on microfiche. Specify group code 1720. The listings are equivalent to the output listings produced by assembling the symbolic modules.

Optional Program Material (Symbolic Modules): Optional program components are available on two distribution volumes, each identified by a Distribution Volume Number for ordering purposes. Distribution may be requested on one 9-track (800 or 1600 bpi ODD parity) or one 7-track magnetic tape (800 cpi ODD parity, Data Conversion feature required).

A separate magnetic tape is required for each distribution volume. The external tape label must show the distribution volume number indicated below, as well as the information required under current procedures. Tapes are blocked 20 cards per record.

If either 9- or 7-track magnetic tape is not specified, 9-track tape at 800 bpi will be forwarded.

<u>Program Extension Number</u>	<u>Program</u>	<u>Number</u>
VOL1	S/A Core Dump	360F-UT-606
	2315 Disk Initialization	UT-607
	2311 Disk Initialization	UT-608
	* Save/Restore	UT-609
	* System Maintenance	UT-610
	* Absolute Loader	UT-611
	System Construction	UT-612
	44 PS Supervisor	IO-613
	Job Control	CL-614
	Linkage Editor	ED-615
	Assembler	AS-616
	Utilities	UT-617
	System Editor	UT-620
	VOL2	FORTRAN Compiler
FORTRAN Library		LM-619

* Stand alone utility

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IBM System/360 Time Sharing System

Time Sharing System/360 is a comprehensive programming system consisting of processing programs and service programs operating under the control of a supervisory program. Its purpose is to provide many users concurrent access to a computing facility in an interactive mode, coupled with concurrent execution of non-conversational (batch) programs. By calling on various facilities of the system, users are able to compile programs, execute programs, manipulate data sets and perform a variety of tasks which may be basically unrelated to each other and are generally unrestricted in their nature. The Time Sharing System (TSS/360) operates on a System/360 Model 67 which has special features that provide the proper machine environment to enhance the time sharing ability of the system. TSS/360 operates either on a single processor System/360 Model 67 (2067 mdl 1 or 2) or on a duplex (two 2067 mdl 2 CPUs) configuration.

TSS/360 is composed of programs designed to perform unique functions. These programs provide: (1) supervisory functions, (2) maintenance and support functions, (3) service functions, and (4) user functions.

SUPERVISORY FUNCTIONS

The Supervisory Functions of TSS/360 are performed by a single supervisor supporting both the 24 and 32 bit dynamic address translation hardware. The supervisory routines provide:

- . Supervision and processing of all types of interrupts.
- . Control over I/O activity.
- . Overlap of CPU operations with I/O activity.
- . Error recovery and restart.
- . Concurrent control of a variable number of tasks.
- . Time-slicing, scheduling and dispatching of tasks in a multiprogramming environment.
- . Core storage, virtual memory and auxiliary storage allocation.
- . Basic accounting facilities to accumulate task usage of CPU time. (An installation provided routine is required to access and output this data.)
- . Configuration Control

Table Driven Scheduler

The Table Driven Scheduler is a CPU scheduling system (for tasks) which is driven from a table made up of a series of entries, each containing scheduling parameters such as time slice length and maximum pages allowed in core during a time slice. The system administrators provide the table entries, and their associated scheduling parameters, as well as the assignment of users to table entries according to the priority and kind of work being done.

Error Control

A set of error-control procedures is provided in the Recovery Nucleus and SERR (System Error Record and Retry) programs for recognition, analysis, retry, and fault-location on the occurrence of error incidents resulting from "inboard" (CPU, storage element) errors. Similar procedures are provided to handle "outboard" (I/O) errors. The intent is to lessen the effect of an error incident on the system; errors are considered transient/intermittent until proven otherwise. Components exhibiting solid failures are restricted from further usage whenever possible, although certain solid and intermittent "inboard" failures will necessitate a new system startup. Individual tasks are terminated where possible, in preference to total system failure. Error data recording concerning "inboard" and "outboard" errors is provided to enhance system maintenance. This data may be requested by the Field Engineer and output time shared with the remainder of TSS/360 operations.

Configuration Control

The facilities provided by Configuration Control enable a system operator to modify the system configuration (i.e., storage elements, CPU, channel control units, channels, etc.). These facilities permit static partitioning, i.e., partitioning at system startup only. However, some components may be made inactive or activated by system operator command after system startup.

MAINTENANCE AND SUPPORT FUNCTIONS

- . Include System Generation.
- . Control Startup and Shutdown of the system.
- . Provide TSS Utilities.
- . Provide for On-line Testing of certain I/O Devices.
- . Provide a Powerful System Maintenance Facility (TSS).

System Generation

System generation macro instructions enable an installation to generate data to adapt TSS/360 to its machine configuration and processing requirements.

Partitioning

Hardware partitioning into subsystems for non-TSS/360 operations such as running of programs in emulation mode, running OS/360, or running the diagnostic monitor (maintenance subsystem) can be done between system shutdown and start-up. This also applies to the removal for maintenance of any system device as well as most other devices in the system.

Time Sharing Support System - TSSS

The Time Sharing Support System consists primarily of two parts: RSS for core, and VSS for Virtual Memory. This support system allows flexible control for diagnostic and investigative work on TSS/360. Its operation in the Virtual Memory mode is time shared. TSSS permits a system programmer to monitor the progress of a task and to debug system programs associated with his task from a terminal or from a central location.

SERVICE FUNCTIONS

- . Perform data management functions for system and user programs. Data management consists of sequential access method (SAM), virtual access method (VAM), and terminal access method (TAM). In addition, for special requirements, users may construct their own access method using the input/output request facility (IOREQ). For operation of on-line card equipment and printers, a Multiple Sequential Access Method (MSAM) is provided.
- . Provide catalog services to maintain information about and facilitate access to data sets (programs and/or data files) and control the sharing of data sets.
- . Provide dynamic loading of separate object modules into a running program at execution time.
- . Include a Command System through which each user interacts with the various portions of TSS/360.
- . Provide facilities for Task Interrupt Handling.
- . Provide device management functions.
- . Provide efficient control of Bulk I/O operations.
- . Perform 2780-1 Remote Job Entry

Data Management

Data Management routines provide efficient usage of I/O devices and allow application programs to be written independent of device and data characteristics. To attain these objectives, data management facilities provide a systematic means of classifying, identifying, cataloging, storing, and retrieving all data - including loadable program modules.

Data management facilities can be grouped into two major categories: Data Set Control and Data Access.

Data Set Control

These functions, which control and regulate the use of all data sets include provision for:

- . Data set location control, supported by catalog services, enabling programmers to retrieve data and programs by symbolic name alone, without specifying volume serial number(s).
- . Shareability of VAM data sets cataloged within the system according to user definitions.
- . A system of standard labels and label checking. Provision is made for handling unlabeled magnetic tape.
- . Successive generations of a data set.

Data Access

The programmer can select, from among the data access methods, facilities tailored to his processing requirements. Each access method supplies a comprehensive set of macro instructions that permit the programmer to specify input/output requests with a minimum of effort.

Access Methods

Access methods provide for:

- . Reading data.
- . Writing data.
- . Blocking and deblocking records.
- . Overlapping reading/writing and processing operations.
- . Reading and verifying standard volume labels; reading, verifying and writing standard data set labels.
- . Detecting error conditions, and optionally correcting them when possible.
- . Providing exits (except VAM) to user written error and label routines.

ASCII Capability

Support in Access Methods for the American National Standard Code for Information Interchange, X3.4-1968, referred to by the acronym ASCII, provides the TSS/360 customer with the capability to interchange data between systems regardless of manufacturer or operating system, provided the data contains only ASCII characters and is recorded in conformance with American National Standard Recorded Magnetic Tape for Information Interchange, 9-track, 800 CPI NRZ1, X3.22-1967.

Sequential Access Method

Data is sequentially organized; physical blocks of data are stored or retrieved. BSAM macro-instructions are provided to synchronize I/O with the problem program. QSAM macro-instructions allow the storage and retrieval of records of a physical sequential data set without requiring the user to supply blocking, deblocking, or buffering routines. This support is provided for magnetic tapes, as well as

sequentially organized data on direct access devices. (See section on Compatibility with OS/360.)

Automatic translation between EBCDIC and ASCII codes is provided in conjunction with support for American National Standard Recorded Magnetic Tapes, Labels and record formats.

Virtual Access Method - VAM

VAM is specially designed for TSS/360 and uses the paging facilities of the supervisor. Three data set organizations are available under VAM: sequential, index sequential, and partitioned. VAM data sets are limited to direct access devices. Records are packed into and across pages as required. Although physical blocks are in units of pages, the logical record length can be as long as one million bytes in sequential. Maximum logical record size supported is 4,000 bytes in index sequential. Partitioned data sets may contain both sequential and index sequential members.

VAM II

VAM II is an improved virtual access method which includes VAM volume format changes and allows the creation of duplicate data sets as well as recovery and validity check options. The VAM volume format changes improve performance through reduced disk activity in OPEN, CLOSE and extending VAM data sets. It will be necessary to translate and convert existing VAM data sets. Conversion routines to accomplish this will also be included.

Terminal Access Method - TAM

TAM is only for System Programs, and is not directly available to user programs.

TAM provides necessary communication to be established between TSS/360 and a terminal. TAM has the complete error detection/correction pertinent to the access method. This consists of the normal read/write checking, error detections and I/O retry.

User programs may access a terminal via Command System facilities. System Programmers may, of course, write special programs which use TAM.

Input/Output Request Facility - IOREQ

IOREQ allows the user to control I/O devices directly without employing the access methods. Facilities for scheduling input/output requests, data protection, interrupt procedures, and error recognition are available. IOREQ may be used only for private devices or volumes and its use requires a detailed knowledge of device control and system functions. It may be used to access data on otherwise unsupported devices.

Multiple Sequential Access Method - MSAM

MSAM is used by System Programs only and is not directly available to user programs. MSAM provides operation of on-line card readers and punches and high-speed printers in a TSS/360 environment. It provides automatic buffering to minimize system overhead.

Dynamic Loader

The Dynamic Loader allocates virtual storage for object modules and links external symbols among these various separately assembled or compiled modules on a dynamic basis. The Dynamic Loader is available for use by other system routines and by the user, in either conversational or non-conversational mode. Normally, with these facilities of the Dynamic Loader the user need not use the Linkage Editor unless it was desired that separate modules be combined into a single program module.

Command System

The Command System provides the interface between the user and the operating system. Commands are provided which permit the user to construct and execute programs, atalog and modify data sets, and control input/output on card, tape, or printer.

Commands control the execution of jobs in both conversational and non-conversational modes.

The Command System provides the user with the ability to define his own commands, call his programs by direct command, and to use a general text editing capability. It provides a regular command syntax and default and profile facilities.

Program Control System - PCS

Included as part of the Command System is a subset called the Program Control System which provides the user with object time symbolic debugging aids. While operating in a conversational mode, it enables a programmer to monitor the progress and control the execution of a program, make modifications to data and attempt to localize areas of difficulty. In non-conversational mode these commands allow debugging information to be produced automatically during execution.

Task Interrupt Handling

Normal task interrupts, including Terminal Attentions, are handled by TSS/360 facilities. In addition the user may write his own programs to handle on or more types of interrupts through use of the Task Monitor Facilities.

Bulk I/O

A single Bulk I/O program, utilizing MSAM, controls all TSS/360 Bulk I/O operations.

2780-1 Remote Job Entry - RJE

The 2780-1 RJE facility for TSS/360 extends the central Bulk I/O capabilities to remote work stations. The remote user can enter batch jobs in the same form as at the central reader and receive printed output at a 2780-1 remote work station.

USER FUNCTIONS

- Language Processors -- FORTRAN IV, PL/I, and Assembler with macro facilities.
- A Linkage Editor allowing users to combine, rename and delete program modules. (The Linkage Editor does not handle PL/I object modules.)

Language Processors

Language Processors are designed to interact dynamically with a conversational user, or operate in a batch mode for a non-conversational user. The conversational user may correct errors as they are discovered by the processors. All processors except PL/I are shared problem programs within the Time Sharing environment.

Assembler

The Assembler and the Assembler Language combine the convenience of the mnemonic assembly language with the flexibility of a macro-definition capability. Assembly is performed conversationally with the user or in a batch mode of operation. The Assembler provides a macro generator facility that allows the user to define his own macro-instructions that can be included in a macro library to simplify and standardize problem definition at his installation. In addition, IBM provides a number of macros. These may differ from OS/360 macros having the same name. (See section on Compatibility with OS/360.)

FORTRAN IV

The FORTRAN compiler provides the user access to FORTRAN IV, a widely used symbolic programming language. The language parallels the symbolism and format of mathematical notation, thereby providing the flexibility for expressing the method of solution of a mathematical problem as a meaningful FORTRAN program. The compiler produces reentrant code designed to be executed efficiently in both conversational and batch modes of operation in the Time Sharing environment. In conversational mode, syntax analysis is performed as the source lines are entered. (See section on Compatibility with OS/360.)

PL/I F Compiler

Compiling or executing PL/I code is restricted to tasks operating in 24 bit addressing mode. The compiler will process source statements from prestored data sets. When errors are detected, diagnostics can be returned to the user's terminal. The user may terminate the compilations, correct the errors and recompile. The compiler is not reentrant and does not provide a line by line syntax analysis. The use of PCS (Program Control System) for debugging is limited to using external definitions. No ISDs (Internal Symbol Dictionaries) will be generated. The TSS/360 compiler does not support multitasking, SORT/MERGE, checkpoint and regional I/O and QTAM of the I/O environment options. If these statements are used, they will be compiled properly. The user will be informed that the feature is not available at execution time. (See TSS/360 Supported Hardware and Features for I/O devices supported.) PL/I object modules which are to be executed as one program must be prepared for the Dynamic Loader by converting the output of the PL/I compiler to executable code. This may be done by option at compile time or at any time before passing them to the Loader.

Linkage Editor

The Linkage Editor, which operates in conversational or batch mode, may be used to combine and edit separate (non-PL/I) object modules to produce a single object module. The Linkage Editor operates as an independent processing program, rather than as part of the dynamic loader. (The Dynamic Loader allows dynamic linking of separate object modules into a running program at execution time without requiring use of the Linkage Editor.)

COMPATIBILITY WITH OS/360

Assembler Language -- The language used to describe instructions is syntactically similar to that of the OS/360 Assembler except for those extensions and restrictions required by unique Model 67 features, TSS/360 Program Services and the TSS/360 operating environment. Programs written in either Assembler language will require reprogramming to run on the other system. Object code produced by the TSS/360 Assembler is not compatible with OS/360 produced code.

FORTRAN IV -- Provides source level compatibility with OS/360 for those portions of the language implemented in both systems, with minor exceptions caused by differences in the compiler implementations. Object code produced by TSS/360 FORTRAN IV is not compatible with OS/360 produced code.

PL/I -- OS and TSS/360 PL/I F source programs will be compatible for those portions of the language implemented in both systems. However the data files they generate may not be compatible. Data compatibility is provided under the Sequential Access Method (SAM).

Data Sets -- The Sequential Access Method of TSS/360 provides data compatibility between OS/360 and TSS/360 sequential data sets, except for minor differences caused by access method implementations and by the different operating environments of the two systems.

TSS/360 SUPPORTED HARDWARE AND FEATURES

(Only units and features listed below are supported.)

Duplex configuration and Extended Dynamic Address Translation.

Note: Isolation features must be specified, as required, for the processing units, channels and control units supported by TSS.

For duplex systems two channel switches are recommended on all I/O control units where available.

See applicable machine pages for availability of 2 channel switch feature with 360/67 and TSS/360 programming pages for 2 channel switches supported by TSS/360.

2067 Processing Unit (Minimum - One 2067 mdl 1 (Simplex System) or one 2067 mdl 2 (Half-duplex System); Maximum - Two 2067 mdl 2s (Duplex System)).

Features and Specifications:

Partitioning Sensing (#5495). Required on each 2067 mdl 2 of a multiple processor system.

Extended Direct Control (#5494). Required on each 2067 mdl 2 of a multiple processor system.

Floating Storage Addressing (#4434). Optional feature used only on 2067 mdl 1.

1052 Adapter (#7920). May substitute 2150 Console with 1052 mdl 7 attached, one per processor unit. A 1052 mdl 7 is required for each processing unit.

Additional 2846 Attachment (#1102). Required to attach second 2846 Channel Controller. If the feature is on one processor, it must be on all processors in the Time Sharing System.

Extended Dynamic Address Translation (#3862). If the feature is on one processor, it must be on all processors in the Time Sharing System.

2nd Wall Section Attachment (#6310). Required on each 2067 mdl 2 in a configuration with two wall sections.

2365 Processor Storage, Models 2, 12

The 360/67 simplex or half-duplex system requires a minimum of two 2365s or 512K bytes of memory.

For the 360/67 multiprocessor system a minimum of three 2365s or 768K bytes of memory is recommended.

2365 mdl 2	Two to four with 2067 mdl 1
2365 mdl 12	Two to four with 2067 mdl 2 (Single processor systems)
2365 mdl 12	Two to eight with 2067 mdl 2 (multiprocessor systems)

(Storage must all be the same model.)

Features and Specifications:

Seven Bit Storage Protect (#7123). One required per 2365 mdl 2 Processor Storage Unit. Standard on 2365 mdl 12.

2067 Attachment (#8035). One required per 2365 mdl 2 Processor Storage Unit. Standard on 2365 mdl 12.

2067 Switching Feature (#8036). Feature #8036 is required for an additional 2067 on 2365 mdl 12 only.

2846 Switching Feature (#8088, #8091). Provides for attachment of a 2846. One #8088 is required for the first, one #8091 for the second. Maximum of one each per 2365 mdl 12.

Expansion Feature (#3846).

Power Sequencing (#5518). 2365 mdl 12 only.

2167 Configuration Unit, Models 1, 2, 3, 4

One configuration unit of appropriate model is required on each 2067 mdl 2 half-duplex or duplex system.

2846 Channel Controller

One or two channel controllers may be attached to a 2067 mdl 2 system. A maximum of two 2846s are supported in a duplex system. Only one channel with 2820s can be attached to a 2846. Maximum one operating 2820/2301 per 2846.

Features and Specifications:

Additional Addressing I (#1086). Required if the 2846 is to address five or six 2365 model 12s. If the feature is on one 2846, it is required on every 2846 in the system.

Additional Addressing II (#1087). Required if the 2846 is to address seven or eight 2365 model 12s. Prerequisite is additional addressing (#1086).

2860 Selector Channel, Models 1, 2, 3

Simplex System (single 2067 mdl 1) - System minimum is two Selector Channels (two 2860 mdl 1s or one 2860 mdl 2).

Half-duplex System (single 2067 mdl 2) - System minimum is two Selector Channels (two 2860 mdl 1s or one 2860 mdl 2) attached to one or two 2846 Channel Controllers.

Duplex System (two 2067 mdl 2s) - System minimum is two Selector Channels (two 2860 mdl 1s or one 2860 mdl 2) attached to one or two 2846 Channel Controllers.

Features and Specifications:

High Speed Direct Access Storage Priority (#4597). Required on 2860(s) attaching 2820/2301(s) through 2846 Channel Controllers. (Attaches to first channel - highest priority channel only.)

Address Prefixing (#1095). Required on each channel, in systems having more than one 2067 Processing Unit.

2870 Multiplexer Channel (System minimum is one 2870 Multiplexer Channel; system maximum is one 2870 per 2846.)

Features and Specifications:

First Selector Sub-Channel (#6990).*

Second Selector Sub-Channel (#6991).*

Third Selector Sub-Channel (#6992).*

Fourth Selector Sub-Channel (#6993).*

Address Prefixing (#1095). Required on each channel in systems having more than one 2067 Processing Unit.

* The only supported devices on 2870 Selector Sub-Channel are magnetic tape (up to 800 bpi) and 1052 mdl 7. Only one control unit is permitted on each selector sub-channel of the 2870.

2821 Control Unit, Models 1, 2, 3, 5 (Minimum - One Control Unit)

Features and Specifications:

1403 Model 2 Attachment (#9241, #9242, #9243). A feature #9241, #9242, or #9243 is required as appropriate with the printer or control unit model selected.

1403 Model 3, N1 (1100 LPM) Attachment (#3615). A feature #9262, #9263, #9264 is required as appropriate with the printer control and control unit model selected.

Universal Character Jet Adapter (#8637, #8638, #8639).

Third Printer Control (#7945).

Two Channel Switch, with partitioning (#8100).

Remote Switch Attachment (#6148).

2150 Console Model 1

Features and Specifications:

Operator Control Panel, First (#5475, #5485).

Operator Control Panel, Second (#5476, #5486).

2702 Transmission Control, Model 1 (Minimum of one 2702 or 2703 required)

Features and Specifications:

IBM Terminal Control - Type I (#4615) with Selective Speed (#9684). Required on 2702.

2741 Break (#8055). Required on 2702.

31 Line Expansion (#7955).

Two Processor Switch, with partitioning (#8110). [1]

Remote Switch Attachment (#6148).

Terminal Control Expansion (#7935).

Expansion Base (#3853).

Telegraph Terminal Control - Type II (#7912)

Break Communication IBM TC-1

Data Set Line Adapter (#3233).

IBM Line Adapter - 4 wire (#4635).

2712 Line Adapter (#8040).

2712 Model 1 Adapter (#8045, #8046).

[1] Manual operation only.

2703 Transmission Control, Model 1 (Minimum of one 2702 or 2703 required)

Features and Specifications:

Start - Stop Base Type I (#7505) -- Required.

IBM Terminal Control Base (#4619) -- Required for 1050 or 2741 terminals.

IBM Terminal Control Type I (#4696) -- Required for 1050 or 2741 terminals.

2741 Break (#8055) -- Required for 2741 terminals.
Break Transmission Required for 1050 or 2741 terminals.
Telegraph Terminal Control Base (#7905) -- Required for TWX or similar terminals.
Telegraph Terminal Control Type II (#7912) -- Required for TWX or similar terminals.
Data Line Set (#3205).
Data Line Set Expander (#3206).
Speed Options (#4877, #4878).
Two Processor Switch (#8110). [1]
Remote Switch Attachment

[1] Manual Operation Only

2803 Tape Control, Model 1

System requires a minimum of one tape control and two tape drives (9-track). May be attached to either a 2860 Selector Channel or a 2870 Selector Sub-Channel.

Features and Specifications:

Data Conversion (#3228).
Seven-Track Compatibility (#7125).
Sixteen Drive Addressing (#7185).
Two Channel Switch, with partitioning (#8100).
Remote Switch Attachment (#6148).

2816 Switching Unit, Model 1

Features and Specifications:

Additional Drives (#1050).
Third Control (#1051).
Fourth Control (#1052).
Additional Drive Adapter (#1055).
Control for Base Drive Third (#2285).
Control for Base Drive Fourth (#2286).
Fourth Control Attachment (#4455).
Second 2816 Attachment
First Control (#6392).
Second Control (#6393).

2820 Storage Control, Model 1 (Minimum - One Storage Control)

System minimum is one 2820 Storage Control for all systems. One additional 2820 Storage Control is recommended for multiprocessor systems. No additional devices may be attached to the same channel as the 2820 other than another 2820. However, only one 2820 per Channel (2860) or Channel Controller may be active at any one time.

Features and Specifications:

Two Channel Switch, with partitioning (#8170).
Storage Priority (#7516). Requires High-Speed Direct Access Storage Priority #4597 on the 2860 Selector Channel to which the 2820/2301 is attached.
Remote Switch Attachment (#6148).

2314 DASF. (System minimum is five 2314 modules)

Features and Specifications:

Two Channel Switch, with partitioning (#8170).
Remote Switch Attachment (#6148).
2844 Attachment (#7949) [Model 1 or A1 only.]

2841 Storage Control, Model 1

Features and Specifications:

Additional 2311 Attachment (#9706) required.
Record Overflow (#6118). One required for each 2841 specified.
Two Channel Switch, with partitioning (#8100).
Remote Switch Attachment (#6148).

2844 Auxiliary Storage Control [with 2314 Model 1 or A1 only].

Features and Specifications:

Remote Switch Attachment (#6150).
Two Channel Switch (#8171).

1051 Printer-Keyboard Control Unit, Models 1, 2

Features and Specifications:

IBM Line Adapter (#4691, #4692, #4693, #4694).
Data Set Attachment (#9114).
Data Set Attachment (#9115).
IBM Line Adapter (#4647).
Receive Interrupt Control *
Automatic EOB After CR * Not Feature (#1313)
Text Time-out Suppression (#9698).*
First Reader Attachment (#4411). For 1056 Model 1.
Transmit Interrupt Control *
First Printer Attachment (#4408).*
Auto Ribbon Shift and Line Feed Select (#1295).
Group and Broadcast Application (#9190).*

* Required.

2780-1 Data Transmission Terminal

Features and Specifications:

Transmission Code: Form EBCDIC (#9762) required.
Terminal Use: (#9710) required.
Data Set Attachment: (#9110)
(2000 bps) or (#9111)
(2400 bps).
Leased Line Termination: (#9402 or #9404).
Extended Retry Transmission: (#9150) required.
Print Line: (#5821) prerequisite (#5820) required.
Selective Character Set: (#6400) required.
Type Bar: 63 character set required.
EBCDIC TRANSPARENCY (#8030) required.

2701 Data Adapter Unit

Features and Specifications:

Synchronous Data Adapter Type II: (#7698 or #7699) required must specify #9060 for EBCDIC for each adapter.
Transparency (#8029) specify (#9700) required.
Expanded Capability (#3815) and Expansion Feature (#3885) for additional (#7698 or #7699).

I/O Units

2301 Drum Storage Model 1 (Minimum 1)

2301 only for system use; minimum of one 2301 in every system. An additional 2301 attached to a separate 2820 Control Unit is recommended for duplex systems.

2311 Disk Storage Drive, Model 1

The system alone requires an absolute minimum of five 2314 modules for system use (see note below). In addition, a number of 2311s or 2314 modules will be needed to support an installation's use of TSS/360. This additional requirement will vary as a function of planned number of users of the installation.

2314 Direct Access Storage Facility

The system alone requires an absolute minimum of five 2314 modules for system use (see note below). In addition, a number of 2311s or 2314 modules will be needed to support an installation's use of TSS/360. This additional requirement will vary as a function of planned number of users of the installation. All system required 2314 modules must be on the same control unit (address 0-7).

2401 and 2402 Magnetic Tape Unit Models, 1, 2, 3, 8

System requires a minimum of one tape control and two tape drives (9-track).

2403 Magnetic Tape Unit & Control, Models 1, 2, 3

System requires a minimum of one tape control and two tape drives (9-track). May be attached to either a 2860 Selector Channel or a 2870 Selector Sub-Channel.

Features and Specifications:

Data Conversion (#3228).
Seven-track Compatibility (#7125).
Sixteen Drive Addressing (#7185).
Remote Switch Attachment (#6148).
Two Channel Switch, with partitioning (#8100).

System requires a 1052 mdl 7 for each processing unit. PTTC/EBCD (#9572) only.

1403 Printer Model 2, 3, N1 (Minimum 1)

Either 1403 model may be selected.

2540 Card Read Punch Model 1 (Minimum 1)

2741 Communications Terminal

System requires a minimum of one 2741 Communications Terminal or one 1052 mdl 1 or 2 Printer-Keyboard. The main operator console must be a 1052 mdl 7.

Features and Specifications:

Data Set Attachment (#9114).
Data Set Attachment (#9115).
IBM Line Adapter (#4635).
Dial-up (#3255).
Interrupt (#4708) required.
Transmit Interrupt required.
PTTC/EBCD Code (#9571) required.

1316 and 2316 Disk Pack (Minimum 5)

System requires a minimum of five 2314 modules for system use and, therefore, five 2316 Disk Packs. For user facility and backup, additional disk packs are recommended.

System Support Programs for OS (360H-TX-035): Consist of the Network Control Program (NCP) Generation Procedure, the Emulation Program (EP) Generation Procedure, the Load Program, the Dump Program, and the Assembler.

NCP (Network Control Program) Generation Procedure

The 3704/3705 NCP Generation Procedure is a two-stage process using the 3704/3705 Assembler and the OS Linkage Editor to generate a 3704/3705 NCP (Network Control Program).

Stage I is an assembly of System Generation macros. The output from Stage I is a job stream containing the JCL and control information necessary to generate and link edit a Network Control Program. Stage II is the execution of the job stream.

System Generation Macros are divided into three groups:

- 1) System macros
- 2) Configuration definition macros
- 3) Block handling macros

The system macros provide information pertaining to the entire Communications Controller. The macros specify facilities such as:

- Memory Size
- Channel type
- Buffer size and number
- Recommended Serviceability Aids
- On-Line Terminal Test
- Address Interrupt Trace
- Dynamic network alteration and interrogation facilities.

The configuration definition macros describe the characteristics of:

- Line Group
- Terminals
- Terminal Components
- Service Order Tables for Switched and non-switched lines
- Terminal ID sequences for BSC devices.

Block Handling macros define processing to be done on data blocks and when the processing is to be performed. Processing functions include:

- Editing out backspaced text
- Date/Time Stamping

Processing may be performed:

- After receipt from a terminal,
- After receipt from CPU, but before the line is available,
- After receipt from CPU, but after the line is available.

EP (Emulation Program) Generation Procedure

The EP Generation Procedure is a two stage process which uses the 3704/3705 Assembler and the OS Linkage Editor to generate a 3704/3705 EP (Emulation Program).

Stage I is an assembly of the System Generation macros. The output of Stage I is a job stream containing the JCL and control information necessary to generate and link edit an Emulation Program. Stage II is the execution of the job stream.

Load Program

The 3705 Load Program retrieves a specified load module from direct access on the host system. This load module is then transferred across the channel to the Communications Controller. Upon successful completion of this transfer, control is passed to the program just loaded. The utility in the host system, having completed, exits to OS.

Dump Program

The Dump Program dumps the storage and register contents of the Communications Controller to a host system data set and provides for the printing of the contents. Formatting of critical control blocks of the NCP is provided as an option. The dump may be a full or partial dump.

3705 Assembler

The 3705 Assembler assembles programs written in 3704/3705 Assembler language. The instructions are similar to those processed by the OS assemblers. The assembler operates on three kinds of instructions:

- 1) 3705 machine instructions (written in 3704/3705 Assembler language notation)
- 2) Macro instructions
- 3) Assembler instructions

The machine instructions are represented to the 3704/3705 Assembler by mnemonic operation codes, usually followed by one or more operands.

The macro language provides a convenient method of generating a desired sequence of assembler language statements many times in one or more programs. Macro definitions can be coded in-line in assembler language programs or stored in a host library and called in when needed by means of a macro instruction coded in the program.

The assembler instructions direct the assembler to perform certain operations during the assembly process, but are not converted into executable code.

System Requirements: The NCP Generation Procedure, EP Generation Procedure, and the 3704/3705 Assembler require 48K bytes for MFT, and 50K bytes for MVT. The Load and Dump Programs require 48K bytes for MFT, 50K bytes for MVT.

System Requirements for OLTs: OLTs to service the 3704/3705 require 8K bytes. OLT for problem determination with the EP program requires 7K bytes. Terminal OLTs for use with EP programs are a minimum of 4K bytes. On-line terminal tests, OLTs for use with NCP or EP programs require a minimum of 8K bytes. The above does not include the diagnostic executive requirements. Diagnostic executives to be used are OLTSEP, OS/OLTEP, DOS/OLTEP, and at release of NCP TCAM/TOTE.

Programming service classification is A.

Basic Program Material (360H-TX-035):

Documentation: A Program Directory.

Machine Readable Material: DTR containing the macros and modules of the IBM 3704/3705 OS/SSP.

Optional Program Material: None.

Ordering Information: Program Number 360HTX035

Program Number Extension	Distribution Type	Medium Code	User Volume Requirement
Basic None	9/800	28	None
	9/1600	29	None
Optional None	None		None

System Support Programs for DOS (360H-TX-036):

Consist of the Emulation Program (EP) Generation Procedure, the Load Program,

the Dump Program and the 3704/3705 Assembler.

EP (Emulation Program) Generation Procedure

The EP Generation Procedure is a two stage process, which uses the 3705 Assembler and the DOS Linkage Editor to generate an EP (Emulation Program).

Stage I is an assembly of the System Generation macros. The output of stage I is a job stream containing the JCL and control information necessary to generate and link edit an Emulation Program. Stage II is the execution of the job stream.

Load Program

The Load Program retrieves a specified load module from direct access on the host system and transfers it across the channel to the Communications Controller. Upon successful completion of this transfer, control is passed to the program just loaded. The Utility in the host system, having completed, exits to DOS.

Dump Program

The Dump Program dumps the storage and register contents of the Communications Controller to a host system data set and provides for the printing of the contents. This dump may be a full or partial dump.

Assembler

The 3704/3705 Assembler is available for assembly of Emulation Programs written in 3704/3705 Assembler language. The instructions are similar to those processed by the DOS Assembler. The 3704/3705 Assembler operates on three kinds of instructions:

- 1) 3705 machine instructions (written in 3704/3705 Assembler language notation)
- 2) Macro instructions
- 3) Assembler instructions.

The 3705 machine instructions are represented to the 3704/3705 assembler by mnemonic operation codes, usually followed by one or more operands.

The macro instructions provide a convenient method of generating a desired sequence of assembler language statements many times in one or more programs. Macro definitions can be coded in-line in assembler language programs or stored in a host library and called in when needed by means of a macro instruction coded in the program.

The 3704/3705 Assembler instructions direct the assembler to perform certain operations during the assembly process, but are not converted into executable code.

System Requirements: The DOS EP Generation Procedure, Load Program, Dump Program and 3704/3705 Assembler require a minimum partition of 18K bytes when used with DOS.

System Requirements for OLT's: OLT's to service the 3704/3705 require 8K bytes. OLT for problem determination with the EP program requires 8K bytes. Terminal OLT's for use with EP programs are a minimum of 4K bytes. On-line terminal tests, OLT's for use with NCP or EP programs require a minimum of 8K bytes. The above does not include the diagnostic executive requirements. Diagnostic executives to be used are OLTSEP, OS/OLTEP, DOS/OLTEP, and at release of NCP TCAM/TOTE.

Programming service classification is A.

Basic Program Material (360H-TX-036):

Documentation: A Program Directory.

Machine Readable Material: DTR containing the macros and modules of the IBM 3705 DOS/SSP.

Optional Program Material: None.

Ordering Information: Program Number 360HTX036

Program Number Extension	Distribution Type	Medium Code	User Volume Requirement
Basic None	9/800	28	None
	9/1600	29	None
Optional None	None		None

Network Control Program Support (360H-TX-034): A set of program modules provided to the customer to generate (by use of the 3704/3705 NCP Generation Procedure) his customized Network Control Program (NCP). The NCP, when generated and loaded, executes in the 3704/3705 and is supported by OS/TCAM operating in conjunction with a System/370 CPU only.

The NCP performs the traditional transmission control unit functions such as line control character recognition, line timeout, character assembly/disassembly and checking. In addition, some functions typically performed by a TP access method are provided by the NCP. Polling, addressing, code translation, data link control and first level error recovery procedures are performed by the NCP.

The basic element of communication between the host access method and the 3704/3705 is the block. A transfer between the CPU and 3704/3705 may consist of one or more blocks. A block consists of control information and any text which may accompany it. The text is generally a transmission block destined to or received from a terminal.

A block is sent by the host to the Communications Controller to request that an operation be performed. When the operation is complete, the 3704/3705 Network Control Program may send a block to the host indicating the results of the requested operation. The NCP will also send unsolicited blocks to the host to provide it with such information as error statistics.

Within the Controller, the installation can optionally select functions to make certain changes in transmission block data. These functions are essentially data editing functions which can be performed on a transmission block before transmission to a terminal on output or before transmission to the CPU on input.

At any time, the NCP may have several transactions in process at various points in the subsystem. The supervisory functions provide the capability for scheduling the NCP activity optimally by resolving contention for processing time within the NCP.

In addition, there are functions in the NCP to accomplish the logical and physical elements of input/output on the communications lines and the channel to the host CPU. These functions are dependent upon the network configuration specifically line and terminal types.

Problem determination aids such as machine and program check recording, permanent line error recording, 3705 panel display, on-line terminal test,abend condition check and debugging aids are provided by the Network Control Program.

Remote attachment via the NCP is shown in the following chart:

Terminals Operating With a 3705/NCP	Type Comm	BCD	EBCD	Corresponden	Other	EBCDIC		US ASCII	PTP Sw	CommNetwk	
						Norm	Trans			non Sw	non Sw
1050	SS	X	X						X	X	X
2740 Mdl 1	SS	X	X	X					X	X	X
2740 Mdl 2	SS	X	X	X					X	X	X
2741	SS	X	X	X					X	X	X
S/360 and S/370	BSC					X	X	X	X	X	X
Mdl 20	BSC					X	X	X	X	X	X
1130	BSC					X	X	X	X	X	X
1800	BSC					X	X	X	X	X	X
S/3	BSC					X	X	X	X	X	X
2780	BSC					X	X	X	X	X	X
2770	BSC					X	X	X	X	X	X
2715-2	BSC					X	X	X	X	X	X
2872-8, -11	BSC					X	X	X	X	X	X
3735	BSC					X	X	X	X	X	X
3271/3275	BSC					X	X	X	X	X	X
S/7*	SS		X						X	X	X
3650	SDLC						X		X	X	X
3680	SDLC						X		X	X	X
3741 Mdl 2, 4	BSC					X	X		X	X	X
3747	BSC					X	X		X	X	X
3780	BSC					X	X	X	X	X	X
5275**	BSC					X	X		X	X	X

* System/7 is supported as a 2740 Model 1.

** 5275 is supported and specified as 3275 with EBCDIC Code (9761) and EBCDIC Character Set (9088).

Q Leased line support must be used on switched line using a manual dial/auto answer procedure.

The NCP also supports communications with terminals employing the following Line Control disciplines:

AT&T 83B3 or WU 115A, start/stop multi-point leased telegraph lines - CPT-TWX (Model 33/35) start/stop over switched TWX network. Attachment of non-IBM terminals is, of course, under the provisions of the IBM Multiple Supplier System Policy.

Minimum Machine Configuration: For program execution -- a 3705 Model A2 with Channel Adapter Type I or Type II, Communications Scanner Type I or Type II, and appropriate line attachment features. A 3704 Model A3 with Channel Adapter Type I, Communications Scanner Type I or Type II, and appropriate line attachment features.

Programming service classification is A.

Emulation Program Support (360H-TX-033): A set of program modules provided to the customer to generate (by use of the Emulation Program Generation Procedure) his customized 3704/3705 Emulation Program. The EP, when generated and loaded, executes in the 3704/3705 and provides the functional capabilities of the 2701 Data Adapter Unit and/or 2702/2703 Transmission Control Units through the physical medium of the 3704/3705.

Programs which operate with an IBM 2701, 2702 or 2703 will operate with a 3704/3705 in emulation mode, provided the programs:

- use only the 2701, 2702 or 2703 features supported by the emulator.
- use only terminals and CPU attachments supported by the emulator.
- require only RPQs supported by the emulator.
- are not time dependent.

A list of 270X features not supported, and terminals, CPU attachments and RPQs supported by the emulator follows:

2701, 2702 and 2703 features not supported by the Emulator are:

- Synchronous Data Adapter Type I
- Parallel Data Adapter
- Programmable Two-Processor Switch
- 6-Bit Transcode
- ASCII Transparency
- Attachment to other than a byte multiplexer channel
- 230, 400 bps Synchronous Speed
- 1032 Digital Time Unit Attachment
- Second Channel Interface

Intermixing of 2701, 2702 and 2703 line and function is permitted, however, sub-channel address assignment must be contiguous. Replacement of multiple 2701, 2702 or 2703s with a 3704/3705 may require device address reassignment.

The following RPQs for 2701, 2702 and 2703 will be provided as standard features in the Emulator:

2701	
E56160	Dataphone 50
M44307	Attach 2711
F26072	Autopoll IBM III
M53193	Break Command IBM I
858492	Break Command IBM I
E60987	IBM Type III at 4800 bps
2702	
F13308	50 bps Speed
E46765	Break Command IBM I
E54838	Immediate End
E62920	Carriage Return on TTY
EA3120	TTY X Off

(cont'd)

2703

E53715	Break Command - IBM I
F17897	50 bps Speed
Z71949	1200 bps Speed
Z16087	Immediate End
E49633	28 Second Timeout - No data
E62376	TTY II Character Recognition
858126	Timeout Change
E61947	TTY II with Telegraph Line Set'
W21061	Timeout Change
W23396	IBM I - No LRC
Y24344	EOT or EOR 4 Character Sequence

Although operation of the 3704/3705 EP is mutually exclusive with operation of the 3704/3705 NCP, EP and NCP modes of operation may be alternated provided the customer has sufficient core to support NCP mode operation. This procedure will necessitate a re-IPL of the 3704/3705.

Thruput rates of the 3704/3705 with the Emulator will be, in most cases, comparable to those attained with a similarly configured 2701, 2702 or 2703.

The following terminals and CPU remote attachments will be supported by the EP:

1030	2703 (BSC)	AT&T 83B2/B3 Line Control Type
1050	2715-II	S/370 Mod 125 with ICA (BSC)
1060	3735	S/370 Model 135 with ICA (BSC)
2740-I (2760)	2845/2265	System/3 (BSC)
2740-II	2848/2260	S/360, S/370 via Local 3705 (BSC)
2741	3650 (as a S/3)	2780
2770/2772	3670	WU 115A Line Control Type
3270	3780	CPT - TWX (33/35) Line Control Type
2972-8, 11	3741-2,4	System/7 (as a 2740-I)
2701 (BSC)	3747	

360/20 equipped with the Binary Synchronous Communications Adapter feature
 360/25 equipped with the Integrated Communications Attachment and Synchronous Data Adapter features
 1130 equipped with the Synchronous Communications Adapter feature (BSC only)
 1800 equipped with the Communications Adapter feature.

Machine Requirements: The minimum 3704/3705 configuration for program execution is a Model A1 with Channel Adapter Type I, Communication Scanner Type I or Type II, and appropriate line attachment features.

Programming service classification is A.

Basic Program Material (360H-TX-033):

Documentation: A program Directory ... IBM 3704/3705 EP Generation and Utilities SRL (GC30-3002) ... IBM 3704/3705 Operators Guide (GA27-3055).

Machine Readable Material: DTR containing the macros and modules of the Emulator Program 360H-TX-033.

Optional Program Material: None.

Ordering Information: Program Number 360HTX033

Program Number	Distribution Medium	User Volume
Extension	Type Code	Requirement
Basic None	DTR 9/800 28	None
	DTR 9/1600 29	None
Optional None	None	None

Note that in order to create an operational Emulator Program, you must have, in addition to this transmittal, either the OS System Support Programs (360H-TX-035) or the DOS System Support Programs (360H-TX-036). The appropriate System Support Program is available from Program Information Department (PID).

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TOS/360 is a Tape Resident System designed to provide operating system capabilities for 16K and larger tape oriented System/360 configurations.

Minimum system requirements: 16,384 bytes of main storage* ... Standard Instruction Set** ... one I/O channel (either multiplexer or selector) ... one card reader*** ... one card punch*** ... one printer*** ... one 1052 Printer-Keyboard ... one 2400/3400 series Magnetic Tape Drive for system residence and three 2400/3400 series Magnetic Tape Drives for language translator functions. An additional tape drive is required for compile-and-execute options. 7-track tape units can be used, but the Data Conversion feature #3228 or #3236 is required. The 9-track residence is recommended because of the significant performance advantage it provides to the program fetch function.

*A 32K minimum system is recommended for COBOL object program execution, and required for multiprogramming.

**Expanded instruction sets may be required depending upon the specific requirement of the language translators utilized. (See Expanded Instruction Set paragraph under TOS/360 Language Function Description.)

***See control program input/output chart for acceptable units. Note that one 2400/3400 series Magnetic Tape Drive may be substituted for those units. For 2400 series tape, if 7-track drives are used, the Data Conversion feature #3228 or #3236 is required, except when a tape is substituted for a printer.

Engineering Changes: The following engineering changes are prerequisite for proper functioning of TOS/360 -2030 hardware - EC 126737 ... 2030 micro - EC 128053 ... 1445 - EC 305247, EC 305252 ... 2040 hardware - EC 255262 ... 2040 micro - EC 255261 ... 2050 - EC 255458 ... 2821 - EC 125598 ... 1443 - EC 305560, EC 305564 ... 2540 - EC 124270.

Note 1: If the multiprogramming support facilities of TOS/360 are used, the 2030 hardware EC 126751 and 2030 micro EC 128058 must be installed.

Note 2: In a storage protected batch job environment, the 2030 micro EC is 128058.

Note 3: The following engineering changes are not required; however, in order to achieve the best performance, they are recommended -- 2401 - EC 254969 ... 2402 - EC 254969 ... 2403 - EC 254969, EC 255981 ... 2404 - EC 254969, EC 255982.

TOS/360 was tested on devices with the following engineering changes: 1051 - EC 125519 ... 1052 - EC 122384 ... 1403 - EC 125730 ... 1442 - EC 807697 ... 1443 - EC 305511 ... 2401 - EC 255010 ... 2402 - EC 730172 ... 2403 - EC 730172, EC 255981 ... 2404 - EC 730145, EC 255982 ... 2415 - EC 255824 ... 2501 - EC 811803 ... 2520 - EC 810943C ... 25440 - EC 812588 ... 2671 - EC 351485 ... 2803 - EC 730909 ... 2821 - EC 125601.

TOS/360 is composed of two types of programs: Control Programs and Processing Programs.

Control Programs

System Control, 360M-CL-405 -- A prerequisite to any Component in TOS/360. This program forms the nucleus of the system and provides for functions of system control, generation, and editing.

Control program input/output functions are: System Residence - system residence unit ... System Reader - unit used for job control cards ... System Input - main system input unit for control programs ... System List - system printer unit for control programs ... System Punch - main system output unit for control programs ... System Log - medium used for operator communication.

Control Functions:

Initial Program Load - to initialize operation of the system.

Job Control - brought into main storage by the supervisor to provide -- job-to-job transition, e.g., compile and execute ... symbolic device assignment within device dependent environment ... entry of additional information.

Supervisor - The TOS/360 Supervisor is to provide main storage resident control functions in a minimum of 6,144 bytes. The size of the supervisor depends on the options specified at system generation time.

The configuration of control functions contained within 6,144 bytes is: scheduling of I/O operations on the multiplexer and up to six selector channels (see Note) ... system loader for program fetching ... transient area for functions such as -- error recovery, file management,

(open, close, end of volume) end of job, checkpoint restart, storage print, operator communications via 1052 ... 7-track tape handling ... physical I/O tables for ten devices.

Note: Burst Mode on the multiplexer channel can be included in the minimum supervisor in lieu of selector channel scheduling. (Burst Mode is required if tapes are intermixed with byte interleave devices.)

Depending on the combination of supervisory functions chosen, the following represent options which may cause the generation of a supervisor greater than 6,144 bytes:

- . Problem program exits for external interrupts such as operator inquiry and interval timer.
- . Storage Protection
- . Interval Timer
- . Tape Error Statistics
- . I/O Tables for additional devices
- . Channel Switching
- . Program Check Interrupt Exit

It can be assumed as a minimum that at least as many as 12 I/O devices and either program check interrupt exist or channel switching can be included within a 6,144 byte supervisor.

A TOS/360 supervisor generated with the multiprogramming option will require a minimum of 8,192 bytes. In many typical configurations the multiprogramming option can be included in an 8,192 byte TOS/360 supervisor.

Multiprogramming will require as a minimum a System/360 configuration with 32K bytes of storage. This requirement results from the fact that the system requires a minimum background area of 10K bytes. Hence, the system resident supervisor cannot exceed 6K bytes if TOS/360 is to function on a Model D (16K) System/360 configuration. The inclusion of multiprogramming capability in the system will result in the generation of a supervisor greater than 6K bytes regardless of the combination of other supervisory options which may be specified.

The total core requirements of the system supervisor is dependent on the combination of optional supervisory functions selected at system generation. Furthermore, the inclusion of the storage protection feature, which is required for multiprogramming, imposes a 2K boundary on the supervisor storage regardless of the actual storage utilized. There are two conditions which mitigate an arbitrary 2K boundary for supervisor storage. They are:

1. Various portions of the supervisory transient areas can reside in unprotected storage (same as background problem program).
2. Label storage areas normally part of the problem program area can reside within the unused area protected by the supervisor.

It is reasonable to assume that 10,240 bytes represents the maximum supervisor capable of generation in TOS/360 with respect to the complement of currently announced supervisory options.

The storage protection feature is required for the multiprogramming option. This requirement results from the fact that a multiprogramming system cannot effectively function without the assurance of continuous system operation in spite of errant problem programs.

The requirement for the interval timer is optional and is conditioned only on the application requirements and the use of certain system macro facilities. No arbitrary requirement for the interval timer is imposed by TOS/360.

Generation and Editing Functions:

System Generation - to initialize the system residence, establish supervisor capabilities, include desired system functions and processing programs.

Librarian - used for maintaining the tape libraries and providing printed and punched output from the libraries. Three libraries are used - Core Image Library, Relocatable Library, and Source Statement Library.

Linkage Editor - for linking and relocating separate program sections from relocatable libraries and/or from a system input unit; and editing into core image libraries for loading by system loader.

Input/Output Control System (IOCS), 360M-IO-404: Logical IOCS is a set of macro instructions which handle logical files of data for the user on the devices supported. Among these functions are -- request physical I/O operations to be performed when necessary ... block and deblock logical records within physical records ... provide label handling capabilities via OPEN/CLOSE/EOV routines ... switching between I/O areas when two areas are specified for a file.

System Control/IOCS: Several extensions to the system control functions will be provided to benefit the tape operating system in both the batched job and multiprogramming operating environments. These extensions are briefly described below.

Greater flexibility will be provided in the assignment and control of system input and output files to facilitate and encourage concurrent peripheral operations. Specifically these extensions will allow:

- . Automatic volume switching for system output files of magnetic tape in TOS/360.
- . Combined system output files on a single magnetic tape volume.

Expanded background program checkpoint and restart facilities will be provided to allow:

- . 7-track checkpoint with translate mode data on magnetic tape in TOS/360. (Data Conversion feature is required.)

Additional support involving input/output devices, features and operations will be provided in TOS/360 as follows:

- . Dual density magnetic tape recording (800/1600 BPI).
- . Enable/disable mode for the Universal Character Set (UCS).
- . Error recovery involving command chaining operations.
- . Automatic retry of devices made ready following operator intervention type input/output errors.

OPTICAL CHARACTER READER IOCS; 360M-IO-417

Optical Character Reader IOCS provides support for the 1285, 1287 and 1288 Optical Readers. This support provides for reading printed paper tapes or journal rolls, such as those produced on cash registers and adding machines (1285 and 1287 models 2 and 4 only). The IOCS also provides support for reading printed and hand printed data and optical mark-read data from cut form documents, such as sales checks, utility stubs and customer orders (1287 and 1288 only).

Optical Character Reader support can be utilized in a multiprogramming environment under TOS/360 for processing documents or printed paper tapes. Factors affecting Optical Character Reader performance under TOS/360 that must be considered are:

1. System/360 model
2. Number of readers (maximum of 8 are supported)
3. Characteristics of tapes and/or documents
4. Batch or multiprogramming environment
5. If processing printed paper tapes, the blocking of input data
6. User's programming

In addition, throughput is dependent on operator loading and unloading time. This handling time is significant when processing short printed paper tape rolls.

Multiprogramming: The information contained in this section completely replaces the information previously announced under the heading of "Concurrent Peripheral Operations."

Partitioning - TOS/360 offers multiprogramming support that is termed fixed partitioned multiprogramming. That is, the number of problem program areas (called partitions) and the size of those areas are established externally. These partitions are defined during the system generation process. Each partition is defined as a block of contiguous storage locations. The definition may subsequently be altered by the operator to satisfy varying requirements of problem program during system operation. Object programs are not relocated by the system when loaded into a given partition. Therefore, (unless a given program is self-relocating) a program is cataloged in the system with reference to a specific partition.

When programs are initially loaded the highest storage location available in the partition is provided by the system supervisor to the problem program. This enables the problem program to be designed such that it can take advantage dynamically of the amount of storage allocated to its partition under varying operating conditions.

The three partitions which may be established are as follows: **Background Partition** - programs which operate in the background partition are automatically initiated by Job Control as defined by the sequence of job statements contained in the system input stream. Only the background partition allows all of the operating system capabilities provided in the batched-job mode of operation (without multiprogramming).

Foreground Partitions (1 and 2) - programs which operate in the foreground partitions are initiated by the operator

from the console keyboard (1052). That is, foreground programs are not initiated automatically from a job stack. The operator must explicitly initiate each program to be executed in the foreground partitions. Since each partition is completely independent of the others, foreground programs may be initiated and terminated completely asynchronously from each other and from the background program.

As a result, program execution can continue in the active partitions during the initiation procedures for an inactive foreground partition. Similarly, job transition occurring in the background partition is conducted concurrently with the execution of foreground programs.

The foreground initiation statements, e.g., ASSGN, VOL, TPLAB, etc., associated with foreground programs are similar to the job control statements for background programs. They may be entered into the system via either the 1052 or an unassigned card reader device.

Partition Selection - With multiprogramming, TOS/360 is capable of concurrently operating one background and one or two foreground programs. The selection of which of the active programs is to be given control of the CPU is performed by the system supervisor. Foreground programs are always given priority for CPU processing over the background program. Normally, control of the processor is passed to the next lower priority program when the higher priority program encounters a wait condition. Control is then returned to the higher priority program when the event for which it was waiting has been completed.

No special user programming is needed in order to indicate a wait condition and thus cause the transfer of control to a lower priority program. For example, I/O device support provided in the system utilizes EXCP-WAIT type logic in order to synchronize physical I/O operations with requests from the problem program for data transfer. The various conditions under which the selection mechanism of the supervisor will be invoked can be summarized as follows:

- Occurance of unsatisfied wait condition identified by the wait macros;
- Porting of I/O or timer interrupt condition;
- Issuance of load or fetch macros;
- Attention interrupt from the 1052 console keyboard;
- Completion of logical transient routines; e.g., OPEN, CLOSE.

Programming Considerations - Object programs capable of operation in the batch-only environment (initial version) of TOS/360 can be executed in the background partition in a multiprogramming environment without modification assuming sufficient configuration requirements. These object programs need only be recataloged when moving from one environment to the other. Problem programs operating in the foreground partitions have access to the full capabilities of the system, aside from those relating to batched job initiation, with the exception of: (1) checkpoint/restart, (2) communications region modification and (3) use of the system logical units other than SYSLOG and SYSRES. Since the symbolic units used for system input/output functions; i.e., RDR, IPT, PCH, and LST, are reserved solely for the services of batched jobs in the background partition, all IBM provided component programs; i.e., language processors, sorts, system service programs, may be operated only in the background partition of a multiprogramming system. For the same reason, problem programs capable of operation in the foreground partitions must not access these symbolic system units. Requests from foreground programs for the checkpoint function are ignored. Requests from foreground programs for the alteration of the communications region cause program cancellation.

Use of the interval timer feature for the time of day function is supported by the system and is available to any or all programs operating concurrently. However, only one of the programs may utilize the timer to request time intervals (elapsed time) during a given period. The operator can assign the time interval function supported by the system to any one of three partitions. Requests for time intervals from a program in a partition not assigned the function will cause program cancellation.

Program Cataloging - In general, programs must be cataloged in the system core image library with reference to the specific storage locations in which they are to operate. An exception to this rule exists in the case of self-relocating programs. A self-relocating program is one which can be executed in any storage location irrespective of the assignments made by the linkage editor. This is accomplished by the object problem program initializing at execute time all of its address dependent constants. Logical IOCS is capable of self-relocation.

A self-relocating program may be loaded by the system into either foreground partition. This means the operator need not know the explicit starting address of a program, as

established by linkage editor, when initiating a foreground partition. Furthermore, the same problem program may be initiated in separate foreground partitions from a single copy in the system core image library.

Self-relocating programs must be specifically designed using the Assembler language. Logical IOCS is not self-relocating. In addition, object programs resulting from RPG, COBOL, PL/I, and FORTRAN are not self-relocating. To facilitate the design of self-relocating programs several utility input/output macros will be provided with the multiprogramming systems.

These macros will produce self-relocating object code which will provide input/output control functions such as: opening and closing files ... blocking/deblocking of fixed length records ... printer forms and stacker select control ... user exits before, during and upon completion of record processing.

These macros will support consecutive organizations on the following devices: card readers/punches (2540, 2520, 2501, 1442) ... printers (1403, 1443, 1445, 1404*) ... magnetic tape (2400/3400) ... console printer (1052).

***Continuous form operation**

With these macros, the user may assemble tailored file to file utilities supporting normal concurrent peripheral operations. Or the macros may be combined with user programming to produce either generalized or specific file processing programs.

Multiprogramming Summary - The following chart summarizes the characteristics and system facilities applicable to the available partitions in the multiprogramming systems.

	Background (BG)	Foreground (F2)	Foreground (F1)
Program Initiation	Automatic	Operator	Operator
Job Control Unit	SYSRDR/IPT Card/Tape	1052 or Card Reader	1052 or Card Reader
Storage Protection	Yes	Yes	Yes
Storage Protect Key	1	2	3
Location (Fixed)	Adjacent to System Supervisor	Adjacent to Background	Adjacent to Storage End
Size (Variable)			
Minimum (Active)	10K Bytes	2K Bytes	2K Bytes
Minimum (Inactive)	10K Bytes	0 Bytes	0 Bytes
Maximum	available strge	510K Bytes	510K Bytes
Intervals	2K Bytes	2K Bytes	2K Bytes
Established by	SYS GEN	SYS GEN	SYS GEN
Alterable by	Operator	Operator	Operator
Priority	3 (lowest)	2	1 (highest)
Use of System Functions:			
System Log	Yes	Yes	Yes
Job Logging	Yes	No	No
System Units (I/O)	Yes	No	No
Programmer Units	Yes	Yes	Yes
Operator Inquiry	Yes	Yes	Yes
IOCS Macros	Yes	Yes	Yes
Fetch/Load	Yes	Yes	Yes
Program Check Exit	Yes	Yes	Yes
Interval Timer Exit 1	Yes	Yes	Yes
Time of Day	Yes	Yes	Yes
Dump (PDUMP) 2	Yes	Yes	Yes
Communication Region Modification	Yes	No	No
Checkpoint/Restart	Yes	No	No
Use of System Components:			
System Serv. (Librarian)	Yes	No	No
Language Processors	Yes	No	No
Service Programs (Sort, Utilities)	Yes	No	No
Autotest	3	No	No
Use of Problem Programs 4			
Compiled by:			
Assembler	Yes	Restricted	Restricted
COBOL	Yes	Restricted	Restricted
RPG	Yes	Restricted	Restricted
FORTRAN	Yes	No	No
Basic PL/I	Yes	No	No
Types of Program Loading:			
Absolute	Yes	Yes	Yes
Self-Relocating	Yes	Yes	Yes

1. Only one partition at a time selectable by the operator.

- In foreground requires magnetic tape or printer assigned to SYS000.
- Autotest for TOS/360 must be run in a dedicated environment; however, this does not preclude its running under the multiprogramming supervisor. The latter case requires that any and all foreground partitions be reduced to zero for the duration of the Autotest operation. If this condition is not met, Autotest is cancelled and a diagnostic message is printed.
- Restricted to those language functions which do not require access to background communication region or symbolic system units.

Processing Programs

Include customer programs and IBM supplied programs that provide both language and service functions. All processing programs, customer and IBM, utilize the functions provided by the control programs.

TOS/360 may be generated and regenerated by the customer to include those languages, service and problem program functions that he desires in system residence.

Language Functions: Languages are available within TOS/360 at the 10K design level. A design level is the minimum main storage requirement in which the processor is designed to operate.

TOS/360 Language Function Description:

Assembler, 360M-AS-465 - A symbolic programming language used to write programs for System/360. The TOS/360 Assembler program processes the language and provides auxiliary functions useful in the preparation and documentation of a program and includes facilities for processing macro instructions. Included in the language are the standard and optional instruction sets, mnemonics, extended mnemonics, literals and macro facilities. An extensive macro library is also included to provide facilities for system generation and I/O device macro support for processing programs.

Report Program Generator, 360M-RG-408 - An expanded language function that has the capability of compiling programs which can produce a wide variety of reports ranging from a single listing to a complete report that incorporates calculation and editing. Sterling conversion, arithmetic, table lookup, branching capabilities, indicator control, split control fields, move left, and the designation of multiple input and output files are also provided.

COBOL, 360M-CB-402 - COBOL (Common Business Oriented Language) is similar to English. COBOL provides a convenient method of coding programs to handle commercial data processing problems.

The TOS/360 COBOL Language Processor has the following advanced features -- source program library facility ... COBOL debugging language ... internal/external floating-point items and floating-point literals ... the linkage section of the data division ... options 1, 2 and 3 of the USE sentence ... the transform statement ... option 2 of the APPLY clause ... inverted print edit.

Note: COBOL for TOS/360 requires 10K bytes of main storage. It will operate in 16K, although most user programs will require a 24K minimum configuration.

FORTRAN IV, 360M-FO-409 - The FORTRAN Language is especially useful in writing programs for scientific and engineering applications that involve mathematical computations.

The TOS/360 FORTRAN Language is compatible with and encompasses the proposed American Standards Association (ASA) Basic FORTRAN, including its mathematical subroutine provisions.

TOS/360 FORTRAN offers the following advanced features -- mixed-mode ... spacing format code ... literal format code ... the A format code ... scale factor ... carriage control ... double precision data type ... three dimension arrays ... functional subprograms may return results via the argument list.

The FORTRAN IV compiler will allow the introduction of source programs in either BCD or EBCDIC character codes.

Basic PL/I - 360M-PL-450 Extends the range of applications that can be handled by a single high level language. It includes the functional capabilities of FORTRAN and COBOL. PL/I for TOS/360 is a subset of PL/I provided under OS/360.

Expanded Instruction Sets may be required depending on the specific requirements of the language programs utilized as

follows:

Language	System Requires	Object Program May Use
FORTRAN IV	Standard Instruction Set Floating Point Option	Standard Instruction Set Floating Point Option
Basic PL/I	Standard Instruction Set	Universal Instruction Set
COBOL	Standard Instruction Set Decimal Arithmetic Option	Universal Instruction Set
Report Pgrm Generator	Standard Instruction Set Decimal Arithmetic Option	Standard Instruction Set Decimal Arithmetic Option

#Floating Point Option is required if floating point literals and/or non-integer exponents are used.

Control Program Input/Output - TOS/360

Units Supported	Residence	Reader	Input	Work*	Punch	List	Log**
1052							x
2540		x	x		x		
1403						x	x
1404						x	x
1442 N1		x	x		x		
1442 N2					x		
1443						x	x
2501		x	x				
2520 B1		x	x		x		
2520 B2, B3					x		
2400	x	x	x	x	x	x	
2400 Dual Density	x	x	x	x	x	x	
3400	x	x	x	x	x	x	
3400 Dual Density	x	x	x	x	x	x	

7-track tapes require Data Conversion feature #3228 or #3236 (except LIST).

System Residence may be either 7- or 9-track. Systems input and systems reader may be designated the same unit.

Systems input, systems punch and systems list are required for systems generation and editing functions.

*Three (3) required.

**In the event that the 1052 is inoperative, printer devices may be assigned temporarily to SYSLOG.

The logical support of input/output file requirements for problem programs is provided as follows:

Problem Programs Compiled by TOS/360 --

Units	Assembler	RPG	COBOL	PL/I	FORTRAN
2540	x	x	x	x	x
1403	x	x	x	x	x
1404 for continuous forms	x	x	x	x	x
1442	x	x	x	x	x
1443	x	x	x	x	x
1445	x	x	x	x	x
2501	x	x	x	x	x
2520	x	x	x	x	x
2400 (7- or 9-track)	x	x	x	x	x
2400 Dual Density	x	x	x	x	x
1052 Console (Note 1)	x	x	x	x	x
2671	x				
3400 (7-or 9-track)	x	x	x	x	x
3400 Dual Density	x	x	x	x	x

Note 1. COBOL Accept and Display Only ... FORTRAN Output Only ... Basic PL/I Display Only.

TOS/360 - Service Functions Description:

Sort/Merge Program, 360M-SM-400 -- Orders unsequenced data into either ascending or descending sequence as specified on the sort control cards. The sort control statement cards permit a diversification of parameters to meet the needs of the magnetic tape user. These assignments of specified parameters maximizes the sort performance to meet the configuration of the individual user.

The sort employs IOCS standard label check or enables the user to bypass or process his non-standard labels. The utilization of the check point-restart facility permits the user to interrupt and continue during the merging phases of the sort. The merge only option gives the user the facility of combining from one to seven presequenced files into a single output file. A sequence check and reblocking capability form an integral part of the merge option.

Utility Programs, 360M-UT-403 -- The following utility programs will be available on the IBM supplied tape:

Card to Printer and/or Punch - This program transfers binary or EBCDIC data from cards to a printer and/or a card punch.

Card to Tape - This program transfers binary or EBCDIC data from cards to magnetic tape.

Tape to Card - This program transfers data from magnetic tape to cards. Data may be punched in either EBCDIC or binary.

Tape Compare - The tape compare program compares two files from two or more tapes to ensure that the files are identical.

Tape to Printer - This program will print a tape file in one of two formats -

Data Display - prints all of the tape block.
Data List - prints one line for each data record.

Tape to Tape - This program transfers the data from one tape to another.

Multiprogramming Support Utility Macros, 360M-UT-411 -- These macros may be utilized to generate the following concurrent peripheral self-relocation utility programs which will operate in 2K bytes of problem program storage: Card to Print ... Card to Tape ... Tape to Print ... Tape to Card.

The inclusion of any user programming with the above utilities may cause the storage requirements to exceed 2K bytes. (See description under multiprogramming.)

Autotest, 360M-PT-407 -- A debugging aid for object programs assembled by the TOS/360 Assembler and executed under TOS/360. Using Autotest, a test run can be performed as a normal job in a batch, with a minimum of operator intervention. Autotest monitors the execution of the program under test and provides the following facilities:

The creation of input data files by means of standard utility programs (IBM or user supplied).

Exchange, addition, or deletion of instructions without reassembly.

Dump of any portion(s) of main storage, permanent storage assignments, general registers and/or floating point registers whenever a designated address is reached during program execution. The main storage dump can be in hexadecimal, character, floating point, fixed point, or mnemonic representation.

Dump of main storage at normal or abnormal end of job in hexadecimal character and/or mnemonic representation. Source symbols can also be printed with the end of job dump.

A list of all phases in the sequence that they are called into main storage.

Print out of any output data files by means of standard utility programs (IBM or user supplied).

Compiler Input/Output Modules, 360M-IO-412 -- This component consists of the pre-assembled Input/Output modules required by the TOS/360 COBOL and RPG compilers. If either the COBOL or RPG compilers are to be used, these pre-assembled modules must be available in the system. Users requesting maintenance on either COBOL or RPG components should also request maintenance on this component.

6K Supervisor, 360M-SV-413 and 8K Supervisor, 360M-SV-414 -- The two supervisor components are identical in content and function. The only difference is in the ending address. The user who does not expect to generate a supervisor in excess of 6144 bytes should order the system with the 6K Supervisor component. The user who expects to generate a supervisor in excess of 6,144 bytes should order the system with the 8K Supervisor component. This will allow him to assemble and catalog the tailored supervisor without link-editing all of the desired system components residing in the Core Image Library. However, if the tailored supervisor exceeds the size of the supervisor component on the system, a complete linkage edit run must be performed.

On-Line Test Executive Program (OLTEP) 360M-DN-418 - OLTEP together with associated on-line unit tests allows testing of System/360 I/O devices while operating under control of the TOS/360 supervisor. OLTEP is a monitor program that controls the execution of individual routines designed to test specific I/O units. It can be run either in a dedicated batch-only environment or in the background partition of a multiprogramming system. This allows the user to continue performing productive work during the running of I/O unit tests. Except for specific I/O units being tested, all units of the system remain available to the user. Some of the advantages of OLTEP are:

- Increased system availability
- Improved serviceability
- Productive work (in foreground partitions) during servicing
- System checkout following maintenance

BASIC PROGRAM PACKAGE

The following SRL publications and documentation appropriate to the components ordered are shipped by PID with each initial TOS/360 order. Machine readable material is distributed as indicated below.

Documentation - Program Material List ... Attachment I - TOS/360 Restrictions ... Attachment II - APAR Submission. SRL publications, appropriate to the component ordered, will be shipped.

System/360 Disk and Tape Operating Systems - Concepts and Facilities	<u>GC24-5030-10</u>
System/360 Tape Operating System - System Generation and Maintenance TNL GN24-5450	GC24-5015-6
System/360 Tape Operating System - Performance Estimates	GC24-5020-5
System/360 Tape Operating System - Operating Guide	<u>GC24-5021-4</u>
System/360 Tape Operating System - System Control and System Service Programs	GC24-5034-2
System/360 Tape Operating System - Supervisor and Input/Output Macros	<u>GC24-5035-4</u>
System/360 Tape Operating System - Data Management Concepts	GC24-3430-3
System/360 Disk and Tape Operating Systems - Assembler Specifications	<u>GC24-3414-8</u>
System/360 Disk and Tape Operating Systems - Tape Sort/Merge Program Specifications TNL GN33-8085	GC24-3438-4
System/360 Tape Operating System - Autotest Specifications TNLs GN21-5054, 5074, 5080; GN33-8585	GC24-3441-3
System/360 Disk and Tape Operating Systems - Utility Program Specifications	<u>GC24-3465-6</u>
System/360 Disk and Tape Operating Systems - COBOL Language Specifications TNL GN28-0245, 0256, 0407	GC24-3433-5
System/360 Disk and Tape Operating Systems - COBOL Programmer's Guide TNL GN28-0253, 0259, 0406, 0430	GC24-5025-5
System/360 Basic FORTRAN IV Language	<u>GC28-6629-2</u>
System/360 Disk and Tape Operating Systems - FORTRAN IV Programmer's Guide	GC24-5038-3
System/360 Disk and Tape Operating Systems - Report Program Generator Specifications	<u>GC26-3570-7</u>
System/360 Disk and Tape Operating Systems - Utility Macro Specifications	<u>GC24-5042-6</u>
System/360 Disk and Tape Operating Systems PL/I Programmer's Guide	<u>GC24-9005-6</u>
PL/I Subset Reference Manual	<u>GC28-8202-2</u>
System/360 Disk and Tape Operating Systems - On-line Test Executive Program Specifications and Operating Guide TNL GN24-5452	<u>GC24-5066-3</u>

Form numbers which have changed since previous release are underlined.

Machine Readable -- Option 1 - Appropriate material delivered for 6K Supervisor and is specified by using Program Number Extension OPT 1. Option 2 - Appropriate material delivered for 8K Supervisor and is specified by using Program Number Extension OPT 2. Components are as follows:

Assembler	360M-AS-465
COBOL	CB-402
Systems Control Program	CL-405
On-Line Test Executive Program	DN-418
FORTRAN IV	FO-409
Input/Output Control System	IO-404
Compiler Input/Output Modules	IO-412
Optical Character Reader	IO-417
PL/I	PL-410
Autotest	PT-407
Report Program Generator	RG-408
Sort/Merge	SM-400
Supervisor, 6K	SV-413
or	or
Supervisor, 8K	SV-414
Utility Programs	UT-403
Multiprogramming Support Utility Macros	UT-411

OPTIONAL PROGRAM PACKAGE

Documentation - Optional Program Material List.

Machine Readable - Source modules are available on five individual distribution volumes each identified by a Program Extension Number as indicated below.

<u>Program Number Extension</u>	<u>Program Component Name</u>	<u>Program Number</u>
OPT 1	System Control	360M-CL-405
	IOCS	IO-404
	Assembler MPS Utility Macros	AS-465 UT-411
OPT 2	FORTRAN IV	FO-409
	Sort/Merge	SM-400
	Report Program Generator 1285 Optical Character Reader	RG-408 IO-417
OPT 3	COBOL	CB-402
	Autotest	PT-407
OPT 4	PL/I	PL-410
	OLTEP	DN-418
OPT 5	Utilities	UT-403

ADDITIONAL PROGRAM MATERIAL

Program Logic Manuals

TOS/360 System Control	GY24-5022
TOS/360 Logical IOCS	GY24-5018
DOS/360 and TOS/360 MPS Utility Macros	GY24-5045
TOS/360 Utilities	GY24-5019
DOS/360 and TOS/360 Tape Sort/Merge	GY24-5016
DOS/360 and TOS/360 Assembler	GY26-3642
DOS/360 and TOS/360 RPG	GY26-3701
DOS/360 and TOS/360 COBOL	GY24-5025
DOS/360 and TOS/360 FORTRAN IV	GY24-5032
DOS/360 and TOS/360 PL/I	GY33-9011
TOS/360 On-Line Text Executive	GY24-5056

Program Listings: The TOS/360 listings are available on microfiche from the IBM Corporation, Mechanicsburg, Pennsylvania.

The listings are equivalent to the output listings produced by assembling the symbolic modules.

CURRENT USERS

Current users will receive a pre-printed Program Order Form and a letter announcing the availability of Release 15 instructing them to order the new Release through the branch office using this pre-printed Program Order Form. Complete ordering instructions are provided in the letter to users.

To order the maintenance package for System Release 15 the user must specify M for Maintenance Package with one of the appropriate Distribution Medium codes on the Program Order Form. User Volume Requirements for the total replacement package is 01. The Maintenance package is available on a DTR. Users who no longer require this program should be instructed to return the pre-printed Order Form to PID with a "D" in column 14 of section 1 line 1. The maintenance package will be available for 60 days from the date of announcement.

Current users may also modify their profile by adding or deleting components.

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Disk Operating System (DOS): DOS is a disk resident system designed to provide operating system capabilities for System/360 and System/370.

System/360 support operates on the following System/360 models: 22, 25, 30, 40, 44 (feature #8501 is required), 50, 65, 67 (in 65 mode), and 75. System/360 support is included in DOS releases through 26. Release 27 and subsequent releases support System/370 only.

The System/370 models supported by specific releases are indicated below.

DOS Release/Version	System/370 models supported	Comments
25 3	145, 155	S/360 and S/370 support
26 3	145, 155	S/360 and S/370 support
27 4	135, 145, 155	S/370 support only
27.1 4	135, 145, 155, 158	S/370 support only

(158 hard stop BC code only)

ENVIRONMENTS

Partitions - When the IBM Disk Operating System is running, main storage is divided into two or more areas of contiguous storage. One area is used to contain the resident Supervisor Control Program. Its minimum size is 6K bytes on System/360 and 14K bytes on System/370. The remainder of storage is then divided into one or three user program partitions. Each partition is an integral multiple of 2K bytes.

Single Partition System - Many functional advantages of DOS may be realized even in a limited operating environment. In a system with one user program partition, only one problem program, such as a compiler, sort, utility or user program, runs at a time. This partition shares main storage with the Supervisor. The Supervisor handles many of the functions common to all problem programs, such as interrupt handling, input/output supervision, error recovery procedures and the loading of executable phases from the core image libraries into main memory for execution. Symbolic device addressing, automatic job to job transition and library maintenance functions are some of the additional advantages to a user of DOS.

Multiprogramming System - If more than one user partition is defined, two or three user programs may be executed concurrently, this is termed Multiprogramming.

The partitions have standard names assigned to them dependent on the number of partitions in the system, as follows:

One User Program Partition	- Background
Three User Program Partitions	- Foreground One, Foreground Two, Background

These names are normally abbreviated to: F1, F2, and BG.

Multiprogramming may be specified at System Generation time and if so, the size of each user program partition may be defined at this time and may subsequently be altered by the operator to satisfy varying requirements of problem programs during system operation.

The Background Partition, which is always present, must at all times have a size of at least 10K bytes.

Foreground Partitions may be either Single-Program-Initiated (SPI) Partitions, in which case they have a minimum size of 2K bytes, or Batched-Job-Foreground (BJF) Partitions, in which case they have a minimum size of 10K bytes. The system may contain two Foreground Partitions of the same type or one of each, whichever is required by the user. Foreground Partitions may further be defined as Inactive and have a size of OK, that is, no main storage is currently allocated to the partition.

Each partition has associated with it a priority which determines the system priority to be given to the program in that partition. The priority sequence is: Foreground One (highest), Foreground Two and Background (lowest).

Each partition must have associated with it sufficient input and output devices to satisfy the requirements of the programs to be run in that partition. The necessary assignments of devices are made initially at System Generation Time and subsequently modified by means of operator commands and Job Control statements to meet the varying requirements of problem programs during system operation. At any point in time Direct Access Storage Devices may be shared by partitions; all other devices must be uniquely assigned to an individual partition (or not assigned at all).

Background and BJF Foreground programs have access to all the general system facilities provided by the operating system. SPI Foreground Programs do not have access to Job Control, and hence each program to be executed in an SPI partition must be separately initiated by the operator. Furthermore, SPI Foreground Programs may not use the System Checkpoint/Restart facility or access the Communications Region.

Timer services may use both the TOD Clock (S/370 only) and the interval timer. All programs have access to the value of the Time of Day Clock; however, only one program may request time intervals from the Interval Timer during a given period. The operator can assign the Interval Timer to any of the partitions. Requests for time intervals from a program in a partition to which the Interval Timer is not assigned will cause program termination.

The majority of system and user programs may be executed both in the Background Partition and any BJF Foreground Partition; there are however, certain restrictions on programs which modify the contents of the system libraries.

Multitasking - The Multitasking option allows concurrent asynchronous activity within one or more partitions. Thus different parts of the same program can be executed concurrently where it is meaningful to do so. To utilize the multitasking facilities of the Disk Operating System, it is necessary to code programs in the Assembler Language. Events occurring concurrently in different parts of the same program can be synchronized to meet the user's requirements.

LIBRARIES

The IBM Disk Operating System is built around disk libraries, of which there are two classes: System Libraries and Private Libraries. A System Library occupies part of the System Residence Extent; a Private Library occupies an entire extent of Direct Access Storage which may be either on the Systems Residence Device or on some other device of the same type.

The following types of System and Private Libraries may be defined:

A Core Image Library contains object program phases ready for execution. Every program that is to be executed by the system must first be placed in a Core Image Library. The System Core Image Library must be present in every system. One or more additional Private Core Image Libraries may be further defined by the user. Core Image Libraries may contain the following types of object program phase:

1. **Absolute phases**, which must be executed at the specific storage locations defined with the text of the phase itself.
2. **Self-relocating phases**, which may be executed at any contiguous set of storage locations. Such programs are specially written in the Assembler Language in such a way as to be address-independent (self-relocating phases cannot be executed in a non-multiprogramming environment).

A Relocatable Library contains relocatable program modules output by the Assembler or compilers which may then be operated on by the Linkage Editor to produce object program phases.

A Source Statement Library contains source program text and Assembler Language macro books which may be included in user programs by means of COPY or macro mnemonic statements.

Both classes of Relocatable Library and Source Statement Library are optional, but the user will normally require at least one library of each type. These may be either System or Private Libraries.

Any number of private libraries may be defined but for any operation involving libraries only one private library (and the system library) may be in use at the same time. When operations involve both private libraries and system libraries, library references will cause the private library to be searched before the system library, except for those phases starting with \$\$A or \$\$B, in which case the system library is searched first.

REQUIREMENTS

Configuration Requirements -- Minimum system and feature requirements are:

General Requirements, Condition, or Explanation	Requirements Fulfilled by
Main Storage (S/360)	
Batch Job Processing SYSRES Device: 2311, 2314/2319, or	16,384 Bytes of Main Storage
For COBOL D Compiler in Batch Environment (COBOL D Compiler design point is 14K)	24,576 Bytes of Main Storage
For Multiprogramming, MICR, BTAM, or System Input/Output on Disk	24,576 Bytes of Main Storage
Main Storage (S/370)	
Batch Job Processing SY SRES Device: 2311, 2314/2319 or 3330/3333 SYSRES	24,576 Bytes of Main Storage
Support available in Release 27	(Minimum S/370 is 98,304 Bytes of Main Storage)
Note: Minimum 135, 145 and 155 Processor Storage Sizes exceed minimum DOS Storage requirements. See DOS SYSTEM Generation (GC24-5033), for details of storage requirements.	
Instruction Set	Exceptions to this may be required by the language processors or application program. See the specific product for additional instruction set requirements
Channel	One I/O Channel, either Multiplexer or Selector. Additionally, <ul style="list-style-type: none"> • Telecommunications and MICR IOCS require multiplexer channel and at least one selector channel • 2314 requires a selector channel for S/360 Models and a special feature or block multiplexer channel for S/370 Models (See machine section)
I/O Devices	Choice of: <ul style="list-style-type: none"> 1442 2540 2501 3504/3505 (S/370 only) 2520 3525 with Read Feature (S/370 only)
One Card Reader	

One Card Punch
Choice of:
1442 2540
2520 3525 (S/370 only)

One Printer
Choice of:
3211 1404 (S/360 only)
1403 1443

Note: A disk extent or a magnetic tape drive may be substituted for the system reader, punch and/or printer. If disk, at least 24,576 bytes of main storage is required. If tape, 9-track or 7-track drives may be used; 7-track drives require the data conversion feature except when tape is substituted for a printer. Through release 26 2400 series or 3400 in 2400 mode series tapes support these functions; beginning with release 27, 2400 and/or 3400 tapes may be used.

One console printer-keyboard
See "Machines" for console availability for each processor model.

One disk storage drive
Choice of: 2311 Disk Storage
2314 DASF - (2312, 2313, 2316 and/or 2319 Disk Storage)
3330-1,2/3333-1 Disk Storage (S/370 only; block multiplexer channel required)

Note: System generation utilizes the assembler and therefore, requires three logical files for working storage. If not available on the system residence unit, either a second disk storage drive or three magnetic tape units are required. (If tape, 2400 or 3400 in 2400 mode series is supported for this function through Release 26, 2400 and 3400 are supported starting with Release 27.

It is strongly recommended that a multiple disk or disk/tape system be used.

Engineering Changes: The following Engineering Changes are prerequisite for proper functioning of DOS:

1419 S/360 Adapter, Single Address Feature	EC 131182
2030 hardware logic level	EC 126737
2030 micro program level	EC 128053
1445	EC 305247
2841 hardware logic level	EC 413160
2841 micro program level	EC 413140
2821	EC 125598

Note 1: If the multiprogramming and/or telecommunications support facilities of DOS are used, the 2030 hardware logic level EC 126751 and 2030 hardware logic level EC 126751 and 2030 multiprogramming level EC 127058 must be installed.

Note 2: In a storage protected batch job environment, the 2030 multiprogramming level EC is 128058.

Note 3: The following engineering changes are not required, however, in order to achieve optimal performance, they are recommended.

2401 ... EC 254969	2403 ... EC 254969 and EC 255981
2402 ... EC 254969	2404 ... EC 254969 and EC 255982

DEVICE AND FEATURE SUPPORT

Features - The features supported by DOS are:

- Interval timer
- Simultaneous read-while-write tape control (2404 or 2804) on selector channel only
- One multiplexer and up to six selector channels
- Storage Protection - (Required for multiprogramming)
- Additional main storage up to Model J (not in Release 26*)
- Universal character set
- Direct Control and External Interrupt (as used with 1255, 1259, 1412 or 1419 only)
- TOD Clock (S/370 only)

Devices - The devices supported for the indicated functions for Control Program input/output are:

Units Supported	Residence	Reader	Input	Work*	Punch	List	Log**
3215						X	
3210						X	
1052 (S/360 only)						X	
2540		X	X		X	X	X
1403, 1404 (S/360 only)**						X	X
3211		X	X		X	X	X
1442 N1					X		
1442 N2					X		
1443						X	X
2501		X	X				
2520 B1		X	X		X		
2520 B2, B3					X		
3504 A1, A2 (S/370 only)		X	X				

Units Supported	Residence	Reader	Input	Work*	Punch	List	Log**
3505 B1, B2 (S/370 only)			X				
3525 P1, P2, P3 with Card Read (1533) (S/370 only)			X			X	X
2311	X	X	X	X	X	X	X
2314/2319	X	X	X	X	X	X	X
2400/3400		X	X	X	X	X	X
3330-1,2/3333-1 (S/370 only)	X	X	X	X	X	X	X
3410/3420 (See Note 4)		X	X	X	X	X	X

* 2311, 2314, 2319 or 3330 is required for control program working storage; i. e., compile and go and linkage editor.

** In the event the Console Printer-Keybaord is inoperative, printer devices may be assigned temporarily to SYSLOG.

The 2400/3400 series tape drives may be used for working storage by language translators only (3 required) except RPG and Assembler F which cannot use 3400 tapes as workfiles unless they have been SYSGENed as 2400 tapes. 7-track tapes require data conversion feature (except LIST). Work devices may not be mixed between disk and tape.

The devices supported by problem program produced by the assemblers are:

Units	Assembler
1017/1018 (2826 Mod 1)	X
1017/1018 (2826 Mod 2)	X
1052 Console (Note 1) (S/360 only)	X
1255	X
1259	X
1275	X
1285	X
1287	X
1403	X
1404 for continuous forms only (S/360 only)	X
1412 (S/360 only)	X
1419	X
1442 N1 and N2	X
1443	X
1445 (S/360 only)	X
2311 Consecutive Org.	X
2311 Direct Access Org.	X
2311 Indexed Sequential Org.	X
2314/2319 Consecutive Org.	X
2314/2319 Direct Access Org.	X
2314/2319 Indexed Sequential Org.	X
2321 Consecutive Org.	X
2321 Direct Access Org.	X
2321 Indexed Sequential Org.	X
2400 (7- or 9-track, dual density)	X

2501	X
2520 B1, B2, and B3	X
2540	X
2596	X
2671	X
2701, 2702, 2703 with 1030, 1050, 1060, 2740 Models 1 and 2, 2848 with 2260 (Remote) (2701 only), Teletype terminals (WU 115A) AT&T 83B3 and AT&T Models 33/35, 2760, 2265 (2701 only)	X
2701, 2703 Binary Synchronous, with 1130, 2972-8, 2780, S/360 Model 20 and remote S/360 or S/370 with 2701, 2703 or ICA (Model 25 or 135), 1800, 2770, 2715 Model 2, 3735, 3780, 3741 Models 2, 4, 3747	X
3210/3215 (Note 1) (S/370 only)	X
3211***	X
3330-1,2/3333-1	X
3330-1,2/3333-1 Consecutive Org. (S/370 only) X	X
3330-1,2/3333-1 Direct Access Org. (S/370 only) X	X
3330-1,2/3333-1 Index Sequential Org. (S/370 only)	X
3420 (7- or 9-track) (Note 4)	X
3420 Dual Density (Note 4)	X
3504/3505 Card Reader (S/370 only) ****	X
3525 Card Punch (S/370 only)****	X
7770, 2848 with 2260 (Local)	X
7772 (S/360 only)	X
S/360 Model 25 via ICA with 1030, 1050, 1060, 2740 Models 1 and 2, Teletype terminals (WU 155A), AT&T 83B3, AT&T Models 33/35, 2760 Optical image unit attached to 2740 Model 1, 2770, 2780, 3735, 3780, 1130 and S/360 Model 20.	

Remote S/360 or S/370 with 2701, 2703 or ICA (Models 25, 135), 1800, 2770, 2715 Model 2, 3780 S/370 Model 135 via ICA with 1050, 2740 Model 1 and 2, 2760 Optical Image Unit attached to 2740 Model 1, 2770, 2780, 3780, 1130 and S/360 Model 20.

2972-8 General Banking Station with up to ten if any 2980-1, 2980-2 or 2980-4

Note 3: 3803 Tape Control Feature Code 1793, Three Control Switch and Feature Code 1794, Four Control Switch are not supported for alternate path.

Note 4: Those components of DOS which use MTMOD and DIMOD to utilize the 2400 Magnetic Tape Subsystem can run without change when using the 3410/3420 Tape Subsystem.

Note 5: For compiler support see applicable program product.

*Release 26 supports up to 512K (maximum value in ALLOC card is 510K).
**1403 is supported on both System/360 and System/370
***Only ALC and program products support 150 character print line.
****3505 and 3525 special features are supported only by program products.

COMPONENTS
System Control and Basic IOCS - 360N-CL-453

The System Control Programs form the nucleus of the IBM Disk Operating System. There are three programs in this class:

Initial Program Load initializes the Disk Operating System for execution.

The **Supervisor** provides main storage resident control functions which are invokable by all other system and user programs. Supervisor generation macro instructions allow the creation of an individual supervisor program to meet the needs of the individual installation. The size of the supervisor will depend on the particular generation options selected by the user. A minimum supervisor requires 6K of main storage for System/360 configurations and 14K for System/370. This latter figure includes full S/370 RAS support.

Job Control provides job-to-job transition functions for Background and Foreground BJT Partitions. The supervisor loads Job Control into the user partition when the job in that partition comes to an end. Job Control occupies 10K for S/370 of partition storage while performing its functions; it is then overlaid by the next program to be executed in the partition.

The **System Service Programs** provide maintenance and service functions for the system. There are two groups of programs in this class:

The **Linkage Editor** links and relocates separate program sections read from the system input unit or from the relocatable libraries or from both, creating executable object program phases which are then stored in the specified core image library.

The **Librarian** is a group of programs which provides maintenance and service functions for the system and private libraries allowing the user to insert, delete, rename, display, copy, condense, and output the contents of the libraries, and to create and use new private libraries. In addition, the system libraries can be reallocated.

The System Control and Service Programs require the following logical units:

For the System as a whole:

- | | |
|---------------------------|--|
| System Residence (SYSRES) | - accommodates the System Residence Volume |
| System Log (SYSLOG) | - used for communications between the system and the operator |
| System Recorder (SYSREC) | - an extent of Direct Access Storage used to store records output by the Recovery Management Support Recorder (RMSR) |

For each user program partition:

- | | |
|------------------------|---|
| System Reader (SYSRDR) | - used to read Job Control input in card or card image form |
| System Input (SYSIPT) | - used to read other system input in card or card image form |
| System List (SYSLSLST) | - used to display print lines or store print line images output by the system |
| System Punch (SYSPCH) | - used to punch cards or store card images output by the system |

The following further logical units will be required when certain specific control and service functions are invoked:

- | | |
|-----------------------------------|--|
| System Link (SYSLNK) | - an extent of Direct Access Storage used to record input for the Linkage Editor |
| Core Image Library (SYSCLB) | - an extent of Direct Access Storage serving as a Private Core Image Library |
| Relocatable Library (SYSRLB) | - an extent of Direct Access Storage serving as a Private Relocatable Library |
| Source Statement Library (SYSSLB) | - an extent of Direct Access Storage serving as a Private Source Statement Library |

ADDITIONAL IOCS SUPPORT
Consecutive Tape Input/Output Control System (IOCS), 360N-IO-456

Consecutive tape macros (GET/PUT) are used to process successive records in a logical file. Magnetic tape records are processed starting with the first record of a file through to the end. The consecutive tape IOCS macro allows for logical records, blocked or unblocked to span multiple physical records. EBCDIC and ASCII files can be processed.

Consecutive Disk Input/Output Control System (IOCS), 360N-IO-455

Consecutive disk macros (GET/PUT) are used to process successive records in a logical file. DASD records are processed starting with a beginning DASD address and continuing in order through the records on successive tracks and cylinders to the ending address. The program may continue immediately following the GET/PUT macro before the input or output operation is completed. These macros are used for processing records on a 2311, 2314/2319, 2321 or 3330/3333.

Direct Access Method, 360N-IO-454

Records within a logical file are organized on direct-access volumes in any manner chosen by the user.

Storage or retrieval of a record (READ/WRITE) is by actual address or by relative address within a logical file. This address can be that of the desired record, or a starting point within the logical file where a search for the record begins. The starting point is based on a record key furnished by the user. The Direct Access Method macros are used for processing records organized in a random manner on a 2311 Disk Storage Drive, 2314/2319, or a 2321 or 3330/3333.

Indexed Sequential File Management System, 360N-IO-457

The Indexed Sequential File Management System (ISFMS) permits DASD records to be processed in random order control information, or in sequential order. For random processing, the user supplies the key (control information) of the desired record to the ISFMS, and issues a READ or WRITE macro instruction to transfer the specified record. For sequential processing, the user issues GET/PUT macro instructions for all records to be processed in sequential order. ISFMS allows the user to construct data files by key sequence in a manner that permits insertions (additions) without sorting, recopying, or merging. ISFMS can be used on a 2311 Disk Storage Drive, 2314/2319 or a 2321 or 3330/3333.

Additional features for ISFMS include the ability to store part or all of the cylinder index in core, and the ability to add new records to a prime data track by reading up to a full track into core, making the addition and rewriting the data. Both cylinder index in core and prime data in core are optional.

Consecutive Paper Tape Input/Output Control System (IOCS), 360N-IO-458

Consecutive Paper Tape IOCS is used for processing paper tape records, with or without translation of any code. A user may specify one or two I/O areas as desired, but work areas are not serviced. Two record formats are acceptable: undefined (end-of-record character mandatory) and fixed unblocked (end-of-record character prohibited).

MICR IOCS, 360N-IO-477

The MICR (Magnetic Ink Character Recognition) IOCS is used to read data from and control the engage, disengage, stacker select and other control functions of the 1255, 1259, 1275, 1412 and 1419 Character Readers. By means of external interrupt, the DOS Supervisor provides the user with the ability to perform stacker selection on a first priority basis, regardless of the partition in which the problem program is operating. Following stacker selection, logical IOCS enables the user to access documents sequentially, process the data, and exercise control over non-MICR and non-OCR input/output devices. This normal processing (as opposed to stacker selection) has the priority of the partition in which the problem program is executed.

The supervisor and logical IOCS support up to six (6) Character Readers, which may operate in any combination in any or all partitions.

The engage, disengage, document reading, and stacker selection functions are performed through macros. A buffer is maintained to provide the problem program with continuous input data.

The External Interrupt capability is employed to provide an automatic entry to the user's stacker select routine on a first priority basis regardless of the partition in which the routine resides.

GET macro logic is provided for the user's processing requirements other than stacker selection: This normal processing takes the priority of the partition in which the program is executed. When higher priority (Non-MICR and Non-OCR) partitions are operative, reduced document throughput may occur, however, the higher priority program is interrupted to perform stacker selection and fill the MICR for OCR input buffer.

The following units are supported by MICR IOCS:

1255 Magnetic Character Reader Models 1, 2 and 3.

1275 Optical Reader Sorter Models 2 and 4.

1412 Magnetic Character Reader with System/360 Adapter feature (#7720). Engineering Change level, EC 131182, required (S/360 only).

1419 Magnetic Character Reader (Model 1) with System/360 Single Address Adapter feature (#7720). Engineering Change level EC 131182 required.

1419 Magnetic Character Reader (Model 1) with System/360 Dual Address Adapter feature (#7730). Engineering Change level, EC 131196 required.

1403 Printer with the Selective Tape Listing Feature (#6410 on Model 3 or N1, #6411 on Model 2, #6420 on Model N1).

All 1275 1412/1419 special features are supported.

Note: 24K bytes of storage and either the Direct Control Feature (#3274) or the External Interrupt Feature (#3895) (System/360 Model 22 or 30) are required.

The following configuration and system design considerations are applicable to DOS MICR or OCR environment:

Up to six (6) Magnetic Character Readers are supported. The maximum number that may be effectively operated is application and configuration dependent. Refer to DOS, Supervisor and Input/Output Macros, GC24-5037, for timing information.

Unique System Supervisors are generated for (a) 1412/1419 with the Single Address Adapter feature (#7720) and (b) 1419 with the Dual Address Adapter feature (#7730); or 1275 Model 2 or 4 therefore concurrent operation of the two features is precluded.

When Magnetic Character Readers are utilized on the multiplexer channel, magnetic tape or direct access devices may not operate on the multiplexer channel.

Optical Character Reader IOCS, 360N-IO-478

Optical Character Reader IOCS provides support for the 1285 (S/360 only), 1287 and 1288 Optical Readers. This support provides for reading printed paper tapes or journal rolls, such as those produced on cash registers and adding machines (1285 and 1287 Models 2 and 4 only). The IOCS also provides support for reading printed and hand printed data and optical mark-read data from cut form documents, such as sales check, utility stubs, and customer orders (1287 and 1288 only).

Optical Character Reader support can be utilized in a multi-programming environment under DOS for processing documents or printed paper tapes. Factors affecting Optical Character Reader performance under DOS that must be considered are:

1. CPU model
2. Number of readers (maximum of 8 are supported)
3. Characteristics of tapes and/or documents
4. Batch or multiprogramming environment
5. If processing printed paper tapes, the blocking of input data
6. User's programming

In addition, throughput is dependent on operator loading and unloading time. This handling time is significant when processing short printed paper-tape rolls.

Compiler I/O Modules, 360N-IO-476

These input/output modules used by object programs compiled by the language processor are pre-assembled and incorporated into the Relocatable Library. They provide all necessary input/output operations so that the user can execute programs written using the language.

BTAM and QTAM - Discussed in next sections.

TELECOMMUNICATIONS SUPPORT

The telecommunications support provided in DOS includes both Basic Telecommunications Access Method (BTAM) and Queued Telecommunications Access Method (QTAM).

The BTAM facilities of DOS may be utilized in any or all of the partitions described in the Multiprogramming section. The QTAM facilities of DOS must utilize Foreground 1 and either Foreground 2 or Background, or both.

The size of the telecommunication program is dependent upon the BTAM/QTAM module and the extent of the following user-determined areas and functions: I/O buffer areas ... terminal lists ... message processing routines ... number of macro instructions issued ... number of lines ... number of terminals per line, line procedure specifications, etc.

The following configuration and system design considerations are applicable to the DOS telecommunications environment:

All telecommunications devices with the exception of the 2701 SDA-II, S/360 Model 25 via its Integrated Communications Attachment, the System/370 Model 135 via its Integrated Communications Adapter, and the 2848-2260 (Local) must be on the multiplexer channel and no burst mode device may co-exist on the channel with telecommunications devices. The support for the 2701 SDA-II attached to the selector channel is limited to non-switched (leased or private line connection) networks.

All terminals (except Binary Synchronous Communication) on a multipoint non-switched line must be the same type. Terminals may be mixed within the same problem program. Different types of BSC terminals may be mixed on the same non-switched multipoint line or on the same computer phone number in a switched network.

See Terminal Support Chart 2 for BSC terminal mix capability.

The following terminals and features are supported by DOS BTAM and/or QTAM. Other features, not listed, have no specific programming support and their existence is ignored by the control program. Attempts to use the DOS with unsupported features can cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device. Support for items in the list below is available except where indicated by date or otherwise noted.

Telecommunication Features

2701 Data Adapter Unit

Autocall (#1302, 1303, 1314), Dual code (#3455), Dual Communications Interface (#3463, 3464, 3465), EBCDIC code (#9060), ASCII code (#9061), 6-bit transcode (#9062), Transparency (#8029).

2702 Transmission Control Unit

Autocall (#1290), Autopoll (#1319), 1032 Attachment (#7918).

2703 Transmission Control Unit

Autocall (#1340, 1341), EBCDIC code (#7714), ASCII code (#7716), 6-bit Transcode (#7717), Transparency for USASCII (#9100).

S/360 Model 25 with Integrated Communications

Attachment (#7551, 7552) ASCII code (#9001, 9002), Transparency (#9751, 9752), Autocall (#1300), Dual Communications Interface (#3461)

S/370 Model 135 with Integrated Communications Adapter (#4640)

EBCDIC Code (std), ASCII Code (#9681-9688) 6-Bit Transcode (#9689-9696), Transparency (#9673-9680) Autocall (#1290)

Telecommunication Terminals and Terminal Features

1030 Data Collection System

1050 Data Communication System

1060 Data Communication System

AT&T 83B3, Models 33/35 TWX, WU 115A, World Trade Telegraph Terminals.

2740 Model 1 Communication Terminal

Dial Up (#3255), Record Checking (#6114), Station Control (#7479), Transmit Control (#8028), 2760 Attachment (#8301).

2740 Model 2 Communication Terminal

Record Checking (#6114), Buffer Receive (#1499).

2760 Optical Image Unit

2260 Display Station
(Local and Remote).

2265 Display

S/360 or S/370 with 2701 or 2703 (Remote Station)

Features same as for 2701 and 2703 under Telecommunication features except: 2701; 6-bit transcode (#9062) not supported, 2703; 6-bit transcode (#7717) not supported.

S/360 Model 25 with Integrated Attachment feature

(Remote Station). Features same as for Mod 25 ICA under Telecommunication Features.

S/370 Model 135 with Integrated Communications Adapter (#4640)

EBCDIC Code (std), ASCII Code (#9681-9688) 6-Bit Transcode (#9689-9696), Transparency (#9673-9680)

S/360 Model 20 Process Unit

Binary Synchronous Communication Adapter (#2074), Automatic Calling (#1315), Transparent Text Mode (#4100), Station Selection (#7477), High Speed (#4500 or #4501).

1800 System

Communication Adapter (#7550), EBCDIC Code (#9321 thru #9328), ASCII Code (#9331 thru #9338).

7770 Audio Response Unit operating in a switched network with: 1001 Data Transmission Terminal, or a telephone set.

7772 Audio Response Unit operating in a switched network with: 1001 Data Transmission Terminal, or a telephone set (S/360 only).

2972-8, 2972-11 General Banking Station (Domestic only)

2770 Data Communication System

Multiple Data Link Control (#5010), Automatic Answering (#1340), EBCDIC Transparency (#3650), EBCDIC Code (#9761), USASCII Code (#9762), Conversational Mode (#1910), Identification (#4610).

2780 Data Transmission Terminals

Automatic Answering (#1340), Automatic Turnaround (#1350), Multiple Records Transmission (#5010), Multipoint Line Control (#5020), EBCDIC Code (#9761), USASCII Code (#9762), 6-bit Transcode (#9760), EBCDIC Transparency (#8030), Terminal Identification (#7850), Dual Communication Interface (#3401)

3270 Information Display Systems

(Local and Remote)

2715 Transmission Control Unit

Model 1 - Expanded Capability (#3801), Local 2740 Adapter (#4850).

Model 2 - Expanded Capability (#3801), Point-to-Point Non-switched (#9401), Point-to-Point Switched (#9402), Multipoint Non-switched (#9403).

3735 Programmable Buffered Terminal

Note: DOS does not support the attachment of the 2701, 2702 or 2703 to the Selector Channel of S/360, Models 22 & 26 ... See M2701, M2702 and M2703 in 'Machines' for other attachments limitations.

- 3780 Data Communication Terminal
 - Switched Network Control (#7651)
 - Additional Print Positions (#5701)
 - EBCDIC Transparency (#3601)
 - Multi-Point Data Link Control (#5010)
 - EBCDIC Code (#9761)
 - ASCII Code (#9762)
 - Terminal Identification (#9300)
- 1130 Central Process Unit
 - Synchronous Communication Adapter (#7690) operating in BSC mode.
- 3735 Programmable Buffered Terminal
 - Multi-point Data Link Control (#5010), ASCII (#9762) or EBCDIC (#9761).
- 3747 Data Converter
 - Communications Adapter (#1660)
 - Data Set Attachment (#9120, 9121, 9122, 9123)

- 3741 Data Station Model 2, 3741 Programmable Work Station Model 4
 - Terminal Identification (#7850)
 - Operator ID Card Reader (#5450)
 - Data Set Attachment (#9120, 9121, 9122, 9123)
 - Expanded Communications (#1680)
 - Expanded Communications/Multipoint Data Link Control (#1685)
- S/3 Central Process Unit
 - Binary Synchronous Communications Adoption (#2074), EBCDIC Transparency (#7850), Station Selection (#7477), Autocall (#1315), EBCDIC Code (#9060), ASCII Code (#9061), Point-to Point (#9481), Multipoint (#9482), Switched (#9483), plus additional specifications.
- System/7
 - Communication Control (#1610) must be specified as a 2740 Model 1 terminal with checking feature.

DOS TERMINAL SUPPORT CHART 1

Terminals Operating with S/360 or S/370*	ACCESS METHOD		PROGRAMMING SUPPORT													
	Date Avail.	Chan. Att	BTAM	QTAM	Auto poll+	ERP	ERR Count	On- Ln Test	Opr. Cntrl.	Chkpt/ Rest						
1030	A	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1050	A	5	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1060	A	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X
AT&T 8383 & WU115A	A	4	X	X		X	X									
AT&T Mod33/35																
TWX	A	4	X	X		X	X									
2740 Mod 1	A	5	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2740 Mod 2	A	5	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2760	A	5	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2260 (Local)	A	L	X	X		X	X									
2260 (Remote)	A	1	X	X		X	X									
2265	A	1	X	X		X	X									
7770/7772	A	L	X	X		X	X									
S/360 & S/370**	A	3	X			X	X	X	X	X	X	X	X	X	X	X
Model 20	A	3	X			X	X	X	X	X	X	X	X	X	X	X
1130	A	3	X			X	X	X	X	X	X	X	X	X	X	X
1800	A	3	X			X	X	X	X	X	X	X	X	X	X	X
S/3	A	3	X			X	X	X	X	X	X	X	X	X	X	X
2780	A	3	X			X	X	X	X	X	X	X	X	X	X	X
2770	A	3	X			X	X	X	X	X	X	X	X	X	X	X
2715 Model 1	A	L	X			X	X	X	X	X	X	X	X	X	X	X
2715 Model 2	A	3	X			X	X	X	X	X	X	X	X	X	X	X
2972-8, 2972-11	A	3	X			X	X	X	X	X	X	X	X	X	X	X
3735	A	5/72	X			X	X	X	X	X	X	X	X	X	X	X
S/7	A	11/71	X			X	X	X	X	X	X	X	X	X	X	X
3277 (Remote)	A	5/72	X			X	X	X	X	X	X	X	X	X	X	X
3277 (Local)	A	5/72	L			X	X	X	X	X	X	X	X	X	X	X
3284/3286 (Remote)	A	5/72	X			X	X	X	X	X	X	X	X	X	X	X
3275 (Local)	A	5/72	L			X	X	X	X	X	X	X	X	X	X	X
3780 (A)	A	3	X			X	X	X	X	X	X	X	X	X	X	X
3741 Mod 2	A	2	X			X	X	X	X	X	X	X	X	X	X	X
3741 Mod 4	A	12/74	X			X	X	X	X	X	X	X	X	X	X	X
3747	A	2	X			X	X	X	X	X	X	X	X	X	X	X

Notes: Channel Attachment: 1 = Supported on 2701 and M135 only.
 2 = Supported on 2701, 2703, and M135 ICA only.
 3 = Supported on 2701, 2703 M25 ICA, and M135 ICA only.
 4 = Supported on 2701, 2702, 2703 and M25 ICA only.
 5 = Supported on 2701, 2702, 2703, M25 ICA and M135 ICA.
 L = Supported on Local Channel (7772 is not supported on M135)

Access Method: X = Supported
 - = Not supported

Programming Support: X = Supported by Access Methods
 - = Not supported
 Q = Supported by QTAM only.

*Autopoll is available on the 2702, 2703 and M25 ICA for terminals using a start-stop communication code and on the 2701, 2703 and M25 ICA for terminals using a BSC communication code.

**System/360 Models 25, 30, 40, 50, 65, 67 and 75 (with 2701, 2702, 2703 on Model 25 with ICA)
 System/370 Models 135, 145 and 155

For details on terminal support when computer is used with 3705 see 360H-TX-033, 3705 Emulator Program Support Package.

**System/360 Models 25 and 30 with BOS/BPS or DOS; Models 40, 50, 65, 67 and 75 with BOS/BPS, DOS, or OS; Models 85, 91 and 195 with OS

System/370 Models 145 and 155 with DOS and OS, and Model 165 with OS

System/370 Model 135 with DOS or OS (MFT)

(A) Supported and specified as 2772 without component selection.

DOS/360 TERMINAL SUPPORT CHART 2

Terminals Operating with S/360 or S/370*	Type Comm	COMMUNICATION CODE				COMM. NETWORK				
		BCD	Other	EBCDIC nor tran	ASCII nor tran	6-bit Trans.	PTP SW	PTP (non-SW)	MP (non-SW)	
1030	SS	X								X
1050	SS	X						X	X	X
1060	SS	X								X
AT&T 8383 & WU115A	SS		X							X
AT&T Mod 33/35										
TWX	SS		X					X	X	
2740 Mdl 1	SS	X						X	X	X
2740 Mdl 2	SS	X							X	X
2760	SS	X						X	X	
2260 (Local)	L		X							
2260 (Remote)	SS		X							X
2265	SS		X							X
7770/7772	L		X						X	
S/360 & S/370**	BSC			X	X	X	X		S1	X
Model 20	BSC			X	X	X	X		S1	X
1130	BSC			X	X	X	X		S1	X
1800	BSC			X	X	X	X		S1	X
S/3	BSC			X	X	X	X		S1	X
2780	BSC			X	X	X	X		S1	X
2770	BSC			X	X	X	X		S1	X
2715 Model 1	BSC			X	X	X	X		S1	X
2715 Model 2	BSC			X	X	X	X		S1	X
2972-8, 2972-11	BSC			X	X	X	X		S1	X
3735	BSC			X	X	X	X		S1	X
S/7 134.5	SS	X							X	X
600	SS	X							X	X
3277 (Remote)	BSC			X	X	X	X			M1
3277 (Local)	L			X	X	X	X			
3284/3286 (Remote)	BSC			X	X	X	X			M1
3275 (Local)	L			X	X	X	X			
3780 (A)	BSC			X	X	X	X		S1	X
3741 Mod 2	BSC			X	X	X	X		S1,R	X
3741 Mdl 2, 4	BSC			X	X	X	X		S1,R	X
3747	BSC			X	X	X	X		S1,R	X

Notes: SS = Start/Stop
 BSC = Binary Synchronous Communication
 L = Local Attachment (2715 Model 1 uses BTAM PTP non-switched programming support)
 X = Supported
 - = Not supported
 R = When dialing in to a 3704/3705 in NCP mode, the 3741/3747 can use the same phone number as other terminals in the group with the following restriction: When a 3741/3747 is dialing in, the NCP must be configured with the 3741/3747 specified for that BSC line appearance. If a 3741/3747 is not dialing in, the NCP must not be configured with the 3741/3747 specified for that BSC line appearance.

S1 = Group of terminals which can share the same phone number(s)
 M1 = Group of terminals which can operate on the same multipoint line

*System/360 Models 25, 30, 40, 50, 65, 67 and 75 (with 2701, 2702, 2703 or Model 25 with ICA)
 System/370 Models 135, 145 and 155 (with 2701, 2702, 2703 or Models 135 with ICA)

For details on terminal support when computer is used with 3705 see 360H-TX-033, 3705 Emulator Program Support Package.

**System/360 Models 25 and 30 with BOS/BPS or DOS; Models 40, 50, 65, 67 and 75 with BOS/BPS, DOS, or OS; Models 85, 91 and 195 with OS

System/370 Models 145 and 155 with DOS and OS, and Model 165 with OS

System/370 Model 135 with DOS or OS (MFT)

(A) Supported and specified as 2772 without component selection.

Basic Telecommunications Access Method, 360N-CQ-469

The BTAM facilities are designed chiefly to provide the tools to facilitate the writing of telecommunications programs. They may be used to design a dedicated telecommunications system. That is to say, the multiprogramming capability is not a prerequisite for BTAM. BTAM includes facilities for performing the following operations:

- . Initiating and answering calls to and from terminals on switched networks.
- . Polling and addressing terminals on non-switched multipoint lines.
- . Changing the status of terminal lists.
- . Transmitting and receiving messages.
- . Posting completion status of messages.
- . Managing buffer pools.
- . Codes translation.
- . Retransmitting messages which are received with detected error.
- . Providing on-line terminal test facilities.
- . Keeping error statistics.

It is expected that, in an MPS system, the teleprocessing program will normally operate in a foreground partition that will include the BTAM module combined with the user's message processing routines. The user may employ any of the IOCS macros available in the system in designing his telecommunications application.

BTAM provides a multiple WAIT macro-instruction for use in telecommunications line operations only. This macro-instruction enables the telecommunications program to release control of the CPU until one or more of a series of events has occurred (such as the completion of a BTAM READ or WRITE operation). Thus, it provides efficient concurrent operation of lower priority programs.

The support of Binary Synchronous Communication combined with that of the various start-stop devices gives BTAM a wide range of applications and flexibility. This programming package supports low and high speed devices in one access method.

Queued Telecommunication Access Method, 360N-CQ-470

QTAM is a generalized input/output control system that extends the techniques of logical IOCS to the telecommunications environment. In addition to the standard GET/PUT macro instructions support for message processing programs, QTAM provides high-level and flexible message control language. Some of the capabilities provided by QTAM through the use of macro instructions are: automatic control of switched networks ... polling terminals ... receiving and editing messages from terminals ... addressing terminals ... sending and editing messages to terminals ... dynamic buffer management ... queueing messages on a direct access storage device.

A telecommunications system built upon QTAM facilities consists of:

1. A message control program (Foreground 1) to control the flow of message traffic from one remote terminal to another (message switching application) and between remote terminals and any message processing programs (message processing application message).
2. Message processing programs (Foreground 2 and/or Background) to perform the message processing required by the user's application.

QTAM allows asynchronous operation of 11 partitions of the system. This method of execution is based on the completion of queued events and on the established priorities of Foreground 1, Foreground 2, and Background.

The following DASDs are supported by QTAM for intermediate storage of message queues:

- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2319 Disk Storage Facility
- 3330/3333 Disk Storage

Communication Serviceability Facilities - (BTAM and QTAM)

Communications Serviceability Facilities are incorporated within BTAM and QTAM. They are provided on an optional basis in BTAM.

It is strongly recommended that users include these facilities in their system since they can increase system availability by providing statistics and diagnostic aids for effective system repair and preventive maintenance. Refer to the Terminal Support Chart 1 for information on device support. The Communication Serviceability Facilities are:

- . Error Recovery Procedures (BTAM and QTAM) - These are provided on a line basis. The operation in error is retried twice on non-BSC devices and three times (or a user specified number of times) on BSC devices. If the error persists, the conditions of the error are posted and a system-to-operator message describing the error is printed on the printer-keyboard.

Job termination and a printout are provided on certain non-recoverable errors.

Diagnostic Write/Read Commands (2701 only) are performed to isolate non-recoverable errors either to the control unit or to an external source.

- . Error Counts (BTAM and QTAM) - Counts are maintained for errors on a line basis. These error counts will be printed on the printer-keyboard when any error rate is excessive. An additional facility enables the user's program to

cause error statistics from cumulative counters to be printed at the printer-keyboard.

- . On-line Terminal Test (BTAM and QTAM) - Terminal Test procedures will operate on-line with the user problem programs, and will not impact user operation other than the time required to perform their function, except that when a test is performed using the IBM 2760, the film should be reloaded prior to continuing the job.

Tests can be requested from a terminal and returned to that terminal or any other terminal on the same system. Normal operation is maintained for unaffected terminals in the system.

- . Operator Control (QTAM) - Operator control is provided as an option to enable the operator to examine and modify QTAM control information and to respond to errors and unusual conditions. An IBM 1050 System, or IBM 2740 Communication Terminal with station control and checking, is required for this function. When operator control facilities are used, operator awareness messages may be directed to the operator control terminal instead of the printer-keyboard.

- . Checkpoint/Restart (QTAM) - Checkpoint/Restart is provided for the QTAM message control program as an optional facility. The terminal table queue control blocks, and the polling lists are checkpointed on the disk at the user specified intervals. Two checkpoint records are maintained with a pointer to the most current record. Restart will be accomplished by reloading the QTAM message control program, using the latest checkpoint records to overlay the initial queue control blocks and polling lists.

3735 Terminal Support, 360N-CQ-493 and 370N-CQ-493

Form Description Macros

The Form Description Macros for the 3735 are used to describe and generate Form Description Programs that are used by the 3735 to control the terminal operations.

The Form Description Macros operate with the DOS Assembler D or F.

The output of the assembly is an object module suitable for input to the Form Description Utility.

Form Description Utility

The Form Description Utility for the 3735 is used to prepare the output of the Form Description Macro assembly for transmission to the 3735 terminal.

The Form Description Utility reads the output of the assembly from a sequential input device, formats the object code into blocks for the 3735, and writes the blocked code into an index sequential data set that is available to the user's program for transmission to the 3735 terminal.

See 5747-AZ1 in the SCP DOS/VS section for ordering information.

Vocabulary File Utility Program for 7772 Audio Response Unit, 360N-UT-472

The System/360 Vocabulary File Utility Program for the 7772 is designed for use within DOS and uses the facilities provided by it, including logical IOCS and supervisor services.

The program provides for the creation and updating of an audio vocabulary file. The customer receives the Vocabulary Input File containing words in digitally coded form on either punched cards or magnetic tape. The program allows the user to select the words he needs (by means of control cards) from this master file, to organize them on disk (2311, 2314 or 2319 Disk Storage) in the manner best suited for his application, and to list the Vocabulary Input File and the Vocabulary File he created.

COMPILERS
Language Processors, Sorts, and Utilities

The Type I processors that run under DOS are listed below:

Refer to the program product section for a description of the program products supported under DOS, including language processors, sort/merge processors and utility programs. Note that these program products, as well as providing extended functional capabilities over any predecessor Type I programs, also provide the support for new devices. The specific devices supported are included in the description in the pages given above.

In determining the applicability of a Type I program to a customer's needs, particular attention must be given to the availability of appropriate device support in that program.

Assembler D, 360N-AS-465

Assembler language is a symbolic programming language used to write programs for the Systems/360-370. The DOS Assembler program processes the language, provides auxiliary functions useful in the preparation and documentation of a program, and includes facilities for processing macro instructions. Included in the language are the standard and optional instruction sets, mnemonics, extended mnemonics, literals, and macro facilities.

The user has the option to generate the following variations of the assembler.

A. 10K Variant

- Three 2311 disk storage extents as work files or
- Three 2400/3400-series magnetic tape units (either 7-track or 9-track) as work files. The data conversion feature is required for 7-track operation

B. 14K Variant

This variation provides

- Ability to select at execution time three 2311, 2314/2319/3330/3333 disk storage extents or three 2400 or 3400-series magnetic tape units as work files (mixed). Disk storage extents may be on the same device that contains DOS system residence.
- Support of 2311 or 2314/2319/3330/3333 as SYSIN, SYSLST, SYSPCH.
- Support of private source statement library.
- Concurrent DECK and LINK options.
- Improved performance.
- Blocked link file for improved linkage editor performance.
- Support of extended precision floating point and System/370 instructions.

When operating in a Foreground partition, Assembler D minimum partition size is increased by 2K bytes.

Assembler F (360N-AS-466)

A high-performance assembler providing improved functions for users with a minimum of 64K of main storage:

- High performance -- up to 45% faster than Assembler D (360N-AS-465).
- Up to two continuation cards per statement rather than one.
- Multiple-operand DC and DS statements.
- Bit-length modifiers, in addition to byte-length modifiers, in DC and DS statements.
- Only 2400 tapes or 3400 in 2400 mode tapes and for 2311, 2314, 2319 DASD can be used as work files.

Any source program that can be assembled by Assembler D 10K variant can be assembled by Assembler F without change.

Assembler F requires a minimum of 44K bytes of main storage in a BG partition or 46K in foreground.

COBOL D, (360N-CB-452)

COBOL (COmmon Business Oriented Language) is similar to English. COBOL D provides a convenient method of coding programs to handle commercial data processing problems.

DOS COBOL provides important new features that reduce the cost of programming and extend the use of the language to new areas of application.

Among the features furnished by the COBOL compiler are:

- Floating point facility.
- Debugging source statements.
- Debugging packets that may be compiled with the source program and executed at object time without alterations to the original source program.

- Subprogram facility.
- Copy and include from a user's source program library.
- Improved object code efficiency.
- Improved object program execution time.
- Improved PERFORM performance.
- DASD statements handled by the COBOL D compiler for 2314 Direct Access Facility, 2319 Disk Storage Facility, 2311 Disk Storage Drive, and 2321 Data Cell Drive. These are:
 - for Indexed Sequential - Load, add, retrieve, retrieve and update.
 - for Direct Access - Sequential build, retrieve, retrieve and update.
 - USE AFTER ERROR clause handled for UTILITY and DIRECT ACCESS files.
 - APPLY WRITE-ONLY clause handled.
 - Inverted Print Edit.
 - Compiler output decks may be executed in a Batched Job Foreground.

A COBOL library consists of subroutines called by the compiler to perform conversions, complex arithmetic operations, and certain I/O functions.

COBOL requires the Standard Instruction Set and the Decimal Arithmetic feature #3237. The Floating Point Arithmetic feature #4427 is also required if floating point literals, data items or non-integer exponents are used. The COBOL D compiler requires a minimum 14K partition for BG operation and 16K for BJJ operation. For this reason a 24K minimum system is required for compilation of COBOL programs on System/360.

This compiler generates object code supporting the following devices:

- 2540, 1403, 1404, 1443, 2501, 2520, 2400, 3211 as a 1403
- 1052 and 3210/3215 consoles for ACCEPT and DISPLAY only
- 2311, 2314/2319, and 2321 for consecutive, direct access and indexed sequential organizations.

Documentation: COBOL Programmer's Guide, GC24-5025-5, TNLs GN28-0253, 0259, 0406, 0430 ... COBOL Language Specifications, GC24-3433-5, TNLs GN28-0245, 0256, 0407.

COBOL, DASD Macros, 360N-CB-468

These macros enable a user of DOS/360 COBOL to access the 2314 Direct Access Facility, 2319 Disk Storage Facility, 2311 Disk Storage Drive, and 2321 Data Cell Drive by using Indexed Sequential or Direct Access IOCS. The following functions are provided:

- for Indexed Sequential - load, sequential and/or random retrieval, random retrieval and add.
- for Direct Access - load, sequential and/or random retrieval.

These macros are assembled using the DOS Assembler and are linkage edited with the object program produced by the COBOL compiler.

Documentation: COBOL DASD Macros, GC24-5039-1, (Note - GC24-5039 and TNLs GN24-5142, 5181 may be used in lieu of GC24-5039-1)

American National Standard COBOL, 360N-CB-482

The DOS USA Standard COBOL compiler complies with the approved USA Standard COBOL language (x3.23.1968 COBOL) and incorporates IBM extensions. The USA Standard COBOL language is the result of a standardization effort of the United States of America Standards Institute using CODASYL COBOL, Edition 1965, as a base. The language complies with the first draft ISO recommendation for COBOL.

The Sort, Report Writer, and Segmentation modules represent a totally new capability for the user of COBOL under DOS.

Sort

The Sort feature permits the COBOL programmer to request execution of a sorting operation within his program. Records may be summarized, inserted, deleted, shortened, or otherwise altered during the initial and final phases of the sort.

Segmentation

Large problem programs can be split up into segments and those segments which are overlayable can be so designated. This allows for more efficient use of core storage at object time.

Report Writer

The Report Writer feature permits the program to use COBOL language statements to specify the format of a written report.

In addition to the features defined in the language standard, the following IBM extensions are provided in this compiler:

- . Indexed Sequential Access Method
- . Cross Reference Listing
- . Condensed Listing Option
- . Data/Procedure Map Separation
- . Both SYSLNK and SYSPCH output
- . Special Registers for Time-of-Day, Date, I/O error codes, and SORT feature flexibility
- . Internal and External Floating Point Items
- . Internal Decimal Items
- . Linkage Section of the DATA DIVISION TRANSFORM statement
- . Debugging Language including DEBUG, TRACE, ON, and EXHIBIT

The USA Standard COBOL compiler under DOS requires a partition size of at least 55,296 bytes of main storage. Extensive Report Writer utilization may require the allocation of additional main storage.

In addition to the features required for the operation of the Disk Operating System, the following features are required for the USA Standard COBOL compiler:

- . The Commercial Instruction Set
- . The Floating Point Feature (if Floating Point literals or calculations are to be used)
- . Four utility work files on 2400/3400 Series Magnetic Tape units, 2311 Disk Storage Drives, or a 2314 or 2319 Storage facility. At least one of these work files must be on a 2311, 2314 or 2319 direct access storage device.

The compiler generates object code supporting the following devices:

- . 2540, 1403, 1404, 1443, 2501, 2520, 2400, 3211 as a 1403.
- . 1052 and 3210/3215 consoles for ACCEPT and DISPLAY only.
- . 2311, 2314/2319, and 2321 for consecutive, direct access and indexed sequential organizations.

Documentation: USA Standard COBOL, GC28-6394-2, TNL GN28-0436 ... USA Standard COBOL Programmer's Guide, GC28-6398-2.

Basic FORTRAN IV, 360N-F0-451

The Basic FORTRAN IV Language is especially useful in writing programs for scientific and engineering applications that involve mathematical computations. The DOS Basic FORTRAN IV Language is compatible with and encompasses the USA Standards Basic FORTRAN, including its mathematical subroutine provisions.

DOS Basic FORTRAN IV offers the following advanced features -- mixed-mode ... spacing format ... literal format code ... the A format code ... scale factor ... carriage control ... double precision data type ... three dimension arrays ... functional subprogram return of results via the argument list.

The following features are furnished by the basic FORTRAN IV compiler:

- . Input/output device support for the IBM 2314 or 2319 Disk Storage facility.
- . Compiler output decks may now be executed in a Batched Job Foreground partition.

The Basic FORTRAN IV compiler allows the introduction of source programs in either BCD or EBCDIC character codes.

The Basic FORTRAN IV compiler and object programs require the Standard Instruction Set and the Floating Point feature #4427.

The compiler generates object code supporting the following devices:

- . 2540, 1403, 1404, 1443, 2501, 2520, 2400, 3211 as a 1403.
- . 1052 and 3210/3215 consoles for ACCEPT and DISPLAY only.
- . 2311 and 2314/2319 for consecutive organizations.

Documentation: Basic FORTRAN IV Programmer's Guide, GC24-5038-3 ... Basic FORTRAN IV Language, GC28-6629-2.

FORTRAN IV, 360N-F0-479

FORTRAN IV Library Subprograms 360N-LM-480

The language features provides beyond DOS Basic FORTRAN IV are: Data initialization statements ... COMPLEX and LOGICAL data types ... The logical IF statement ... END and ERR parameters to allow testing for end-of-file and error conditions on input ... ASSIGN and assigned GO TO statements ... Labeled COMMON.

DOS FORTRAN IV is fully compatible with and encompasses USA Standard FORTRAN IV. Extensions beyond the USA Standard language level include: Direct access input/output statements for the 2311, 2314 and 2319 direct access storage devices ... Seven dimensions for arrays ... An IMPLICIT statement allowing extended implicit classification by the first character of a name ... The NAMELIST statement permitting input/output and conversion without an explicit I/O list and FORMAT statement ... The PAUSE statement option allowing output of messages to the console typewriter ... Generalized subscripts ... Multiple ENTRY points to subprograms ... Non-standard RETURNS from SUBROUTINES.

DOS FORTRAN IV has the ability to: Combine object modules with those produced by Basic FORTRAN IV ... Compile approximately 250 source statements in the minimum 40K bytes of main storage ... Automatically expand to use additional main storage, as available, to compile larger programs ... Produce options pseudo-assembly listings of compiler output ... Simultaneously use the LINK and DECK options ... Overlay phases at object time ... Accept Explicit BCD or EBCDIC character codes ... Support batched compilation (i.e., the ability to compile multiple programs without reinvoking the compiler).

A Debug package is available enabling the user to locate errors in a source program. Minimum System Requirements -- For compilation a partition of at least 40K bytes.

DOS FORTRAN IV compiler and object programs require the Standard Instruction Set and the Floating Point Feature.

The compiler and library produce object code supporting the following devices:

- . 2540, 1403, 1404, 1443, 2501, 2520, 2400, 3211 as a 1403.
- . 1052 and 3210/3215 consoles for ACCEPT and DISPLAY only.
- . 2311, 2314/2319, and 2321 for consecutive and direct access organizations.

Documentation: S/360 FORTRAN IV Language, GC28-6515-8, TNL GN28-0595 ... S/360 FORTRAN IV Library Sub-program, GC28-6596 ... FORTRAN IV Programmer's Guide, GC28-6397.

PL/I, 360N-PL-464

The DOS Basic PL/I Compiler provides, in a single high-level language, many new features, such as:

- . Comprehensive data conversion and editing facilities.
- . Data structures for alphanumeric information.
- . Ability to process a wide range of data types, including character and bit strings, fixed and floating decimal, and fixed and floating binary.
- . Both structured data and array data have arithmetic capability, including expressions whose elements are simple variables, structured data, and arrays.
- . Data stream transmission.
- . Record transmission capability.
- . Batched Job Foreground execution capability for compiler output decks.
- . Object time performance is improved through the elimination of repetitive transient fetches.
- . CATALR cards are now produced by the compiler for object modules if UPSI bit 0 is on.
- . Sterling Picture capability now includes PICTURE characters 6, 7, and 8.
- . Source statement numbers now appear in the object code listing.
- . LIST Directed Input/Output allows free-form data transmission.
- . INITIAL Attribute enables initialization of variable at the time that storage is assigned.
- . Certain keyword abbreviations reduces the overall effort of source program coding.
- . Built-in functions ADD, MULTIPLY and DIVIDE permit user control over the precision resulting from these functions.
- . Provide tracing of object program flow initiated by source program CALL statements.
- . XREF option allows cross reference listing to be written.
- . PROCESS card allows compile-time option to be specified overriding job control options.

Basic PL/I provides the user with a key for solving both computing and resource allocation problems. It enables the user to employ an organization of programmers using one common language, thus reducing training cost and enhancing communication between scientific and commercial applications groups.

Because of the space required for the Foreground Save Area, both the 10K and 12K variants of this compiler require an additional 2K of main storage when run in a Batched Job Foreground partition.

The Basic PL/I compiler requires the floating point feature when floating point literals, data items or non-integer exponents are used.

The compiler generates object code supporting the following devices:

- . 2540, 1403, 1404, 1443, 2501, 2520, 2400, 3211 as a 1403
- . 1052 and 3210/3215 consoles for ACCEPT and DISPLAY only
- . 2311, 2314/2319, and 2321 for consecutive, direct access and indexed sequential organizations.

Documentation: PL/I Subset Reference Manual, GC28-8202 ... PL/I Programmer's Guide, GC24-9005 ... PL/I DASD Macros, GC24-5059.

Report Program Generator (RPG), 360N-RG-460

DOS RPG is a powerful, high level, problem oriented language capable of generating programs that range from producing simple reports to full file maintenance. The generated programs will read data from punched cards, tape and disk, update records according to user specifications, write output records on tape and disk, punch cards and prepare printed reports. RPG offers a rapid method of converting defined applications to operational programs producing results.

With minimal specifications, RPG generated programs can:

- . Obtain data records from single or multiple input files.
- . Perform record identification.
- . Sequence check input files.
- . Determine logical order of record processing.
- . Perform calculations on data taken from input records or literals.
- . Perform automatic decimal alignment.
- . Perform tests and/or comparisons that may influence processing.
- . Exit to user subroutines written in a language other than RPG.
- . Produce reports with an unlimited number of heading and detail lines up to nine levels of total lines, and an end-of-job total.

In addition, RPG has the capabilities of processing the following requirements:

- . Automatic handling of sterling fields.
- . Alternate collating purposes.
- . Inverted field in editing.

RPG requires the Standard Instruction Set and Decimal Arithmetic feature #3237. The compiler generates object code supporting the following devices:

- . 2540, 1403, 1404, 1443, 2501, 2520, 2400, 3211 as a 1403.
- . 2311, 2314/2319, and 2321 for consecutive, direct access and indexed sequential organizations.

Documentation: Report Program Generator, GC26-3570.

SORTS

Disk Sort/Merge, 360N-SM-450

The sort program enables the user to sort files of unsequenced disk (2311) records into one sequential file. The merge program enables the user to merge (collate) up to four pre-sorted disk files into one file. The program assumes that input records for a sort operation are in random sequence. Records can be sorted or merged into ascending or descending sequence. The output sequence for a merge-only operation must be the same as the input sequence.

Significant features of the sort/merge program are:

- . Sorting or merging on as many as twelve control-data fields.
- . Collating sequences and data format can be specified separately for each control field.
- . Option of writing an output file on disk composed of the disk addresses or disk addresses plus control data for the sorted records.
- . Provides exits to storage areas for user-written routines.
- . Sorts multiple input files.
- . Input and output can be from either tape or disk.
- . Disk intermediate storage may be designated on the system residence device assuming sufficient working storage is available.
- . Disk storage is used as work areas.

Disk Sort/Merge does not support the 2314, 2319 or 3330/3333 Disk Storage facility as an input/output device.

Tape Sort/Merge, 360N-SM-400

Enables the user to sort files of unsequenced tape records into one sequential file. The merge program enables the user to merge (collate) up to seven presorted tape files into one file.

Significant features of Tape Sort/Merge are:

- . Sorting or merging on as many as twelve control-data fields.
- . Collating sequences and data format can be specified separately for each control field.
- . Records can be sorted or merged into ascending or descending sequence.
- . The sort employs IOCS standard label checking or enables the user to bypass or process his non-standard labels.
- . The checkpoint-restart facility permits the user to interrupt and continue during the merging phases of the sort.
- . Magnetic tapes are used as work files.
- . An alternate work drive is available during sort and will allow the maximum input file size to be approximately doubled.

Sort/Merge, 360N-SM-483

The DOS Tape and Disk Sort/Merge provides support for the 2314/2319 Disk Storage facility. In addition to the features provided by the other 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

This sort/merge program enables the user to sort files of unsequenced records into one sequential file. The control data information can be read from as many as 12 fields in each record. The program assumes that input records for a sort operation are in random sequence. However, if an inherent sequencing exists, the program takes advantage of it.

Records can be sorted or merged into ascending or descending sequence, and an individual sequence can be specified for each control-data field. The output sequence for a merge-only operation must be the same as the input sequence.

Minimum System Requirements -- A 10K for S/370 partition for 2311 and 2400 sorts, and a 22K partition for 2314/2319 sorts.

This sort is designed to be tailored at system generation time to meet the specific requirements of the customer installation. The following facilities can be included at system generation:

- The entire Sort/Merge Library
- The entire Sort Library
- The entire Merge Library
- A 2400 Sort Library
- A 2311 Sort Library
- A 2314/2319 Sort Library

DOS UTILITIES

Current DOS utilities have been divided into three groups in order to simplify ordering and maintenance. Each group is itemized and described below. The disk-oriented utilities will support file transfer to and from the 2311 and 2314/2319. The following features are available in most of the programs:

- Moving and copying a logical file or part of a logical file from one volume to another.
- Copying a logical file from one location to another on the same volume.
- Printing and/or punching a logical file.
- Field selecting, blocking, and deblocking records.
- Computing I/O area assignments based on available storage space and the size of the input and output blocks. Maximum advantage of device and process overlap for a given block size is taken.
- Label checking.
- Skipping a number of input records before processing begins.

The utilities will be distributed for operation in the background partition, but may be linkage edited by the user to operate in a Batched Job Foreground partition.

Group 1 Utilities (360N-UT-461) is a prerequisite for using Group 2 and/or Group 3.

Group 1 (Unit Record and Disk) Utilities, 360N-UT-461

Card to Printer and/or Punch - Transfers binary or EBCDIC data from cards to a printer and/or a card punch.

For Card to Printer only - prints in one of two formats:

- Data Display - prints all of the block.
- Data List - prints one line for each data record.

Card to Disk - Transfers binary or EBCDIC data from cards to disk, with or without key fields.

Disk to Card - Transfers data from disk to cards. The disk file may or may not have key fields. Data may be punched in either EBCDIC or binary.

Disk to Printer - Prints a disk file in one of two formats:

- Data Display - prints all of a disk block.
- Data List - prints one line for each data record.

Disk to Disk - Transfers the data from one disk file to another. The input and/or output file may or may not have key fields.

Clear Disk - Clears one or more areas of 2311, 2314, 2319 or 3330/3333 disk storage, and establishes pre-formatted tracks containing an indicated base throughout the area cleared.

VTOC Display - Provides the means of displaying the individual labels in the Volume Table of Contents from either a system pack or a data pack. The labels are identified by location within the VTOC and their format, type, and major fields are indicated by appropriate heading lines.

Initialize Disk - This program performs the functions of BPS/360 16K Initialize Disk (2311/2314/2319), 360P-UT-206. It prepares a complete disk pack for use on the 2311, 2314, 2319.

Alternate Track Assignment - This program assigns an alternate track to a defective track or changes from defective to nondefective the flag indicating the track's condition. A parameter allows for the bypassing of surface analysis when running the initialize disk utility.

Copy Disk to Card and Restore Card to Disk - These programs permit the user to transfer a file or a volume of data from disk to cards, and to restore that data to a disk pack at a later date. The restored records occupy areas of the disk pack identical to the original file. Consecutive, Indexed Sequential, and Direct Access methods of file organization are supported with a copy volume feature.

Both the Copy and the Restore programs write checkpoint records enabling them to be restarted at the end of a new extent or after processing 80 tracks of an extent. The checkpoint file may be assigned to either disk or to tape.

An additional option permits copying IPL records during a copy file job.

The output created by the copy program is designed for use by the DOS Restore Program only.

Copy and Restore Disk to Disk - This program performs the same function as the Copy/Restore Disk to Card programs without the intermediate storage medium.

Group 2 (Magnetic Tape) Utilities, 360N-UT-462

Tape to Printer - Prints a tape file in one of two formats:

- Data Display - prints all of a tape block.
- Data List - prints one line for each data record.

Card to Tape - Transfers Binary or EBCDIC data from cards to magnetic tape.

Tape to Card - Transfers data from magnetic tape to cards. Data may be punched in either EBCDIC or binary.

Disk to Tape - Transfers data from a disk file to a tape file. The disk file may or may not have key fields.

Tape to Disk - Transfers data from a tape file to a disk file. The disk file may or may not have key fields.

Tape to Tape - Transfers the data from one tape to another.

Data Cell to Tape - Transfers data from a data cell file to a tape file. The data cell file may or may not have key fields.

Tape to Data Cell - Transfers data from a tape file to a data cell file. The data cell file may or may not have key fields.

Tape Compare - Compares two files from two or more tapes to ensure that the files are identical.

Copy and Restore Disk to Tape - These programs perform the same functions as the Copy/Restore Disk to Card programs but substitute tape as the intermediate storage medium.

Group 3 (Data Cell) Utilities, 360N-UT-463

Data Cell to Printer - Prints a data cell file in one of two formats:

- Data Display - prints all of a data cell block.
- Data List - prints one line for each data record.

Disk to Data Cell - Transfers data from a disk file to a data cell file. The input and/or output file may or may not have key fields.

Data Cell to Disk - Transfers data from a data cell file to a disk file. The input and/or output file may or may not have key fields.

Data Cell to Data Cell - Transfers the data from one data cell file to another. The input and/or output file may or may not have key fields.

Clear Data Cell - Clears one or more areas of 2321 data cell storage, and establishes pre-formatted tracks containing an indicated base throughout the area cleared.

Initialize Data Cell - Prepares from one to five cells for use on a 2321 Data Cell Drive.

Assign Alternate Track - Assigns an alternate track on an IBM 2321 Data Cell at a time other than data cell initialization.

Multiprogramming Support Utility Macros, 360N-UT-471

Macros provide the user of DOS with a direct and easy means of generating efficient file-to-file utility programs tailored to his specific needs. The generated utility programs are designed to operate as foreground programs within the multiprogramming environment of DOS, but can also operate as background programs. These macros may be combined with user programs to produce either generalized or specific file processing programs.

These macros will produce self-relocating object code that will provide input/output control functions such as:

- . Opening and closing files, including label processing.
- . Blocking/deblocking fixed length records.
- . Printer forms and stacker selection control.
- . User exits before, during, and upon completion of record processing.

DOS System Utility Programs, 370N-UT-491

DOS System Utility Programs assist the user in accomplishing common system oriented utility functions, such as initializing tape and disk volumes, copying and restoring disk packs for back-up purposes and printing the contents of disk data set labels.

The units supported by the DOS System Utilities are:

- card units : 1442, 2501, 2520, 3504/3505, 3525, 2540
- tape units : 2400-series, 3400-series
- DASD : 2311, 2314, 2319, 2321, 3330/3333
- printers : all printers supported as SYSLST or SYSLOG by IOCS.

The utility functions provided are:

Assign Alternate Track-Disk

The program functions are to assign an alternate track to a defective track on disk, to change the flag indicating the track's condition from non-defective to defective and, if update records are supplied as input, to replace bad records on a track. The alternate track may be assigned either unconditional or conditional, based on the result of a surface analysis. For a 3330 only unconditional alternate track assignment is possible.

Assign Alternate Track-Data Cell

Same functions as Assign Alternate Track-Disk, for a 2321 Data Cell.

Clear Disk

Clears one or more areas of disk and establishes preformatted tracks containing an indicated base through out the area cleared.

Clear Data Cell

Same functions as Clear Disk, for a 2321 Data Cell.

Copy and Restore Disk to Card

Permits the user to copy of volume or a file of data from Disk to Cards and to restore that data to a disk pack of the same type on a later date. The restored records occupy areas of the Disk pack identical to the original volume or file. Sequential, Indexed Sequential and Direct Access files are supported.

The copy and restore programs provide checkpoint and restart facilities. The checkpoint file may be assigned to either disk or to tape.

The output created by the copy program is designed for use by the DOS restore program only.

Copy Disk to Disk

Permits the user to copy a volume or a file of data from one disk pack to another disk pack of the same type. The output records occupy areas identical to the input volume or file. Sequential, Indexed Sequential and Direct Access files are supported.

Copy and Restore Disk or Data Cell to Tape

Permits the user to copy a volume or a file of data from Disk or Data Cell to tape and to restore that data to a disk pack or Data Cell of the same type on a later date. The programs perform equivalent functions as the Copy and Restore Disk to Card programs.

Initialize Disk

For 2311, 2314 and 2319 disk packs, the initialization consists of VTOC label checking, home address generation, surface analysis and track descriptor record (RO) generation, volume label creation, IPL and TOC creation. A volume can be initialized with or without surface analysis (i.e., a test for defective tracks); however, a surface analysis should be included when a volume is initialized for the first time.

For 3330 disk packs, the initialization consists of VTOC label checking, track descriptor record (RO) generation, volume label creation, IPL and VTOC creation. No surface analysis or home address generation may be performed.

Initialize Data Cell

Prepares one to five cells for use on a 2321 Data Cell drive. The initialization of a Data Cell is identical to the initialization of a 2311 disk pack.

Initialize Tape

Prepares up to sixteen tape volumes. The program prepares up to eight volume labels, one dummy header label and a tape mark for each tape volume submitted. This program

may be used to initialize either EBCDIC tapes with IBM Standard Volume labels or ASCII tapes with ANSI Standard Volume labels.

VTOC Display

This program is used to display the labels contained in the Volume Table of Contents to enable the user to keep track of his files and their extents. The labels are identified by locations within the VTOC and their format, type and major fields are indicated by appropriate heading lines.

EMULATORS

1401/1440/1460 Emulator Programs Under DOS	Allows the user
<u>Compatibility Support/30 (CS/30)</u> - 360N-EU-484	to run 1401/
<u>Compatibility Support/40 (CS/40)</u> - 360N-EU-485	1440/1460
	programs under

the Disk Operating System in conjunction with following machine features:

Model 25 - 1400 Series Compatibility (#4440) and 1401/1440/1460 DOS Compatibility (#4470) using CS/30.

Model 30 - 1401/1440/1460 Basic Compatibility Feature (#4456) and Programmed Mode Switch (#5856).

Model 40 - 1401/1440/1460 DOS Compatibility Feature (#4460).

This allows 1400 programs to be run in a stacked-job environment mixed with System/360 jobs. All initialization required by the Basic Compatibility Features are handled by the emulator programs except for disk. Initialization and clearing of disk packs is performed by options in the DOS Initialize Disk utility program and in the DOS Clear Disk utility program. All of the 1400 CPU instructions are executed by the compatibility features except the Move Character and Edit (MCE) and Move Character and Suppress Zeros (MCS) instructions, which are executed by a macro in the CS/40 program. The emulator programs use the physical IOCS capabilities of the Disk Operating System to simulate the 1400 I/O instructions. In addition, when the 1400 end-of-job halt is recognized, the emulator programs call DOS Job Control to provide transition to the next job. 1400 error conditions may be trapped automatically to the operator to allow operator intervention or an abnormal end of job with a 1400-style main storage dump, followed by a release to end of job.

There are three main levels of support for the emulator programs. They are:

- . **1400 Unit Record:** Support for 1400 card programs and for reading and punching both BCD and binary data is provided.
- . **1400 Tape:** Support is provided for 1400 tape operations under the emulator program. This support enhances the performance of 1400 original equipment and requires no reprogramming of 1400 programs written consistent with 1400 SRL manuals published by IBM.
- . **1400 Disk:** Support is provided for 1311 Disk Storage Drives and 1301 and 1405 Disk Storages. Disk Programming Support offers full upward and downward compatibility between the CS/30 under DOS and the Model CS/40 under DOS. Upward disk compatibility is provided between Models 25/30/40 stand-alone emulation and the Model 30/40 emulator programs under DOS.

The CS/30 emulator program can be executed on both the S/360 Models 25 and 30 in any partition of DOS that provides a batched job environment; however, CS/30 emulator programs cannot be executed concurrently.

Certain generated optional emulator routines and functions are now transient. This change results in a significant reduction in the amount of main storage required by the CS/30 emulator program. The main storage savings realized depends upon the options selected by the user at emulator generation time.

When the 1400 Storage Relocation Feature (#4462) is installed on the Model 40, the CS/40 emulator program can be executed in any partition of DOS that provides a batched job environment. CS/40 emulator programs can also be executed concurrently in up to and including three partitions of DOS. The 1400 Storage Relocation Feature allows in multiples of 16,384 (16K) thru 114,688 (112K) bytes. The DOS Supervisor increases approximately 1,600 bytes in size when the relocation of simulated 1400 storage is specified at DOS system generation time.

When executing the emulator in a multiprogramming environment it may be desirable to assign SYSRDR and SYSIPT (the combination known as SYSIN) to a magnetic tape unit or disk extent. If SYSIN is assigned to a magnetic-tape or disk unit, that device must input all of the control cards that normally are included in the job stream.

SYSIPT, SYSLST, and SYSPCH can be either sequential or split-cylinder in organization. Other forms of disk organization are not supported.

The assignment of SYSIN to a magnetic tape or disk for the background program also makes the card reader available to read the control cards and data cards for a foreground program. This has the effect of reducing the number of statements entered by the operator from the console typewriter.

Most 1400 unit-record output (card and printer) can be produced through concurrent peripheral operations by assigning the card punch SYSPCH and/or the printer SYSLST to either a magnetic tape or disk.

The following are system requirements configuration for CS/30 on the Model 25.

- System/360 Model 25 with a 2025 Processing Unit containing at least 24,576 (24K) bytes of Program Storage.
- 1400 Series Compatibility Feature (#4440) and 1401/1440/1460 DOS Compatibility (#4470)
- Storage Protection Feature (#7520) for Multiprogramming
- One card reader (1442, 2501, 2520 or 2540, 2560 with 2540 Emulation or Control Feature (see note 3))
- One card punch (1442, 2520 or 2540) (see note 3)
- One printer (1403, 1404 or 1443) (see note 3)
- One 1052 Printer Keyboard
- Integrated 2311 Attachment (#4598) for attaching up to four 2311 Disk Storage Drives Model 1's ... includes File Scan Capability
- One 2311 Disk Storage Drive for DOS System Residence
- Whatever systems configuration is required for operation of the user's Disk Operating System.

The following are system requirements configuration for CS/30 on the Model 30.

- System/360 Model 30 with a 2030 Processing Unit containing 24,576 (24K) bytes of main storage (the amount of actual storage is variable, depending on the features of the CS/30 program and the features of the Disk Operating System that are included in the program).
- 1401/1440/1460 Basic Compatibility Feature (#4456)
- Programmed Mode Switch Feature (#5856)
- Decimal Arithmetic Feature (#3237)
- Storage Protection Special Feature (#7520) for multiprogramming
- File Scan Feature (#4385) (supported, but not required)
- I/O Compatibility Features for customer-engineer diagnostics of supported devices (recommended, but not required):
 - Column Binary (#1990)
 - 1402/1403 (#4463) or 1442/1443 (#4464) Attachment
 - Console Inquiry Station (#4465)
 - Disk Storage Drives (#4466)
 - Magnetic Tapes (#4467) for multiplexer and #4468 for selector channels)
- Standard instruction set (see Note 1)
- One I/O channel (either multiplexer or selector) (see Note 2)
- One card reader (1442, 2501, 2520 or 2540) (see Note 3)
- One card punch (1442, 2520, or 2540) (see Note 3)
- One printer (1403, 1404, 1443 or 3211) (see Note 3)
- One 1052 Printer-Keyboard
- 1051 Attachment (#7915)
- 1051 Control Unit with CPU Attachment (#3130)
- One 2311 Disk Storage Drive or 2314 Direct Access Storage Facility for DOS System Residence
- Whatever systems configuration is required for operation of the user's Disk Operating System

The following are system requirements for a Model 40 configuration for the emulator program:

- System/360 Model 40 with a 2040 Processing Unit containing 32,768 (32K) bytes of main storage
- 1401/1460 Compatibility Feature #4457 and 1311 Disk Compatibility Feature #9710 (see Note 4)
- 1401/1440/1460 DOS Compatibility Feature (4460) (see Note 4)
- File Scan Feature (#4385) (supported, but not required)
- Decimal Arithmetic Feature (#3237)
- Storage Protection Special Feature (#7520) for multiprogramming
- Standard instruction set (see Note 1)
- One I/O channel (either multiplexer or selector) (see Note 2)
- One card reader (1442, 2501, 2520, or 2540) (see Note 3)
- One card punch (1442, 2520, or 2540) (see Note 3)
- One printer (1403, 1404, 1443 or 3211) (see Note 3)
- One 1052 Printer-Keyboard
- 1052 Adapter (#7920)

- One 2311 Disk Storage Drive or 2314 Direct Access Storage Facility for DOS System Residence
- Whatever systems configuration is required for operation of the user's Disk Operating System
- 1401/1440/1460 Relocatable DOS Compatibility Feature #4462 (supported but not required).

Note 1: DOS language translators may require extended instruction sets.

Note 2: DOS telecommunications require a multiplexer channel and at least one selector channel.

Note 3: One 2400-Series Magnetic Tape Unit (7- or 9-track) may be substituted for this device. (If SYSIPT, SYSPCH, or SYSLST are assigned to 7-track tape units, the Data Conversion Feature is required.)

Note 4: When the 1401/1440/1460 DOS Compatibility Feature 4460 is installed, the operation of the Model 40 emulator (360C-EU-074) is excluded on the system.

Once the minimum configuration requirements are met, the configuration may range from a card-oriented System/360 Model 25/30/40 to a maximum configuration of disk, tape, and teleprocessing. Tape and teleprocessing are mutually exclusive on the Model 25 under DOS.

CS/30 has the capability to execute in any partition of DOS that is initiated in batch job mode. However, CS/30 emulator programs cannot be executed concurrently.

CS/40 has the capability if the 1401/1440/1460 Relocatable DOS Compatibility Feature (#4462) is installed on the Model 40, to execute in any partition of DOS that is initiated in batch job mode. This feature provides the relocation of simulated 1400 storage boundaries to multiples of 16,384 bytes beginning at location 16,384 and extending up to and including location 114,688. With this feature installed, concurrent execution of CS/40 emulator programs is provided in up to and including three partitions of DOS.

One of the objectives of CS/30, CS/40 is to provide flexibility of external devices for the user who needs to grow and requires system availability to do so. 1400 programs operating under the CS/30, CS/40 can request I/O operations on the following System/360 devices:

- 1442, 2520, 2540 Card Read Punch, or 2501 Card Reader
- 1403 (for continuous-forms operations), 1404 (for continuous-forms and cut-card operations), 3211 or 1443 Printer
- 1052 Printer-Keyboard (for operator communications)
- 2311 Disk Storage Drive or 2314 Direct Access Storage Facility
- 2400/3400-Series Magnetic Tape Units (and Controls)

Input/output device correspondence between a 1401, 1440, or 1460 system and a System/360 Model 25/30/40 is as follows:

<u>1401/1440/1460 I/O Device</u>	<u>System/360 I/O Device</u>
1402 or 1442* Card Read Punch or 1444 Card Punch	2501 Card Reader or 1442, 2520, or 2540 Card Read Punch*
1403, 1404***, or 1443 Printer	1403, 1404***, 1443 or 3211** Printer
729, 7330, or 7335 Magnetic Tape Unit	2400/3400-Series Magnetic Tape Unit (and Control)†
1407 Console Inquiry Station or 1447 Console	1052 Printer-Keyboard
1301 or 1405 Disk Storage or 1311 Disk Storage Drive	2311 Disk Storage Drive or 2314 Direct Access Storage Facility

* 1442 reading and punching into the same card can be simulated by the punch unit on the 2540 (if the PFR feature is installed), by the 1442 Model N1, or by the 2520 Model B1.

** 3211 Printer for System/360 Models 30 and 40 only.

*** The 1404 Printer should be used if cut-card operations are to be simulated; otherwise, 1403 or 1443 should be used.

Additional features supported by CS/30, CS/40 are: Timer feature ... Simultaneous Read-While-Write Tape Control (2404 or 2804) ... Any channel configuration up to one multiplexer channel and two selector channels ... Tape Switching Unit (2816) ... Universal Character Set ... Multiple Character Set (on 2025).

Input/Output feature correspondence between a 1401, 1440, or 1460 system and a System/360 Model 25/30/40 is as follows:

<u>1401/1440/1460 I/O Feature</u>	<u>System/360 I/O Feature</u>
1402 Punch Feed Read and Control Unit (#5890 and #5895)	2540 Punch Feed Read (#5890); Punch Feed Read Control (#5895) on the 2821 Control Unit* or on the Integrated 2540 Attachment (#4595) on 2025
Column Binary Feature (#1990)	Column Binary Feature (#1990) must be installed on the 2821 Control Unit (standard on Integrated 2540 Attachment (#4595) on 2025)
Binary Transfer Feature (#1468)	

Card Image Feature (#1531)

Card Image Feature (#1532)

cont'd

1402 51-Column Interchangeable Read Feed (#4150) and Feed Adapter (#1013)

1403 Preferred Character Set (#5523) and Adapter (#5524)
1416 Interchangeable Train Cartridge equipped with Preferred Character Set Print Chain

Scan Disk (#6396)

2540 51-Column Interchangeable Read Feed (#4151)**

1403 Universal Character Set*** for Model 2 (#8641) or Model N1 (#8640) with pre-requisite Interchangeable Train Cartridge Adapter or Interchangeable Train Cartridge, and appropriate Universal Character Set Adapter and the 2821 Control Unit or 1403 Multiple Character Set*** (#5110 on Model 2, #5111 on Model N1) with Multiple Character Set Adapter (#5100) on Integrated 140 Attachment (#4590) on 2025 or 3211 Print with 3811 Control Unit

File Scan (#4385) must be installed on the 2841 Storage Control Unit (standard on Integrated 2311 Attachment (#4598) on 2025)

* If stacker selection of punch-feed-read cards is to be simulated, 2540 Compatibility Attachment (8065) must be installed on the 2821 Control Unit not required on Integrated 2540 Attachment (4595) on 2025.
** When this feature is installed, reading speed is permanently reduced from 1000 cpm to 800 cpm.
*** With this feature, printing speed is dependent upon the number of characters in the character set and if unprintable characters are included in the print line.
† 3420 Magnetic Tape Units for System/360 Model 30 and 40 only

The CS/30, under DOS in conjunction with the 1401/1440/1460 Basic Compatibility Features (#4456) on Model 30 or 1401/1440/1460 DOS Compatibility feature (#4470) on Model 25 provide support for all 1401, 1440, and 1460 standard operations and instructions, CS/40 with the 1401/1440/1460 DOS Compatibility Feature (#4460) provides support for all the basic 1401/1460 features, and the following special features (for those items followed by an asterisk, refer to the list of I/O feature correspondence): Advanced Programming (#1060) for the 1401 ... Bit Test (#1470) ... Column Binary (#1990)* ... Binary Transfer (#1468) for the 1460* ... Expanded Print Edit (#3835) [CS/30] ... 51-column Interchangeable Read Feed (#4150)* ... High-Low-Equal Compare (#4575) ... Multiply-Divide (#5275) ... Print Storage (#5585) ... Additional Print Control (#5540) ... Punch-Feed Read (#5890)* ... Space Suppression (#7426) ... Sense Switches (#7600) ... Scan Disk (#6396)* ... Direct Seek (#3281, 3282, 3283) for the 1311 ... Track Record (#8011) for the 1311 ... Indexing and Storage Address Register (#4631) for the 1460 ... Processing Overlap (#5730) [CS/40].

Note: Processing Overlap is not available as such, but overlap is provided by the emulator program for tape, disk, and 1400 unit record devices.

The following units and features, supported by DOS, are not supported by the CS/30, CS/40 programs: 1445 Printer ... 2671 Paper Tape Reader ... 2321 Data Cell Drive ... 1285 and 1287 Optical Readers ... 1255, 1259, 1412, and 1419 Magnetic Character Readers ... 7770 and 7772 Audio Response Units ... Selector Tape Listing Features (1403) for continuous paper tape ... Teleprocessing Devices.

Note: The 1255, 1259, 1412, and 1419 Magnetic Character Readers require special consideration if utilized while the emulator program is operating.

1401/1440/1460, 1410/7010 Emulation on System/370 Models 135, 145, and 155 (360N-EU-490): Compatibility features, supported by Type I emulator programs under

DOS are available on the models 135, 145 and 155 as indicated in the following table:

	1401/1440/1460 Compatibility	1401/1440/1460/1410/7010 Compatibility
Model 135	Feature #4457	1410/7010 Compatibility not supported
Model 145	Feature #4457	Feature #4458
Model 155	Supported with Feature #3950, as indicated in next column	Feature #3950

The 1401/1440/1460 Emulator Program, using the appropriate compatibility feature, enables programs written for these systems to run on System/370 models 135, 145 and 155.

Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 1,400 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiply-Divide, Processing Overlap, Sense Switches, Advanced Programming/Indexing, Bit test, Print Storage, Additional Print Control, Space Suppression, Column Binary, Binary Transfer, 51-Column Card, Punch-Feed Read, Card Image (on 1442), Selective Stacker.

The following features and operations are not emulated: Selective Tape Listing (on 1403), Compressed Tapes, Read Compare (1404).

The input/output devices not emulated are: 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices, Audio Response Units, and 1404 printer in cut card mode.

The 1401 Model G is emulated.

The emulator program takes advantages of the multiprogramming facilities of the Disk Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system and it takes advantage of the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and System/370 jobs can be placed in a single input job stream for processing.

Card, tape, and disk programs are emulated. Cards and tapes used and produced by the 1401/1440/1460 system or by other emulated programs, and mixed parity tapes, are emulated.

For additional information regarding performance, system requirements, Device correspondence and emulator file creation, see P-360-C section of "Program".

The 1410/7010 Emulator Program

Using the appropriate Compatibility Feature, allows programs written for those systems to run on System/370 models 145, and 155. Most 1410/7010 programs require no changes for execution under the emulator, although certain special custom features are not emulated. Emulation is provided for 1410/7010 systems with main storage sizes from 10K to 100K positions of core storage.

All basic features are emulated, along with the following optional features: Processing Overlap ... Priority Processing ... Two Channels on 1410 ... Inverted Print Edit ... 7010 Second, Third, and Fourth Data Channels ... 7010 Store and Restore Status ... 7010 Floating Point Arithmetic Feature.

The features and operations not emulated are: 1401/1410 Compatibility Mode ... Column Binary ... 51-Column Card ... 1410/7010 Diagnostic Instruction Branch on C bit ... 7010 Program Relocation and Storage Protection ... 7010 Interval Timer.

The input/output devices not emulated are: 1311 Disk Storage Drive ... 1405 Disk Storage ... 7340 Hypertape Drives ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Magnetic Character Readers ... Teleprocessing Devices ... Optical Readers ... Audio Response Units.

The emulator program takes advantage of the multiprogramming facilities of the Disk Operating System. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently.

The emulator program uses the data management services of the operating system, and takes advantage of the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator jobs and native mode jobs can be placed in a single input job stream for processing.

Card, tape and disk programs are emulated. Cards and tapes, used and produced by the 1410/7010 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program.

For additional information regarding emulator disk and tape file creation, performance and I/O device correspondence, see P-360-C section of "Program".

DIAGNOSTIC AIDS

On-Line Test Executive Program 360N-DN-481): The On-Line Test Executive Program (OLTEP) directs the selection, loading and execution of the On-Line Test Sections (OLTS) within the DOS environment.

This On-Line Test System is designed to allow the testing of Input/Output hardware components of a system, concurrent with the running of customer jobs.

The OLTEP/OLT System is for:

- Diagnosing I/O errors
- Verifying I/O Hardware repairs and Engineering Changes
- Exercising a device requiring dynamic adjustments
- Checking of I/O Hardware
- Providing integrity of customer data

As a background only job under DOS, it is called by standard Job Control Language and is under control of the Disk Operating System at all times. It uses Disk Operating System facilities to accomplish the testing and competes with other jobs in the system for use of these facilities while running in a multiprogramming environment.

Definition of Test Runs can be entered via console or non-console devices. Prompting is available on consoles to aid in defining test to be run.

Customer Engineering will supply the OLTs on magnetic tape or cards. They must be link edited into a Core Image Library in order to be used under the Disk Operating System.

Integrity of customer data sets is provided by OLTEP.

Recovery Management Support S/370 only

The Recovery Management routines for the System/370 models 135, 145 and 155 attempt to recover from and/or otherwise reduce the impact of machine malfunctions indicated by a machine-check or channel-check interruption. It features transparent recovery with a successful retry, continuation if the error is unrecoverable but the job or task can be terminated, and comprehensive environment record recording. RMS is included in the minimum supervisor for System/370.

The Recovery Management Support Recorder gathers information about the reliability of the systems hardware. The environmental records produced and recorded on the IJSYSRC data set will facilitate rapid diagnosis and repair by a CE.

Environmental Recording and Editing Program (EREP), 370N-UT-492

EREP is a DOS system utility program that runs as a problem program and that processes the RMSR output recorded on the Environmental Recording Data Set.

Operator selectable EREP options are provided so that the data on the SYSREC file and/or history RDE tape may be treated in various manners, such as

- editing/printing the entire IJSYSRC file
- selectively retrieving data from either the IJSYSRC file or the history/RDE tape for edit/print purpose
- controlling print format of tape oriented data when retrieving from either IJSYSRC or the history/RDE tape
- summarizing the data on the IJSYSRC file
- managing an IJSYSRC tape, an RDE tape, and a TES history tape
- summarizing or editing/printing the tape volume oriented data on the IJSYSRC file or the history/RDE tape.

The Reliability Data Extractor (RDE) Summary program summarizes system error data for the user of RDE. Analysis of the summarized hardware errors by the CE will facilitate rapid diagnosis and repair of system/subsystem errors.

EREP is self-relocating and will operate in any 10K byte partition. EREP will take advantage of additional available core storage to improve its performance.

Problem Determination Service Aids

PDAIDS consist of several debugging tools which may be used to advantage by both installation programmers and IBM CEs. The aids provided are:

- The option of tracing one of the following events, specified by the user, during the operation of a program.
 - . Fetching or loading of other programs (F/L Trace)
 - . Input/Output activity (I/O Trace)
 - . Supervisor calls (GSVC)
 - . Tracing consists of recording pertinent data, when the specified event occurs, which can then be used for error analysis.
 - . QTAM TRACE
- Transient Dump provides the facility of dumping to tape or printer the contents of the transient areas and relevant control information, at each program interruption. Its primary purpose is to aid in debugging system transient routines.

OTHER DIAGNOSTIC AIDS

Additional problem determination facilities are system capabilities to provide:

- Main storage alter - which allows the operator to alter from the console up to 16 bytes of main storage at an address he specifies.
- Main storage display - which allows the operator to display, in hexadecimal on the console, 16 Bytes of main storage from a specified address.
- Main storage dump - which allows the operator to initiate a dump of main storage to the system printer.
- Stand-alone dump - DUMPGEN produces a stand-alone dump program, tailored to individual installation requirements.
- Label cylinder dump - which provides a formatted listing of the SYSRES label cylinder.

Autotest, 360N-PT-459 (S/360 only)

Autotest is a debugging aid for object programs assembled by the Assembler and executed under DOS. Using Autotest, a test run can be performed as a normal job in a batch, with a minimum of operator intervention. Autotest monitors the execution of the program under test and provides the following facilities.

- . The creation of input data files by means of standard utility programs (IBM or user supplied).
- . Addition or deletion of instructions without reassembly.
- . Dump of any portion(s) of main storage, permanent storage assignments, general registers and/or floating point registers whenever a designated address is reached during program execution. The main storage dump can be in hexadecimal, character, floating point, fixed point, or mnemonic representation.
- . Dump of main storage at normal or abnormal end of job in hexadecimal, character and/or mnemonic representation. Source symbols can also be printed with the end-of-job dump.
- . A list of all phases in the sequence that they are called into main storage.
- . Print out of any output data files by means of standard utility programs (IBM or user supplied).

Autotest does not support the IBM 2314, 2319 or 3330/3333 Disk Storage.

COBOL to American National Standard COBOL Language Conversion, 360N-CV-489

The Language Conversion Processor (LCP) converts DOS COBOL D source programs into USA Standard COBOL source programs suitable for compilation by the USA Standard COBOL compiler under DOS. This LCP operates as a problem program under DOS.

The differences between the USA Standard COBOL language and the System/360 COBOL language are largely syntactical and the conversion process is primarily concerned with changing the format of selected COBOL statements. Because this process is mainly a routine clerical task, the LCP is provided to ease the conversion effort, reduce conversion costs, and minimize user involvement in the conversion.

Input

The input to the LCP must be a DOS COBOL D source program which adheres to the COBOL D specification and compiles and executes correctly under DOS COBOL D.

Output

A listing is produced which identifies all changes made to the original source program and flags statements requiring verification or manual conversion.

A converted source program may optionally be produced as output.

The amount of conversion is relative to the extent of use of COBOL D elements that differ in specification from the corresponding USA Standard COBOL elements. The LCP handles a majority of the items that must be considered when converting of the remainder, those items which require manual conversion are flagged with a warning message, the rest (which represent minor differences in processing in USA Standard COBOL rather than syntactical language differences) are unchanged.

The LCP requires a minimum partition size of 18K bytes of main storage. In addition to the requirements of the Disk Operating System, the Commercial Instruction Set is required for the execution of the Language Conversion Processor.

Note: The second character of the following component program identification numbers has been changed for Release 27.

COMPONENT	RELEASE	IDENTIFICATION
	26 27	
Sys Control/Basic IOCS	360 370	N-CL-453
Direct Access Method		N-IO-454
Sequential Disk IOCS		N-IO-455
Magnetic Tape IOCS		N-IO-456
ISFMS		N-IO-457
Paper Tape IOCS		N-IO-458
Assembler D (14K)		N-AS-465
BTAM		N-CQ-469
QTAM		N-CQ-470
Compiler I/O Modules		N-IO-476
Magnetic Character Reader		N-IO-477
Optical Character Reader		N-IO-478
On-Line Test Executive Prog		N-DN-481
System/370 Emulator		N-EU-490

RELEASE 26.1 BASIC PROGRAM MATERIAL (Available from PID) For S/360 User

Documentation -- Program material list and Attachment I to the basic program material list.

Machine Readable -- Appropriate material is distributed for the 2311 Resident System and the 2314 Resident System by specifying one of the program number extensions described below.

- 2311 users who specify Program Number Extension 2311A will receive all the DOS components listed below.
- 2311 users who specify Program Number Extension 2311 will receive all the DOS components listed below except the Model 30, Model 40, System/370 Emulator, ANS COBOL, Disk Sort/Merge, and Autotest.
- 2311 users who specify Program Number Extension 2311B will receive ONLY the Model 30, Model 40, System/370 Emulators, ANS COBOL, Disk Sort/Merge and Autotest. This Program Number Extension is provided for those users who originally ordered Program Number Extension 2311 and now wish to add one or more of the 2311 B components.
- The 2314 user should specify Program Number Extension 2314.

Note: PID will distribute Release 26.1 of DOS on 2316 Disk Packs provided that they have been initialized by the customer prior to being sent to PID. The disk should be initialized with one of the following programs: 360P-UT-206, 360P-UT-208 or 360N-UT-461. (All disks must have Volume ID 111111.)

The following is a list of the available components:

*2311 and 2314 Resident Systems	3-10	360N-SV-474
*Assembler D	3-8	AS-465
*Assembler F	3-9	AS-466
*COBOL D	3-10	CB-452
COBOL DASD Macros	3-1	CB-468
*American National Standard COBOL	3-4	CB-482
*System Control and Basic IOCS	3-10	CL-453
*BTAM	3-9	CQ-469
*QTAM	3-10	CQ-470
*Language Conversion Program	3-4	CV-489
*On Line Test Executive Program	3-7	DN-481
*Model 30 Emulator	3-7	EU-484
*Model 40 Emulator	3-6	EU-485
*System/370 Emulator	3-1	EU-490
Basic FORTRAN IV	3-9	FO-451
*FORTRAN IV	3-6	FO-479
*Direct Access Method	3-9	IO-454
*Sequential Disk IOCS	3-10	IO-455
*Magnetic Tape IOCS	3-10	IO-456
*ISFMS	3-10	IO-457
Paper Tape IOCS	3-4	IO-458
*Compiler I/O Modules	3-10	IO-476
*Magnetic Character Reader IOCS	3-10	IO-477
*Optical Character Reader IOCS	3-10	IO-478
*FORTRAN IV Library Subprograms	3-6	LM-480
*PL/I D	3-10	PL-464
Autotest	3-3	PT-459
Report Program Generator	3-9	RG-460
Tape Sort/Merge	3-8	SM-400
Disk Sort/Merge	3-8	SM-450
*Tape/Disk Sort/Merge	3-6	SM-483
*Group 1 Utilities - Unit Record/Disk	3-10	UT-461
*Group 2 Utilities - Tape	3-10	UT-462
Group 3 Utilities - Data Cell	3-7	UT-463
*MPS Utility Macros	3-10	UT-471
Vocabulary File Utility Program	3-3	UT-472

* Changed with this release

The DOS data is preceded by an initialize 2311/2314 Utility Program and a Restore Tape-to-Disk program.

IF A SYSTEM RESIDENCY IS NOT SPECIFIED, 2311 SYSTEM WILL BE FORWARDED.

OPTIONAL PROGRAM MATERIAL (For S/360 Users)

The optional volumes listed below have not been changed to Release 26.1 level. They are at Release 26.0.

Documentation -- Appropriate material delivered.

Machine Readable -- Source code is available on Magnetic Tape (2400') or Disk Pack as specified by Program Number Extension indicated in the following ordering information:

Program Number Extension	Program Component Name	Program Number
VOL1	System Control (VOL1)	360N-CL-453
	Basic IOCS (VOL2)	360N-CL-453
	Optical Character Reader IOCS	360N-IO-478
	Magnetic Character Reader IOCS	360N-IO-477
VOL2	Assembler	360N-AS-465
	Assembler F	360N-AS-466
VOL3	Group 1 Utilities - Unit Record Disk	360N-UT-461
	Group 2 Utilities - Tape	360N-UT-462
	Group 3 Utilities - Data Cell	360N-UT-463
	MPS Utility Macros	360N-UT-471
VOL4	COBOL	360N-CB-452
	Language Conversion Program	360N-CV-489
VOL5	Tape/Disk Sort/Merge	360N-SM-483
VOL6	Autotest	360N-PT-459
	Report Program Generator	360N-RG-460
	Basic FORTRAN IV	360N-FO-451
VOL7	BTAM	360N-CQ-469
	Vocabulary File Utility Program	360N-UT-472
	QTAM	360N-CQ-470
VOL8	PL/I (Volume 1)	360N-PL-464
	PL/I Continuation (Volume 2)	
VOL9	On-Line Test Executive Program	360N-DN-481
	Tape Sort/Merge	360N-SM-400
	Disk Sort/Merge	360N-SM-450
VOL10	System/370 Emulator	360N-EU-490
	FORTRAN IV	360N-FO-479
	FORTRAN IV Library Subprograms	360N-LM-480
VOL11	ANS COBOL (Volume 1)	360N-CB-482
	ANS COBOL Continuation (Volume 2)	

Each tape may also be restored to a 2316 Disk Pack on a 2314-type Disk Drive. When using a 2316 Disk Pack, the user should designate the device as a 2311 for all operations involving the restoring and using of the Disk Pack. However, it should be initialized as a 2316.

There is no optional program material for the following components: Consecutive Disk IOCS, 360N-IO-455; Consecutive Tape IOCS, 360N-IO-456; Direct Access Method, 360N-IO-454; ISFMS, 360N-IO-457; Consecutive Paper Tape IOCS, 360N-IO-458; COBOL DASD Macros, 360N-CB-468; Model 30 Emulator, 360N-EU-484; Model 40 Emulator, 360N-EU-485.

Source statements for the Supervisor - 2311 (6K), 360N-SV-474, and the Compiler Input/Output Macros, 360N-IO-476, are not available. See System/360 Disk Operating System, System Generation and Maintenance, GC24-5033-11, for information on these modules.

ORDERING INFORMATION: System Number 360N

Note: Both basic and optional machine readable material for this system is ordered by specifying a "System Line" (columns 1-7, 15-24) of the Program Order Form. Respecify the System Line for each different Program Number Extension. Component lines are NOT required.

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	2311	MT 7 DC/800	26	01
		MT 9/800	28	01
		MT 9/1600	29	01
		Disk 1316	52	02
	2311A	MT 7 DC/800	26	02
		MT 9/800	28	01
		MT 9/1600	29	01
		Disk 1316	52	03
	2311B	MT 7 DC/800	26	01
		MT 9/800	28	01
		MT 9/1600	29	01
		Disk 1316	52	01

IBM DISK OPERATING SYSTEM

Program Number Extension	Distribution Medium Type Code	User Volume Requirement	Supplement Number	TNL To	Base Form
			SCO-4451		GJD1-2040 - DOS IOCS-ISF MS
			4411		2059 - CE Aids
			4401		2058 - Sort Merge D/T
			4331		2052 - QTAM
			4321		2050 - BTAM
			4181		2046 - Util Group III
			4171		2045 - Util Group II
			4161		2044 - Util Group I
			4151		2043 - RPG
					2037 - Basic FORTRAN
					2036 - Sort Merge Disk
					2035 - Sort Merge Tape
					2038 - COBOL
					2056 - FORTRAN Lib. IV
					2049 - Assembler F
					2048 - Assembler
					2047 - PL/I
					2060 - ANS COBOL
					2062 - Lang. Conv. Prog.
			4371		
			4311		
			4301		
			4191		
			4420		
			4430		

Note:

For each program number extension (VOL1 thru VOL11) that is specified a separate reel of magnetic tape or 1316 disk pack is required.

ADDITIONAL PROGRAM MATERIAL (DOS Release 26.1)

Program Logic Manuals

DOS

System Control Introduction	GY24-5017-12
Librarian Maintenance and Service	GY24-5079-3
Linkage Editor	GY24-5080-3
IPL and Job Control	GY24-5086-5, TNL GN33-8740
Logical IOCS Introduction	GY24-5020-7, TNL GN33-8739
Unit Record, Magnetic Tape, and Compiler Files	GY24-5087-6, TNL GN33-8741
Sequential and Direct Access Files	GY24-5088-5
ISFMS	GY24-5089-4, TNL GN33-8743
BTAM	GY30-5001-6
QTAM	GY30-5002-4
Utilities	GY24-5023-3, TNL GN33-8747
Disk Sort/Merge	GY24-5021-1
Autotest	GY24-5027
FORTRAN IV	GY28-6394-1, TNL GN28-0415

DOS and TOS

OLTEP	GY24-5056-2, TNL GN24-5451
MPS Utilities	GY24-5045-4
Tape/Disk Sort/Merge	GY28-6645-2
Assembler	GY26-3642-4
Assembler F	GY26-3716-1, TNL GN33-8120
RPG	GY26-3701-1, TNLS GY21-0009, 0005
COBOL	GY24-5025-3
FORTRAN IV	GY24-5032
Subroutine Library	GY33-9013-1, TNL GN33-9108
PL/I Volume 1	GY33-9010-4
PL/I Volume 2	GY33-9011-2
PL/I Volume 3	GY33-9012-2
DOS 1401/1440/1460	
Emulator Program Compatibility Support 30	GY27-7164-2, TNL GN33-7013
DOS 1401/1440/1460	
Emulator Program Compatibility Support 40	GY27-7165-2, TNL GN33-7014
DOS: USA Standard COBOL	GY28-6392-2
Conversion Aids: COBOL-to-USA	GY28-6397-1
Supervisor and Related Transients	GY24-5151-3, TNL GN33-8744
Logical Transients	GY24-5152-2, TNL GN33-8745
System Service Programs	GY24-5153-3, TNL GN33-8746
DOS OLTEP	GT64-5154-2
Emulate the 1401/1440/1460 on S/370 145 and 155 using DOS	GY33-7008, TNLS GN33-7019, 7022
Emulate the 1410/7010 on S/370 145 and 155 using DOS	GY33-7009, TNLS GN33-7020, 7023

Reference Material: Order from Mechanicsburg only.

DOS TOS Assembler Specs	GC24-3414-9, TNL GN33-8157
DOS Tape Disk Sort/Merge Program	GC28-6676-5
DOS TOS PL/I Program Guide	GC24-9005-6, TNLS GN33-9124, 9130, 9129
DOS Emulator for Models 30 & 40	GC27-6940-5
BPS TOS BOS DOS Tape Labels	GC24-5070-3
DOS DASD Labels	GC24-5072-2
DOS Data Management Concept	GC24-3427-8
DOS TOS Utility Macro Specs	GC24-5042-6, TNL GN33-8697
DOS TOS Utility Specs	GC24-3465-7, TNL GN33-8738
DOS TOS COBOL Language Specs	GC24-3433-6
PL/I Subset Reference Manual	GC28-8202-3
DOS OLTEP	GT24-5086-2, TNL GN28-2535
DOS USA Standard COBOL Program	GC28-6398-3
360 DOS Emulator 370/155	GT33-2004-1
360 DOS Emulator 370/155 1410	GT33-2005-1

Program Listings - The DOS Assembly Listings (Source Statement Library) SSERV Listings, are available on microfiche from IBM Distribution Center, Publications Order Department, Mechanicsburg, PA. For complete decks at Release 26.1, order the base form as listed below. For the update portion only, order supplement number as listed below. The assembly listings are equivalent to the output listings produced by assembling the symbolic modules as required for each of the DOS components.

RELEASE 27 BASIC PROGRAM MATERIAL (Available from PID)

Documentation -- Memo to System/370 users. The following SRL publications are distributed with each initial DOS order:

Disk Operating System --

Version 4 Systems Generation	GC33-5008-0
Version 4 Messages	GC33-5009-0
DOS Version 4	GC33-5007-0

If only the publications or if additional copies of the publications are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Note: Six weeks after the availability of a release, all SRLs are available through the SRL subscription service. After this period, no form numbered documents will be shipped by PID with the machine readable material.

Machine Readable -- Appropriate material is distributed for the 2311 Resident System, the 2314 Resident System and the 3330 Resident System by specifying one of the program number extensions described below:

- 2311 users who specify Program Number Extension 2311A will receive all the DOS components listed below.
- 2311 users who specify Program Number Extension 2311 will receive all the DOS components listed below except S/370 Emulators, RPG, Tape Sort/Merge, Disk Sort/Merge, and ANS COBOL.
- 2311 users who specify Program Number Extension 2311B will receive ONLY the S/370 Emulators, RPG, Tape Sort/Merge, Disk Sort/Merge, and ANS COBOL. This Program Number Extension is provided for those users who originally ordered Program Number Extension 2311 and wish to add one or more of the 2311B components.
- The 2314 user should specify Program Number Extension 2314.
- The 3330 user should specify Program Number Extension 3330.

Note: PID will distribute Release 27.1 of DOS on 2316 Disk Packs provided that they have been initialized by the customer prior to being sent to PID. The Disk should be initialized with one of the following programs: 360P-UT-206, 360P-UT-208, or 360N-UT-461. (All disks must have Volume ID 111111.)

The following is a list of the available components:

*2311/2314/3330 Supervisor	4-0	370N-SV-495
*System Control and Basic IOCS	4-0	370N-CL-453
*Direct Access Method	4-0	370N-IO-454
*Sequential Disk IOCS	4-0	370N-IO-455
*Magnetic Tape IOCS	4-0	370N-IO-456
*Indexed Sequential File Management System	4-0	370N-IO-457
*Paper Tape IOCS	4-0	370N-IO-458
*Compiler I/O Modules	4-0	370N-IO-476
*Magnetic Character Reader IOCS	4-0	370N-IO-477
*Optical Character Reader IOCS	4-0	370N-IO-478
*Assembler D (14K)	4-0	370N-AS-465
*Basic Telecommunications Access Method	4-0	370N-CQ-469
*Queued Telecommunications Access Method	4-0	370N-CQ-470
**3735 Terminal Support	4-0	370N-CQ-493
*On-Line Test Executive Program	4-0	370N-DN-481
*System/370 Emulators	4-0	370N-EU-490
**System Utility Programs	4-0	370N-UT-491
**Environmental Recording and Editing Program	4-0	370N-UT-492
*Assembler F	3-10	360N-AS-466
*COBOL D	3-11	360N-CB-452
*American National Standard COBOL	3-5	360N-CB-482
*COBOL Language Conversion Program	3-4	360N-CV-489
COBOL DASD Macros	3-1	360N-CB-468
FORTRAN D	3-9	360N-FO-451
*FORTRAN F	3-7	360N-FO-479
*FORTRAN F Library Sub Program	3-7	360N-LM-480
*PL/I	3-11	360N-PL-464
Report Program Generator	3-9	360N-RG-460
Tape Sort/Merge	3-8	360N-SM-400
*Disk Sort/Merge	3-9	360N-SM-450
*Modular Sort/Merge	3-7	360N-SM-483
*Group 1 Utilities, Unit Record/Disk	3-11	360N-UT-461
*Group 2 Utilities, Tape	3-11	360N-UT-462
Group 3 Utilities, Data Cell	3-7	360N-UT-463
MPS Utility Macros	3-10	360N-UT-471

* changed with this release
** new with this release

The DOS data is preceded by an initialize 2311/2314/3330 Utility Program and a Restore Tape-to-Disk program.

IF A SYSTEM RESIDENCY IS NOT SPECIFIED, 2311 SYSTEM WILL BE FORWARDED.

OPTIONAL PROGRAM MATERIAL

Documentation -- Appropriate material delivered.

Machine Readable -- Source code is available on Magnetic Tape (2400') or Disk Pack as specified by Program Number Extension indicated in the following ordering information:

Program Number Extension	Program Component Name	Program Number
VOL1	System Control (VOL1)	370N-CL-453
	Basic IOCS (VOL2)	370N-CL-453
	Optical Character Reader IOCS	370N-IO-478
	Magnetic Character Reader IOCS	370N-IO-477
	EREP	370N-UT-492
VOL2	Assembler D	370N-AS-465
	Assembler F	360N-AS-466
VOL3	Group 1 Utilities - Unit Record Disk	360N-UT-461
	Group 2 Utilities - Tape	360N-UT-462
	Group 3 Utilities - Data Cell	360N-UT-463
	MPS Utility Macros	360N-UT-471
	System Utilities	370N-UT-491
VOL4	COBOL D	360N-CB-452
	Language Conversion Program	360N-CV-489
VOL5	Modular Sort/Merge	360N-SM-483
VOL6	Report Program Generator	360N-RG-460
	Basic FORTRAN IV	360N-FO-451
VOL7	BTAM	370N-CQ-469
	3735 Terminal Support	370N-CQ-493
	QTAM	370N-CQ-470
VOL8	PL/I (Volume 1)	360N-PL-464
	PL/I Continuation (Volume 2)	
VOL9	On-Line Test Executive Program	370N-DN-481
	Tape Sort/Merge	360N-SM-400
	Disk Sort/Merge	360N-SM-450
	PDAIDS/RAS/3211/IPL Disk	370N-CL-453
VOL10	System/370 Emulator	370N-EU-490
	FORTRAN IV	360N-FO-479
	FORTRAN IV Library Subprograms	360N-LM-480
VOL11	ANS COBOL (Volume 1)	360N-CB-482
	ANS COBOL Continuation (Volume 2)	
VOL12	Maintenance volume for VOL1 through VOL11	

Each tape may also be restored to a 2316 or 3336 Disk Pack.

There is no optional program material for the following: Sequential Disk IOCS, 370N-IO-455; Magnetic Tape IOCS, 370N-IO-456; Direct Access Method, 370N-IO-454; ISFMS, 370N-IO-457; Paper Tape IOCS, 370N-IO-458; COBOL DASD Macros, 360N-CB-468.

Source statements for the Supervisor, 370N-SV-474, and the Compiler Input/Output Macros, 370N-IO-476, are not available.

ORDERING INFORMATION: System Number 370N

Note: Both basic and optional machine readable material for this system is ordered by specifying a "System Line" (columns 1-7, 15-24) of the Program Order Form. Re-specify the System Line for each different Program Number Extension. Component lines are NOT required.

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	2311	MT 7DC/800	26	01
		MT 9/800	28	01
		MT 9/1600	29	01
		Disk 1316	52	02
	2311A	MT 7DC/800	26	02
		MT 9/800	28	01
		MT 9/1600	29	01
		Disk 1316	52	03
	2311B	MT 7DC/800	26	01
		MT 9/800	28	01
		MT 9/1600	29	01
		Disk 1316	52	01
2314	MT 7DC/800	26	02	
	MT 9/800	28	01	
	MT 9/1600	29	01	
	Disk 2316	57	01	
3330	MT 7DC/800	26	02	
	MT 9/800	28	01	
	MT 9/1600	29	01	

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Optional	VOL1	MT 7DC/800 26	01
	thru VOL12	MT 9/800 28	01
		MT 9/1600 29	01
	VOL2 thru 7, 9 & 10	Disk 1316 52	01
	VOL1, 8 & 11	Disk 1316 52	02

Program Listings - The DOS Assembly Listings (Source Statements Library) SSERV Listings, are available on microfiche from IBM Distribution Center, Publications Order Department, Mechanicsburg, PA. Since Release 27 operates only on System/370, new order numbers have been assigned for microfiche.

Note:

For each program number extension (VOL1 thru VOL12) that is specified a separate reel of magnetic tape or 1316 disk pack is required. VOL12 must be ordered as it contains the maintenance against the other optional 11 volumes.

Microfiche list of form numbers and corresponding TNLs

Microfiche 27.1

Form Number	Component	TNL
GYC7-1900	370N-AS-465	GNC7-1903
GYC7-1901	370N-CL-453	GNC7-1904
GYC7-1902-1	370N-IU-454	Complete Replacement
GYC7-1903	370N-IU-455	GNC7-1905
GYC7-1904	370N-IU-456	GNC7-1906
GYC7-1905	370N-IU-457	GNC7-1907
GYC7-1906	370N-IU-458	No Change
GYC7-1907	370N-UT-491	GNC7-1908
GYC7-1908	370N-UT-492	GNC7-1909
GYC7-1909	370N-CQ-469	GNC7-1910
GYC7-1910	370N-CQ-470	GNC7-1911
GYC7-1911	370N-CQ-493	No Change
GYC7-1912	370N-DN-481	No Change
GYC7-1913	370N-EU-490	GNC7-1912
GYC7-1914	370N-IU-476	GNC7-1913
GYC7-1915	370N-IU-477	GNC7-1914
GYC7-1916	370N-IU-478	GNC7-1915
GYC7-1917-1	Master Index	Complete Replacement
GYC7-1918	360N-AS-466	No Change
GYC7-1919	360N-CB-452	No Change
GYC7-1920	360N-CB-482	No Change
GYC7-1921	360N-CV-489	GNC7-1916
GYC7-1922	360N-FO-479	GNC7-1917
GYC7-1923	360N-LM-480	No Change
GYC7-1924	360N-PL-464	GNC7-1918
GYC7-1925	360N-SM-450	No Change
GYC7-1926	360N-SM-483	GNC7-1919
GYC7-1927	360N-UT-461	GNC7-1920
GYC7-1928	360N-UT-462	GNC7-1921
GYC7-1930	360N-UT-463	
GYC7-1931	360N-UT-471	
GJD1-2032	360N-CB-468	No Change
GJD1-2037	360N-FO-451	No Change
GJD1-2043	360N-RG-460	No Change
GJD1-2035	360N-SM-400	No Change

ADDITIONAL PROGRAM MATERIAL (DOS Release 27.1 Version 4)

Program Logic Manuals

<u>DOS</u>	
<u>OLTEP</u>	<u>GY24-5154-3</u>
370 DOS Version 4 Basic Telecommunications Access Method	
1401/1440/1460 DOS Emulator on Models 135/145/155	<u>GY27-7245-1</u>
1410/7010 DOS Emulator on Models 145/155	GY33-7008-0, TNLs <u>GN33-7022</u> , GN33-7019
Introduction to DOS Logic*	GY33-7009-0, TNLs <u>GN33-7023</u> , GN33-7020
Supervisor and Related Transients*	
Local Transients*	
Systems Services*	
IPL and Job Control*	
Linkage Editor*	
Librarian Maintenance and Service*	
LIOCS 1*	
LIOCS 2*	
LIOCS 3*	
LIOCS 4*	
Systems Utilities*	

* To be announced in a future Publications Release Letter.

Reference Material: Order from Mechanicsburg only.

<u>DOS OLTEP</u>	<u>GC24-5086-3</u> , TNL GN28-2536
<u>DOS TOS PL/1 (D) Compiler Programmer's Guide</u>	GC24-9005-6, TNLs <u>GN33-9129</u> , <u>GN33-9130</u> , <u>GN33-9124</u>
<u>370 DOS Version 4 BTAM</u>	<u>GC27-6978-0</u>
<u>1410/1440/1460 Emulator on Models 135/145/155</u>	<u>GC33-2004-3</u>
<u>1410/7010 DOS Emulator on Models 145/155</u>	<u>GC33-2005-2</u>

IBM System/360 Basic Programming Support (BPS/360)

The BPS/360 programs are a group of independent programs designed primarily for 8K and 16K card and tape configurations. For card systems, a Basic Assembler, an RPG, and a FORTRAN compiler are available. Programs are also available to load object programs into main storage and print the contents of storage and registers when the user requires this information.

For tape configurations, the Basic Tape System compiles Assembler and RPG programs. Facilities for system generation, system maintenance, macro handling, and an Input/Output Control System are provided. The user builds a control program (or control programs) to suit his own particular processing requirements.

This control program resides in core storage during object program execution to:

- Initialize files and process labels.
- Handle interruptions.
- Schedule and execute all I/O operations.
- Handle operator communication.
- Handle device errors.
- Retrieve program phases for overlays.
- Provide end-of-job and job transition control.

A FORTRAN compiler for the tape user also is available.

Sort/Merge programs for both one- and two-channel tape systems enable the user to sort files of random records or merge multiple files of sequenced records into one sequential file.

An Autotest (tape) program enables the BPS user to debug programs at object time.

In addition, card, tape, and disk utilities are also provided for common peripheral operations, including programs for both multiple and single file-to-file operations.

Other BPS programs support applications involving the 1412 and 1419 Magnetic Character Readers, the 1418 and 1428 Optical Character Readers, and the 1231 N1 Optical Mark Page Reader. These programs also provide control for other I/O units in addition to the associated OCR and MICR readers.

A program supporting the universal character set special feature is also provided.

Most BPS programs utilize object machine storage above the minimum required.

BASIC CARD SUPPORT

Basic Assembler, 360P-AS-021

The Basic Assembler Language is a symbolic programming language for use with the System/360. This language provides programmers with a convenient means of writing machine instructions, designating registers and input/output devices, and specifying the format and addresses of storage areas, data, and constants. All operational capabilities of the System/360 can be expressed in Basic Assembler language programs.

The BPS/360 Basic Assembler program is a two-phase, one-for-one assembly program which translates source programs written in the System/360 Basic Assembler Language into machine language object programs. In the process of translation, the assembler performs certain auxiliary functions, some automatically, others requested by special assembler instructions the programmer writes in his source program. The output from the assembly is in relocatable deck format and can be loaded with either the Absolute Loader (360P-UT-017) or the Relocating Loader (360P-UT-020) provided with the Basic Utility programs. A program listing with error indications is optional. If available, from one to five magnetic tape units may be utilized to speed the assembly process.

The assembler is divided into two parts, Phase 1 and Phase 2. Input to Phase 1 consists of source program statements punched into cards or written on magnetic tape. Phase 1 partially translates the source program statements into machine - language object code. The partially translated statements are passed to Phase 2 where the translation process is completed. The assembled object programs may be punched in cards or written on tape.

The most significant features provided by the assembler and its language are briefly summarized in the following paragraphs.

Mnemonic Operation Codes: Mnemonic operation codes, provided for all machine instructions, are used instead of the more cumbersome internal operation codes of the machine.

Symbolic Referencing of Storage Addresses: Instructions, data areas, register numbers, and other program elements

can be referred to by symbolic names instead of actual machine addresses and designations.

Renaming Symbols: A symbolic name can be equated to another symbol so that both refer to the same storage location, general register, etc.

Convenient Data Representation: Constants can be specified as decimal digits, alphabetic characters, hexadecimal digits, and storage addresses.

Relocatable Programs: The assembler produces object programs in a relocatable format; that is, a format that enables programs to be loaded and executed at storage locations different from those assigned when the programs were assembled.

Program Linking: Independently assembled programs to be loaded and executed together may make symbolic references to instructions and data in each other.

Assembler Instructions: A set of special instructions for the assembler is included in the language.

Device Assignment: The assembler has five types of input/output: Four (the assembler, source program, intermediate text, and object code) can use card read punch or tape; the fifth (the listing) can use printer, printer-keyboard, or tape.

Program Listings: For every assembly, the assembler can provide a listing of the source program and the resulting object program.

Error Checking: Source programs are examined by the assembler for possible errors arising from incorrect usage of the language. Whenever an error is detected, a coded error message (a flag) is printed in the program listing. For card systems without printers, limited error notification is provided.

Program Reassembly: A special reassembly option is provided for programs assembled using the 1442 Model N1 or 2520 Model B1 Card Read-Punch card-operating procedure. This permits partially or completely assembled (and modified) source programs to be reassembled in less time than required for a new assembly.

Minimum System Requirements: A System/360 with 8,192 bytes of storage ... Standard Instruction Set ... 1442 Model N1, 2540 or 2520 Model B1 Card Read Punch; or 2501 Card Reader with 2520 Model B2 or B 3 Card Punch.

If additional input/output devices are attached to the system, the assembler's operational capabilities are increased. The various input/output devices and their uses are listed below.

2400 Series Magnetic Tape Unit -- From one to five magnetic tape units can be used for the storage of any of the following -- source program ... basic assembler object decks ... intermediate text ... program listing* ... object program. Support for the Dual Density feature is provided. 7-Track Tape units must have the Data Conversion Feature.

One 1403 or 1443-2 Printer -- Used by the assembler to provide program listings, complete with operator and error messages, for each assembly.

One 1052 Printer-Keyboard-- Used by the assembler to provide program listings, complete with operator and error messages, for each assembly.

One 1403 or 1443-2 Printer and One 1052 Printer-Keyboard -- The assembler uses the 1403 or 1443-2 Printer to print program listings. The 1052 Printer-Keyboard is used for operator and error messages.

*This option is not supported for Model 30 systems.

BASIC UTILITIES

Input/Output Support Package 360P-UT-018

This is a modular set of Basic Assembler language subroutines which provide user with standard tested I/O support. There are routines to read or punch a card, write on the message or printer device, sense information from a device, single space on the message or printer device, skip to channel one on the printer, read or write tape, write a tapemark, rewind tape, backspace tape a record or file, forward-space tape a record or file, and to read tape backward. The desired functions are selected by the user and either combined with his source programs as input to the Basic Assembler, or are pre-assembled into relocatable text and combined with the relocatable text of independent assemblies for loading by the Relocating Loader.

Absolute and Relocating Loaders 360P-UT-017 and 360P-UT-020

The Absolute loader loads assembled programs into the storage locations assigned by the assembler. Facilities for making corrections or replacements to the assembled program at load time are also provided. The distinguishing feature of the Relocating Loader is its ability to relocate separate assemblies and to complete the linkages between them. The functions of the Absolute Loader are also provided by the Relocating Loader. In addition, the Relocating Loader lists the storage locations of the separate assemblies which it loads.

Dump Program 360P-UT-019

The Dump Program provides the facility to print the contents of all or a portion of main storage and the general and floating point registers at selected points during object program execution. The output will be suppressed if the associated priority number does not match that requested by the user with a control card at object time, thus providing the facility to activate storage dumping at load time. A two-phase version of this program is provided to economize on storage requirements during the execution of the user's program.

Minimum System Requirements: System/360 with 8,192 bytes of storage ... one 1442-NL, 2520-B1 or 2540 Card Read-Punch; or, a 2501 Card Reader with a 2520-B2 or B3 Card Punch ... Standard Instruction Set ... 1403-N1 or 1443 Printer, or the 1052 Printer-Keyboard if the dump program is being used.

The user's input/output configuration determines what routines he can use from the input/output support package.

Support for 2400 Series Magnetic Tape Units, with or without the Dual Density Feature, is provided by the Basic Utility Programs.

Report Program Generator (Card), 360P-RG-200

The BPS/360 Report Program Generator (Card) is a program language and a processor program that is used to produce machine language object programs. The object programs will be used primarily to produce business reports, but the reports may range from a simple card-to-printer listing to a complete report that incorporates numerous calculations and editing.

Some of the capabilities of the language are:

The object program can obtain data records from as many as three card-input files.

The object program can match records in as many as three card files to govern processing of the report.

Input records may be checked for sequence.

The object program can search tables, and it can use data found in the tables to produce the report.

Calculations may be performed on data taken from input records or RPG literals.

The program can branch to a subroutine that has been written in a language other than RPG, perform calculations, and return to the RPG program.

The report can be produced on as many as three printer or punch files.

Five different specification sheets are used to code the user's program requirements. One of these is used only when a table search is required by the object program. The headings on the specification sheet suggest the function to be performed. Thus, the programmer needs to know only the job requirements. All instruction writing is done by the RPG processor.

After the specifications have been written on the appropriate forms, cards are keypunched with the data from the forms. Each line of the form is a card in the source deck.

The source deck, along with control cards and the RPG processor, is supplied to an input device for compilation. At the end of this processing run, a program capable of preparing the report specified by the programmer has been produced. This program contains all of the computer instructions necessary to prepare the desired report.

At this point, the user may choose to generate an object program deck, execute the object program or both. The object program can be retained for later runs without recompilation. RPG object programs produced by this system operate by themselves (no control system is associated with them when they are executed).

Machine Requirements: To generate an RPG object program, the following are the minimum machine requirements -- 8K bytes of main storage (up to 32K bytes of main storage may be utilized) ... card reader ... card punch (if object program card deck is desired) ... printer (if diagnostics are desired) ... Standard Instruction Set ... Decimal Arithmetic Feature.

To execute an RPG object program, the following are required -- 8K bytes of main storage (up to 32K bytes of main storage may be utilized) ... Standard Instruction Set ... Decimal Arithmetic Feature ... I/O units as required by the object program.

The following card I/O devices and printers are supported -- 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch, Model B1 ... 2520 Card Punch, Model B2 ... 2520 Card

Punch, Model B3 ... 2540 Card Read Punch, Model 1 ... 1403 Printer ... 1404 Printer* ... 1443 Printer ... 1052 Printer-Keyboard.**

*The 1404 Printer may be utilized for continuous forms operations only.

**The 1052 may be used only as an output logging device.

Up to three card input devices and up to three card output devices or printers may be used in any combination. For combined files, the 1442 and 2540 can be used. In this case, the file is counted as one of the three input devices and one of the three output devices. The 2520 cannot be used for a combined file.

The object program requires at least one card input device and one card output or printer device.

FORTRAN IV (16K Card), 360P-FO-205

The BPS/360 FORTRAN IV (16K Card) system operates independently of any other programming system. It is supplied as a set of card decks consisting of a compilation system, an execution system, and system subprograms.

The BPS/360 FORTRAN IV language, which closely resembles the language of mathematics, is especially useful in writing programs for scientific and engineering applications that involve mathematical computations.

Source programs written in the FORTRAN language consist of a set of statements from which the compiler generates machine instructions, constants, and storage areas. The programs are coded in either BCDIC or EBCDIC character codes. Mixing of the two, however, is not allowed.

The FORTRAN compiler analyzes the source program statements and transforms them into an object program that is suitable for execution on the System/360. In addition, when the FORTRAN compiler detects errors in the source program, appropriate error messages are produced. At the user's option a complete listing of the source program is produced.

Compilation and execution are performed as separate operations on the machine.

Compilation -- Input to a compilation may be from cards only. The input card deck consists of the compilation system, possibly one or more control statements, and the program unit* to be processed. The compilation system translates the source program or source subprogram into System/360 coding called an object module.

*The term program unit refers to a source program or a source subprogram. The term source subprogram refers either to a FUNCTION or SUBROUTINE subprogram.

The possible output from a compilation is:

Loader messages ... printed messages indicating errors occurring in loading the compilation system.

Source listing ... printed listing of the program unit.

Warning and error message-numbers ... printed list of numbers referencing messages that describe potential or actual errors in the program unit.

Routines-required listing ... printed list of the subprograms referenced in the program unit.

Operator messages ... printed list of messages to the operator concerning machine conditions requiring his intervention.

Object module ... punched card deck containing the System/360 code resulting from the compilation.

Size indication ... the size, in bytes, of the program and the COMMON area.

The user can suppress the printing of the source listing and the punching of the object module by using a control statement. The remaining output always appears if the conditions for their appearance are present.

Execution -- Two or more object modules make up a load module, which, when supplemented by the execution system and control card statements, if any, is ready for loading and execution. The simplest load module consists of a single main program object module compiled from a Card FORTRAN program (without references to the FORTRAN Library, Supplemental or User Subprograms) and the system I/O Subprogram. Load modules, however, may also consist of a main program module compiled from a Card FORTRAN program (with references to FORTRAN Library, Supplemental or User Subprograms), the system I/O Subprogram, and additional subprogram modules (which may be FORTRAN Library or Supplemental subprogram modules and/or user subprogram modules compiled from FUNCTION and/or SUBROUTINE source subprograms).

The execution system loads and initiates the execution of the object program. If separately compiled programs are loaded, the system can complete the linkages between them. The system can also load any input acceptable to the BPS/360 Basic Utilities Relocating Loader (360P-UT-020).** Large jobs which exceed available core may be broken into segments and loaded sequentially into the same core area ... information is passed between the segments through COMMON storage, which can be preserved at the user's option.

**Relocatable subprograms written in BPS Basic Assembler Language and assembled using the BPS Basic Assembler program (360P-AS-021) may be used with a FORTRAN job.

The execution system also handles machine and program interrupts, input and output, reading, printing and punching, error processing, and termination of object-time execution. Control card capabilities enabling the user to change device assignments at object time are also provided.

In addition to load-module output, execution output may also contain:

A Storage map ... indicates where in core storage the object modules comprising the load module are loaded for execution.

Loader messages ... indicates any errors occurring during the loading of the execution system or the load module.

IBERR messages ... indicate errors occurring during load-module execution.

Operator messages ... messages to the operator indicating situations needing his intervention.

Program-interrupt messages ... indicate any program-interrupts occurring during load-module execution.

Compiler Design Limitations: The card FORTRAN compilation system is designed to operate in 16K bytes of core storage. Information regarding limitations, in writing FORTRAN program units, because of the design of the compilation system, is contained in the publication, IBM System/360 Basic Programming Support Programmer's Guide, FORTRAN IV (16K Card), C21-5000.

Programming Considerations: Suggestions and techniques for improving FORTRAN programs, for increasing compilation or execution speed, or for making efficient use of available core storage, are contained in the publication, IBM System/360 Basic Programming Support Programmer's Guide, FORTRAN IV (16K Card), C21-5000.

Minimum System Requirements: The minimum System/360 Model 25, 30, 40, or 50 machine configuration required for compilation is -- 16K bytes of core storage ... Standard Instruction Set, any one or any combination of the following devices that provides for card reading and punching -- 2540 Card Read Punch, 1442 N1 Card Read Punch, 2501 Card Reader, 2520 Card Punch, one 1443 Printer, 1403 Printer, or 1052 Printer-Keyboard.

The minimum System/360 machine configuration required for execution is -- 16K bytes of core storage ... Floating-Point Arithmetic Feature ... any of the following card reading units -- 2540 Card Read Punch, 1442 N1 Card Read Punch, 2501 Card Reader ... one 1443 Printer, 1403 Printer, or 1052 Printer-Keyboard ... any device to be used by the user's program. The devices that may be used are all those card reading, card punching, and printing devices previously mentioned, and the 2520 Card Punch.

In each case, the Card FORTRAN IV System uses only those devices and features listed. Additional core storage and features are not used.

BASIC TAPE SUPPORT

Basic Tape System (8K), 360P-AG-091

The BPS/360 Basic Tape System consists of a group of programs that provide the following functions:

Assemble user programs written in Assembler language.

Compile programs written in Report Program Generator language.

Assemble a Supervisor and Program Loader (for use with, and controlling the operation of problem programs).

Link together separately assembled program sections and/or subroutines into a single output deck that can be executed without reassembling.

Add user-written macros to the System Tape so they are available for inclusion in problem programs at assembly time.

Build a tape of problem program(s) in loadable form permitting batch execution.

Maintain the System Tape.

The system tape, tailored to the installation, is built using a master tape supplied by the Program Information Department and a set of control cards (supplied by the user and describing his requirements). The major functions of the system tape are assemblies, RPG compilations, and preparation of problem programs for execution. The system tape is not used when these problem programs are being executed.

Assembler

The Assembler language is a flexible, easy-to-use symbolic language which is machine-oriented and applicable to both commercial and scientific problems. The Assembler language provides facilities for macros and literals. Both system macros and installation macros may be made available to the programmer. Source programs written in this language are assembled by the Assembler program to produce executable object programs.

One major advantage of the Assembler program (and also of RPG) is that it can produce object programs in a relocatable form, if desired. Therefore, programs or subroutines can be written, assembled, and tested in sections. After all testing is complete, the sections or subroutines can be combined into a single, logical program and be made ready for execution without reassembly. The process of linking program sections is accomplished by the Linkage Editor program.

Executable program(s), i.e., programs with no unresolved linkages, can be loaded from the card reader or from tape.

The Basic Tape System allows for building a loadable tape from cards. Programs on this tape are executed exactly in the order in which they appear.

Report Program Generator (8K Tape)

The BPS/360 Report Program Generator (8K Tape) produces relocatable object programs that are used to produce listings, perform numerous calculations, use multiple files, search tables, and update files. Thus, it is possible to produce reports ranging from simple listings from cards or tape to complete jobs such as payroll, accounts receivable, etc. Special coding sheets are provided to describe the job to be performed. Through precisely defined entries, the programmer describes the type of input data, the calculations to be performed, and the type of output necessary. RPG is a problem-oriented language that does not require detailed knowledge of machine functions. The information from the coding sheets is compiled to produce object language programs ready for execution.

Input/Output Control System (IOCS)

The IOCS macros of the basic tape system relieve the user of the detailed programming involved with input/output operations. Two major functions are provided:

The control of actual transfer of data between storage and I/O devices. This is referred to as physical IOCS.

The retrieval and storing of logical data records, making files available for processing (including label handling), and end-of-file processing. This is referred to as logical IOCS.

Logical data records are made available for processing and stored after processing by the use of I/O macros in the

problem program. Execution of these macros may or may not cause physical IOCS to transfer data between core storage and an I/O device.

STR (Synchronous Transmitter Receiver) macros providing DIAL and leased line programming support for System/360 Models 30, 40, 50, 65 and 75 with 2701 Data Adapter Unit and Synchronous Data Adapter Type I (#7695 and #7696) are also included. Most STR applications will probably require 16K; however, utility type applications requiring minimum processing and code conversion are supported in an 8K environment.

IBM System/360 * via a 2701 equipped with an SDA Type-II adapter, or an IBM System/360 Model 25 via the Integrated Communications Attachment to another S/360 * via the 2701 equipped with an SDA - Type II adapter or via a 2703 with a Synchronous Base, or an S/360 Model 25 via the Integrated Communications Attachment. This support is for point-to-point, nonswitched and switched lines. Included within this support are the 2701 Error Recovery Procedures and Error Counts.

Macros are provided to handle the following Binary Synchronous Line Control functions:

- Contention (point to point)
- Headers and normal text
- Inquiry and alternating replies
- WABT (optional),
- Full Transparent Text
- Dial with and without identification
- Disconnect and Conversational

EBCDIC is supported as the transmission code. The minimum core storage requirement is 16K bytes.

BPS/360 Binary Synchronous Communications support communicates with other System/360s using DOS/360 BTAM, OS/360 BTAM and BOS/BPS/360 Binary Synchronous Communication support.

* Model 25, 30, 40, 50, 65, 67 (in 65 mode) or 75

Note: 2701 Support on a selector channel is limited to non-switched (leased or private direct connection)

It is recommended that a 1052 console be used in order to facilitate the printing of error messages and error counts as the result of a persistent error condition. This facility will aid in system repair and preventive maintenance.

Note: RPG is not supplied as a resident component of the system tape. It is supplied as a separate program (360P-RG-201), and must be incorporated into the system tape by the user before it can be used. Additional information on RPG is provided below.

Control Programs

The Basic Tape System provides a series of programs called control programs. They are:

Initial Program Loader (IPL): This program is provided to initiate system operation.

Supervisor: The Supervisor is the control program that always resides in core with problem programs. It can be defined and assembled to satisfy the requirements of an installation. The Supervisor can be assembled independently of, and operate with, many different problem programs, or may be assembled with each problem program. The Supervisor consists of:

- A communication region
- Interrupt handling routines
- A Channel Scheduler
- Device error recovery routines
- Operator communication routines
- Program retrieval (FETCH) routine
- End-of-job routine

The supervisor will handle physical input/output operations, interrupt activity, operator communication, and interjob functions. Therefore, the programmer is concerned only with the logic and instructions actually necessary to solve his problem.

Program Loader: This program loads problem programs into storage for execution. Upon completion of the loading routine, control is passed to a specified entry point in the problem program. Subsequent problem programs may be loaded by use of the Program Loader instead of the IPL procedure.

Job Control: The Job Control program is executed prior to the loading and execution of a problem program, but it is not always required. The following conditions make this program necessary:

- Processing of standard tape labels
- Changing of symbolic I/O assignments
- Changing the date or user switch indicators
- Restarting a previously checkpointed job

To allow flexible operation, a programmer refers to input/output devices by symbolic names in his program. Assignment of actual addresses to symbolic names can be done when the Supervisor is assembled. However, when a change of device address is required, it can be accomplished by Job Control.

A separate phase of the Job Control program is used for restarting checkpointed programs. This phase (RSTRT), when used, is the final phase of Job Control and follows the job control cards.

Control Program Operating Characteristics

Step 1: The initial program loading procedure (IPL) initiates system operation. First, the Supervisor and the Program Loader are loaded and control is transferred to the Program Loader.

Step 2: The Job Control program may be loaded next. Its use is optional since its functions are not always needed. Job Control processes necessary control cards to initialize the Supervisor.

Step 3: Next, a problem program is loaded. It can overlay the area used by Job Control. When the Program Loader recognizes that execution is to begin, it transfers control to a specified entry point. During execution, control alternates between the problem program and Supervisor. At any time during a job, a program can request the Supervisor to load a program phase into storage. The Program Loader performs this function and transfers control to the appropriate entry point.

When a problem program reaches end of job, the Supervisor informs the operator of this condition. If the next job to be run uses the same Supervisor and if the Program Loader has not been overlaid, the operator can signal the Supervisor to give control to the Program Loader to load the next job (step 2 or 3). If these conditions do not exist, the next job must be initiated by the IPL procedure (step 1).

SYSTEM CONFIGURATION

This section is divided into two major parts: Minimum System Requirements and Features Supported. The minimum system requirements are listed by function: system tape generation, system operation, execution of user's program compiled by the assembler, and execution of user's program compiled by RPG. The System Operation section lists the minimum features required for both the Assembler and RPG, followed by the additional required features that pertain to only the Assembler or RPG.

The Features Supported section provides a complete listing of the features supported by the BPS Basic Tape System.

Note: The IBM-supplied programs assume the availability of a problem program area of at least 4096 bytes.

Engineering Change Levels 811839 and 811842 must be installed on all models of the 2520 for proper functioning of the device support routines.

Minimum System Requirements

System Tape Generation

For generation of a System Tape, the minimum configuration is:

- . 8K bytes of main storage.
- . Two tape units (2400 series), one must be 9-track. If a 7-track tape unit is used, it must have the Data Conversion Feature. (See Features Supported: 2400-Series Magnetic Tape Units.)
- . One card reader (1442, 2501, 2520, or 2540).
- . One I/O channel (either multiplexer or selector).

System Operation

Minimum features required for both the Assembler and RPG are listed under Basic. Additional required features that pertain specifically to the Assembler or RPG are then listed.

Basic

- . 8K bytes of main storage (the Supervisor must not exceed 4K).
- . Three 2400-Series Magnetic Tape units, one of which must

be 9-track for systems residence. If 7-track tape units are used, the Data Conversion Feature is required. (See Features Supported: 2400 Series Magnetic Tape Units.)

- . Standard Instruction Set.
- . Either one multiplexer or one selector channel.

Assembler

To perform an assembly, the Assembler program requires a System/360 with the following additional features:

- . If the Supervisor requires less than 4K bytes of main storage, the Assembler may use additional main storage to allocate area for input/output buffers and Assembler tables whenever they are needed.
- . At least one additional tape unit is required for any or all of the following conditions:
 - . If the source program is to be read from tape.
 - . If the text output from the Assembler is to be written on tape.
 - . If the program listing is to be written on tape.
- . A second additional tape unit is required if both the text output and program listing are to be written on tape.
- . One 1442, 2520, or 2540 Card Read-Punch, or one 2501 Card Reader, is required under either of the following conditions:
 - . If the source program is to be read from cards by the Assembler.
 - . If the job-control information is to be read from cards by the Supervisor program.

This device may be the same I/O unit used for punching the output deck.

- . One 1442, 2520, or 2540 Card Read-Punch or one 2520 Card Punch is required if the object program is to be punched into cards by the Assembler. This device may be the same I/O unit used for reading the source deck.
- . One 1403, 1404 (continuous forms only), or 1443 Printer is required if the program listing is to be printed out.
- . When a 1052 Printer-Keyboard is available, it may be used for the output of special diagnostic messages.

RPG

To compile an RPG object program, the following additional features are required:

- . One 1442, 2520, or 2540 Card Read-Punch.
- . One 1403, 1404 (continuous forms only), or 1443 Printer.
- . Decimal Arithmetic Feature.

Execution of User's Program Compiled by the Assembler

To execute an assembler object program, the minimum configuration is:

- . 8K bytes of main storage.
- . One I/O channel (either multiplexer or selector).
- . One card reader (1442, 2501, 2520, or 2540) if the object program is to be loaded from cards, or 1 2400 Series Magnetic Tape Unit if the program is to be loaded from tape.
- . Any I/O devices required by the problem program.
- . If in STR (Synchronous Transmitter Receiver) mode, one 2701 Data Adapter Unit with a Synchronous Data Adapter, Type I is required.

Note: If in STR mode, 16K bytes of storage are required for most applications; however, utility type applications requiring minimum processing and code conversion are supported in an 8K environment.

Binary Synchronous Communication using a 2701 SDA - Type II adapter or S/360 Model 25 with an Integrated Communication Attachment requires a 16K bytes of storage.

Execution of User's Program Compiled by RPG

To execute an RPG object program, the following is required:

- . 8K bytes of main storage.
- . Standard Instruction Set.
- . Decimal Arithmetic Feature
- . I/O Units as required by the object program. Up to ten I/O Devices may be used (see Features Supported: I/O Devices Supported by the Assembler and/or RPG). One input file is required.

Note: Although the RPG compiler will operate in 8K, most user object programs will require 16K.

FEATURES SUPPORTED

- . Interval timer.
- . Simultaneous Read-While-Write.
- . Any channel configuration up to one multiplexer channel and two selector channels (1 and 2).
- . Additional main storage, with the following restrictions:
 - . All control programs (Supervisor, Job Control, and Program Loader), the Linkage Editor, the OPEN/CLOSE routines, maintenance and service programs for the System Tape, and the restart routine used following a checkpoint cannot be located beyond 32K.
 - . When the user's program is executed, the portion of the problem program that communicates with IOCS and the Supervisor must be located in the first 64K of main storage. This includes channel command words (CCW's), command control blocks (CCB's), file definitions (DTP's) and the entry to certain problem program routines, i.e., 1052 operator communication routine, program check routine, and interval timer routine. User imperative macros, e.g., GET, PUT, may be originated beyond 64K, if desired.
- . For RPG, a maximum of 64K bytes of main storage.
- . Dual Density Feature, #3471 and #3472.
- . I/O devices supported by Assembler and/or RPG object program.
 - . 1442 Card Read Punch.
 - . 2501 Card Reader.
 - . 2520 Card Read-Punch.
 - . 2520 Card Punch.
 - . 2540 Card Read Punch (also with Punch Feed Read Feature).
 - . 1403 Printer.
 - . 1404 Printer (for continuous forms only).
 - . 1443 Printer.
 - . 1445 Printer.
 - . 2400-Series Magnetic Tape Units. If variable-length records are written on 7-track tape, the Data Conversion special feature is required.

If the 800/1600 bpi Dual Density feature is to be used, the tape unit must be one of these:

- . 2401 or 2402 Magnetic Tape Unit Model 4, 5, or 6 and 2803 or 2804 Tape Control, Model 2.
- . 2403 Magnetic Tape Unit and Control, Model 4, 5, or 6.
- . 2415 Magnetic Tape Unit and Control Model 4, 5, or 6.
- . I/O devices supported by Assembler object programs only.
 - . 1052 Printer-Keyboard (Only one 1052 is supported. It is attached to the multiplexer channel. When this device is on the system, it is used for operator communication.)
 - . 2671 Paper Tape Reader.
 - . 1285 Optical Reader (up to eight 1285's are supported).
 - . 1287 Optical Reader (maximum of 8).*
 - . STR (Synchronous Transmitter Receiver) devices connected by leased or dial lines through Synchronous Data Adapter -- Type 1, on 2701 Data Adapter Unit. The following Devices are supported:
 - . 1978 Read, Print, Punch Terminal
 - . 1974 II Data Transmission Terminal
 - . 1009 Data Transmission Unit
 - . 1013 Card Transmission Terminal
 - . 7701, 7702 Magnetic Tape Transmission Terminal
 - . 7711 Data Communication Unit
 - . System/360 Model 20 with a Communications Adapter, Feature #2073
 - . System/360 Model 30, 40, 50, 65, or 75 with a 2701 Data Adapter Unit equipped with the Synchronous Data Adapter Type 1 (SDA-1).

Note: The STR devices must be at or above the following engineering change levels:

Unit Number	Engineering Change Level
2040	255490
7702	706973 ERC R0641
7711	254441
1978	892559
1009	123005
1974	120593
2701	707484
2020	11924

Binary Synchronous Communication supports a System/360 Model 25, 30, 40, 50, 65, 67 (in 65 mode) or 75 with a 2701 SDA - Type II adapter. Model 25 is also supported via the Integrated Communication Attachment.

*Programming specifications for using this device may be used for planning purposes only. Source programs must not contain instructions for it until the Basic Tape System includes the appropriate programming. An MNOTE stating IMPROPER DEVICE will appear if coding for the device is included in a source program.

Report Program Generator (8K Tape), 360P-RG-201

The BPS/360 Report Program Generator (8K Tape) is a problem-oriented, programming language which provides an efficient, easy-to-use technique for generating object programs. The object programs will be used primarily to produce reports, but the reports may range from a simple card-to-printer listing to a complete report that incorporates numerous calculations and editing.

Some of the capabilities of the language are:

The object program can obtain data records from as many as three card-input files or three tape-input files, or a combination of both ...

The object program can match records in as many as three files to govern processing of the report...

Input records may be checked for sequence...

The object program can search tables, and it can use data found in the tables to produce the report...

Calculations may be performed on data taken from input records or RPG literals...

The program can branch to a subroutine that has been written in a language other than RPG, perform calculations, and return to the RPG program...

The report can be produced on as many as ten output devices. A maximum of three printer files is allowed.

Five coding forms (The RPG specification sheets) are used to describe the program. The permissible entries of the specification sheets are strictly defined, and the headings on the specification sheets suggest the function to be performed.

After the specifications have been written on the appropriate forms, cards are keypunched with the data from the forms. Each line of the form is a card in the source deck.

The source deck, along with control cards, is supplied to an input device and is processed by the RPG program (360P-RG-201), which is a separately orderable component of the BPS/360 Basic Tape System (360P-AS-091).* At the end of this processing run, an object program capable of preparing the report specified by the programmer has been produced.

At this point, the user may choose to generate an object program deck, execute the object program, or both. The object program can be retained for later runs without recompilation.

*The BPS/360 Basic Tape System contains programs that compile and/or assemble user programs (also called problem programs) written in Report Program Generator language or Assembler language. The object programs which result are used with the Supervisor, Program Loader, and Job Control programs. The design of these programs is such that the programmer need only be directly concerned with solving his problems.

System Requirements: The system requirements for RPG are indicated in the System Configuration section for the Basic Tape System.

FORTRAN IV (Tape), 360P-FO-031

The BPS/360 FORTRAN IV System operates independently of any other programming system. The FORTRAN system provides an extensive range of capabilities including:

A FORTRAN language for efficiently expressing a user's problem.

The facility for compiling and executing programs.

The provision for system maintenance to simplify the tailoring of the system to individual installation requirements.

A variety of system library facilities, including mathematical and service (utility) subprograms.

A simplified set of operating instructions and diagnostic messages that minimize operator intervention during program processing and machine operation.

The BPS/360 FORTRAN IV language, which closely resembles the language of mathematics, is especially useful in writing engineering applications that involve mathematical computations.

Source programs written in the FORTRAN language consist of a set of statements from which the compiler generates machine instructions, constants, and storage areas. The programs are coded in either BCDIC or EBCDIC character code. Mixing of the two, however, is not allowed.

The FORTRAN compiler analyzes the source program statements and transforms them into an object program that is suitable for execution on the System/360. In addition, when the FORTRAN compiler detects errors in the source program, appropriate error messages are produced. At the user's option a complete listing of the source program is produced.

To simplify the compilation and execution of FORTRAN programs, the FORTRAN system provides the user with a flexible yet concise control language. This language is expressed by means of control statements that enable the programmer to specify run type (e.g., one or more source programs), the processing to be performed (e.g., compile and execute), and the output desired (e.g., source program listing). If certain control information is not specified by the user, the FORTRAN system will operate with a set of assumed specifications.

The subprogram facilities of the FORTRAN system can be expanded to include user-written assembler language subprograms, which can be used with FORTRAN programs.

Program Size Considerations

Source Program Size: The maximum source program size depends upon: (1) the size of main storage available, (2) the number of statement numbers and symbols, such as subprogram, variable, and array names used in the source programs; and (3) the size of the dictionary reserved by the compiler.

Object Program Size: The amount of storage reserved for a compiled source program (i.e., the object program) depends upon: (1) the amount of main storage available; (2) the size of the FORTRAN System Director; (3) the size of the IBCOM routine; and (4) the size of each different out-of-line library subprogram referred to by the object program.

Compilation Speed Considerations

During a compilation, information about the program is passed between various phases of the compiler to produce an object program. This information may be transmitted to each phase by storing it either in a reserved portion of main storage (called a buffer area) or on an input/output device (e.g., tape). Because this information can be accessed faster within main storage than from input/output devices, maximum compilation speed will be attained when few or no input/output operations occur.

The number of input/output operations can be appreciably reduced by decreasing the size of the source program and/or increasing the main storage size, thereby increasing the buffer area. When the main storage size is equal to 16K bytes, the buffer size reserved is 100 bytes.

In addition to the buffer size consideration, compilation time may be reduced by limiting the number of output options (e.g., DECK, LIST, MAP) in a job.

Minimum System Requirements: A System/360 with a Scientific Instruction Set and 16K or more bytes of main storage and the following minimum I/O units: one or any combination of the following devices that provides for card reading and punching -- 1442 Card Read Punch, 2501 Card Reader, 2520 Card Read Punch, 2520 Card Punch, 2540 Card Read Punch ...

1403 or 1443 Printer ... three 2400 Series Magnetic Tape Units, either 9-track or 7-track with the Data Conversion and 7-track Compatibility features ... an optional 2400 Series Magnetic Unit for compile-and-go ... an optional 1052 Printer Keyboard (cannot be used as an input device).

System Configuration:

SYSIN	Punch	Print	Compiler		Object Program Workfiles
			Work Files	Go File	
2501	X				X
2520	X	X			X
2540	X	X			X
1442	X	X			X
1403			X		X
1443			X		X
1052			X		X
2400	X	X	X	X	X

Note: The Dual Density Feature is supported.

Sort/Merge (8K Tape), 360P-SM-043 (1 Channel) and 360P-SM-044 (2 Channel)

The BPS/360 Sort/Merge (8K Tape) programs are generalized sort/merge programs designed to operate on the System/360. With these programs the user can sort records into one sequential file, or merge multiple presorted files into one continuous sequential file. Control-data information can be contained in as many as twelve fields in each record.

Each sort/merge program is in the form of an assembled object deck when it is received by the user. In addition, the facility to create a program tape (9-track, or 7-track if the Data Conversion feature is present) is provided.

Control statements tailor the generalized sort/merge program to the user's specific application. The control statements are punched into cards and inserted into the program deck before it is loaded, if the program will be loaded from cards. Or, the control statement cards are inserted into the card reader if the program will be loaded from magnetic tape.

The programs assume that input records for a sort operation are in random sequence; however, if any inherent sequencing exists within the input file, the programs will take advantage of it. Records can be sorted or merged into ascending or descending sequence, and an individual sequence can be specified by the user for each control data field. The output sequence for a merge-only operation must be the same as the input sequence.

The 2-channel sort/merge program functions in a Read-Write-Compute environment. This overlapped processing improves the performance of the 2-channel program over the performance of the 1-channel program. Also when the 2-channel program is executed on a system with one selector channel and 16,384 or more positions of main storage, the resulting performance will generally surpass the performance of the 1-channel program when each is executed on the same system configuration.

Program Features

Translates mnemonic control-card information that describes the file parameters for each input and output file.

Sorts single or multiple input files under control of the VOLUME entry in the INPFIL statement.

Merges a minimum of one to a maximum of five input files.

Allows multivolume input and/or output.

Provides for specification of an alternate input drive (sort only) and an alternate output drive (sort or merge).

Provides for specification of an alternate work drive allowing the maximum input file size to be approximately doubled.

Provides for input from and output to 7-track and/or 9-track magnetic tapes.

Provides checkpoint, interrupt, and restart procedures during the merge phase (phase 2) of a sort operation.

Provides exits to user-written routines.

Prints out -- the control card information (optional), record counts at the end of phase 1 and phase 2 (optional), and necessary diagnostics.

Upon detection of a permanently unreadable block during Phase 1, provides an option to either bypass the block or terminate the sort. In either case, a user exit is

available for outputting the unreadable block using either the sort IOCS print routine or a user-written routine for any I/O device.

Sequence-checks the records during the final pass.

Sorts or merges on each control field independently, permitting the user to specify either ascending or descending sequence for each individual field.

Processes standard System/360 volume and file labels.

Provides standard System/360 IOCS error procedures.

Program Description: The sort/merge is divided into four phases:

- Assignment Phase (Phase 0)
- Internal Sort Phase (Phase 1)
- External Sort Phase (Phase 2)
- Merge Only Phase (Phase 3)

If sorting is to be done, phases 0, 1, and 2 are executed. If only merging is to be done, the assignment phase and the merge-only phase are executed.

Assignment Phase (Phase 0)

The assignment phase reads the control statement cards and analyzes the information. Constants to be used during the actual sort or merge operation are stored for later use. Any errors detected are printed out for the operator and the system enters the wait state. If no errors are detected, execution of the sorting or merging process begins immediately without operator intervention. If label checking is specified, the assignment phase checks the labels on all the phase 1 output tapes and partially checks the first phase 1 input tape. Exits from the program are provided to allow for user modifications and for processing user-prepared subroutines.

Internal Sort Phase (Phase 1)

Phase 1 performs the initial sequencing of the input file. The records are read into the main-storage input area and sorted into sequences that are at least G (the number of records that can be sorted internally at one time) in length. The program will take advantage of any inherent sequencing in the input file. These sequences are distributed on the phase 1 output tapes according to an output scheme that minimizes the time required to complete the sort.

Phase 1 allows multivolume input files. Exits from the program are provided to allow for user modifications and for processing user-prepared subroutines.

The 2-channel program utilizes two output areas. While blocks of records are being written on tape from one output area, the alternate area is being filled. One channel is used for reading records into storage, and the other channel is used for writing records out on tape.

External Sort Phase (Phase 2)

The external sort phase merges the sequenced strings created by the internal sort phase. The merging technique is a generalized, read-backward polyphase for three to six tapes. This technique minimizes the amount of time required to complete the merging process with the specified system configuration. The final output drive can be specified before the sort is begun.

Exits from the program are provided to allow for user modifications and for processing user-prepared subroutines. An interrupt-restart procedure is provided for the user's convenience.

The 2-channel program utilizes an extra input area, in addition to the prescribed single input area for each drive. This technique keeps a new block of records available in storage whenever necessary. Two output areas are utilized so that processing can continue while blocks of records are being written on the output tape.

Merge - Only Phase (Phase 3)

The merge-only phase can be used to merge existing presorted files into one sequential file. A maximum of five input files can be merged. The program allows for multiple volume input and multiple-volume output. The program also allows for a single file to be reblocked and sequence checked. Exits from the program are provided to allow for user modifications and for processing user-prepared subroutines.

Minimum System Requirements: For 1 channel program (360P-SM-043) -- 8,192 bytes of main storage ... one multiplexer

or one selector channel ... three 2400 series Magnetic Tape Units (7- and/or 9-track) ... one 1403, 1404, 1443 Printer or one 1052 Printer Keyboard ... one 1442, 2501, 2520 or 2540 Card Reader ... Standard Instruction Set.

For 2 channel program (360P-SM-044) -- 8,192 bytes of main storage ... either one or two selector channels ... three 2400 series Magnetic Tape Units (7- and/or 9-track) ... one 1403, 1404, 1443 Printer or one 1052 Printer Keyboard ... one 1442, 2501, 2520 or 2540 Card Reader ... Standard Instruction Set.

If the system has two selector channels and the 2-channel program will be executed, one of four minimum combinations must be observed:

- . One 2404 Magnetic Tape Unit and Control, or one 2804 Tape Control. (This combination produces a read-write-compute environment.)
- . One 2816 Switching Unit with two 2403 or 2803 Tape Controls. (This combination produces a read-write-compute environment.)
- . Two 2403 or 2803 Tape Controls. (This combination produces a read-compute and write-compute environment only.)
- . Two 2415 Magnetic Tape Units attached one to each of two selector channels. (This combination produces a read-compute and write-compute environment only.) The POOLED entry cannot be specified with this configuration.

If the system has one selector channel and the 2-channel program will be executed, one of the following minimums must be observed.

- . One 2415 Magnetic Tape Unit. (This combination produces a read-compute and write-compute environment only.)
- . Two 2403 or 2803 Tape Controls. (This combination produces a read-compute and write-compute environment only.)
- . One 2403 or 2803 Tape Control. (This combination produces a read-compute and write-compute environment only.)

Both programs take advantage of the following:

- . A maximum of 65,534 bytes of main storage.
- . Up to twelve 2400-Series Magnetic Tape Units (7- and/or 9-track):
 - up to two for input drives
 - up to six for work drives
 - up to two for output drives
 - one for program residence
 - one for alternate work drive
- . Dual Density Feature for 2400 Series Magnetic Tape.

The possible combinations of 7-track or 9-track tapes for a sort operation are:

Input	Work	Output
7	7 and or 9	7 or 9
9	9	9

Note: With 7-track work tapes, records created with the Data Conversion feature cannot be sorted; that is, only character data can be sorted using 7-track work tapes.

The possible combinations of 7-track or 9-track tapes for a merge-only operation are:

Input	Output
7 and/or 9	7 or 9

The 7-track tapes must all have the same characteristics.

AUTOTEST (Tape), 360P-PT-045

The BPS/360 Autotest (Tape) program is the debugging aid for object programs that have been assembled using the BPS/360 Basic Tape System (8K Tape). Programs that have been assembled by the Basic Operating System can also be tested if they can run with the Supervisor that is a core resident control program used in the Basic Tape System (8K Tape).

Autotest provides dynamic testing services by monitoring the execution of the user's object program. If one of the

programs being tested gets into an unending loop or destroys some vital portion of a controlling program, Autotest provides special operating instructions to continue the run.

The user communicates with the Autotest program through control cards. These control cards provide two main advantages. One, they facilitate remote testing; using them, a programmer can preplan his test to run with a minimum of operator intervention. Two, by removing the control cards, the user can convert his program to its non-Autotest state easily without a reassembly.

Autotest allows a user to batch as many individual test jobs as he wants and to get extensive diagnostics and testing services in each with just one load procedure.

For each program tested, Autotest:

- Clears main storage before the object program is loaded.
- Monitors the execution of the object program.
- Performs a storage printout if the program comes to an abnormal end-of-job.

Autotest provides the following optional features that a programmer may select for his test job:

Autopatch: Instructions can be exchanged, added, or deleted without reassembling or computing linkage addresses. Constants can be exchanged or added using Autopatch.

Display: Any portion or all of main storage can be dumped whenever a designated address (test-point address) is reached during execution of the object program.

Panel: The permanent storage assignments (bytes 24-127) and the general registers (0-15) can be dumped whenever a designated address (the test-point address) is reached during execution. The floating-point registers (0-6) can also be dumped if requested.

On: The programmer may also control the conditions under which a Panel or Display occurs in a loop.

Card List: Any portion or all of the input/output cards used in an Autotest run can be listed. This facilitates separating the jobs.

Autotest Output Tape: All Autotest output can be stored on an available scratch tape to be printed off-line by the BPS/360 Tape to Printer Utility Program.

Card to Tape Utility: One or more test-data tape files can be generated just before the execution of each program. The records can be fixed- or variable-length, blocked or unblocked. Header and trailer labels can be created.

Tape to Printer Utility: The user may print any tape he uses in his program immediately before or after execution.

Normal End-of-Job Dump: The programmer can specify the kind of dump desired: (a) hexadecimal, (b) hexadecimal and alphanumeric, (c) hexadecimal and mnemonic representation of operation codes, (d) hexadecimal, alphanumeric, and mnemonic representation, or (e) no dump.

Types of Abnormal End-of-Job Dump: The programmer can choose either dump a, b, c, or d as described under Normal End-of-Job Dump.

The testing process can be carried out in any manner the user desires. On the first run, a programmer might use the utilities to build the necessary test files for his program. He might take some displays of different areas in main storage while his program is being executed. He might also call for a dump in all possible formats at both normal and abnormal end-of-job. If his program runs, he can examine his main storage dump to make sure all the details were executed the way he wanted them to be done. If the program doesn't run to normal end-of-job, he can examine his dump and output for clues to his errors.

On his next run, the programmer might want to take more displays and panels to investigate the specific problems uncovered by the first run.

Once he determines what the trouble is, the user can use Autopatch to experiment with solutions until a workable solution is found (Autopatch makes it unnecessary to reassemble each time patches are made to the program). Or, he could reassemble his corrections into his program and test later.

Autotest can be used either at a user's installation or at a remote testing center without altering the testing procedures.

Minimum System Requirements: 16,384 bytes of main storage

... One 1442, 2520 or 2540 Card Read Punch - or one 2501 Card Reader ... One 7-track or 9-track 2400 Series Magnetic Tape Unit for system residence (7-track requires the data conversion feature ... Standard Instruction Set ... One 1403, 1404 (continuous forms only) or 1443 Printer or one 2400 Series Magnetic Tape Unit.

The Autotest program supports these optional features: 32,768 or 65,536 positions of Main Storage ... 1052 Printer-Keyboard ... Dual Density Feature for 2400 Series Magnetic Tape Units.

CARD AND TAPE UTILITY PROGRAMS

The BPS/360 Card and Tape Utility Programs are generalized object programs designed to assist the user in the day-to-day operation of his installation. With these programs, certain frequently required operations, such as transferring files between cards and tape, can be performed without programming effort on the part of the user.

Each program handles a particular type of job. To handle a specific job, the generalized program is modified by control information entered by cards or the printer keyboard. The control information statements are free-form, in that optional parameters can be punched in any order. The programs assume a normal use for most options when a choice is not indicated. Consistency of control information is maintained by providing for all control information to be specified in a similar manner for all programs.

The programs are grouped into two categories: Single-Transfer and Special-Purpose. The single-transfer programs transfer a single file from an input medium to an output medium. The special-purpose programs are used either to prepare a system for use, to provide multiple functions, or to be used as part of the diagnostic or physical error procedures.

Single Transfer

- Card to Printer and/or Punch, 360P-UT-050
- Card to Tape, 360P-UT-051
- Tape to Card, 360P-UT-053
- Tape to Printer, 360P-UT-052
- Tape to Tape, 360P-UT-054

These utility programs are provided for the transfer of data files from any of the normal input devices to any of the normal output devices.

A file can be transferred between unlike storage mediums (card to tape) or like mediums (tape to tape). A file can be transferred from an input medium to an output medium with these options:

Copy. This type of transfer indicates that the file is to be transferred from an input medium to an output medium without change to the format of the records or the file.

Deblock. Format one logical record per physical record in the variable-length format.

Reblock. The input file is transferred from an input medium to an output medium with only the block size being changed.

Field Select. Prior to performing output, fields within each input record are rearranged, dropped, or converted to zoned or packed decimal through the choice of this option.

Deblock and Field Select. Debblock and field select in the fixed portion of a variable-length record.

Reblock and Field Select. This is a combination of the reblock and field-select options. The format of the record is rearranged by moving, dropping, or converting fields within a record along with changing the block size.

Printer Output. Allows the user to show the output in one of three ways:

Display. This option allows the user to display a byte-for-byte representation of the information.

List. This option gives an edited representation of the information.

List and Field Select. This is a combination of the list and field-select options.

For the CARD TO PRINTER AND/OR PUNCH programs the possible combinations are:

Both Print and Punch. This is a combination of copy and list for the card-to-printer punch program.

Both Print and Punch with Field Select. This is a combination copy and list with field select in the card-to-printer punch program.

Fixed-length, variable-length, and undefined-length records may be handled; however, only fixed-length records can be reblocked or field-selected.

These programs take advantage of up to 65,536 positions of main storage. The maximum amount of storage available as I/O area is the area beginning at the end of the program being run, and extending to the end of the available storage. The available storage area is reduced by Tape Label Processing, Field Selection, and Reblocking, Debblocking or Listing.

If the utility program can assign two input or output areas, overlap of the I/O operation can be performed whenever channel assignment permits. The utility program determines the method of I/O area assignment based on the maximum block size, the available I/O area, and the type of job being processed.

Card to Printer and/or Punch, 360P-UT-050

Card to Printer -- The card-to-printer function produces printed output in two formats:

Display - transfers the contents of a card file to a printer with each record being placed on one print line. The field-select option cannot be performed with display. In this format the first 20 positions of the print line are reserved for information describing the file.

List - input records are transferred to the printer with each record being fully printed. The field select option may be used. In this format the entire print line is available to the user.

Sequence checking can be performed on card input.

Card to Punch -- The card-to-punch function accepts input records punched in either EBCDIC or binary. Output records may also be in either EBCDIC or binary. The records may be copied or field-selected.

Card to Tape, 360P-UT-051

Transfers the contents of a card file from cards to tape.

The cards may be punched in either EBCDIC or binary. The input records must be fixed-length unblocked, and each logical record must fit on one card. The maximum size record is 80 bytes for EBCDIC and 160 bytes for binary.

These files may be copied, reblocked, field-selected, or reblocked and field selected. An option is available for specifying the number of logical records to be bypassed before processing starts.

Tape to Printer, 360P-UT-052

Displays a tape file in two formats: data display and data list. Data display provides a byte-for-byte representation of the data file. This format can handle fixed, variable, and undefined records. Data list provides a single edited representation of the file. Input records for this format must be fixed or variable length, and the field-select option may be used. An option is available for specifying the number of logical records to be bypassed before printing starts.

Tape to Card, 360P-UT-053

Transfers the contents of a tape file to a card file. The output file may be in either EBCDIC or binary. Each logical output record must fit into one card (80 bytes for EBCDIC or 160 bytes for binary). Unless only a portion of the input record is transferred through the field-select or reblock-and-field-select option, the input record size will be restricted to 80 or 160. Input records to the program must be fixed length.

These files may be copied, reblocked, field-selected, or reblocked and field-selected. Blocked input records must be reblocked. An option is available for specifying the number of logical records to be bypassed before punching starts.

Tape to Tape, 360P-UT-054

Transfers a file from one or more tape reels to one or more other reels. The files may be copied, reblocked, field-selected, or reblocked and field-selected. If the reblock or field-select options are used, the input records must be fixed or variable length. An option is available for specifying the number of logical records to be bypassed before the copy function is initiated.

Special Purpose

Initialize Tape, 360P-UT-057

In order to perform standard label checking on tapes, standard Volume labels must be present. This program places the Volume labels on the tapes. The Initialize Tape program prepares up to eight Volume labels, one dummy header label (HDR1 followed by binary zeros), and a tape mark on any number of tapes supplied. No label checking is performed.

The user has two options for creating the Volume labels:

- . A single control card can be used to provide (for example) the starting Volume serial number, the owner name and address code, and the protection code. This information will be written on the first tape supplied. Each succeeding tape will have the same Volume label written on it with the exception that the serial number will be incremented by one.
- . From one to eight Volume label image cards can be used as a set to write a unique Volume label(s) on each tape initialized. This card is the exact image of the 80 character label. This option should be used when the volume serial number field contains any alphameric values.

Following the Volume label(s), a dummy Header label is written, followed by a tape mark. This completes initialization. The tapes may then be either rewound or rewound and unloaded as the user specified.

Multiple Utility, 360P-UT-055

Allows from one to three utility operations to be performed simultaneously. Each of the operations transfers a file of information from an input device to an output device. The appropriate unit record device and a separate tape drive must be on-line for each operation being performed.

Card to Tape: Transfers binary or EBCDIC data from card to magnetic tape.

Tape to Printer: Transfers data from magnetic tape to printer. The data may be listed (one logical record per line). The operation will also recognize the first character of a record as a forms control character on preformatted tapes.

Tape to Card: Transfers data from magnetic tape to cards. Data may be punched in EBCDIC or binary.

Any combination of these utility operations up to a total of three may be initially selected (e.g., two tape-to-printer and one card-to-tape operation). Once the operations to be performed are assigned, they can be started and ended any time during the running of the program. However, only those operations originally assigned can be performed during the program execution.

While the primary purpose of this program is to transfer preformatted records, one field can be selected (field select) from an input record and written as the output record.

The Multiple Utility Program makes efficient use of main storage when assigning I/O areas. Active tape I/O areas are assigned contiguously, allowing for a maximum available I/O area. When possible, two tape areas are assigned for each operation to allow overlap of processing. The unit record areas assigned are fixed length.

Storage Print, 360P-UT-056

Produces a printout of storage and registers to aid the user in locating the reason(s) for a program malfunction. The only item of control information that must be provided is the address of the printer to be used. The program is divided into three major sections:

Initial Print: The initial-print section prints the contents of storage (320-767) that is to contain the program for displaying the rest of storage. The contents of the area taken by the initial overlay cannot be printed out, and if desired, must be manually displayed.

Register and Low-Storage Print: If the Floating Point feature is present, the floating point registers are printed in hexadecimal representation. The general registers (0-15) are printed in hexadecimal representation on two lines, 8 registers to a line.

Storage below hexadecimal address 80 contains permanently assigned fields that can be used to determine the status of a program. This area is printed in a special form to

facilitate identification of fields. The line to be printed following register printout contains the channel status word (CSW) and channel address word (CAW) separated into their various sections.

The next section of printing depicts in chart form the old and new program status word (PSW) for the five types of interrupt. Each program status word is broken down into its component parts.

The line that follows shows bytes 4C - 57, which are made up of unused bytes and the timer.

Main Print: Remaining storage is printed by this section. Eight words are printed on each line in hexadecimal. The storage address of the first byte of each line is printed to the left of the line.

If an area of storage produces one or more lines that contain the same word throughout, the lines are suppressed. A message is printed indicating the area of storage and the repeated word.

The Storage Print program will not destroy more than 192 bytes of main storage.

Tape Compare, 360P-UT-202

Tape compare compares two files from two or more tape reels to ensure that the files are identical. The number of reels in each file need not be equal.

Reels containing fixed, variable, or undefined record lengths may be compared. Physical records which do not compare are printed with an index of the bytes that do not match and the corresponding physical record number. A user routine may be supplied for processing records that are not identical.

When possible, two input areas are assigned to each tape to allow overlap of processing with physical I/O if channel assignments permit.

The compare operation may be terminated at any time by pressing the 1052 request key or console stop key. A compare operation for a new file can be initiated by supplying the correct control card and following the restart procedures.

- . Minimum System Requirements: The minimum system requirements for the BPS/360 Card and Tape Utility Programs are -System/360 Processing Unit with 8,192 positions of core storage ... for program loading and control cards - 1442 Card Read Punch, or 2501 Card Reader, or 2520 Card Read Punch*, or 2540 Card Read Punch ... for program generation Input/Output devices required by the specific program.

Note: The Multiple Utility program allows the tape unit(s) to be attached to either the multiplexer or selector channels but the unit record I/O devices must be attached to the multiplexer channel.

For logging and error messages -- 1403 Printer ... or 1404 Printer (continuous forms only) ... or 1443 Printer ... or 1052 Printer-KeyBoard (required for the Multiple Utility Program).

Supported devices include -- 2501 Card Reader ... 1442 Card Read Punch ... 2520 Card Read Punch* ... 2540 Card Read Punch ... 2520 Card Punch* ... 1403 Printer ... 1404 Printer (continuous forms only) ... 1443 Printer ... 2400 series tape unit (with or without the 7-track feature), dual density feature.

*For proper functioning of the device support routines, the 2520 (all models) must have Engineering Changes 811839 [ECA 25] and 811842 [ECA 20] installed.

DASD UTILITY PROGRAMS

The BPS/360 DASD Utility Programs are generalized object programs designed to assist the user in the day-to-day operation of his installation. With these programs, certain frequently required operations, such as transferring disk storage files to or from cards and/or tape, can be performed without programming effort on the part of the user.

Each program handles a particular type of job. To handle a specific job, the generalized program is modified by control information entered by cards or the printer keyboard. The control information statements are free-form, in that optional parameters can be punched in any order. The programs assume a normal use for most options when a choice is not indicated. Consistency of control information is maintained by providing for all control information to be specified in a similar manner for all programs.

The programs are grouped into two categories: Single-Transfer and Special-Purpose. The single-transfer programs transfer a single file from an input medium to an output medium. The special-purpose programs are used either to prepare a disk or data cell for use, to provide multiple functions, or to assign an alternate track.

Single Transfer

Card to Disk	360P-UT-063
Disk to Card	360P-UT-064
Disk to Disk	360P-UT-067
Disk to Printer	360P-UT-073
Disk to Tape	360P-UT-065
Tape to Disk	360P-UT-066

These utility programs are provided for the transfer of data files from any of the normal input devices to any of the normal output devices.

A file can be transferred between unlike storage mediums (tape to disk), or like mediums as is the case of disk to disk when the files may be transferred from one area to another area of the same unit.

A file can be transferred from an input medium to an output medium with these options:

Copy. This type of transfer indicates that the file is to be transferred from an input medium to an output medium without change to the format of the records or the file.

Reblock. The input file is transferred from an input medium to an output medium with only the block size being changed.

Field Select. Fields within each input record are rearranged, dropped, or converted to zoned or packed decimal through the choice of this option.

Reblock and Field Select. This is a combination of the reblock and field-select options. The format of the record is rearranged by moving, dropping, or converting fields with a record along with changing the block size.

Printer Output. Allows the user to show the output in one of three ways:

Display. This option allows the user to display a byte-for-byte representation of the information.

List. This option gives an edited representation of the information.

List and Field Select. This is a combination of the list and field-select options.

Fixed-length, variable-length, and undefined-length records may be handled; however, only fixed-length records can be reblocked or field-selected.

These programs take advantage of up to 65,536 positions of main storage. The maximum amount of storage available as I/O area is the area beginning at the end of the program being run, and extending to the end of the available storage. The available storage area is reduced by Tape Label Processing, Field Selection, and Reblocking.

If the utility program can assign two input or output areas, overlap of the I/O operation can be performed whenever channel assignment permits. The utility program determines the method of I/O area assignment based on the maximum block size, the available I/O area, and the type of job being processed.

Card to Disk, 360P-UT-063

The BPS/360 Card-to-Disk program transfers the contents of a card file from cards to an area of disk. The cards may be punched in EBCDIC or in binary. The input records must be fixed-length unblocked, and each logical record must fit on one card. The maximum-size input record is 80 bytes, or 160 for binary.

These files may be simply copied, block by block; or reorganized by altering the number of records in the block (reblocking); or reorganized by deleting or re-positioning the fields within the record (field selecting) as well as reblocking.

Disk to Card, 360P-UT-064

Transfers the contents of a disk file to a card file. The output file may be punched in either EBCDIC or binary. Each logical-output record must fit on one card (i.e., 80 bytes for extended BCD or 160 bytes for binary). Unless only a

portion of the input record is transferred through the field-select option, the input-record size will be restricted to 80 or 160. Input records to this program must be fixed length.

Files in this program may be copied, reblocked, field selected, or reblocked and field selected.

Disk to Disk, 360P-UT-067

Transfers a file between disk units, or between areas of the same unit. A maximum of six drives can be assigned by assigning one as input, one as output, and the remaining as both input and output. Using the same device for input and output can cause a reduction in performance.

Files can be copied, reblocked, field selected, or reblocked and field selected. If the field-select or reblock options are to be used, the input records must be fixed length.

Disk to Printer, 360P-UT-073

Displays a disk file in two different formats: data-display and data-list. Data-display provides a visual picture of the data where every byte appears in the printed output. This format can handle fixed, variable, and undefined records. Data-list provides a simple edited list of the file. Input records must be fixed length, and the field select option can be used. The input file can come from a maximum of five disk units.

Disk to Tape, 360P-UT-065

Transfers a file from one or more disk units to one or more tape units. These files may be copied, reblocked, field selected, or reblocked and field selected. If the field-select or reblock options are to be used, the input records must be fixed-length. The data portion of the output tape is preceded by a tape mark.

Tape to Disk, 360P-UT-066

Transfers a file from one or more tape reels to a maximum of five disk units. These files may be copied, field selected, reblocked, or reblocked and field selected. If the field-select or reblock options are to be used, the input records must be fixed length.

Special Purpose

Alternate Track Assignment (2311)	360P-UT-098
Alternate Track Assignment (2321)	360P-UT-212
Clear Disk	360P-UT-068
Initialize Data Cell	360P-UT-204
Initialize Disk	360P-UT-069
Multiple Disk to Printer	360P-UT-203
Copy Disk to Tape, and Restore	
Tape to Disk	360P-UT-061
Copy Disk to Card, and Restore	
Card to Disk	360P-UT-062
Copy Disk to Disk	360P-UT-072
Copy Data Cell to Tape, and Restore	
Tape to Data Cell	360P-UT-071

Alternate Track Assignment (2311), 360P-UT-098

Designed to assign an alternate track to a defective track on a 2311 Disk Pack at any time other than when initializing the pack.

When a defective track is encountered, the Volume Table of Contents is checked to determine the next alternate track to be assigned. If an alternate track is available, the records contained on the defective track are transferred to it.

Surface analysis is performed on the track in error after all records have been transferred to the alternate track. If the home address and/or the track descriptor record (RO) area(s) is defective, all records associated with the track in error are printed, and the program is terminated. If these areas are not defective, but a permanent error exists elsewhere on the track, the data records remain on the alternate track, and the job is completed. If the error is only temporary, the data records are transferred back to the originally defective track.

An indication is given to show where errors occur and the action that is to be taken. An option is available allowing all records, or only the invalid records transferred to an alternate track, to be printed on the printer, or on the printer-keyboard. If an error is found in the home address or RO area, this option is ignored and all records are printed.

Engineering Change Considerations: 2841 Control Unit

Engineering Change 413140 or higher is a prerequisite for use of Version 3 or subsequent versions of the Alternate Track Assignment (2311) program.

Note: If the 2841 Control Unit is at Engineering Change Level 413140, or higher, Version 3, or subsequent versions, must be used (Version 2 will not function properly if this engineering change is installed.)

If the 2841 Control Unit is at an Engineering Change Level lower than 413140, then Version 2 must be used (Version 3 and subsequent versions will not function properly unless Engineering Change Level 413140 is installed).

16K Alternate Track Assignment (2311/2314), 360P-UT-207

Performs all of the functions of the program, Alternate Track Assignment Program (360P-UT-098) with these improvements:

The specified track will be flagged defective and an alternate track assigned without performing surface analysis of the specified track.

Optionally, surface analysis will be performed on the specified track (or its assigned alternate) and an alternate track will be assigned only if the surface analysis fails.

Optionally, remove the defective indication from the specified track and unassign the alternate track.

Optionally, perform surface analysis of the specified track up to a total of 255 times.

Perform the selected functions on either an IBM 2311 or an IBM 2314.

Selection of the added options is indicated through additional parameters in the utility modifier statement.

Minimum System Requirements: System/360 with 16K Main Storage ... Card Reader (1442, 2501, 2520 or 2540) ... Printer (1403, 1404 [Continuous Forms], 1443, 1445 or 1052) ... Disk Drive (2311 or 2314).

Alternate Track Assignment (2321), 360P-UT-212

Designed to assign an alternate track to a defective track on a 2321 Data Cell at any time other than when initializing the cell.

When a defective track is encountered, the Volume Table of Contents is checked to determine the next alternate track to be assigned. If an alternate track is not available, the condition is logged and the job is terminated. If an alternate track is available, the records contained on the defective track are transferred to it.

An indication is given to show where errors occur and the action taken. An option is available allowing either all records, or only the invalid records which are transferred to an alternate track, to be printed on the assigned logging device. If an error is found in the home address or track descriptor record areas, this option is ignored and all records are printed as they are transferred.

Surface analysis is performed on the track in error after all records have been transferred to an alternate track. If the home address or track descriptor record areas are not defective, but a permanent error exists elsewhere on the track, the defective track points to the alternate track, and the job is completed. If the error is only temporary, the data records are transferred from the alternate track back to the originally defective track.

If the home address or track descriptor record areas are defective, the home address and track descriptor record are advanced 800 bytes and are rewritten to allow the track to be flagged defective. If an error occurs while attempting to advance these areas, the program is terminated. If no error occurs, the defective track points to the alternate track and the job is completed.

Engineering Change Considerations: 2841 Control Unit Engineering Change Level 413140 or higher is a prerequisite for use of Version 1 of the Alternate Track Assignment (2321) program. Engineering Change 811839 and 811842 must be installed on a 2520 used as a card reader.

Clear Disk, 360P-UT-068

Clears one or more areas of the 2311 Disk Storage, and establishes a pre-formatted track containing an indicated base throughout the area cleared. For each track cleared, records are formatted to the end of the track. The maximum number of records depends on the size of the records.

The area to be cleared can be as small as one track or up to

a maximum of a complete disk pack. As many as five areas can be designated to be cleared with one run of the program. When an area of disk is cleared, fixed-length blocks containing count, key, and data areas are established on the disk. The information defining the key and data areas is indicated in the utility-modifier card, or, if a utility-modifier card is not entered, assumed values are made.

The key and data areas defined are filled with a user-defined character. Label-checking is done to determine if the area to be cleared contains all or part of an unexpired file. Expired labels for the area to be cleared are deleted from the VTOC.

Initialize Data Cell, 360P-UT-204

Prepares from one to five data cells for use on any 2321 Data Cell Drive. The program initializes the data cells with a method compatible to DOS/360 and OS/360. The preparation of each of these cells consists of:

- . VTOC Label Checking ...
- . Home-Address and Track-Descriptor Record (RO) Generation ...
- . Surface Analysis and Initialization Verification ...
- . IPL, Volume-Label, and VTOC Format Creation.

Two types of control information are required by the program: Job control-card information, and utility-control information. The job control-card information relates to the channel and unit assignment and physical device description. The utility-control information, which is provided in the utility modifier statement and the label control-card set, specifies which data cell(s) is to be initialized, and provides the labeling information for VTOC and volume label creation.

VTOC Label Checking: Before a cell is initialized, a check is performed to see if a VTOC is present. If the cell has been previously initialized and the VTOC is present, any labels in the VTOC are checked to see if the files on the data cell have expired. If any files have not expired, a message is printed. If the user still wishes to initialize the cell after receiving the message, he can bypass the label condition and continue to process. If the user does not wish to bypass the condition, that cell may be deleted from the job.

Home Address Generation: A binary, five-byte home address is written on every track by the program. The five bytes cylinder (head bar) number, and track (element) number. The flag byte, which is propagated to the flag byte of each record on the track, is used to indicate the condition (defective or not defective) of the track, and whether or not it has been assigned as an alternate track.

Track Descriptor (RO) Generation: A track descriptor record or record zero (RO) is written as the first record following the home address. It is divided into two parts: count and data. If an error occurs in the home address or RO area, the home address and record zero are advanced 800 bytes and are rewritten. The track is then flagged defective, and an alternate track is assigned. If an error occurs at this time, the program is terminated.

Surface Analysis and Initialization Verification: Surface analysis is performed first in an alternate track area consisting of 400 tracks. Tracks in this area found to be defective are flagged and cannot be assigned as alternate tracks.

Surface analysis is then performed on all remaining tracks of the cell. If defective ones are encountered, alternate ones are established in the alternate track area. If there are no more alternate tracks available, the cell is deleted from further processing.

Messages are printed on SYSLOG to notify the user of defective tracks, assigned alternate tracks, and their locations.

An initialization verification routine ensures that the home address and track descriptor record have been written on each track, and that surface analysis has been performed on every track.

IPL Format Creation: The program formats two IPL records. These are written on cylinder zero, track zero, records one and two. Record one is written with a 24-byte data field of binary zeros. Record two is written with a 144-byte data field of binary zeros.

VTOC-Format Creation: Pre-formats the Volume Table of Contents (VTOC), reserving the first two record locations in it for the Volume Table of Contents - Data Set Control Block (VTOC - DSCB) label, and the Space-Management label.

The location on the cell in which the VTOC is to be placed is indicated in a control card. The standard location is on cylinder zero immediately following the volume label(s), and extending to the end of the cylinder. The VTOC can, however, appear on any cylinder (excluding alternate cylinders), but cannot exceed cylinder boundaries.

Initialize Disk, 360P-UT-069

Prepares from one to five complete disk packs for use on IBM 2311 Disk Drives. The preparation of a pack consists of:

- . VTOC Label Check ...
- . Home-Address Generation ...
- . Surface Analysis and Track Descriptor (RO) Record Generation ...
- . Volume-Label Creation ...
- . IPL and VTOC Format Creation.

VTOC Label Check: Before a pack is initialized, it is checked to see if any labels present in the VTOC are expired. If the file has not expired, a message is printed. If the user still wishes to initialize the disk pack after receiving the message, he can bypass the label and continue to process. If the user does not wish to bypass the pack(s) with unexpired labels, the pack or packs are deleted from the job.

Home Address Generation Five bytes of the seven-byte home address are written by this program in binary representation.

If the home-address cannot be written on a track, a message is printed to identify each home-address that cannot be written. If a home-address cannot be written for every track of a pack, that pack is deleted from the job.

Surface Analysis and Track Descriptor (RO) Record Generation: Surface analysis is performed first on the alternate cylinders (200, 201, and 202). When a track on an alternate cylinder is found to be defective, the track is flagged as defective and cannot be assigned as an alternate track. Surface analysis is then performed on all remaining tracks. If a track is detected to have a defective surface area upon which data cannot be written, an alternate track is established to record the data. A message is printed to notify the user of defective tracks.

Processing is terminated after detection of the thirty-first defective track (30 alternate tracks). The defective tracks are logged to provide a record of the condition of each pack processed. When analysis has shown that a track is not defective, the track descriptor record (RO) is written.

If the track-descriptor record cannot be written on a track, a message is printed to identify the error. The program continues analysis and RO generation to log any other defective tracks. The pack on which the error occurs is deleted from the job.

Volume-Label Creation: Through the use of a control card unique to this program, a Volume label is created in the standard format (VOL1) for each pack processed. The Volume label is written on cylinder zero, track zero, record three of each disk pack. Seven additional (VOL2-VOL8) user Volume labels can be created, if desired, and will be placed in records four through ten.

IPL Format Creation: This function formats two IPL records. These records are written on cylinder zero, track zero, records one and two. Record one is written with a 24-byte data field of binary zeros. Record two is written with a 144-byte data field of binary zeros.

VTOC Format Creation: The initialize disk program preformats the Volume Table of Contents (VTOC). The location on the disk in which the VTOC is to be placed is indicated in a control card.

The standard location of the VTOC is on cylinder zero immediately following the volume label(s), and extending to the end of the cylinder. However, the VTOC can appear on any cylinder (excluding alternate cylinders), but cannot exceed cylinder boundaries. A VTOC placed anywhere other than in the standard location can be any number of tracks desired on the cylinder.

16K Initialize Disk (2311/2314), 360P-UT-206

Performs all of the functions of the Initialize Disk Program (360P-UT-069) with these improvements:

Perform surface analysis of only those tracks not previously flagged as defective. The tracks already flagged as defective are left unchanged.

Optionally, perform surface analysis of all tracks, including those tracks previously flagged as defective.

Flag individually specified tracks as defective without performing surface analysis.

Optionally, perform the surface analysis of each track up to a total of 255 times.

Perform initialization of from one to five 2316 Disk Packs mounted on the IBM 2314.

The selection of functions to be performed is indicated on a utility modifier statement inserted in the program deck by the user.

Minimum System Requirements: System/360 with 16K Main Storage ... Card Reader (1442, 2501, 2520 or 2540) ... Printer (1403, 1404 [Continuous Forms], 1443, 1445 or 1052) ... Disk Drive (2311 or 2314)

Multiple Disk To Printer, 360P-UT-203

The BPS/360 Multiple Disk to Printer Program allows from one to three disk-to-printer functions to be performed simultaneously.

Each function is capable of printing (in character mode) fixed length records with or without key fields. The records may be either blocked or unblocked if key fields are absent. If they are present, the records must be unblocked.

One printer and one disk unit must be on-line for each separate function being performed. A new function may be started at any time while other functions are in process. When the job of any function is complete, a new job may be initiated for that function.

The Multiple Disk to Printer Program makes efficient use of core storage when assigning I/O areas. To allow for a maximum available I/O area, active I/O areas are assigned contiguously. When possible, two disk input areas are assigned for each function to allow overlap of input with processing and output.

Copy Disk to Tape and Restore Tape to Disk, 360P-UT-061

Copy Disk to Card and Restore Card to Disk, 360P-UT-062

Copy Disk to Disk, 360P-UT-072

These programs provide a 2311 DASD Utility function in support of BOS/360 and DOS/360. They enable the user to transfer volumes and files of data from 2311 Disk Storage to a magnetic tape, cards, or 2311 Disk Storage. If the data was transferred to card or tape, it can be restored to the disk pack at a later date. The transfer processes all fields necessary to restore the data so that it is identical to the original volume or file.

Consecutive, Indexed Sequential and Direct Access Methods of file organization are supported.

The output created by the Copy programs (except Copy Disk to Disk) is designed for use by the Restore programs only.

Program Functions: The Copy programs can transfer data from a 2311 by file or by volume. The Copy file option transfers the file described by the File-Label XTENTS as referenced by the volume table of contents in the defined 2311. An option permits copying of IPL records.

A special open on-line option allows as many as five XTENTS to be opened at the beginning of the run, thus freeing the open-routine space for use as I/O area during execution of the Copy function. Otherwise, the user may specify a consecutive open which processes each XTENT as it is encountered. The consecutive open option allows an unlimited number of XTENTS to be processed in one run.

The Copy volume option permits the user to copy a complete volume including the IPL records, Volume Label(s), Volume Table of Contents, and data.

The restore programs will replace data from cards or tapes to the 2311 by file or by volume depending on the method (Copy Program option) used to copy and data originally. When files are restored, the Format 1 label is modified to include the serial number of the new pack. When volumes

are restored, the Format 1 labels are restored as originally copied and the Format 4 label modified.

The programs assign I/O areas based on the size of core storage. I/O overlap is performed if core storage is equal to or greater than 16K and channel assignment permits. The restored records occupy areas of the 2311 identical to the original file.

The Copy Disk to Card and Restore Card to Disk program allows the program to be restarted at the beginning of any track that was processed, or at the beginning of any pack (consecutive open only).

Copy Data Cell to Tape and Restore Tape to Data Cell,
360-UT-071

The BPS/360 Copy Data Cell to Tape and Restore Tape to Data Cell program provides a 2311 Data Cell utility function in support of BOS/360 and DOS/360. It enables the user to transfer volumes and files of data from a data cell(s) to tape. The tape can then be restored to the data cell(s) at a later date. The transfer processes all fields necessary to restore the data so that it is identical to the original volume or file.

Consecutive, Index Sequential, and Direct Access Methods of file organization are supported.

The output created by the Copy program is designed for use by the Restore program only.

The program copies and restores a data cell in one of two ways:

Copy and Restore File: With this option one data file may be copied and restored. The file may consist of more than one volume. RMs are copied for the area occupied by the file, and IPL Records may be optionally copied.

A special open on-line option allows as many as five XTENTS to be opened at the beginning of the run, thus freeing the open-routine space for use as I/O area during execution of the Copy function. Otherwise, the user may specify a consecutive open which processes each XTENT as it is encountered. The consecutive open option allows an unlimited number of XTENTS to be processed in one run.

Copy and Restore Volume: With this option one entire data cell will be copied and restored, including RM, IPL Records, data records, Volume Label(s), and the VTIOC.

The restore program will replace data from tape to the 2311 by file or by volume depending on the method (Copy Program option) used to copy the data originally. When files are restored, the Format 1 label is modified to include the serial number of the new pack. When volumes are restored, the Format 1 labels are restored as originally copied and the Format 4 label modified.

The program will assign I/O areas based on the size of main storage. I/O overlap will be performed if the main storage is equal to or greater than 16K and channel assignment permits. The restored records will occupy areas of the 2321 identical to the original file.

An option is available to checkpoint and restart during program execution. An additional tape drive is required to support this option.

Minimum System Requirements: The minimum system requirements for the BPS/360 DASD Utility Programs are: System/360 Processing Unit with 8,192 positions of core storage [16K for the Alternate Track Assignment (2311), Copy and Restore Data Cell, Initialize Data Cell, and Multiple Disk-to-Printer Programs].

For program loading and control cards -- 1442 Card Read Punch ... or 2501 Card Reader ... or 2520 Card Read Punch* ... or 2540 Card Read Punch.

*For proper functioning of the device support routines, the 2520 (all models) must have Engineering Changes 811839 [ECA 25] and 811842 [ECA 20] installed.

For program operation -- Input/Output devices required by the specific program.

The Multiple Disk to Printer program requires the disk unit(s) to be attached to the selector channel and the printer(s) to be attached to the multiplexer channel.

For logging and error messages -- 1403 Printer ... or 1404 Printer (continuous forms only) ... or 1443 Printer ... or 1052 Printer-Keyboard** (required for the Multiple Disk to Printer Program).

**If the system does not have the 1052 Printer-Keyboard at the fixed address X'001F', a replace card (REP) must be inserted between the supervisor and job control of the

program deck. See Appendix A of System/360 Basic Programming Support DASD Utility Programs Operating Guide, C24/3392, for additional information.

Supported devices include -- 2501 Card Reader ... 1442 Card Read Punch ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2520 Card Punch ... 1403 Printer ... 1404 Printer (continuous forms only) ... 1443 Printer ... 2400 Series Tape Unit, (with or without the 7-track feature ... For the Copy and Restore Programs, the Data Conversion feature must be used with 7-track tape) ... 2311 Disk Storage Drive ... 2321 Data Cell Drive ... Dual Density Feature.

PAPER DOCUMENT SUPPORT

Input/Output 1412/1419, 360P-IO-058

Provides control of up to four user programs concurrently. These four programs, referred to as a user program set, may be: a) one 1412 or 1419 program and up to three additional user programs, or b) two 1419 programs and up to two additional user programs, or c) one to four user programs which do not include 1412 or 1419 input. A user set once loaded must complete processing of all programs within that set prior to loading a new set of programs.

The program can control the input and output functions associated with typical MICR processing, such as demand deposit capture, outgoing transit and proof of deposit.

The Input/Output 1412/1419 program provides ... control for all supported devices and their error routines ... control of the document input buffer(s) ... batch numbering (1419 Model 1 only) ... control of System/360 standard tape label and 2311 disk label processing.

The user can insert his routines for ... stacker determination ... formatting output ... document data processing ... recognition of control levels.

The 1412 or 1419s should be placed at the highest priority on the multiplexer channel to minimize contention problems.

The Input/Output 1412/1419 program includes a multiplexing capability providing four request queues which will permit four unbuffered byte mode I/O devices to operate in a data interleaved mode on the multiplex channel. The 1412 and 1419s have their own queues and are interleaved in addition to the four request queues. If a burst mode operation is attempted on a multiplex channel, I/O operations which can be multiplexed on the remaining queues will be processed prior to the burst mode operation.

Performance: The Input/Output 1412/1419 program is designed to make possible maximum MICR reader to printer throughput. Throughput speeds will vary with document length, amount of user processing time, other input and/or output operations and system configuration.

The minimum time available for stacker selection for each MICR Reader is: 1412 --- 7.5 milliseconds ... 1419 --9.5 milliseconds. At least 9.5 milliseconds are available for stacker decisions on the 1419 for 100% of the documents read. For those cases where the 9.5 milliseconds (7.5 milliseconds for the 1412) of stacker selection time are exceeded and worst case conditions such as minimum document spacing occur, an increase in rejects can be expected.

Assume a System/360 Model 30 with a 1.5 microsecond storage cycle. The timings in parenthesis are for a System/360 Model 30 with a 2.0 microsecond storage cycle, and a System/360 Model 40, respectively. The Input/Output 1412/1419 program will use:

- For one MICR Reader ... 1.5 (2.0, 1.2) milliseconds (minimum) to process the external interrupt which signals the end of the document and 2.1 (2.8, 1.4) milliseconds (maximum) if a unit check has occurred.
- For two MICR Readers ... 1.6 (2.1, 1.2) milliseconds (minimum) to process each external interrupt whenever the interrupts are not concurrent and 3.1 (4.1, 2.1) milliseconds to process two interrupts concurrently ... 4.2 (5.6, 2.8) milliseconds (maximum) if two concurrent unit checks occur with two concurrent external interrupts.
- The I/O control program may take up to an additional .38 (.5, .25) milliseconds to process the external interruptions, if any other interruption is being serviced.
- For other I/O operation ... approximately 3.8 (5.0, 2.5) milliseconds for each I/O operation to start the I/O service the interrupt and recognize errors.
- For document data ... approximately 1.5 (2.0, 1.0) milliseconds to "get" a document record from the input buffer to make it available for user processing.

The available time for selection processing will be reduced by the character transfer time associated with concurrent I/O operations and the time needed to complete instruction execution prior to interruption. The I/O control program may take up to an additional .5 milliseconds to process the external interruption, if any other interruption is being serviced.

In making timing calculations, only one printer can affect, and thereby reduce, the MICR Reader document selection time.

Note: Channel contention problems may be minimized by -- placing the 1412 or 1419s at the highest priority on the multiplexer channel ... disengaging the 1412 or 1419s whenever other I/O operations might conflict.

The average document cycle times (without considering the printer) for user processing are:

	1412	1419
Document length - 6 inches	60 ms.	37.4 ms.
Document length - 8 3/4 inches	87.5 ms.	54.5 ms.

To determine the processing time available, it is necessary to subtract the time required for the following factors from the average document cycle time. This applies for either one or two MICR Readers.

1. MICR Reader(s) interrupt servicing time.
2. User's document selection time(s).
3. The time required to get document record(s).
4. The time required for each I/O operation (exclusive of the MICR Reader(s)).
5. Character transfer interference times for all I/O operations including the MICR Reader(s).

Approximately 5 milliseconds will be taken for each I/O operation exclusive of the Reader Sorter.

This time includes -- Start I/O, interrupt servicing and recognition of errors.

Approximately 2 milliseconds will be taken to get each document record from the input buffer.

The Input/Output 1412/1419 program has the following core storage requirements:

	Model 30	Model 40
One program (one MICR Reader with 2400 Tape)	4400 bytes	4650 bytes
One program (one MICR Reader with 2311 Disk)	4400 bytes	4650 bytes
Two or more programs (two 1419s with 2400 Tape or 2311 Disk)	5600 bytes	5600 bytes

An additional 160 bytes are required when the multiplexer capability is utilized.

Minimum System Requirements: One 1419 or one 1412 MICR Reader with Adapter Feature (#7720)* ... 2030** Processing Unit Model D is required for Dual 1419 operation) or 2040 Processing Unit Model D (1419 only ... 1412 is not supported on 2040) or 2050 Processing Unit Model F (1419 only ... 1412 is not supported on 2050) or 2065 Processing Unit Model G (1419 only ... 1412 is not supported on 2065) ... a card reader (1442, 2501, 2520 or 2540) ... a printer (1403, 1404,*** 1443, 1445 or 1052 Printer-Keyboard) ... External Interrupt (2030 only) on Direct Control ... Standard Instruction Set ... Appropriate control units.

*Not required if the user program does not include 1412 or 1419 input.

**The 2030 Processing Unit must be at or beyond Engineering Change Level 125919.

***Continuous forms only.

Additional Machine Features Supported: Additional core storage ... 2400 Series Magnetic Tape Units (7- or 9-track) or 2311 Disk Storage Drive ... Selector Channel 1 and Selector Channel 2 ... Highspeed Multiplexer Channel ... 1442, 2520, or 2540 Card Punch ... Selective Tape Listing Feature ... Interchangeable Chain Cartridge ... 1416 Interchangeable Train Cartridge ... Universal Character Set Feature ... Endorser Feature ... Pocket Light Control Feature (1419 only) ... Batch Numbering Device (1419 only) ... up to two 1419s ... Dual Density Feature.

Input/Output 1418/1428, 360P-IO-059

The BPS/360 Input/Output 1418/1428 program is designed to eliminate the user's need to program logical details associated with input and output of OCR processing. The basic control program provides a single request queue for input/output operations on the multiplexer channel. The multiplex capability provides four request queues which will permit four unbuffered devices (which do not operate in the burst mode) to operate in the data interleaved mode. If any burst mode (tape or disk) operations are attempted on a multiplexer channel queue, input/output operations which can be multiplexed on the remaining queues will be processed first until all such requests have been serviced.

The multiple program facility provided to handle four applications consists of several subroutines that become an integral part of the 1418/1428 control program. The multiple program facility uses program control words (PCW's) to transfer control among the user programs. A PCW is a 240 byte area reserved by the user for each of his programs.

The control program stores the status of the System/360 when control is being transferred from one user program to another. This facility permits the user to operate one 1418/1428 reader on-line with a System/360 with up to three other non-1418/1428 programs. Each of the applications is controlled by a separate user program.

A user program written for a single 1418/1428 reader program may be easily adapted for use in a multiple program application. In order to adapt a user's single 1418/1428 program to a multiple application:

- A program control word must be provided to control transfer from one user program to another user program.
- Entry points must be provided to the subroutines associated with the multiple program facility.

The Input/Output 1418/1428 program controls the input and output functions that are associated with such typical OCR processing as formatting, blocking and conversion to magnetic tape or disk storage, batch balancing and punching of out-of-balance data.

The control program provides maximum programming flexibility in the time dependent OCR applications. The following functions are provided for the user's problem program:

- Channel scheduler and complete error routines for I/O devices other than the 1418/1428 ...
- Maintenance of a document input buffer ...
- Operator communication routine ...
- Tape label processing or disk label processing.

The I/O program allows the user to insert his routines for such functions as:

- Stacker determination ...
- Formatting of printer, punch, and magnetic tape or disk output ...
- Document arithmetic processing ...
- Recognition of control levels.

The program consists of -- Supervisor ... Job Control ... Tape and Disk processing routines ... Initial Program Loader (IPL).

These components (except IPL) and the user-provided problem program(s) are assembled, and the resulting object decks (with IPL) are loaded into main storage from cards. The combined deck [Input/Output 1418/1428 Program and the user's problem program(s)] allows the processing of data read and effects the reading and writing of other input/output devices which the user may require. Input/output operations and other supervisory functions are requested through the use of the Supervisor-Call (SVC) Interruption Feature of the System/360.

Performance: The 1418/1428 Control Program is designed to make possible maximum OCR throughput. Throughput speeds will vary with document length, amount of user processing time, and other I/O operations. Disengaging the 1418 or 1428 in order to perform a burst mode operation on the multiplexer channel or any other operation requiring a disengage will decrease throughput.

The maximum stacker select time for the 1418 and 1428 is 10 ms plus any additional time provided by terminating the last read command prior to the trailing edge of the document passing the "Document End 4" sensing station.

If the read command is terminated with the trailing edge of the documents passing the selected document end switch setting, the following times are available:

Document End		Time
1		94 ms
2		63 ms
3		25 ms
4		10 ms

Assume a System/360 Model 30 with a 1.5 microsecond storage. The times for a 2 microsecond storage cycle are shown in parentheses.

The control program will use a maximum of 1.5 (2.0) milliseconds to process each external interrupt and .75 (1.0) millisecond (maximum) additional if a unit check has occurred. Concurrent I/O operations will deduct from the user's stacker selection routine. The time needed to complete the instruction being executed when the interrupt occurs will also reduce the available time. The I/O program can delay the External Interrupt up to .38 (.5) milliseconds if another interrupt is currently being processed.

Document rejects will occur when the available stacker select time is exceeded.

Note: Channel contention problems may be minimized by -- (1) placing the 1418 or 1428 as the highest priority on the multiplexer channel ... (2) disengaging the 1418 or 1428 where other I/O operations would conflict.

The user will have the following times available for his overlapped process time in the main line program assuming no concurrent I/O operations. These times consider interference from 39 OCR characters per 6 inch document with a single read command in the CCW chain.

1418	113 milliseconds
1428	113 milliseconds

Approximately 3.8 (5.0) milliseconds will be required for each I/O operation requested (this includes start I/O, interrupt servicing, and recognition of errors). Approximately 1.5 (2.0) milliseconds will be required to get a document record from the input buffer. Concurrent I/O operations will deduct from the user's available process time.

Minimum System Requirements: One 1418 or one 1428 Optical Reader with Adapter Feature (#7720) ... 2030 (Model C) (a model D is required if the multiple program facility is used) or 2040 (Model D) or 2050 (Model F) ... External Interrupt Feature (2030 only) or Direct Control Special Feature ... Standard Instruction Set ... appropriate Control Units ... One Printer (1403, 1404*, 1443, 1445, or 1052 Printer-keyboard) ... one Card Reader (1442, 2501, 2520, or 2540).

Note: The Model 2030 must be at or beyond Engineering Change Level 125919.

*Continuous forms only.

Additional Machine Features Supported: Additional machine features supported by the Input/Output 1418/1428 program are: additional core storage ... 2400-series Magnetic Tape Units (7- or 9-track) or 2311 Disk Storage Drive ... Selector Channel 1 and Selector Channel 2 ... High-speed multiplexer channel ... 1442, 2520, or 2540 Card Punch ... Mark Reading Feature ... Read Station Feature, Additional ... Dual Density Feature.

Input/Output 1231 N1, 360P-IO-060

Provides input/output program control for System/360 installations using the 1231 N1 Optical Mark Page Reader. The basic control program provides a single request queue for input/output operations on the multiplexer channel. The multiplex capability provides four request queues which will permit four unbuffered devices (which do not operate in the burst mode) to operate in the data interleaved mode. The multiplex capability permits the user to operate up to four 1231 N1 readers on-line with a System/360. If any burst mode (tape or disk) operations are attempted on a multiplexer channel queue, input/output operations which can be multiplexed on the remaining queues will be processed first until all such requests have been serviced.

The multiple program facility provided to handle up to four applications consists of several subroutines that become an integral part of the 1231 N1 control program. The multiple program facility uses program control words (PCW's) to transfer control among the user programs. A PCW is a 240 byte area reserved by the user for each of his programs. The control program stores the status of the System/360 when control is being transferred from one user program to another. Up to four 1231 N1 readers may be distributed in any manner among the four programs.

A user program written for a single program application may be easily adapted for use in a multiple program application. In order to adapt a user's single application to a multiple application:

- A program control word must be provided to control transfer from one user reader program to another user reader program.
- Entry points must be provided to the subroutines associated with multiple program facility.

The Input/Output 1231 N1 Program is designed to eliminate the user's need to program logical details associated with input and output of 1231 N1 data sheet processing. In addition, the ability to conveniently read, write and control other I/O devices (tape, disk and punched card data processing) is included. Features of the program include:

- Provision for controlling functions of the Master Mark Special Feature (the Master Mark Special Feature permits reading data that is recorded common to a specific batch of documents).
- Automatic servicing of interrupts.
- Complete disk and/or tape label checking.
- Control of such 1231 N1 functions as -- feeding documents ... reading documents ... stacker selecting documents ... handling validity check conditions.

The Input/Output 1231 N1 program consists of -- Supervisor ... Job Control ... Tape and Disk Label Processing Routines ... Initial Program Loader (IPL).

These components and the user provided problem program(s) are assembled, and the resulting object decks (with IPL) are loaded into main storage from cards. The combined deck [Input/Output 1231 N1 Program and the user's problem program(s)] allows the processing of data read from the optical mark pages and effects the reading and writing of other input/output devices which the user may require in his 1231 N1 applications.

Input/output operations and other supervisory functions are requested through the use of the Supervisor-Call (SVC) Interruption Feature of the System/360.

Performance: In a 1231 N1 configuration, throughput will vary with user processing time requirements and other input/output operations. However, the Input/Output 1231 N1 program is designed to make possible the maximum 1231 N1 reader throughput which is a rated speed of 2,000 data sheets per hour (Version 2 of the IOCP is designed to make possible this throughput rate for each 1231 N1 reader up to a maximum of four).

The basic cycle time for the 1231 N1 is 1,677 milliseconds. Of this time, 1,452 milliseconds are required for data transfer when the Control Timing Marks Switch is set to NO. When the Control Timing Marks Switch is set to YES, the data transfer time is 1,527 milliseconds. Within this time, data is read from the document and transferred into core storage. Both user and Input/Output 1231 N1 Program processing can proceed during document read time.

If maximum throughput is to be maintained, the maximum re-instruct time for subsequent read operations is 225 milliseconds after the end of data transfer if the Control Timing Marks Switch is set to NO. If the Control Timing Marks Switch is set to YES, the maximum re-instruct time for subsequent read operations is 150 milliseconds after the end of data transfer.

Minimum System Requirements: 2030 (Model C) [a Model D is required if the multiple program facility is used] or 2040 (Model D) or 2050 (Model F) or 2065 (Model G) ... Standard Instruction Set ... one 1231 Optical Mark Page Reader Model N1 ... one Card Reader (1442, 2501, 2520, or 2540) ... one Printer (1403, 1404*, 1443, 1445, or 1052 Printer-keyboard) ... appropriate Control Units.

*Continuous forms only.

Additional Machine Features Supported: Additional core storage ... either (or both if sufficient core storage is available) 2400-series Magnetic Tape Units (7- or 9-track) or 2311 Disk Storage Drive ... Selector Channel 1 and Selector Channel 2 ... 1442, 2520, or 2540 Card Punch ... Master Mark special feature ... up to four 1231 N1s ... Dual Density Feature.

MISCELLANEOUS SUPPORT

Universal Character Set Utility Program 360P-UT-048

The BPS/360 Universal Character Set, a special feature, provides the System/360 1403 Models 2, 3, and N1 Printers with the ability to print any set of 240 graphics, arranged in a desired sequence on the print train or print chain. The advantage of this feature is that print trains or chains can be tailored to the needs of the particular user applications.

The Universal Character Set feature utilizes a 240 character read/write storage unit located in the 2821. One storage unit is supplied for each printer equipped with the feature. Each position of the 240 character storage corresponds sequentially to a graphic on the train or chain of the respective printer. This storage unit is sequentially read out as the various graphics are brought into print position by the movement of the train or chain. Codes read out of the storage unit are matched to the successive codes of the data record to be printed. When a match occurs, the corresponding print position prints. The codes in the data record are selected from the 256 codes of the Extended Binary Coded Decimal Interchange Code.

The Universal Character Set Utility program loads the arrangement of 240 codes selected from the Extended Binary Code Decimal Interchange Code into the read/write storage units located in the 2821 Control Unit. Ten train and ten chain arrangements are provided for System/360, but any previously announced 1400-series arrangement or any custom-designed arrangement can be used.

The program prints a train/chain image after loading is complete. This image must be checked by the machine operator for accuracy. The System/360 arrangements have an identifying message printed with the image. If a custom-designed or 1400-series arrangement is used, no message is printed. An optional name control card permits the user to identify the customer application of the train or chain installed. Control card errors are checked by the program.

Data checks caused by unprintable characters may be suppressed by using Version 1, Modification Level 1, and later modifications of the UCS program. However, this suppression can only be accomplished if the 2821 Control Unit has been updated through Engineering Change #125632 or Request for Engineering Action #0100037. If this modification level or a later modification level is used on a System/360 not equipped with the feature, a Command Reject will result. To suppress data checks on a system equipped with the feature, an additional operand (,NO DATA CHECK) is punched in columns 16-29 of the BL card. The data check suppression will remain in effect until the UCS program is rerun without the additional operand (blanks in cols. 16-29), or otherwise reset. If the System/360 is being run with the 1401 compatibility feature, the data check suppression feature cannot be used.

Minimum System Requirements: An 8K System/360 with a 2520, 2540, 1442, or 2501 Card Reader ... a 1403 Printer, Model 2, 3, or N1 ... and Universal Character Set Special feature.

Distribution Program, 360P-UT-208

Performs the following functions:

Build two tape loadable programs on an output tape. The two programs are an Initialize Disk (2311/2314/2319) program and a Restore Tape to Disk program.

Copy one or more disk files, defined by the file name parameter on the utility modifier cards, to the output tape(s).

The volume built by the above two steps will allow a disk pack to be initialized by the first tape loadable program and allow that disk pack to be restored with the disk file(s) information contained on the tape volume by the second tape loadable program.

Performance ... The program has three functions whose performance is as follows:

Copy -- This segment requires not more than 14 minutes to copy to tape a 2311 disk file whose extents are from cylinder 0 to cylinder 198. It requires not more than 28 minutes to copy to tape a 2314/2319 disk file whose extents are from cylinder 0 to cylinder 198.

Initialize Disk -- This segment requires not more than 7 minutes to initialize a 1316 disk pack when performing

surface analysis once per track. Increasing the number of times surface analysis is performed adds approximately 5 minutes per repetition.

Initialization of a 2316 disk pack requires not more than 14 minutes per one execution of surface analysis. Each additional repetition of surface analysis adds approximately 10 minutes.

Restore Tape to Disk -- This function requires not more than 11 minutes to restore a 2311 disk file from tape to a 1316 disk pack whose extents are from cylinder 0 to cylinder 198. It requires not more than 25 minutes to restore a 2314/2319 disk file from tape to a 2316 disk pack whose extents are from cylinder 0 to cylinder 198.

Minimum System Requirements ... System/360 with 16K bytes of main storage ... Card Reader (1442, 2501, 2520 or 2540) ... Printer (1403, 1404 [Continuous Forms], 1443 or 1445) ... Printer Keyboard (1052) ... Tape Drive (2400 series) ... Disk Drive (2311, 2314 or 2319).

Modular File Maintenance Program 360P-UT-219

The complete Modular File Maintenance Program is supplied in both object (basic) and symbolic (optional) formats. The program performs these functions:

Building of self-loading master and update DTR(s) such as those on which IBM will now supply BPS programs and updates. This function can be employed by users to prepare master and update tapes containing user-written programs.

Update of current master tapes by merging with an update DTR(s) to produce new master tapes. IBM will supply update DTR(s) only for the basic volumes of BPS programs. For the optional volumes, complete replacements must be ordered.

Retrieval of individual programs from both master and update DTR(s). The output media can be card, tape, printer, or any combination of these.

Retrieval of header records only to identify the programs on masters and update DTR(s).

Each master and update DTR supplied by IBM consists of two files. The first file contains IPL, supervisor, job control, and the Update/retrieval phase of the Modular File Maintenance Program. The second file is a series of data modules, each containing a header record and one phase of a BPS program (IPL, supervisor and job control are each considered phases of a BPS program).

The header records on a current master and an update DTR(s) control the merging operation by which a new master is created. A program phase is omitted from the new master when the header for that phase on the update DTR(s) specifies a delete action.

Minimum System Requirements: System/360 Model 3, 40 or 50 with 8K bytes of main storage...Card Reader - 1442, 2501, 2520 or 2540...Card Punch - 1442, 2520 or 2540...Printer 1403, 1404 (continuous forms only) or 1443...Tape 2400-series, 9-track or 7-track with Data Conversion feature. One to three drives required depending on functions performed.

Performance: The Modular File Maintenance Program runs at approximately the rated speed of the slowest I/O device used.

Remote Job Entry Work Station Program 360P-CQ-218 (BPS/360)

-- This program works in conjunction with the OS/360 Remote Job Entry (RJE) system to provide a convenient means of entering OS/360 jobs to a central computing system from a remote location equipped with a System/360. It accepts OS/360 jobs and RJE control statements and commands from a card reader to 1052 printer-keyboard, transmits this data to the Central (OS/360) processor via high-speed communication lines, receives data from the central system, and outputs this data to an attached output device (printer, punch or console printer), or passes it to a user-written routine. The console printer-keyboard cannot be used for input and output of jobs.

Without the inclusion of user-written routines, a System/360 with at least 16K of main storage, a 2701 Data Adapter Unit or Integrated Communications Attachment equipped for binary synchronous communication in EBCDIC transparency mode, a card reader, a printer, a 1052 Printer-KeyBoard, and a card punch are required for RJE operation. If user-written routines are included, a System/360 with at least 24K bytes of main storage is required. BPS/360 minimum device requirements apply.

Basic Program Package

Documentation: The following SRL publications and documents appropriate only to the components ordered are shipped by PID with each initial BPS/360 order. The Volume numbers listed below correspond to machine readable VOL numbers.

————— Volume 1 —————	
BPS/360 Programmer's Guide - 8K Tape (360P-AS-091) TNLs GN33-8569, 8596	GC24-3354-7 Note 1
BPS/360 Assembler with Input/Output Macros - 8K Tape (360P-AS-091)	GC24-3355-7
BOS/BPS/360 Macro Definition Language - 8K Disk/Tape (360P-AS-091) TNL GN33-8639	GC24-3364-3
BPS/360 Operating Guide - Basic Tape System - 8K (360P-AS-091; RG-201) TNLs GN33-8562, 8573, 8640	GC24-3391-4 Note 2
BPS/360 System Generation and Maintenance - Basic Tape System (360P-AS-091) TNL GN33-8636	GC24-5061-4
BPS/360 Specifications - Report Program Generator (360P-RG-201)	GC24-3418-3 Note 3
————— Volume 2 —————	
S/360 Basic FORTRAN IV Language (360P-F0-031)	GC28-6629-2
BPS/360 FORTRAN IV Programmer's Guide (360P-F0-031) TNL GN28-0230	GC28-6583-2
————— Volume 3 —————	
BPS/360 Modular File Maintenance Program Specifications and Operating Guide (360P-UT-219) TNLs GN33-8590, 8607, 8662	GC24-5069-0
BPS/360 Sort/Merge Program Specifications (360P-SM-043, 044)	GC24-3320-7 Note 4
BPS/360 Sort/Merge Program Operating Guide (360P-SM-043, 044)	GC24-3413-3 Note 5
BPS/360 Autotest Specifications 8K Tape (360P-PT-045) TNLs GN21-5025, 5068; GN33-8582, 8637	GC24-3343-2
BPS/360 Operating Guide Autotest 8K Tape (360P-PT-045) TNLs GN21-5026, 5069; GN33-8642	GC24-3417-2
————— Volumes 3 and 4 —————	
BPS/360 Specifications - Card and Tape Utility Programs (360P-UT-050, 057, 202) TNL GN28-2340	GC24-5026-2 Note 6
BPS/360 Operating Guide - Card and Tape Utility Programs (360P-UT-050, 057, 202) TNL GN33-8658	GC24-5027-4
BPS/360 Operating Guide Universal Character Set Utility Program (360P-UT-048) TNL GN28-2339	GC24-3396-3
————— Volume 4 —————	
BPS/360 DASD Utility Programs - Specifications (360P-UT-061, 069, 071, 072, 073, 098, 203, 204, 206, 207, 212) TNL GN33-8638	GC24-3363-6
BPS/360 DASD Utility Programs - Operating Guide (360P-UT-061, 069, 071, 072, 073, 098, 203, 204, 206, 207, 212) TNL GN33-8641	GC24-3392-8
BPS/360 Distribution Program Specifications and Operating Guide (360P-UT-208)	GC21-5001-1
————— Volume 5 —————	
BPS/360 Basic Assembler and Basic Utility Programs (Card) Specifications and Operating Guide (360P-UT-017, 018, 019, 020) (360P-AS-021) TNLs GN33-8697, 8659	GC28-6503-7 Note 7
BPS/360 Specifications - Report Program Generator - Card (360P-RG-200)	GC24-3374-2 Note 8

BPS/360 Operating Guide- Report Program Generator - Card (360P-RG-200) TNL GN21-5106	GC24-3464-2 Note 9
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BPS/360 Support Programmer's Guide FORTRAN IV (360P-UT-208) TNL GN28-0219	GC21-5000-1
BPS/360 Specifications - FORTRAN IV - 16K Card (360P-F0-205) TNL GN28-0223	GC21-9040-1 Note 10

————— Volume 6 —————	
BPS/360 Input/Output 1412/1419 Specifications and Operating Guide (360P-IO-958) TNLs GN24-5228; GN33-8574	GC24-3398-4
BPS/360 Input/Output 1418/1428 Specifications and Operating Guide (360P-IO-059) TNLs GN24-5350; GN33-8576	GC24-3437-2
BPS/360 Input/Output 1231 (360P-IO-060) TNL GN33-8575	GC24-3408-2

Form numbers which have changed since previous release are underlined.

- NOTE 1 SRL GC24-3354-6 plus TNLs GN24-5327, 5339, GN33-8541, 8569 and 8596 may be used in lieu of SRL GC24-3354-7 plus TNLs GN33-8569 and 8596.
- NOTE 2 SRL GC24-3391-3 plus TNLs GN24-5322, 5353, GN33-8539, 8562, 8573 and 8640 may be used in lieu of SRL GC24-3391-4 plus TNLs GN33-8562, 8573 and 8640.
- NOTE 3 SRL GC24-3418-1 plus TNLs GN24-5056, 5160, 5176, 5200, GN21-5059, 5087, 5094, 5097 and 5098 or SRL GC24-3418-2 plus TNLs GN21-5059, 5087, 5094, 5097 and 5098 may be used in lieu of SRL GC24-3418-3.
- NOTE 4 SRL GC24-3320-5 plus TNLs GN21-5028, 5052, and GN28-2346 or SRL GC24-3320-6 plus TNL GN28-2346 may be used in lieu of SRL GC24-3320-7.
- NOTE 5 SRL GC24-3413-1 plus TNLs GN21-5008, 5020, 5029, 5046, GN24-5027, GN28-2244 or SRL GC24-3413-2 plus TNLs GN21-5046 and GN28-2244 may be used in lieu of SRL GC24-3413-3.
- NOTE 6 SRL GC24-5026-1 plus TNLs GN21-5030 and GN28-2340 may be used in lieu of SRL GC24-5026-2 plus TNL GN28-2340.
- NOTE 7 SRL GC28-6503-6 plus TNLs GN33-8581, 8597 and 8659 may be used in lieu of SRL GC28-6503-7 plus TNLs GN33-8597 and 8659.
- NOTE 8 SRL GC24-3374-1 plus TNLs GN21-5065 and GN24-5052 may be used in lieu of SRL GC24-3374-2.
- NOTE 9 SRL GC24-3464-1 plus TNLs GN21-5066, GN24-5171 and GN21-5106 may be used in lieu of SRL GC24-3464-2 plus TNL GN21-5106.
- NOTE 10 SRL GC21-9040-0 plus TNLs GN21-5007 and GN28-0223 may be used in lieu of SRL GC21-9040-1 plus TNL GN23-0223.

If only the publications or if additional copies of the publications are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable - Machine Readable material for all 360P programs is contained on six (6) functional volumes. The machine readable for VOLs 1-5 is in object form. The machine readable for VOL 6 is in source form. See packaging chart.

Basic machine readable material for some 360P programs (see packaging chart) can be obtained in card form. If cards are preferred, specify each program desired in columns 4-12 and specify medium code 15 in columns 21-22 of the Program Order Form.

Current users for all the BPS programs will receive the following materials.

Documentation: Memo to user and attachments; Program Material List.

Publications will be distributed to affected current users for the programs they are registered for.

Machine Readable Material† - Machine readable material will be distributed to affected current users for the programs they are registered for.

† All maintenance machine readable material will be supplied on either one, two or three Distribution Tape Reel(s) or for customers requiring card, in card form. The DTR(s) will be 9-track 800 or 1600 GPI or 7-track 800 CPI (Data Conversion feature required) as specified in their original request for the programs.

Optional Program Package:

Documentation: Program Material List and appropriate Attachment.

Machine Readable: Optional machine readable material (source code) is contained on five functional volumes which contain the same program numbers per volume as the five basic volumes, numbers 1-5. (See packaging chart.)

Additional Program Material:

Program Logic Manuals

BPS/360 Basic Assembler	GY24-5014 with TNL GN33-8653
BPS/360 Basic Utilities	GY24-5015 with TNL GN33-8654
BPS/360 FORTRAN IV (1.6K Card)	GY21-0001
BPS/360 Basic Tape System (8K) - System Control and IOCS	GY24-5010
BPS/360 Basic Tape System (8K) - Tape Assembler Program	GY24-5012 with TNL GN33-8651
BPS/360 Report Program Generator (8K Tape)	GY24-5028
BPS/360 FORTRAN IV (Tape)	GY28-6620
BPS/360 Sort/Merge (8K Tape, 1 & 2 Channel)	GY24-5008
BPS/360 Autotest (Tape)	GY24-5011 with TNL GN33-8650
BPS/360 Paper Document Support	GY24-5007 with TNL GN33-8649
BPS/360 Universal Character Set Utility	GY24-5013 with TNL GN33-8652
BPS/360 Modular File Maintenance Program	GY24-5096 with TNL GN33-8655

There are no Program Logic Manuals for Report Program Generator (Card), Card and Tape Utility Programs, and DASD Utility Programs.

Program Listings: A listing of all BPS/360 programs is available on microfiche from the IBM Corporation, Microfiche Distribution, Mechanicsburg ... individual program listings are not available. Specify Group Code 2000. The listings are equivalent to the output listings produced by assembling the symbolic module(s) for the applicable BPS/360 program.

BPS/360 BASIC AND OPTIONAL PROGRAM MATERIAL PACKAGING

	Program Number Extension	Program Number		Available on Cards
		Basic	Optional	
Basic Tape System (8K)	360P-AS-081*	VOL1	VOL1	no
RPG (8K Tape)	RG-201*			no
RJE Work Station	CQ-218			no
FORTRAN IV (Tape)	360P-FO-031*	VOL2	VOL2	no
Card to Printer and/or Punch	360P-UT-050	VOL3	VOL3	yes
Card to Tape	UT-051			no
Tape to Printer	UT-052			no
Tape to Card	UT-053			no
Tape to Tape	UT-054			no
Multiple Utility	UT-055		**	no
Storage Print	UT-056		**	yes
Initialize Tape	UT-057			no
Sort/Merge (8K Tape) 1 Channel	SM-043			no
2 Channel	SM-044			no
Universal Character Set Utility	UT-048			yes
Autotest (Tape)	PT-045			no
Tape Compare	UT-202			no
Modular File Maintenance	UT-219			no
Copy Disk to Tape, Restore Tape to Disk	360P-UT-061	VOL4	VOL4	no
Copy Disk to Card, Restore Card to Disk	UT-062			yes
Storage Print	UT-056		**	yes
Initialize Tape	UT-057			no
Universal Character Set Utility	UT-048			yes
Card to Disk	UT-063			yes
Disk to Card	UT-064			yes
Disk to Tape	UT-065			no
Tape to Disk	UT-066			no
Disk to Disk	UT-067			yes
Clear Disk	UT-068			yes
Initialize Disk (2311)	UT-069			yes
Copy Data Cell to Tape, Restore Tape to Data Cell	UT-071			no
Copy Disk to Disk	UT-072			yes
Disk to Printer	UT-073			yes
Alternate Track Assignment	UT-098			yes
Multiple Disk to Printer	UT-203			yes
Initialize Data Cell	UT-204			yes
16K Initialize Disk (2311, 2314/2319)	UT-206			yes
16K Alternate Track Assignment (2311, 2314/2319)	UT-207			yes
Distribution Program	UT-208			no
Alternate Track Assignment (2321)	UT-212			yes
Basic Assembler	360P-AS-021	VOL5	VOL5	yes
Absolute Loader	UT-017			yes
Input/Output Support Package	UT-018		**	yes
Dump Program	UT-019			yes
Relocating Loader	UT-020			yes
Report Program Generator (Card)	RG-200		**	yes
FORTRAN IV (1.6K Card)	FO-205			yes
Input/Output 1412/1419	360P-IO-058	VOL6	***	yes
Input/Output 1418/1428	IO-059		***	yes
Input/Output 1231 N1	IO-060		***	yes

*These programs are directly tape loadable. Therefore, the file maintenance program is not present on Basic Volumes 1 and 2.

**Not optional material.

***Optional material not required as basic material is distributed in symbolic form.

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The System/360 Operating System (better known as Operating-System/360) is the most comprehensive operating system available for users having 64 K or more of core storage. OS/360 offers the broadest range of control program options, language processors, I/O device support, application programs, and service programs to meet the needs of users who will benefit from the more extensive facilities that a large operating system can provide.

The control program performs the supervisory functions of job management and scheduling, resource allocation, I/O scheduling, location, storage and retrieval of data and monitoring multiprogramming activity.

Device independence is achieved through symbolic allocation of I/O devices and execution-time selection of device dependent routines. This feature of OS/360 results in effective I/O resource utilization, independent of program compilation specifications.

Dynamic program loading facilities, which permit the automatic retrieval of programs or segments of programs, are especially beneficial to those users considering complex teleprocessing systems, graphic data processing applications, or total information systems.

A specially generated system may be tailored to match the machine configuration and the Operating System options which best meets the users' requirements. The Primary Control Program (PCP), provides for the inclusion of all basic OS/360 functions which are appropriate for single job execution and are upward compatible with other control program options. Multiprogramming with a Fixed number of Tasks (MFT) permits the concurrent processing of several jobs, one per partition, in a user controlled, partitioned core storage environment. Multiprogramming with a Variable number of Tasks (MVT) provides for the scheduling of a variable number of jobs to be run concurrently, depending on the core space available, in a dynamically allocated core storage environment. This reduces the requirement for user control and intervention.

A wide range of processing programs including assemblers, compilers, and service programs are available with OS/360. The language processors are provided at various core storage requirement levels and include PL/I, COBOL, Assembler, RPG, FORT-RAN, and ALGOL. Service programs are Sort/Merge, Linkage Editor, Remote Job Entry, Graphic Job Processor, Testran, and Utilities.

The following paragraphs describe the components of the system, Minimum System Requirements, I/O Device Support, Publications and Distribution.

SUPERVISORS (PCP/MFT/MVT)

Primary Control Program (PCP) 360S-CI-566 provides for the inclusion of basic OS/360 functions which are appropriate for single job execution. When generating a system, functional capabilities may be selected in a variety of combinations and added to those included in PCP to produce additional capabilities.

PCP has been functionally stabilized with OS Release 19.

MFT/MVT have been functionally stabilized with OS Release 21.

PCP is not supported on the Model 85, 91, 195, or on System/370 Models 135, 145, 155, 155 II, 158, 165, 165 II, 168, and 195.

The supervisor in general controls the use of the CPU, I/O, and main storage automatically and as requested by a user through system macro instructions. The primary supervisor provides:

- . Resident access methods.
- . In core library search (BLDL).
- . Job step main storage protection.
- . Control of a single task.
- . Overlap of CPU operations with I/O channel activity.
- . Error checking and standard I/O error recovery procedures.
- . Queuing of I/O requests for channel use.
- . An SVC transient area and an I/O transient area are provided.
- . Supervision and processing of all types of interruptions.
- . Dynamic allocation of main storage for load modules.
- . Synchronous overlay supervisor.
- . Block loading of relocatable programs.

Services available to user programs through system macro instructions include:

- . Locating a named program.
- . Dynamically loading and transferring control to a named program.
- . Specifying exits for selected program interruptions.
- . Saving registers at the start of a subroutine.
- . Returning to the calling routine or next higher control level.
- . Waiting for the completion of an event.
- . Waiting for the completion of multiple events.
- . Posting the completion of an event.
- . Identifying an inbedded subprogram to the supervisor so that it can be shared within the same task.
- . Dynamically allocating or releasing variable amounts of main storage.
- . Writing a message to the operator with a reply required.
- . Setting the timer to interrupt after some time interval.
- . Testing or resetting the time interval previously requested.

Multiprogramming with a Fixed Number of Tasks (MFT) 360S-CI-505 provides all the facilities of PCP and in addition, provides concurrent operation of up to 15 problem program partitions with job to job transition for both user application and sys-

tem functions available in any partition. The additional functions in MFT are:

- . Control up to 15 single task jobs
- . Control of up to 3 system input readers (resident or transient)
- . Control of up to 36 system output writers
- . Small problem program partitions (8K or more)
- . Dynamic Partition Definition - Operator can redefine partitions without reinitializing system
- . Data set integrity - Prevents multiple tasks from concurrently using the same data set
- . Storage Protection - Problem program integrity (write protect) is maintained by supervisor assigned protection keys.
- . System Restart - After re-IPL is performed, jobs not previously initiated for execution are in the ready queue. The output queue contains all job output that has not been completely transcribed to tape, cards or printer. Jobs that were in execution are removed from the system. Whatever data that was placed in the output queue by such jobs can be printed or punched
- . Provision for conditional requests for resources (ENQ/DEQ)
- . Priority Job Class Scheduling - Provides for more effective balancing of system resources by permitting the assignment of jobs by type to a partition
- . Telecommunications Support - BTAM, QTAM, and TCAM are supported. QTAM requires two partitions; one partition for message control, the second partition for message processing. Only one BTAM partition is normally recommended in a given system although multiple partitions can coexist provided that, if the BTAM READ/WRITE module is resident, then all shared device I/O modules must be made resident. A user planning a multiple BTAM partition system should be cautioned that high contention for system/BTAM facilities among the partitions may cause serious performance degradation, particularly if a binary synchronous partition is assigned a secondary priority.
- . Graphics Support - Provides Graphic Programming Services including all features for the 2250 Models 1, 2, and 3 and the 2260 Direct Attachment.
- . Disk SYSIN allows disk to be used as a source for a Reader/Interpreter's job stream.
- . Job Step Timing - makes job step task time available to a user written accounting routine.
- . System Management Facilities - Gather, format, and optionally record basic system and user information from which an installation can determine resources such as CPU, I/O, data sets, volumes and storage used by each program.
- . Support of System/370 Time-of-Day (TOD) clock for all reference to time of day.
- . Status Display Support - Provides for writing multiple-line messages to the operator using the write-to-operator macro instructions; provides time-interval updating for the display of active jobs status display; provides a means of separating status displays and certain write-to-operator messages from the operator's message traffic by designating certain consoles or separate areas of display console screen exclusively for these displays and messages.

MFT is not supported on the Model 195.

Multiprogramming with a Variable Number of Tasks (MVT) 360S-CI-535 includes the supervisor functions of MFT although there are significant differences in its use of storage. MFT operates in fixed partitions which can only be changed by operator action; while in MVT, a part of the available core storage (i.e. dynamic area) is allocated as a region to a job step as it is initiated. Region requirements usually vary from job step to job step. Thus, the use of storage in MVT may better reflect the requirements of the job mix at a point of time.

MVT is not supported on the S/370 Model 135.

The supervisor uses the MVT Priority Scheduler and the Interval Timer feature. The functions in addition to those provided with OS/360 PCP and MFT are:

- . Task dispatching priority may be changed by the task itself during execution.
- . Concurrent control of a variable number of tasks ... initiation of up to 15 independent jobs for concurrent operations.
- . Dynamic creation and synchronization of subtasks.
- . Task dispatching priority may be changed by the task itself during execution.
- . Scatter loading of relocatable programs within an assigned main storage region.
- . Control Block protection prevents problem programs from destroying system Control Blocks.
- . Link Pack Area for reentrant system and user routines.
- . Asynchronous overlay supervision.
- . More than two SVC transient areas are available in order to increase the performance of the system when several SVC routines from the SVC LIB are required concurrently.
- . Shared Modules - A directory of modules currently residing in main storage together with information describing their use and attributes so that, if their attributes permit, the modules may be shared within a job step. Across Job Step (MFT also) sharing is controlled by separate directory of modules selected by the user for inclusion in the resident portion of the control program provided for this use.
- . Rollout/Rollin - Allows one job to obtain additional main storage by displacing the contents of one or more regions occupied by lower priority jobs. The rolled out region(s) are returned to their original locations in main storage when the job step requiring the extra main storage releases them.
- . Job Step Timing - Job steps are terminated when the time limit is exceeded.
- . Model 65 Multiprocessing - An extension of the MVT option that combines two

CPU's under one supervisor program residing in main storage. The CPU's are treated as system resources and are assigned by the supervisor to process any task. Multiprocessing provides more efficient and more flexible allocation of CPU's, I/O units, and main storage. Availability is increased by Recovery Management Support, which minimizes the impact of intermittent failures and by Storage Reconfiguration which bypasses failing components and deallocates affected resources, allowing the reconfigured system to continue accepting and processing jobs without reinitialization.

Time Sharing Option (TSO) - An extension which provides OS/360 MVT users general purpose time sharing capability in a compatible OS/360 environment. Terminal users share remote access to the powerful facilities of the Operating System/360 for conversational -- preparation, syntax checking, execution, updating of programs and data -- concurrently with normal background OS/360 operations. A comprehensive easy-to-use conversational command language is provided for the terminal user to communicate with the system. TSO provides conversational remote access to the OS/360 environment for both the experienced professional programmer and the individual with little or no experience with computers.

Additional OS/360 Functions

The advanced checkpoint/restart feature for PCP, MFT and MVT provides the following capabilities:

- . External suppression of checkpointing and restarting through JCL.
- . An end-of-volume exit routine to allow Checkpointing when end-of-volume for BSAM or QSAM data sets occurs.
- . A SYSGEN facility to allow the user to determine which user or system/ABEND conditions will result in an automatic restart.
- . Unit and volume switching at restart time.
- . Automatic quiescing of I/O operations.
- . Supported by COBOL E, Full ANSI COBOL Versions 2 and 3*
- . Automatic restart from a job step or from a checkpoint. Automatic restart must be specifically authorized by the operator. In addition, in MVT, the operator may defer the execution of an automatic restart. A deferred restart can be made by the programmer through JCL.

*Program Product

Main Storage Hierarchy Support for LCS: Main Storage Hierarchy Support for 2361 Models 1 and 2 is an optional feature supported under PCP, MFT, and MVT (excluding MVT Model 65 Multiprocessing). Main storage is divided into two hierarchies, LCS, and Processor Storage, and a combination of either is selectable under user control.

SCHEDULERS (Sequential, Priority)

The schedulers in general regulate the flow of jobs through the computing system, allocate I/O devices, and serve as the interface between user and system through the Job Control Language, operator commands, and console messages.

Sequential Scheduler

The Primary Control Program uses the sequential scheduler. The sequential scheduler is not resident, but is brought into main storage between job steps. Three schedulers are provided, requiring a minimum of 18K bytes, 44K bytes, or 100K bytes. These minimums are increased by the inclusion of the AVR option and/or a user accounting routine. These schedulers support:

- . A single input job stream. (unblocked records only).
- . Sequential processing of jobs in the input stream.
- . Reading and interpreting of control statements using all features of the job control language except those peculiar to MFT or MVT.
- . Assignment of input/output devices.
- . Alternate console.
- . Composite Console - A card reader and printer used to stimulate the actions of a printer-keyboard.
- . Channel Separation and Affinity Requests.
- . Frequently used sets of job control statements may be stored in a procedure library; any time that a procedure is to be executed, the user need only specify the procedure name on the EXEC statement.
- . Automatic Volume Recognition - Allows the operator to pre-mount labeled volumes on available I/O devices. The scheduler then determines if the desired volume is mounted on any of the "unused" devices. If so, the device is allocated to the step. AVR supports all 9 and 7-track tape drives in the density specified at system generation time and the 2311 Disk Storage Drive and 2314 Direct Access Storage Facility, 2319 Disk Storage Facility and the 3330/3333 Disk Storage.

MFT Priority Scheduler

MFT has a priority scheduler requiring a minimum partition size of either 30K or 44K. It supports one task per job step with 1 to 15 user jobs and 37 system functions, of which three may be readers and 36 may be writers, being processed concurrently. The scheduler operates as follows -

- . Main Storage is divided into a maximum of 15 problem program partitions.
- . Each partition can service up to three job queues (job classes).
- . Job classes are assigned priority within partition. A job class can be assigned

to more than one partition.

- . Each partition has a fixed task dispatching priority within the system for scheduling CPU execution.
- . Jobs are enqueued on job class queues by class. The job class is specified in JOB statements.
- . Position on the job class queue is determined by the priority specified on the JOB statement.
- . Jobs are dequeued and initiated by priority within class by the Initiator/Terminator.
- . Small program partitions (minimum 8K) are only scheduled when a scheduler size partition (30K or 44K) is available.
- . Readers create SYSIN data sets from user data in the input stream(s). SYSOUT data sets created on direct access devices by problem programs and system messages created by the Initiator/Terminator are written by the output writers on printers, punchers or magnetic tapes.

MVT Priority Scheduler

MVT employs the same scheduler as MFT with some exceptions --

- . A region as small as 12K may be used for step execution if portions of the terminator is made resident in the link pack area.
- . User assigned job priority is used for both job scheduling and job execution in MVT. In MFT user assigned job priority is used for scheduling, but partition priority is used for job execution.
- . The MVT initiator is a minimum of 52K and may be resident or non-resident. Its size is increased by the inclusion of a user written accounting routine and/or buffers for track stacking.
- . MVT initiator handles 1 - 8 job classes and also allocates regions.

DATA SET CONTROL

Data Set Control 360S-DM-508 -- These functions which control all data in the system and regulate the use of data sets, include provision for:

- . Data set location control, supported by a cataloging system, enables programmers to access data sets by symbolic name, without specifying volume serial number or location of the volume.
- . Classification of data set names stored within the catalog according to installation needs (general usage, private usage, temporary, permanent, always resident, or portable storage).
- . A system of labels and label checking.
- . Successive generations of related data sets, controlled by a Generation Data Group feature.
- . Control of direct access storage space allocation; allocating specific space or any available space during stop initiation as requested by the programmer. When the original space provided is not adequate, an automatic extension of space can be provided (QSAM, BSAM, BPAM).
- . Password Protection - Optional protection of specified data sets from unauthorized use.
- . Facilities for handling user data set labels.
- . Error statistics by tape volume.

ACCESS METHODS

Data Access: The data access facilities provided by the Operating System permit the user to select that method which most efficiently meets his application data storage and retrieval requirements. The input/output routines efficiently schedule and control the transfer of data between main storage and input/output devices. These routines are loaded into main storage when the data set is opened, and they are released from main storage when no longer required. Access methods can be made resident to be shared by user and system tasks in MFT and MVT to some storage requirements for job steps and to reduce access method modules load time. The programmer can select from various data access methods to obtain facilities tailored to his processing requirements. Each access method supplies a comprehensive set of macro-instructions that permit the programmer to specify input/output requests with a minimum of effort. Access methods provide for:

- Device independence.
- Reading and writing data randomly and sequentially.
- Blocking and deblocking records.
- Overlapping reading/writing and processing operations.
- Detecting error conditions and correcting them when possible.

ASCII Capability: Support in Data Management for the American National Standard Code for Information Interchange, X3.4-1968, referred to by the acronym ASCII, provides the OS customer with the capability to interchange data between systems regardless of manufacturer or operating system, provided the data contains only ASCII characters and is recorded in conformance with American National Standard Recorded Magnetic Tape for Information Interchange, 9-track, 800 CPI NRZI, X3.22-1967.

Sequential Access Methods 360S-DM-508

Basic Sequential Access Method - BSAM

Data is sequentially organized; physical blocks of data are stored or retrieved. The read/write macro instruction causes the initiation of an input/output operation. The completion of these operations are tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided in conjunction with support for American National Standard Recorded Magnetic Tape, Labels, and record formats.

Queued Sequential Access Method - QSAM

Data is sequentially organized. Logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have the desired record in main storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record has been written immediately, although the access method's routines may block it with other logical records, and defer the actual writing until the output buffer has been filled. Automatic translation between EBCDIC and ASCII codes is provided in conjunction with support for American National Standard Recorded Magnetic Tapes, Labels and record formats.

Basic Partitioned Access Method - BPAM

This access method when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a direct access device. Each member has a simple name. The data set includes a directory that relates the member name with the address where the sequence begins. Members may be added to a partitioned data set as long as space is available.

Direct Access Method 360S-DM-509

Basic Direct Access Method - BDAM

Records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage or retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set, where a search for the record, based on a key furnished by the programmer begins. Addresses are also used by BDAM as starting points for searching for available space for new records.

Indexed Sequential Access Methods 360S-IO-526

Sequential and direct processing are provided. Records are maintained in control field sequence by key. A multi-level index structure is system maintained allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without a data set rewrite.

Queued Indexed Sequential Access Method - QISAM

QISAM is used to create an indexed sequential data set, and to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/unblocking are automatic. QISAM is also used to reorganize an existing data set.

Basic Indexed Sequential Access Method - BISAM

This access method stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed by using the READ macro-instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

Telecommunications Access Method - TCAM 360S-CQ-548

TCAM combines the broad range of device support found in BTAM with the multiple application concepts of QTAM. The application program interface has been specified to provide maximum compatibility with BSAM (READ/WRITE level) and QSAM (Get/Put level) yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications with TCAM are constructed by providing a Message Control Program and one or more TCAM application programs. The Message Control Program is defined and generated by the user with TCAM macro-instructions. When using a 3705, functions of the Message Control Program that are associated with network management will be generated in the 3704/3705 Network Control Program.

The Message Control Program describes the TP network and specifies the device dependent handling requirements needed to insulate the application programs from device dependent considerations. Different applications may have different handling requirements. Alternate paths and procedures may be provided to meet these needs. Additional facilities are furnished especially for use in inquiry and conversational applications.

Application programs are developed separately. A single application may be built which services several terminals concurrently. Also, a single terminal may be used with several independently developed application programs. QTAM application programs or other applications using BSAM or QSAM options supported by TCAM may be easily adapted to run as TCAM application programs.

TCAM is especially recommended in situations where several terminal types, e.g., start-stop terminals, Binary Synchronous Terminals, Display Stations, etc. are present on a system or where the same terminal is desired to be used for several applications. Terminals serviced by TCAM for application programs can be used for TSO. In an OS TSO System, application programs using TCAM can be swapped in and out of a time shared region. In this connection, it should be noted that RJE and CRJE cannot share communications lines with TCAM applications. BTAM or QTAM programs supporting other communications lines may co-reside with TCAM.

Information on terminal support is provided by Terminal Support Charts 1 and 2.

All terminals on a multipoint non-switched line or terminals sharing the same switched connection (phone number) must be of the same type, with the two exceptions.

1. 2741s and 1050s may share the same switched line or line group. This means that either terminal type may call the computer using the same phone number.
2. Terminals using Binary Synchronous Communications.

System Requirements:

Device requirements for MFT or MVT apply. TCAM operates under either control program option on a System/360 Model 40 or above having at least 128K of main storage. Normally, space on one or more 2311, 3330/3333, 2314 or 2319 DASD units will be needed for intermediate storage of message queues.

Queued Telecommunications Access Method - QTAM 360S-CQ-519

QTAM can support a variety of applications such as message switching, high-volume inquiry, transaction processing. The QTAM facilities include a comprehensive set of message control and editing routines that relieve the programmer assigned to the telecommunications application of the detailed and specialized programming otherwise required for such an application. These routines can be assembled into an integral message control program, which is designed to meet the exact requirements of an installation.

To simplify and speed the construction of a message control program, a message control language is provided. This language is compiled by any Operating System/360 assembler program and consists of a set of macro-instructions and parameters. The language is specifically designed for easy use in describing the line configurations, buffer lengths, polling procedures, and types of message editing required for a particular application. QTAM requires either MFT or MVT options of the OS Control programs.

One or more of the following DASD's is supported by QTAM for intermediate storage of message queues -- 2311, 2314, or 2319.

QTAM is functionally superseded by TCAM. QTAM will be available for one year after availability of TCAM. At that time it will revert to normal maintenance status.

Basic Telecommunications Access Method - BTAM 360S-CQ-513

The BTAM facilities are designed chiefly to provide the basic tools required to write a telecommunications program. These include facilities for creating terminal lists and performing the following operations:

- Initiating and answering calls to and from terminals on switched networks.
- Polling and addressing terminals on non-switched multipoint lines.
- Changing the status of terminal lists.
- Transmitting and receiving messages.
- Posting completion status of messages.
- Managing buffer pools.
- Code translation.
- Retransmitting messages which are received with detected error.
- Providing on-line terminal test facilities.
- Keeping error statistics.

BTAM operates under the MFT and MVT options of the OS Control Program.

Information on terminal support is provided by Terminal Support Charts 1 and 2.

The support of binary synchronous communications combined with that of the various start/stop devices such as the 1050 gives BTAM a wide range of applicability and flexibility. BTAM supports both low, medium and high speed devices in one access method.

BTAM supports Binary Synchronous Communication over non-switched (leased or private direct connection) and switched (dial) networks in a S/360† to S/360† and S/360† to terminal communication.

† Model 40, 50, 65, 65MP, 67 (65 model), 75, 85, 195 or System/370 Models 145, 155, 155 II, 158, 165, 165 II, 168 and 195 via a 2701 equipped with SDA Type II or a 2703 equipped with Binary Synchronous Features or 3704/3705 Communications Controller.

All terminals (except Binary Synchronous Communication) on a multipoint non-switched line must be the same type. Terminals may be mixed within the same problem program. A S/360, S/370 computer with a 2701 SDA II or 2703 Synchronous Base, a 3704 or 3705 in emulation mode or a S/370 Model 135 with ICA can control the following BSC terminals:

- on a multipoint non-switched line - S/360 Model 20, 1130, 2780, 3780, 1800, 2741 Models 2, 4.
- on a switched line another S/360, S/370 with 2701, or 2703, S/370 Model 135 with ICA, S/360 Model 25 with ICA, S/360 Model 20, 1130, 2780, 3780, 1800, 3741 Model 2, 3747

Communication Serviceability Facilities - BTAM & QTAM

Communications serviceability facilities are included in QTAM, and as an option in BTAM. It is strongly recommended that these facilities be included since they increase system availability by providing statistics and diagnostic aids for effective system repair and preventive maintenance. The communication serviceability facilities are:

Error Recovery Procedures - These are provided on a line basis and are specified by line group. The operation in error is retried seven times for BSC terminals and up to two times for non-BSC terminals. If an error persists the conditions of the error are posted and a system-to-operator message describing the error is printed on the system operator console.

Job termination and system operator print out are provided on certain non-recoverable errors for BTAM.

Diagnostic read/write commands (2701 only) are performed to isolate non-recoverable errors.

Error Counts - Counts are maintained for errors on a line basis. These counts will be printed at the system operator console when a user specified error rate is exceeded. An additional facility enables the user's program to cause error statistics from cumulative counters to be printed at the operator console.

On-line Terminal Test - Terminal test procedures will operate on-line with the user problem program, and will not impact user operation other than the time required to perform their function, except that when a test is performed using the IBM 2760, the film should be reloaded prior to continuing the job.

Tests can be requested from a terminal and returned to that terminal or any other terminal on the same line. Normal operation is maintained for unaffected terminals in the system.

Operator Control (QTAM only) - Operator control is provided as an optional facility to enable the operator to examine and modify QTAM control information and to respond to errors and unusual conditions. An IBM 1050 or IBM 2740 (with station control and checking) terminal may be designated as the Operator Control terminal. When operator control is used the tele-communications operator messages may be directed to the Operator Control terminal instead of the system operator console.

Checkpoint/Restart (QTAM only) - Checkpoint/Restart is provided for the QTAM message control program as an optional facility. The terminal table, queue control blocks, and the polling lists are checkpointed on disk at user specified intervals. Two checkpoint records are maintained with a pointer to the most current record. Restart is accomplished by reloading the QTAM message control program. The latest checkpoint record is read from disk and overlays the initial table, lists, and queue control blocks.

3735 Form Description Macros and Utility, 360S-CQ-596

Form Description Macros

The Form Description Macros for the 3735 are used to describe and generate Form Description Programs that are used by the 3735 to control the terminal operations.

The Form Description Macros operate with the OS Assembler E, F, or H.

The output of the assembly is an object module suitable for input to the Form Description Utility.

Form Description Utility

The Form Description Utility for the 3735 is used to prepare the output of the Form Description Macro assembly for transmission to the 3735 terminal.

The Form Description Utility reads the output of the assembly from a sequential input device, formats the object code into blocks for the 3735, and writes the blocked code into a partitioned data set that is available to the user's program for transmission to the 3735 terminal.

Graphic Assess Method

Graphic Programming Services 360S-10-523 --- Graphic Programming Services is supported under PCP, MFT or MVT. It consists of the functions necessary to handle graphic input/output, and a set of macro-instructions and problem oriented routines that can be used as building blocks in the construction of graphic process programs. These services support the 2250 Display Unit, Models 1, 2, and 3; and the 2260 direct attachment (local). Functions provided are:

- Macro instructions to generate all orders for the 2250, models 1 and 3, including the Model 1 with the Graphic Design feature.
- Data handling aids for arranging orders and data in main storage prior to transferring them to the graphic device buffer.
- Problem oriented routines that dynamically generate orders and data for displaying on the 2250 models 1 and 3.
 - Alphanumeric characters.
 - Rectangular grids (linear or semi-log).
 - Grid labels.
 - Polar coordinate grids (linear or semi-log).
 - Circles and arcs.
 - Input to these routines can be either fixed point or floating point and can be scaled by the routines.
- Graphic Data Generation subroutine - to generate data, during program execution, for use with the 2-byte incremental data modes of the 2250 Model 1 with

- the Graphic Design feature and 2250 Model 3.
- Light Pen Tracking - 2840 Model 2 buffer subroutine to track the pen movement on the CRT and display a pattern showing its current position.
- The Graphic Access Method (GAM), which includes:
 - Read/write level macro instructions for transferring data between main storage and the graphic device buffer.
 - Buffer management facilities that allocate, control, and protect sections of the 2250 Model 1 or 2840 buffer.
 - Routines that facilitate man-machine communication using the 2250 or 2260 local, at both the express and basic attention handling levels (provides synchronous attention handling).
 - Routines that diagnose synchronous errors and accomplish the necessary error handling.

MULTIPROCESSING CONFIGURATIONS

Model 65 -

The OS/360 multiprocessing system includes two Model 65 processors which, through the use of inter-processor communications, alternate path I/O control, and shared main storage, provide increased flexibility in the use of computing resources. To provide improved load balancing over that attained with two separate systems, resources such as main storage, secondary storage and central processing units can be pooled. A MP/65 multiprocessing system can operate as a single system or as two independent systems. Support for Model 65 multiprocessing is with a single control program through MVT. 2361 LCS, is the only MVT function excluded from MVT Model 65 Multiprocessing Support. Storage Reconfigurations provides high system availability by permitting de-allocation of operating system resources from an interrupted job, and by performing logical isolation of failing storage in 2K byte elements.

Storage reconfiguration support is not provided for TSO Foreground Regions.

SHARED DASD (S/360 Models 30-195, S/370 Models 135, 145, 155, 155II, 158*, 165, 165II, 168*, and 195.

* MP models in UP mode.

Up to two CPUs can share a pool of 2311, 2321, 2303 devices on a 2841 Control Unit, and up to four CPUs a pool of 2314 direct access storage devices. For S/360 Models 85, 195, and S/370 Models 145, 155, 155 II, 158, 165, 165 II, 168 and 195 up to 2 CPUs can share a pool of 3330/3333s or 2305s. The catalog, program libraries, and user data sets may be accessed by any CPU. Advantages are reduced file maintenance, improved operational flexibility and reduced disk space requirements. The system establishes access for each catalog generation. Exclusive Access for all other data sets is controllable by using the RESERVE macro.

MVT - TIME SHARING OPTION

The OS/360 Time Sharing Option (TSO) extends to the terminal user the full power of OS/360. Under TSO up to 14 Time Shared regions may be defined, each of which may be time shared by many terminal users.

Features:

- General purpose time sharing capability operating concurrently with normal OS/360 background operation within one operating system.
- Up to 14 regions can be devoted to time sharing.
- Sharing of the main storage allocated to time sharing by more than one remote terminal user by swapping remote terminal user's programs in and out of time shared regions.
- Installation control of the time sharing algorithms which determine the priority and amount of processing time allocated to each job.
- Dynamic control of the allocation of system time between time sharing and background operation.
- Statistics gathering routines which provide data to assist the installation in tuning the system.
- SMF support by individual terminal user as an installation option.
- Control of the system resources by installation management.
- Conversation terminal command language which is powerful, easy to use, and permits the installation to add additional commands.
- Environment for creating and executing conversational programs. A device independent BSAM/QSAM interface to terminals is provided for ease of development and installation of terminal-oriented application programs.
- Language, data and Data Management compatibility between conventional (batch) programs and programs developed at the terminal. Batch or terminal developed programs can be stored, retrieved and executed locally (at the computer center) or from the remote terminal allowing the sharing of data sets between time shared and background regions.
- A TCAM message control program is provided to support 1050, 2741, 2260/2848, 2265/2845 and TELETYPE(c) terminal Model 33/35*** as Time Sharing Terminals.
- Use of TCAM to handle terminals allows the same terminal and/or communications lines to be used for both TSO and other TCAM applications.
- TCAM message processing programs can be swapped in and out of a time

shared region. This provides more efficient utilization of main storage; especially during period of low utilization of terminal application programs.

- Terminal user may use any currently supported IBM OS/360 language processor (or equivalent) that is available at the installation.
- Command language facilities provide for creating, editing, copying**, merging**, formatting**, listing**, deleting, or renaming data sets
- Direct access data sets can be dynamically allocated in a time shared region as they are needed.
- Test command allows systems programmers and assembly language programmers to control the execution of a program, interrupting it at dynamically specified points.
- Languages supporting problem solving:
 - Interactive Terminal Facility: PL/I, BASIC**
 - Code and Go FORTRAN**

Conversational language support provided by TSO includes:

- Prompting for required parameters to invoke compilers, dynamic allocation of required data sets and compilation output and diagnostic messages sent to the terminal for the following: Assembler (F), ANS COBOL Version 3**, Code and Go FORTRAN**, FORTRAN IV (GI)***, PL/I Optimizing Compiler**, Linkage Editor and Loader.
- Syntax Checking for PLI (F) and FORTRAN (E, G, & H).
- Dynamic on-line program debugging facilities for systems programmers and assembly language programmers.
- Conversational program execution capability.
- Conversational initiation of batch execution (CRJE-like function).

Terminals Supported: TSO provides a TCAM Message Control Program which provides support for the following terminals and special features. The special terminal features are highly desirable in the TSO environment but are not required.

1050 Data Communication System on either switched or point-to-point lines with:

- 1051 Control Unit (Model 1 or 2)
- 1052 Printer-Keyboard
- *Standard PTTC/EBCD print element (#9571, Part #1167963).
- Text time-out suppression 9698
- Automatic EOB 1313 (or RPQ E28235)
- Transmit Interrupt 7900
- Receive Interrupt 6100

2741 Communications Terminal on either switched or point-to-point lines with:

- Standard PTTC/EBCD preferred, (#9571, Part #1167963); or standard PTTC/BCD (#9567, Part #1167938); or standard Correspondence (#9812, Part #1167043 print elements.
- Transmit Interrupt 7900
- Receive Interrupt 4708
- Print Inhibit - CPU control 5501

TELETYPE^(c) terminal Model 33/35*** on switched lines

2260 Display Station Models 1 and 2 for operation with: the IBM 2848 Display Control Models 1, 2 or 3. They may be attached either for the Remote terminal control operation or for local connection to S/360 or S/370 by Direct channel attachment. The Keyboard Alphameric (#4766) is required for the 2260. The non-destructive cursor (#5340, 5341 for 2848) and the rapid cursor which is part of the extended cursor control (#3606 for 2260 and #3901 for 2848) are optional.

The TAB feature which is part of the Extended Cursor Control, Line Addressing (#4787 for 2848) and the 1053 printer attachment are not supported by TSO.

2265 Display Station, Model 1 for operation with: the 2845 Display Control, Model 1 which is attached for remote terminal control operation using the 2701 Data Adapter Unit IBM Terminal Adapter Type III (#4656 4657). The Keyboard Alphameric (#4766) is required for the 2265. The Destructive Cursor (#3301 for 2845) is optional.

The Line Addressing (#4801 for 2845), TAB (#7801 for 2845) and the 1053 printer attachment are not supported by TSO.

3275 and 3277 Display Stations in both local and remote configuration of the 3270 Information Display System. Selector Pen, Program Function Keys, Operator Identification Card Reader and additional flexibility in controlling screen formats can be supported in user-written TSO Command Processors and TSO Application Programs using the TGET/TPUT ASIS terminal macros. The 3270 Printers are not supported.

TSO support of the 3270 utilizer brightness control to differentiate system-generated output (brightened intensity) from user input (normal intensity), and suppresses display of information entered in response to system prompt for password.

Transmission Control Units: TSO supports the following transmission control units:

1. **IBM 2701 Data Adapter Unit** with an IBM Terminal Adapter Type 1 and/or IBM Telegraph Adapter and/or Telegraph Adapter Type 2 and/or IBM Terminal Adapter Type III (#4656, 4657). The 2741 and 1050 Transmit Interrupt (7900) and Receive Interrupt (4708, 6100) cannot be used when these terminals are attached to the 2701.
2. **IBM 2702 Transmission Control Unit** with an IBM Terminal Control Type 1 and/or Teletype Terminal Control Type 2. The following feature is necessary

to support the 2741 and 1050 Transmit Interrupt (7900) and/or Receive Interrupt (4708, 6100): 8200 Type 1 Terminal Interrupt

3. **IBM 2703 Transmission Control** with an IBM Terminal Control Type 1 and/or Teletype Terminal Control Type 2. The following feature is necessary to support the 2741 and 1050 Transmit Interrupt (7900) and/or Receive Interrupt (4708, 6100): 8200 Type 1 Terminal Interrupt

4. **A 3704 or 3705 Communications Controller.**

Minimum System Configuration: The minimum TSO configuration consists of System/360 Models 50, 65, 65MP, 75, 85, or 195 (and 67 in 65 mode) or System/370 Models 145, 155, 155 II, 158*, 165, 165 II, 168* or 195 with at least 512K bytes of main storage for operation with MVT for concurrent Batch and TSO Operations. (A System/360 Model 50 with 384K bytes of main storage can be configured, providing a limited set of TSO functions; either time sharing or local batch job processing can be run, but no both at the same time.) Direct Access Storage Devices (2301, 2303, 2305, 2314, 2319, or 3330) are required for swap data sets. The record overflow feature is required. Additional DASD space is required for library storage; the exact requirements must be established by the installation. See 3704/3705 machine pages for attachment capability. * MP models in UP mode.

See the Program Products section which contains explicit support for the TSO environment.

(c) Trademark of TELETYPE Corporation

* Formerly known as USA Standard (USASI) COBOL

** Program Product

***Terminals which are equivalent to those explicitly supported may also function satisfactorily. The customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM supplied programs or products may have on such terminals.

OS - Extended Precision Floating Point Simulator for S/360 and S/370

The Extended Precision Floating Point Simulator is a set of modules providing full extended precision (16 byte) arithmetic support for OS MFT and MVT users on S/360 and S/370. It includes:

- Extended Precision Floating Point divide for models 85, 195 and S/370.
- Simulation of all EP instructions for models which do not have the feature.

Features:

- Calculations are performed on fractions of 28 hexadecimal, or approximately 33 decimal digits of precision.
- Object programs will be portable between systems with and without the EP feature.
- The Simulator is used by the FORTRAN IV (H Extended) and OS PL/I Optimizing Compiler.

Operation: The Simulator is loaded only when needed by a job, or may reside in the LINKPACK area. Extended Precision operations in problem programs will be coded using the eight EP operation codes regardless of the machine model on which the program will ultimately be run. Execution of the instruction will occur normally if the model supports that EP op code. Otherwise, an operation exception program interruption will occur. Control will be passed to the program's interrupt handler, which then invokes the Simulator.

These operations will be transparent to users of the FORTRAN IV (H Extended) and OS PL/I Optimizing Compiler program products.

Residence Requirement: The Simulator resides in LINKLIB. It requires less than two tracks of DASD space.

Performance: The performance of an OS system that does not employ Extended Precision Floating Point is not affected by this support.

For systems that do employ this support, the effect is primarily a function of the number of times that Extended Precision arithmetic operations are used. Performance is a combination of:

- a. The system processing time required to pass control of the user's interruption routine, which in turn invokes the simulator.
- b. The time required to execute the simulation routines.

Thus, the total processing time required under simulation may far exceed that required if the comparable function were performed by extended precision hardware.

Operator Console Support

Operation of an MFT or MVT system is controlled from an operator's console(s). This may be either with or without Multiple Console Support (MCS). If more than one active console is required, MCS must be used. Graphic console support is provided only under MCS.

Console Support without MCS

Includes one primary console and optionally one alternate console for backup. The following devices are supported:

- 1052 Model 7 attached directly to a Model 40, 50, 65, and 75.
- 1052 Model 7 attached through a 2150 Console.
- 3210 attached directly to a Model 135, 145, 155 and 155 II.
- 3215 attached directly to a Model 135, 145, 155 and 155 II.
- Model 158 in 3215 mode with a 3213.
- Composite console comprised of card reader input and printer output (see Device Support). The input or output half of any supported input/output console may serve as part of a composite console.

Console Support with MCS

Multiple Console Support (MCS) is an option that enables systems to be configured with a Master Console (primary console) and one or more secondary consoles, with each console dedicated to one or more system functions. The MCS user, by selecting which routing codes each console is to receive, tailors his system to his requirements. Through the use of routing codes, both system and problem programmers can indicate to which functional area(s) a message is to be sent.

Graphic consoles are supported under MCS by Device Independent Display Operators Console Support (QIDOCs).

A hard copy log may be selected to record system and problem program messages and operator commands and responses. The hard copy log can be either a console or the System Log (SYSLOG). The hard copy log is mandatory when (1) there is more than one active console in the console configuration, or (2) a graphic console is in the console configuration.

Multiple Console Support (an option of systems with MFT or MVT) permits a maximum of 32 operator consoles. The following devices are supported.

- . 1052 Model 7 attached directly to a Model 40, 50, 65, or 75.
- . 1052 Model 7 attached through a 2150 Console.
- . 3210 Printer Keyboard attached directly to a Model 135, 145, 155, and 155 II
- . 3215 Printer Keyboard attached directly to a Model 135, 145, 155, and 155 II
- . 2740 Communications Terminal Model 1 with Record Checking (6114). (One 2740 for each non-switchable communications line used. Feature 9571 should be ordered for EBCDIC Character Set Support.)
- . 3284 or 3286 Printers Models 1 and 2 attached to 3272 Control Units Models 1 and 2, are supported as hard-copy consoles.
- . Currently supported composite consoles.
- . Output units of currently supported composite consoles (1403 and 1443 only).
- . 3277 Model 2 Character Display Device (local attachment).
- . 3277 Model 1 Character Display Device, output only console (local attachment).
- . 2250 Model 1 or 3.
- . 2260 Model 1 on a 2848 Model 3 (local attachment).
- . Model 91 Display Console.
- . Model 85 Operator's Console (5450).
- . 3060 System Console (Model 195).
- . 3066 Systems Console (Model 165, 165 II and 168).
- . Model 158 Display Console has two modes of operation: 3215 mode and 3270 mode. When operating in 3215 mode, this console will function as a 3215 printer-keyboard using the 3213 output printer. The 3213 is mandatory in 3215 mode to produce hard copy.

When operating in 3270 mode, this console will function as two devices: (1) a 3158 graphic display console and (2) a 3213 output printer. In 3270 mode, the 3213 is optional and may be used to satisfy the hard copy requirements of MCS or any other "output only" console function.

Processing Programs

Main storage requirements for compilers stated in the system requirements sections are in addition to the main storage required by the control program.

Language Translators: Language translators compile symbolic source programs (source modules) into object programs (object modules). Object modules serve as input to the Linkage Editor which produces the relocatable program.

The language compilers are at various design levels providing maximum efficiency and flexibility. All compilers function with any control program configuration with the exception of Assembler E under MVT. All OS compilers provide upward compatibility within each language, except that Full ANSI COBOL provides a language conversion program to convert the user from COBOL E or F to the standard compilers.

PL/I (360S-NL-511)

PL/I Subroutine Library (360S-LM-512)

PL/I extends the range of applications that can be handled by a single high level language. In addition to covering problems similar to FORTRAN and COBOL, PL/I also covers problem areas beyond the scope of each, where past application efforts have required the use of an assembly language. Many features provided simplify programming of both commercial and scientific applications and assist the programmer in making efficient use of the supervisor facilities of OS/360. In terms of function, PL/I is the most complete high level language ever developed.

Features -- Provided are:

- . Many data types including fixed and variable length character and bit strings, floating decimal and binary data, fixed decimal and binary data and complex numeric data.
- . Complex data and arithmetic capability include expressions whose elements are scalars (individual numeric items), structures (collection of alphanumeric field, and arrays - tables).
- . Program segmentation capability providing for modular program structure.
- . Automatic conversion and editing of data types where necessary.
- . Initialization of data elements and arrays.
- . Dynamic storage allocation under user control permitting more efficient use of variable size data areas.

- . Source program debugging facilities, including an option for a source statement number reference during executing, indication of variable names and values, and optional checking for unusual conditions.
- . Time recording for compilation.
- . Stream input/output (an extension of FORTRAN - like I/O).
- . Record oriented input/output (an extension of COBOL - like I/O).
- . Multitask capability under MVT and VS/2 is provided with appropriate control of posting and waiting upon task completion.
- . Ability to change task priority under MVT during execution.
- . Compile time facilities which allow analysis and modification of source programs and for the inclusion of source statements from libraries.
- . Update mode for QSAM input/output.
- . Sort capability.
- . Teleprocessing support under MFT and MVT only.
- . Halfword binary storage.
- . Optimization options permit the compiler to optimize within limits set by source programmer.
- . TRANSLATE/VERIFY feature permits the handling of non-EBCDIC character sets.

System Requirements for Compiling PL/I:

- . Minimum of 44K bytes of main storage.
- . Significant increases in compile performance result from the availability of more storage.
- . Decimal and floating point instruction set options for compiling and executing all programs.
- . CPU interval timer and the OS timer control program option can be used.
- . Data Management space and/or device allocation is required for:
 - Source program input (SYSIN)
 - Intermediate (work) storage (SYSUT1, SYSUT3,) optional
 - Object modules (SYSLIN) optional
 - Printed output (SYSPRINT)
 - Punched output (SYSPUNCH) optional
 - Source (macro) library (SYSLIB) optional

PL/I - F object programs can utilize the following OS/360 control program and Data Management services.

Data Management access methods available with PL/I:

- . BSAM (unblocked, unbuffered, sequential files, record formats F, U, V).
- . QSAM (blocked and/or buffered sequential files, all record formats)
- . BISAM (blocked or unblocked files, formats F, FB)
- . QISAM (blocked or unblocked, buffered files, formats F, FB)
- . BDAM (unblocked, unbuffered files, formats F, U, V)
- . QTAM under MFT and MVT only.

Options:

- . UPDATE mode (when maintaining established DASD files, only records being changed need be rewritten)
- . SCAN mode (ESETL/SETL facilities are used for sequential processing of randomly selected parts of QISAM files)
- . LOCATE mode (records are processed in buffers without moving them to work areas)
- . READ BACKWARDS (for fixed and undefined formats)
- . TRACK OVERFLOW (for BDAM files using fixed length records and QSAM and BSAM record formats)
- . DD and DCB Subparameters with PL/I (provide object time specification processing parameters)

RECFM	MODE	LRECL	CYLOFL
BUFNO	STACK	KEYLEN	DSORG
CODE	PRTSP	LIMCT	NCP
DEN	OPTCD	RKP	
TRTCH	BLKSIZE	NTM	

- . Missing DD card provisions (mispunched or missing DD cards can be recognized by the program avoiding unwanted ABENDS)
- . I/O EVENTS & WAITS (programmer can overlap processing with I/O for unbuffered files on BSAM, BISAM & BDAM -- this permits, for example, overlapping DASD seek. Multiple events may be WAITed upon).

Control Program Services Directly available with PL/I: Time of Day ... Date ... Storage Allocation (GETMAIN/FREEMAIN) ... Checkpoint ... Return codes ... EXEC card parameters (passed to PL/I program) ... Multitasking (ATTACH, CHAP) (MVT only) ... System console (write to operator with or without reply. Processing may continue while awaiting reply using I/O EVENTS.) ... Events (ECBs) ... WAITS (including multiple waits) ... CALL/RETURN ... Delay of task or step ... Program check control (Cause of interrupt is made available to PL/I program via SPIE macro. ABEND will not occur.) ... ABEND ... System core dumps (Programmer can control when a dump will occur and whether the current task or all active tasks will be dumped. Program may optionally proceed or ABEND after dump.) ... STAE Utilization of ABEND.

The following OS/360 options are available to the PL/I user via EXEC cards or SYSGEN options: Storage size (specific size or use what is available) ... Lines per page of output ... Source program listing ... Object program listing (simulated assembler listing) ... Listing of external references ... Data item attribute listing ... Cross reference listing ... Object deck output ... Object module (SYSLIN) output ... NAME card output (for linkage editor control) ... Optimization levels 0, 1, specifications (portion of card used for program vs page numbers or deck ID.) ... Listing carriage control - skipping - spacing ... Checkout option (provides for source statement numbers in object time diagnostics.) ... Extended dictionary (permits users to compile very large programs) ... Nesting count (of DO-loops and blocks for source listing) ...

Use of compile-time processor ... Compile-time processor deck output ... Level of diagnostics to be printed (at compile) ... Shared Object Time library between concurrent jobs in several regions under MVT.

Batch compilation and dynamic invocation of the PL/I compiler are supported.

The printed output produced by the compiler provides comprehensive aids to the programmer for development and maintenance of the PL/I program.

- . Source program (before and/or after compile-time processing)
- . Object program (simulated assembler listing associating source statements to output)
- . Listing of options selected for compilation
- . Listing of external name references
- . List of data attributes, explicit or default for each data item
- . Cross reference listing
- . Terminal, severe and warning levels of diagnostics (sorted by statement number within class)
- . Nesting levels of groups, blocks and procedures
- . Storage used by static and dynamic parts of programs.
- . Size of aggregates (in bytes) used in the source program.

FORTRAN E 360S-F0-092
FORTRAN G 360S-F0-520
FORTRAN H 360S-F0-500

OS/360 FORTRAN is compatible with and encompasses the American National Standard (ANS) FORTRAN. The E level language supports ANS Basic FORTRAN Language. The G and H level language supports the ANS FORTRAN Language.

All three OS/360 FORTRAN compilers provide a compile time option which allows the introduction of source programs in either BCD or EBCDIC character codes (see note).

The output of the compilers -- source listings and literal data in the object programs -- will utilize the original, untranslated character codes. At object time, literal A-format, and H-format input and output data will not be translated; D-, E-, F-, and I- format input data may be in either BCD or EBCDIC code representation.

Note: OS/360 FORTRAN H and G source programs in BCD must use 7090 FORTRAN syntax in those areas where the syntax differs from OS/360 FORTRAN syntax (for example, a dollar sign rather than an ampersand must be used in a CALL statement when presenting the statement number as an argument).

The E Level subset provides language extensions beyond ANS basic FORTRAN including:

- Support of the direct (BDAM fixed length only) data access method.
- Double precision arithmetic.
- Compatible extensions to the READ and WRITE statements to provide direct data organization in support of direct access storage devices is planned.
- Mixed mode arithmetic.
- Ability to replace the H FORMAT specification by substituting enclosing apostrophes.
- The T-specification, permitting printed output to begin at any print position.
- Arrays of up to three dimensions.
- P-scale factors in FORMAT statements.
- STOP statement allows the processing of codes for testing by OS/360 Job Control statements.

FORTRAN H provides the above as well as extensions to the language beyond ANS FORTRAN, including:

- IMPLICIT statement allowing extended implicit classification by first character of a name.
- An extended type statement, including length specification and initializing data from type statement.
- G- conversion, extended to cover all numeric and logical data types.
- Multiple entry points to subprograms, and non-standard returns from subroutines.
- Arrays of up to seven dimensions.
- PAUSE statement extended to permit output of messages.
- NAMELIST statement permitting input/output and conversion without an explicit I/O list and FORMAT statement.
- Generalized subscripts.
- Hexadecimal constants and FORMAT code.
- END and ERR parameters in READ statement.
- Double exponentiation

FORTRAN G provides all the above plus a Debug facility as a programming aid.

System Requirements: All three compilers and object programs require floating point arithmetic option during execution. They require floating point arithmetic at compile time only if floating point contents appear in the source program. In addition to the OS/360 residence, space in auxiliary storage is required for the following data sets -- system input ... two intermediate (E level work storage only, not required for G and H) ... print output ... punch output ... object module (last three system requirements are selectable through JCL).

Note: In FORTRAN H if a cross reference listing and/or a structural source listing is requested, a data set for each option must be defined.

FORTRAN Library 360S-LM-501

The FORTRAN Library contains relocatable subprograms which can be called by FORTRAN object programs. This library, which includes subprograms for logarithmic, exponential, trigonometric and other mathematical functions, serves FORTRAN E, G and H.

This component also contains interfaces between the FORTRAN program and data management for sequential data sets and random access data sets. Interfaces are present to support NAMELIST, PDUMP and other service subprograms. The handling of object time error conditions is provided by the library as an option. Some features of the FORTRAN data management support are backspace of logical records and support for spanned records.

Graphic Subroutine Package 360S-LM-537

The services consist of subroutines and functions that enable a FORTRAN, COBOL, or PL/I, programmer to create a display on one or more 2250 Display Units (Models 1 and 3) under PCP, MFT or MVT. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs rectangles, etc. The subroutines are requested through use of CALL statements in a sequence that produces desired characters or graphic forms on the 2250 screen, and that provides two-way communication between the user's program and the 2250 operator (if desired). In producing desired displays, the subroutines automatically:

- . Generate necessary graphic orders and data for the displays.
- . Transfer the generated orders and data to the 2250 buffer for execution, relocating them as necessary.
- . Allocate, control, and protect sections of main storage and of the 2250 buffer as required by the user's graphic program.
- . Diagnose asynchronous errors and accomplish necessary error handling.

Features -- Available are:

- . Two levels of graphic order and data grouping, each of which can be referenced as an entity:
 1. **element** -- all orders and data produced by one call to a GSP subroutine.
 2. **sequences** -- all orders and data produced by several calls to GSP subroutines.
- . Acceptance of input data in any rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.
- . Provision for temporarily removing an image from a display while its associated orders and data are in the buffer, and later redisplaying the image.
- . Modification of graphic orders and data produced by a single call wherever they are located (in main storage or in the buffer) by another call to the same subroutine.
- . Display of alphameric characters using either the character generator feature of the 2250 or a series of lines called strokes.
- . Capability to read information from the buffer into main storage.
- . Capability to locate the position of the light pen on the screen even if the light pen is pointed at a blank portion of the screen.
- . Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 2250 operator with the light pen. (Restricted to 2250 Model 3).
- . Allowance for in-buffer subroutines that can be repeatedly invoked through in-buffer linkage (restricted to 2250 Model 3).
- . Ability to check the status of the program while it is being processed.
- . Calling any of the subroutines from an assembler language program.
- . Single and multiple queueing of attention information, and in-line processing of that information.

COBOL E 360S-CO-503

Operating System/360 COBOL (E) is a commercially-oriented programming language similar in form to English. It provides a number of IBM extensions to the language.

Systems Requirements: The COBOL E compiler and object programs require the Standard Instruction Set and the Decimal Arithmetic option. If floating-point literals, data items, or non-integer exponents are used in the object program, both the compiler and object program will require the floating-point feature. The minimum core requirement for COBOL 17K bytes.

COBOL E is non-standard, will not be enhanced and has programming service classification "C". It is not recommended for new program development.

COBOL E requires, in addition to the standard Operating System DASD system residence, the following data sets:

- System input - for source programs
- Working Storage - three intermediate utility data sets on devices of the same type
- System output - for listings, maps, and messages
- Either object module or punch output
- COBOL source COPY library (optional)

COBOL E Library 360S-LM-504

The COBOL E Subroutine Library consists of subroutines which fall into the following major categories:

- . Conversion routines
- . Arithmetic verb routines
- . Input/output verb routines
- . Other verb routines

Full American National Standard COBOL 360S-CB-545

Version 2 of the OS FULL ANSI COBOL compiles with the highest level of the ANSI STANDARD X3.23-1968 COBOL. The IBM implementation complies with the first draft. International Organization for Standards (ISO) recommendation for COBOL.

New Features:

Segmentation -- The programmer identifies the overlay segments of the program, the compiler generates the overlay structure to provide more efficient core usage.

Table Handling -- A new INDEXED BY option for more efficient direct and relative addressing of tables. Table Search is simplified by SEARCH and SET statements.

Sort Verb -- Improved flexibility for OS.

Report Writer -- Improved for OS. The programmer can specify, in the Data Division, the report format. This minimizes the amount of Procedure Division code and enables simplified report preparation within the COBOL program.

Write Before Advancing -- Improved Printer efficiency by printing before spacing.

The CORRESPONDING option of ADD, SUBTRACT, and MOVE - New for DOS.

Language Extensions: The IBM extensions to System/360 COBOL are available in the new compilers.

START statement, permits initiation of sequential processing of an ISAM file at any record specified.

Special Register items, allow access to:

TIME-OF-DAY
CURRENT-DATE
I/O Error Codes

Special Registers for sort optimization at object time. SORT-FILE-SIZE, SORT-CORE-SIZE, SORT-MODE-SIZE.

Apply CORE-INDEX - Specifies highest level index in core for indexed files.

New Usability Features: Cross reference listing -- Condensed Procedure listing option -- Individual options for Data Map and Procedure Map.

American National Standard COBOL Considerations

The American National Standards Institute approved the American National Standards Institute Standard COBOL (ANSI STANDARD X3.23-1968-COBOL) on August 23, 1968. The following functional processing modules of the American National Standards Institute Standard are included in the Subset Compiler:

2 NUC 1, 2	2 SRT 0, 2
3 TBL 1, 3	2 RPW 0, 2
2 SEQ 1, 2	2 SEG 0, 2
2 RAC 0, 3	2 LIB 0, 2

The first digit above represents the level of the modules included in the compiler; the second digit represents the lowest level in the American National Standards Institute Standard (0 implies that the module may be completely missing from some standard compilers); the third digit represents the highest level of the American National Standards Institute Standard.

Equipment Configuration: The FULL ANSI Compiler runs under OS and, in addition to the storage required for OS, requires a minimum of 80K bytes of storage. It makes use of additional storage up to that specified.

In addition to the features required by the Operating System, the following features must be present at compile time:

The Commercial Instruction Set (decimal simulator on the 91)

Floating Point Arithmetic if floating point literals or calculations are used.

Four Utility Data Sets on 2400 Tape Units, 2311 Disk Drives or 2314 Disk Storage Facility. One Utility Data Set must be on a 2311 or 2314.

The compiler is capable of producing a card deck and a SYSLIN data set. SYSIN, SYSLIB, and SYSPRINT are used for input, source language library input and listing output respectively.

Assembler E 360S-AS-036
Assembler F 360S-AS-037

The OS assembler language permits the solution of problems to be expressed in convenient statements. Both assemblers provide essentially the same language features, macro instruction capability, functions, and data management support. The major differences are in performance; Assembler F uses larger work tables and has fewer phases than Assembler E, and is therefore faster. Both assemblers will take advantage of additional available main storage by expanding the size of certain tables constructed during the assembly process.

Macro Instructions -- The macro instruction capability provided by OS assemblers is a powerful programming tool. It is flexible and easy to use, and permits new language capabilities to be defined as new or expanded applications are developed.

Conditional Assembly Statements -- Conditional assembly statements can be used within a macro definition or in a source program to alter the sequence in which statements are processed, or to specify selective assembly of instructions.

Private Libraries -- A private library may contain assembler language statements to be called by the assembler COPY instruction and/or the user's private macro definitions.

Pseudo-Registers in Assembler F -- Multiple common areas may now be shared between separately assembled subroutines that are processed together by the linkage editor. Space for each uniquely named common area is assigned dynamically at problem program execution time.

System/370 Instructions in Assembler F -- The assembler contains support of the additional instructions found in the System/370.

TSO Support in Assembler F -- Special terminal support is provided for OS - TSO including control over the output listing format and disposition of output listings and diagnostic messages to the remote terminal.

System Requirements -- All assemblers use the Standard Instruction Set. Object programs may use any instruction set. The minimum storage requirement for Assembler E is 18K bytes; Assembler F is 44K bytes. In addition to the standard OS/360 requirements the assemblers require space in auxiliary storage for the following data sets: System input ... Three intermediate (work storage) ... Macro instruction library (this optional requirement may be satisfied by DASD system residence or private library) ... Print output -- Selectable through JCL ... Object module -- Selectable through JCL ... Punch output -- Selectable through JCL.

Note: Assembler E does not support both object module and punch output during the same assembly.

Report Program Generator (RPG) 360S-RG-038

The Operating System Report Program Generator provides a powerful, high level, problem-oriented language which offers the user many advantages and functions beyond those of the prior RPGs.

Features: Outstanding improvements include:

- . Translation directly to object module code.
- . Modification specification sheets for easier coding.
- . Simple re-education requirements for use of prior RPGs.
- . Obtain data records from single or multiple input data sets.
- . Create formatted printed reports.
- . Perform calculations on data from input records or program created constants.
- . Do table lookup.
- . Ability to control operation with the use of indicators.
- . Branch within calculations.
- . Sequence check input records.
- . Edit output reports.
- . Operate on split control fields.
- . Provide sterling conversion and inverted print edit.
- . Ability to process records using QSAM.
- . Update in place.
- . Create new data sets.
- . Use of direct access method.
- . Use of indexed sequential access method.

System Requirements -- The OS RPG requires the standard instruction set and the decimal arithmetic option. The minimum main storage requirement is 15K bytes. In addition to the standard system residence, space is required in auxiliary storage for: System input ... Three intermediate (work storage) all on tape or all on disk ... Print output -- Selectable through JCL ... Either object module or punch output -- Selectable through JCL.

ALGOL F Compiler 360S-AL-531

ALGOL F Library 360S-LM-532

Language Features: OS ALGOL is a proper subset of ALGOL 60. It encompasses the ECMA subset of ALGOL as well as the IFIP subset. The recursive use of procedures and recursively defined procedures are features provided beyond the ECMA Subset.

In addition to the IFIP Input/Output procedures, the following facilities are available: Store and retrieve intermediate data ... Set and access system parameters ... Read and write integers, integer arrays, Boolean values, and Boolean arrays ... Output character strings.

System Requirements: Both the compiler and generated object program require floating point arithmetic option. In addition to the normal OS System residence requirement, space in auxiliary storage is required for three intermediate (work storage) data sets of which one must reside on DASD.

ALGOL support exists under all three options (PCP/MFT/MVT).

The sequential access methods BSAM and QSAM are used by the compiler. The compiler object programs use BSAM only.

Options: The following compile time options may be specified: Single or double precision of floating point numbers ... Full compilation or syntax checking only ...

Compilation of program or procedure ... compiler output options like source listing, storage maps, object module deck ... source code in EBCDIC or DIN/ISO.

Caution: ALGOL usage must be on a restricted basis since there are no plans for additional ALGOL processors, improvements, or increased language function. PL/I contains many ALGOL features, plus many additional features that give PL/I a wider range of applicability. IBM intends to provide full and continuing support for PL/I; we do not intend to extend our support of ALGOL beyond that announced. No formal customer education or documentation beyond the SRL is planned.

It is mandatory that the effect of ALGOL use be clearly understood by all users. As a result, the following rules must be adhered to before proposing the use of ALGOL:

1. ALGOL should be committed or referred only to an account where clear need is evident. (For example, currently using ALGOL)
2. The user should understand the limitations of IBM's plans (stated above) in regard to ALGOL.
3. Every effort must be made to move an ALGOL account to PL/I.

Service Programs

OS service programs provide functions ranging from standard utility services to program module linking and editing, remote job entry, graphic job processing and an extremely flexible sort/merge.

Sort/Merge 360S-SM-023

The OS Sort/Merge is designed to satisfy the sorting and merging requirements of both tape-oriented and DASD-oriented installations. It is a generalized program that will use different sorting and merging techniques, depending on the control information supplied by the user, on the main storage and on the secondary storage devices available to it. The minimum main storage requirement is 15.5K bytes. Additional main storage will be used, if available, for performance improvement.

Features -- Significant features of the sort/merge are:

- Sorting or merging on as many as sixty-four control data fields.
- Collating sequences and data format can be specified separately for each control field.
- Device independent initial input and final output.
- With additional main storage, as many as 32 tape units or 6 access mechanisms on 2311 and 17 on 2314 can be used for intermediate storage, as well as multiple input and output devices.
- An advanced sorting technique on larger tape systems with the 2816 Switching Unit.
- Callable through COBOL, assembler language and PL/I.

5734-SM1 or equivalent is a prerequisite for sorting on OS with the 3330/3333. 360S-SM-023 does not support the 3330/3333.

System Requirements -- In addition to the standard system residence, the sort/merge requires, as a minimum, devices for each of the following:

- System input
- Three intermediate storage (same device type) - 3 tape units or one DASD.
- Initial input and final output (may be the same device) or the input device may also be used for intermediate storage.

Devices for intermediate storage can be any one of the following:

- 2400/3400 Series Magnetic Tape Units (except 3420 Models 4, 6, or 8 at 6250 BPI)
- 2311 Disk Storage Drive
- 2301 Drum Storage
- 2314 or 2319 Disk Storage Drive
- 3330 is not supported

Note: 9-track input requires 9-track for output, and, if tape is used, 9-track tape for intermediate storage. If 7-track input is used, any combination of 7- and 9-track tape may be used for output or for intermediate storage.

The 2321 Data Call Drive and 2305 FHSF are not supported as a sort work file.

Linkage Editor E 360S-ED-510

Linkage Editor F 360S-ED-521

The linkage editor combines separately assembled or compiled object modules into one or more load modules that is in a format suitable for loading by the control program, and subsequent execution. It also combines previously edited load modules with each other or with object modules.

Linkage Editor F (44K, 88K, 128K) offers functions not available with E (15K or E (18K) related to input and output blocking and the number of entries in certain table structures.

The 15K design for Level E has a larger capacity than the 18K with the 18K design providing faster performance. For Linkage Editor F, in a given amount of available main storage, the 44K design provides capacity, the 88K design speed and the 128K offers the best overall performance.

Features -- Although linking or combining of program modules is its primary function, linkage editor also:

- Incorporates modules from data sets other than those in its primary input, either automatically or upon request.
- Constructs an overlay program for loading by the control program.
- Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.
- Defines the storage requirements for the common control sections generated by assemblers and FORTRAN compilers, and the static external areas generated by PL/I compilers.
- Provides processing options and logs diagnostic error messages.

System Requirements -- The minimum main storage requirement for Linkage Editor E is 15K bytes, and 44K for Linkage Editor F. In addition to the standard system residence, the linkage editor requires space in auxiliary storage for at least the following data sets:

- System input
- One intermediate - requires DASD
- Print output - Selectable through JCL
- Output load module - requires DASD

There may also be one or more library data sets containing object or load modules requiring DASD, and one or more object module data sets as additional input.

LOADER 360S-LD-547

The OS LOADER provides improved performance in a compile-load-go environment. The LOADER combines the basic editing and loading functions of the linkage editor and program loading (fetch) in one job step. It loads object modules produced by the language processor and load modules produced by the linkage editor directly into main storage for immediate execution. The LOADER is supported under PCP, MFT and MVT and will be reentrant so that it can reside in the link pack area of MVT to further enhance performance. The LOADER is operational in 21K bytes of main storage, plus that required for the program to be executed.

Remote Job Entry 360S-RC-536

OS Remote Job Entry allows OS jobs to be entered from remote locations using binary synchronous communications. Output may be returned to the remote work station submitting the job, to another remote control station, or at the central computer. A job entry control language (JECL) is provided for operator communication and control. It features:

- System/360 using BOS or BPS, an 1130 Computing System, Model 20, 2780 Data Transmission Terminal or the 2770 Data Communication System may serve as remote work stations. The 2770 and 2780 work stations can share the same non-switched multipoint line or the same switched connection at the central computer.
- The 1130 and Model 20 Work Stations can share the same non-switched multipoint line.
- The System/360, Model 20 and 1130 Work Stations can use the same switched network connection (phone number) at the RJE central computer. (Not supported in WTC).
- Uses the binary synchronous communication system.
- Provides completely automatic scheduling, initiation, execution, and output of job data.
- Notification of forms change requirements.
- System restart
- Uses BTAM with error recovery procedures
- Started and stopped like OS readers and writer

System Requirements -- Operates under the MFT or MVT control program. MFT or MVT device requirements apply. In addition, a 2701 or 2703 equipped with appropriate features for binary synchronous communication in EBCDIC transparency mode, and direct access storage space sufficient for storage of tables and work queues is required. Space is dependent on application, but will normally not exceed one 2311 Disk Storage Drive.

Dependent upon other installation requirements the MFT option may permit installation of RJE in a system having 256K of main storage.

Graphic Job Processor 360S-RC-541

This processor allows an application user, such as an engineer, to conveniently initiate and control jobs directly from the 2250 Display Unit. The jobs may either be graphic in nature and utilize the 2250 or may be requests for batch processing. The Graphic Job Processor allows the user to LOG ON, SPECIFY JOB STEP, DESCRIBE DATA, BEGIN JOB, BEGIN PROCEDURE, WRITE MESSAGE ENTER DATA, CANCEL JOB, RECALL and LOG OFF. GJP is supported under MFT or MVT. The system requirement is the 2250 Display Unit, Model I or Model III equipped with a minimum of 4096 bytes of buffer storage, the alphameric keyboard, and the character generator.

Satellite Graphic Job Processor 360S-RC-543

The Satellite Graphic Job Processor (SGJP) is an extension of the Graphic Job Processor and provides similar facilities. It enables an application user, such as an engineer, to request the initiation of System/360 jobs from the 2250-4 attached to his 1130 computer. He can initiate an OS/360 job to run in conjunction with a related 1130 program. Once the programs are initiated, they can utilize the FORTRAN Data Transmission Subroutines to transmit control information and data between a program and each processor. He may also request that a program be initiated in the background job stream of OS/360. SGJP is supported under MFT and MVT.

TESTRAN and TESTRAN Editor 360S-PT-516

TESTRAN statements can be grouped or interspersed in source modules and will be identified by the assemblers. The assemblers will produce from them a separate, replaceable control section which can be deleted by the linkage editor. These statements can also be assembled separately and link edited with a program to be tested.

The TESTRAN editor processes the data placed in auxiliary storage by TESTRAN during a preceding text execution of a load module. It edits and prints the data in a format indicated in the symbol table produced by the assembler, unless an overriding format has been specified through TESTRAN macro instructions.

The time used to process test output is minimized by:

- Preventing runaway test execution by allowing limits to be placed on the quantity of test output and the number of TESTRAN macro instructions.
- Allowing selective editing and printing of test results according to any of eight priority categories designated by the programmer.
- Allowing test output editing and printing at any convenient time after test execution.

System Requirements -- The minimum main storage requirement is 18K bytes. Space is required in auxiliary storage for the following data sets:

- System input
- Print output
- Test results from interpreter
- One intermediate - requires DASD

Restriction -- The instructions of S/370 are not supported by TESTRAN.

OS/360 Utilities 360S-UT-506

The Operating System utilities operate with the control program and provide the following features:

- Moving and copying a data set or part of a data set from one volume to another.
- Moving a data set from one locating to another on the same volume.
- Unloading a data set onto a removable volume and loading it at a later time to a device of the same type as the original.
- Copy, move, load and unload functions can be accomplished on groups of data sets data sets cataloged under common high level qualifiers.
- Printing or punching a data set, and printing information contained in the catalog or volume table of contents.
- Generating a data set based upon the contents of a sequentially organized input data set. Fields within records may be repositioned and/or converted as specified accounting to programmer specifications.
- Updating source language modules and the macro instruction library.
- Building and modifying the catalog data set.
- Analyzing the contents of the system library when updating is required and creating appropriate control statements for system maintenance.
- Unloading disk resident data sets to 7-track tape.
- Permitting inclusion of a control character in each logical record which controls printer carriage spacing when the data set is printed.
- Tape volume label creation.
- Unloads an indexed sequential data set to a special format sequential data set and reloads the indexed sequential data set at a later time.
- Record overflow support in the move/copy utility.
- Initialize and assign alternate tracks to a direct access volume; dump and restore the data contents of a direct access volume.
- Reads input from a 2495 Tape Cartridge Reader, optionally edits the data (created

on either an IBM 50 Magnetic Data Inscrber or a Magnetic Tape SELECTRIC Typewriter) and creates a sequential data set using QSAM. (P69-64)

System Requirements -- The Operating System utilities require the standard system residence device and space on the auxiliary storage for the following data sets:

- System input
- Intermediate storage (varies with utility)
- Print output

In addition to the OS utilities, a number of independent utilities (360S-UT-507) are provided:

The independent utilities do not operate with the control program, but they support the operating system with the following services:

Initializing DASD's by writing home addresses and record zero for each track, checking for defective tracks, initializing tracks to zero, and writing volume tables of contents.

Unloading and loading data between DASD and a removable volume.

Recover/Replace Utility -- This utility attempts to read data from a bad track and, after the operator has corrected the data, replaces it on an alternate track of the direct access device.

Conversational Remote Job Entry 360S-RC-551

Allows remote access to OS/360 via low-cost Printer Keyboard terminals. Terminal users share a Central System/360 for conversational preparation and updating of programs and data, submission of jobs for execution, selective listing of job output -- concurrently with normal background OS/360 operations. An easy-to-use command language is provided to control entry, editing, inquiry and other communication and control functions provided.

Features:

- Supports 2740, 2741 and 1050 printer keyboard terminals using BTAM
- FORTRAN and PL/I statements are checked for intra-statement syntax errors
- Logon security
- Data Set Protection
- Library storage of remotely entered programs and data
- Administrative aids
- Extensive data editing and manipulation capability
- Operator control of network
- Job Status inquiry at terminal or console
- Routing of output data to central computer output devices or selectively to a remote terminal

System Requirements: For MVT, a System/360 Model 50, 65, 65 MP, 67 (65 mode), 75, 85, 91, 195 or System/370 Models 145, 155, 155 II, 158*, 165, 165 II, 168*, and 195 with at least 384K bytes of main storage is required.

For MFT, a System/360 Model 40, 50, 65, 67 (65 mode), 75, 85 or System/370 Models 135, 145, 155, 155 II, 158*, 165, 165 II, and 168* with at least 256K bytes of main storage is required.

* MP models in UP mode.

Control program device requirements apply.

In addition, DASD space on a 2311 Disk Storage Unit or a 2314 or 2319 Disk Storage facility for CRJE tables, System Data Sets and work areas. Normally a portion of one 2311 Disk Drive capacity will be sufficient. Additional DASD space must be provided for user library data sets and directories, the exact requirement for which must be established by the using installation.

A 2701, 2702, 2703 with a Type I Terminal control, or 3704/3705 in emulation mode is required on the multiplexer channel with appropriate features for attachment of 1050 (1051 control unit Model 1 or 2), 2740 Model 1, or 2741 terminals over communications lines.

All 2740 terminals must have the Record Checking feature, and not have the Station Control feature.

If BTAM On-Line Test Facilities are omitted from CRJE, full system resources must be made available to the customer engineer for terminal maintenance when required.

Because of command chaining techniques, CRJE may not function properly when residing in the 2361 Large Core Storage on the S/360 Model 50. Its use from LCS on the Model 50 is therefore not recommended. CRJE in the 2361 on Models 65 and 75 will most likely operate correctly under conditions of normal I/O activity rates.

RECOVERY MANAGEMENT AND DIAGNOSTIC AIDS
SERO, SER1 & EREP for Models 40, 50, 65, 75 360S-DN-527
Recovery Management (RMS) for MVT and MFT
Models 65, 85, S/370 360S-DN-539

SERO, SER1 and RMS are model dependent Programming Support and provide several levels of recovery: (See table for applicable models)

MCH/CCH - This is the highest level of RMS and provides maximum support for Machine Checks and Channel Checks (i.e., Channel Control Checks, Interface Control Checks, Channel Data Checks).

SER1/CCH - This is the highest level of RMS on models which do not allow MCH support. This can also be optioned on some models where MCH is available. It provides full Channel Check Handling and selective termination and recording on Machine Checks.

SER1 only - This is the highest level of RMS on S/360 - M50 and below. It provides selective termination and recording on Machine checks and recording on channel checks.

SER Ø - Provides recording prior to loading wait.

TABLE OF APPLICABLE MODELS

MOD.	MCH/CCH	SER1/CCH	SER1	SERØ
All S/370	STD	-	-	-
M85	STD	-	-	-
M65MP	STD*	-	-	-
M195	--	STD	OPT	OPT
M75, 91/95	--	OPT	OPT	OPT
M50, below	--	-	OPT	OPT
M65	OPT	OPT	OPT	OPT
M67 (65 Mode)	OPT	OPT	OPT	OPT

* On M65MP, MCH & CCH must be specified in order to SYSGEN. On the M85 & S/370, MCH & CCH will automatically be included.

On-Line Test Executive Program (OLTEP) 360S-DN-533

The On-Line Test Executive Program (OLTEP) is an optional function designed to direct the selection, loading and execution of the On-Line Test Sections (OLTS) within the Operating System environment.

OLTEP with the related OLTS (OLTEP/OLT) is designed to allow the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs.

The OLTEP/OLT System is designed for:

- Diagnosing I/O errors.
- Verifying I/O hardware repairs and Engineering Changes.
- Exercising a device requiring dynamic adjustments.
- Checking I/O hardware.
- Integrity of customer data.
- Analysis of System Error Recording Data

As a job under OS it is called by standard Job Control Language or via a console command and is under control of the Operating System at all times. It uses Operating System facilities to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of Test Runs can be entered via console or via reading sequential data records. Prompting is available on consoles to aid in defining tests to be run.

Customer Engineering will supply the OLTs to the customer on magnetic tape or cards. The OLTs must be reformatted and link edited into a partitioned data set in order to be used under the Operating System.

Input/Output Recovery Management Support (I/O RMS)

Input/Output Recovery Management Support (I/O RMS) consists of Alternate Path Retry (APR) and Dynamic Device Reconfiguration (DDR). I/O RMS is not model dependent. It supports MFT, and MVT, including Model 65 Multiprocessing.*

APR and DDR are separate optional extensions to the present error recovery facilities of OS/360. APR guarantees an I/O operation that has developed an error on one channel to be retried on another, if there is another channel assigned to the device performing the I/O operation. DDR allows a demountable volume, i.e., 2400/3400 Tape Series, 2321, 2311, 2314, 2319 and 3330/3333 to be moved from one device to another without stopping the system or the job; a DDR can be requested by the system when a permanent error condition exists, or by the operator while a job is using the device. An additional option DDR SYSRES is available to provide the DDR function on SYSRES devices, with movable media, 2311, 2314, 2319 and 3330/3333.

*For Model 55 Multiprocessing, APR and DDR are not options. DDR SYSRES is optional in all cases.

OS SERVICE AIDS 360S-DN-554

The Service Aids are a group of programs designed to improve the serviceability of OS and to aid in Problem Determination, debugging and system maintenance by:

- Gathering information about the cause of a failure.
- Formatting and printing information in a form that makes it easy to use.
- Aiding in the development and application of a fix for a given problem.

Included are:

Generalized Trace Facility (GTF)

The generalized trace facility (GTF) service aid is a debugging tool that can be used to trace software behavior (system or problem program). GTF uses a hardware instruction (Monitor Call) to detect occurrences of system events and to create trace records. Problem programs may also use a GTF macro instruction (GTRACE) to record problem program data in the trace data set. Through the use of the GTRACE macro instruction, GTF will utilize the monitor call (MC) instruction on models of S/370 which have the hardware instruction and will provide support on models of S/370 and all models of S/360 which do not have the instruction. The macro is such, that programs which use it will run on models of S/360 and S/370 and will utilize the MC instruction where it is available. Thus, for consistent, compatible results, the interface to GTF and Monitor Call must be via this macro.

GTF provides the ability to single out those programming activities to be traced within the system, including such things as all (or specific) I/O interrupts, all (or specific) program interrupts, and all (or specific) supervisor call interrupts.

The output from GTF is a trace data set that can be used with a data reduction program (IMDPRDMP EDIT function) to edit the data set. The data reduction program provides the capability to format specific trace activities. It operates as a problem program that can be called via the job control language.

IMAPTFILE

This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies information on the module and CSECT to which the PTF is to be applied. The program then either produces the necessary Job Control Statements for application of the PTF; or, if specified, dynamically invokes the linkage editor to update the operating system.

IMBLIST

This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on IMBLIST control statements the following listings may be produced:

- Formatted load module listings
- Formatted object module listings
- Load module map and cross-reference listings
- Listings of the data stored in the CSECT Identification records (IDR) of load modules
- Load module summary data including entry point address, module attributes, and the contents of the module's System Status Index (SSI)
- Lists program modifications to a load module library.

IMASPZAP

This service aid program assists authorized personnel to:

Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set.

Inspect and modify data in a specific data record that exists in a direct access data set.

Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

IMDSADMP

This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. IMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the general purpose registers in and the contents of storage, onto a tape volume in large blocks. The low-speed version can write the general purpose registers and the contents of storage to a printer or tape volume in unblocked, printable format.

IMDPRDMP

This service aid allows the user to selectively format and print a storage dump when utilizing the dump tape produced by the high-speed version of the IMDSADMP service aid, or print a storage dump produced by the low-speed version of IMDSADMP. IMDPRDMP also provides an EDIT function to EDIT output of the Generalize Trace Facility (GTF). The EDIT function provides the capability to format specific trace activities.

IMCJDMP

This service aid selectively produces a formatted copy of the contents of the job queue data set. This program operates independent of control program, and does not alter the existing status of the records that are displayed.

IMCOSJOD

This service aid selectively produces a formatted copy of the contents of the job queue data set. It runs under control of the OS control program and does not alter the existing status of the records that are displayed.

IMBMDMAP

This service aid selectively produces formatted maps of load modules, the system nucleus and the system link pack area.

HMASMP

This program replaces IMAPTFILE for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Additional Information

MINIMUM SYSTEM REQUIREMENTS

The following table shows the required system elements and the device types which may be used for each function:

System Function	Units Permitted
Processing Unit*	System/360 Model 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195, or System/370 Models 135, 145, 155, 155II, 158*, 165, 165II, 168*, and 195. Main storage of 64K bytes or more is required for PCP, 128K bytes or more for MFT and 256K bytes or more for MVT (Note 4) and 512K bytes or more for MVT Model 65 Multiprocessing. * MP models in UP mode.
Operator Console	1052 Model 7, 3210, 3215, 2740 Model 1 Composite Console, 3277 Model 2, 2260 Model 1, 2250 Model 1 or 3, 3060, 3066, 2085 (5450), 2091, or 3158 (Note 3).
Card Input Unit	2540, 1442-N1, 2501, 2520 or magnetic tape 3505, 3525 with Card Read (1533) or magnetic tape (Note 1).
Punched Output Unit	2540, 1442-N1 a single 1442 cannot be both input and output) 1442-N2, 2520, 3525 or magnetic tape (Note 1).
Printer Output	1403, 1404 (continuous form only), 1443, 3211 (Note 7) or magnetic tape (Note 1).
Generating System Residence	2311, 2314/2319, 2303 (Note 5), 2301 (Note 5) and 2305 (Note 5), 3330 (Note 5).
Generated System Residence	2311, 2314/2319, 2303, 2301, 2305 or 3330/3333 (different unit from generating system residence).
Two Intermediate (work) data sets (direct access required)	2311, 2314/2319, 2301, 2303 or 3330/3333 (Note 2), Column for two Intermediate (work) data sets (direct access required).
Two Intermediate (work) data sets (sequential)	2311, 2314/2319, 2301, 2303 or 3330/3333, or magnetic tape (Note 1), Column for two Intermediate (work) data sets (sequential): 2305.

Notes:

- Magnetic tape unit may be 2400/3400 9-track, or 2400/3400 7-track with data conversion feature.(3228 or 3236). Multiple functions not permitted on a single tape drive. The 2400 7-track requires the Data Conversion feature (3228 or 3236).
- These intermediate (work) data sets normally will be placed on the same DASD as the generating system residence.
- A minimum of one operator's console is required. A hard copy log is mandatory when (1) there is more than one active console in the console configuration or (2) a graphic console is in the console configuration. See OPERATOR CONSOLE SUPPORT for more details. See System Generation section for list of consoles supported during generation.
- The practical main storage requirement is a function of user options and application requirements. Caution should be exercised to ensure that sufficient storage exists for proposed configurations. PCP is not supported on the Models 85, 195 and System/370 Models 135, 145, 155, 165 and 195. MVT is not supported on the Model 135. MFT is not supported on the Model 195.
- Not applicable for starter system.
- Interchange of ASCII data on magnetic tape requires a unit that reads or writes one-half inch, 9-track, 800 CPI NRZI tape. (Use of 1600 bpi tape while non-standard is not prohibited.)
- MVT and MFT only.

FEATURE SUPPORT

The following features are supported by the Operating System. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use the OS/360 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device. Support for items in the list below is available except where indicated by date or otherwise noted.

CPU Features

Decimal Arithmetic (#3237) - used by some compilers ... Floating Point Arithmetic (#4427) - used by some compilers ... Interval Timer (#4760) - used with Timer Option ... Selector Channels (#6960, #6961, #6981, #6982) ... and Storage Protection (#7520) ... Extends Channels (#3800 for Model 85, #3851 for Model 195) ... Integrated Storage Control feature (#4650).

Multiplexer Channel -- Excludes: Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer channel, standard on S/360 Models 30, 40 and 50 and Multiplexer channel (#5248) on a System/360 Model 44. Existence of these devices is not recognized by the control program.

I/O Features

- 1285 Model 1 - Not supported on System/370 Model 135.
- NOF (NCR Optical Font)
- 1287 Models 1, 2, 3, 4 and 5
Farrington 7B Font ... 1428 and USASCSOCR Font ... NOF (NCR Optical Font) - Model 2 or 4 only ... Numeric Handwriting ... Optical Mark Reading ... Alphameric - Model 3 or 4 only.
- 1288 Model 1
Numeric Handwriting ... Optical Mark Reading.
- 1403 Printer
Universal Character Set Feature (#8641, Mdl 2; #8640, Mdl 3, N1).
- 1419 Magnetic Character Reader Model 1
Program Control for Pocket Lights (#5739, #5741) Batch Numbering (#1445)
- 1442 Card Read Punch Model N1
Card Image (#1532). For problem program use only.
- 1442 Card Read Punch Model N2
Card Image (#1531).
- 1443 Printer Model N1
24 additional print positions (#5558)
- 2305 Fixed Head Storage Facility - Not supported on System/370 Model 135.
Features Two Channel Switch
- 2540 Card Read Punch
Card Image (#1531)
- 2520 Card Read Punch
Card Image (#1531)
- 2501 Card Reader
Card Image (#1531)
- 2520 Card Punch
Card Image (#1531)
- 2314 Direct Access Storage Facility
Feature #8170 Two Channel Switch
- 2400/2415 Magnetic Tape Units and 2803 Tape Control Model 2
Dual Density 800 - 1600 bpi (#3471 and #3472).
- 2401, 2402 Magnetic Tape Unit Models 1, 2, 3, 4, 5, 6, 8 (7-track).
- 2403, 2404 Magnetic Tape Unit and Control Models 1, 2, 3, 4, 5, 6.
- 2415 Magnetic Tape Unit & Control Models 1, 2, 3, 4, 5, 6.
- 2420 Magnetic Tape Unit Model 5 and 7.
- 3420 Magnetic Tape Unit Model 3, 5, 7
Dual Density (#3550)
Single Density (#6631)
7-track (#6407)
- 3420 Magnetic Tape Unit Models 4, 6, 8
6250 Density (#6420)
6250/1600 Density (#6425)
- 2803, 2804 Tape Control Model 1, 2
Simultaneous Read-While-Write (#7160, #7161)
Data Conversion (#3228, #3236) - Required for all 7-track tapes that record binary data such as variable length (format V) records and abnormal end dumps.
The inclusion of 7-track tapes without this feature is not recommended.
7-track Compatibility (#7125, #7126, #7127, #7135).
16 Drive Addressing (#7185).
2420 Attachment (#7900) to the 2803 Model 2.
- **3410/3411 Magnetic Tape Unit and Control Models 1, 2, 3
Dual Density (#3221)
Single Density (#3211)
S/360-/370 Attachment (#7360)
- 3803 Tape Control Model 1 -- Dual Density (#3551) ... 7-track (#6408) ...
Communicator 1-2 (#9071) ... Communicator ... Three Control Switch (#1793) ...
Four Control Switch (#1794).
- 3803 Tape Control Model 2 -- 9-track NRZI (#5310) ... 7-track NRZI (#6320) ...
Communicator 1-2 (#9071) ... Communicator 3-4 (#9073) ... 2 Control Switch (#1792) ... 3 Control Switch (#1793) ... 4 Control Switch (#1794) ...
Two-Channel Switch (#8100).

** See sales manual page for 3410/3411 magnetic tape subsystem to determine CPUs supporting the 3410/3411.

2816 Switching Unit Model 1

All features for additional switching (#1050, #1051, #1052, #1055, #2285, #2286, #4455, #6392, #6393).

2821 Control Unit Model 1, 4, 5

Column Binary (#1990). For problem program use only.
Universal Character Set Adapter (#8637, #8638, #8639).

2841 Storage Control Unit

Feature #6118 Record Overflow,
Feature #8100 Two-Channel Switch.

2844 Auxiliary Storage Control

Feature #8171 Two Channel Switch.

2870 Multiplexer Channel -- Excludes:

1. Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer subchannel. The 2321 and magnetic tapes are supported on the selector subchannels.
2. Cross channel devices (2804 Tape Control, 2404 Magnetic Tape Unit and Control, 2816 Switching Unit, 3803 with communicator feature and either two control switch, three control switch or four control switch, 3803 with two channel switch feature #8100, 2841 Storage Control with Feature #8100 Two Channel Switch) attached between any 2870 selector subchannel and any selector channel; or between any 2870 selector subchannel and a selector subchannel of a different 2870.
3. SEP and AFF parameters for device allocation are not supported.

2848 Display Control

Feature #4787 Line Addressing.
Local Support - Graphic Programming Services.

2880 Block Multiplexer Channel

Two Byte Interface (#7850/#7851)

3505 Card Reader, Models B1, B2

Optical Mark Read (#5450)
Read Column Eliminate (#6122)
Selective Stacker (#6555)

51/80 Column Interchangeable Read Feed (Model B2 only)

3525 Card Punch, Models P1, P2, P3

Card Read (#1533)
Multiline Card Print (#5272)
Two-Line Card Print (#8338)

3211 Printer

18 Additional Print Positions (#5554)

3811 Control Unit 18 Additional Print Positions

3830 Storage Control

Feature #8170 Two Channel Switch
Feature #8171 Two Channel Switch Additional

Telecommunication Features

2701 Data Adapter Unit

Autocall (#1302, 1303, 1314), Dual Code (#3455), Dual Communication Interface (#3463, 3464, 3465), Transparency (#8029), EBCDIC code (#9060), ASCII code (#9061), 6-bit Transcode (#9062).

2702 Transmission Control Unit

Autocall (#1290), Autopoll (#1319), 2741 Break (#8055).

2703 Transmission Control Unit

Autocall (#1340, #1341), EBCDIC code (#7715), ASCII code (#7716), 6-bit Transcode (#7717), Transparency for ASCII (#9100), 2741 Break (#8055).

2715 Transmission Control Unit

Model 1 - Expanded capability (#3081), Local 2740 Adapter (#4850).

Model 2 - Expanded capability (#3801), Point-to-Point Non-switched (#9401), Point-to-Point Switched (#9402), Multipoint Non-switched (#9403).

3704/3705 Communications Controller

Note: EBCDIC Code, ASCII Code, Autopoll, EBCDIC Transparency, do not have special feature codes on the 3704/3705, but the equivalent functions are program supported as capabilities of the 3704/3705 Network Control Program and Emulation Program.

System/370 Model 135 ICA (#4640)

Terminal Adapter Type I Model 2, (#9721-9728)
Terminal Adapter Type III, (#9753-9760) Synchronous
DATA Adapter Type II (#9649-9656)
EBCDIC Code (Std), ASCII Code (#9681-9688)
6-Bit Transcode (#9689-9696)
Transparency (#9673-7680)
Autocall (#1290)

Telecommunication Terminals and Terminal Features

1030 Data Collection System.

1050 Data Communication System.

1060 Data Communication System.

AT&T 8383, Models 33/35 TWX, WU 115A, WT Telegraph terminals.

2715 Transmission Control Unit

Model 1 ... Expanded Capability (#3801), Local 2740 Adapter (#4850) ...
Model 2 ... Expanded Capability (#3801), Point-to-Point non-switched (#9401),
Point-to-Point switched (#9402), Multipoint non-switched (#9403).

2740 Model 1 Communication Terminal

Dial Up (#3255), Station Control (#7479), Transmit Control (#8028), 2760 Attachment (#8031), Record Checking (#6114).

2740 Model 2 Communication Terminal

Record Checking (#6114), Buffer Receive (#1499).

2741 Communication Terminal

Dial Up (#3255), Interrupt (#4708).

2760 Optical Image Unit

2260 Display Station

2265 Display Station

1130 Central Process Unit

Synchronous Communications Adapter (#7690) (operating in BSC Mode).

2972-8 General Banking Station

S/360 Model 20 Process Unit

Binary Synchronous Communications Adapter (#2074), Automatic Calling (#1315), Full Transparent Text Mode (#4100), Station Selection (#7477), High Speed (#4500 or #4501).

System/360, System/370 with 2701, 2703, 3704/3705 (Remote Station)

Features as as for 2701, 2703 and 3705 under Telecommunication
Features except: 2701: 6-bit Transcode (#9062) not supported.
2703: 6-bit Transcode (#7717) not supported.
3705: 6-bit Transcode and ASCII Transparency are not supported by the 3704/3705 Network Control Program or the 3704/3705 Emulation Program.

S/360 Model 25 Integrated Attachment Feature

Synchronous Data Adapter (#7551, #7552), Autocall Adapter (#1300), Dual Communications Interface (#3461), ASCII code in lieu of EBCDIC (#9001, #9002), Transparency (#4751, #9752).

System/370 Model 135 Integrated Communication Adapter (#4640) with a Synchronous DATA Adapter Type II (#9649-9656).

EBCDIC Code (Std), ASCII Code (#9681-9688).
6-Bit Transcode (#9689-9696).
Transparency (#9673-9680)
Autocall (#1290)

1800 System

Communication Adapter #7550, EBCDIC code #9321 thru #9328, ASCII code #9331 thru #9338.

2770 Data Communication System

Multipoint Data Link Control #5010 ... EBCDIC #9671 ... ASCII #9672 ...
EBCDIC Transparency #3650 ... Automatic Answering #1340 ... Conversational Mode #1910 ... Buffer Expansion #1490 ... Trans/Rec. Monitor Print #7950 ... Keyboard Correction #4690 ... Display Format Control #3250 ... Synchronous Clock #7705 ... Identification #4610.

2780 Data Transmission Terminal

Automatic Answering (#1340), Automatic Turnaround (#1350), Multiple Record Transmission (#5010), Multipoint Line Control (#5020), EBCDIC code (#9670), EBCDIC Transparency (#8030), Identification Terminal (#7850), Dual Communication Interface (#3401)

3780 Data Communication Terminal

Switched Network Control (#7651), Additional Print Positions (#5701), EBCDIC Transparency (#3601), Multipoint Data Link (#5010) EBCDIC Code (#961), ASCII (#9762), Identification (#9350).

S/3 Central Process Unit

Binary Synchronous Communications Adapter (#2074), EBCDIC Transparency (#7850), Station Selection (#7477), Auto Call (#1315), EBCDIC Code (#9060), ASCII Code (#9061), Point-to-Point (#9481), Multipoint (#9482), Switched (#9483), plus additional specifications.

System/7 Communications Control (#1610) must be specified as a 2740 Model 1 terminal with checking.

7770 Audio Response Unit operating in a switched network with: 1001 Data Transmission Terminal, or a telephone set.

3735 Programmable Buffered Terminal

Multi-point Data Link Control (#5010)
ASCII (#9762), EBCDIC (#9761)

(continued)

TERMINAL SUPPORT CHART 1

TERMINAL SUPPORT CHART 2

Terminals Operating with S/360 or S/370*	ACCESS METHOD			PROGRAMMING SUPPORT							Chkpt/Rest
	Date Avail.	Chan Att	BTAM	QTAM	TCAM	Auto poll+	ERP	ERR Count	On-Ln Test	Opr. Ctr.	
1030	A	4	X	X	X	X	X	X	X	X	OT
1050	A	5	X	X	X	X	X	X	X	OT	OT
1060	A	4	X	X	X	X	X	X	X	OT	OT
WT Telegraph	A	4	X	X	X	X	X	X	X	T	OT
AT&T 8383 & WU 115A	A	4	X	X	X	X	X	X	X	T	OT
AT&T Mdl	A	4	X	X	X	X	X	X	X	T	OT
33/35TWX	A	4	X	X	X	X	X	X	X	T	OT
2740 Mdl 1	A	5	X	X	X	X	X	X	X	OT	OT
2740 Mdl 2	A	5	X	X	X	X	X	X	X	OT	OT
2741	A	5	X	X	X	X	X	X	X	T	OT
2760	A	5	X	X	X	X	X	X	X	T	OT
2260 (Local)	A	L	X	X	X	X	X	X	X	T	OT
2260 (Remote)	A	1	X	X	X	X	X	X	X	T	OT
2265	A	1	X	X	X	X	X	X	X	T	OT
7770-3	A	L	X	X	X	X	X	X	X	T	OT
S/360 & S/370**	A	2	X	X	X	X	X	X	X	T	OT
Model 20	A	2	X	X	X	X	X	X	X	T	OT
1130	A	2	X	X	X	X	X	X	X	T	OT
2780	A	2	X	X	X	X	X	X	X	T	OT
2770	A	2	X	X	X	X	X	X	X	T	OT
2715 Mdl 1***	A	L	X	X	X	X	X	X	X	T	OT
2715 Mdl 2***	A	2	X	X	X	X	X	X	X	T	OT
2972-8, 2972-11	A	2	X	X	X	X	X	X	X	T	OT
3735	A	2	X	X	X	X	X	X	X	T	OT
1800	A	2	X	X	X	X	X	X	X	T	OT
S/3	A	2	X	X	X	X	X	X	X	T	OT
3277 (Remote)	A	L	X	X	X	X	X	X	X	T	OT
3277 (Local)	A	L	X	X	X	X	X	X	X	T	OT
3275	A	2	X	X	X	X	X	X	X	T	OT
3284/3286 (Remote)	A	2	X	X	X	X	X	X	X	T	OT
3284/3286 (Local)	A	L	X	X	X	X	X	X	X	T	OT
System/7	A	5	X	X	X	X	X	X	X	T	OT
3670	A	2	X	X	X	X	X	X	X	T	OT
3780†	A	2	X	X	X	X	X	X	X	T	OT
3741 Mdl 2	A	2	X	X	X	X	X	X	X	T	OT
3741 Mdl 4	12/74	2	12/74	X	X	X	X	X	X	T	OT
3747	A	2	X	X	X	X	X	X	X	T	OT

Terminals Operating with S/360 or S/370*	COMMUNICATION CODE				COMM. NETWORK				
	Type Comm	BCD	Other	EBCDIC nor tran	ASCII nor tran	6-bit Tran	PTP SW	PTP (non-SW)	MP (non-SW)
1030	SS	X	-	-	-	-	-	-	X
1050	SS	X	-	-	-	-	X	X	X
1060	SS	X	-	-	-	-	-	-	X
WT Telegraph	SS	-	X	-	-	-	-	X	-
AT&T 8383 & WU 115A	SS	-	X	-	-	-	-	-	X
AT&T Mdl 33/35	SS	-	X	-	-	-	-	-	X
TWX	SS	-	X	-	-	-	X	-	-
2740 Mdl 1	SS	X	-	-	-	-	X	X	X
2740 Mdl 2	SS	X	-	-	-	-	-	X	X
2741	SS	X	-	-	-	-	X	X	-
2760	SS	X	-	-	-	-	X	X	-
2260 (Local)	L	-	X	-	-	-	-	-	-
2260 (Remote)	SS	-	X	-	-	-	-	-	X
2265	SS	-	X	-	-	-	-	-	X
7770-3	L	-	X	-	-	-	X	-	-
S/360 & S/370	BSC	-	-	X	X	X	X	S1, R1	X
Model 20	BSC	-	-	X	X	X	X	S1, R	X
1130	BSC	-	-	X	X	-	-	S1, R	X
2780	BSC	-	-	X	X	X	-	S1, R	X
2770	BSC	-	-	X	X	X	-	S1, R	X
2715 Mdl 1****	L	-	-	X	-	-	-	-	M1, R
2715 Mdl 2****	BSC	-	-	X	-	-	-	S1	X
2972-8, 2972-11	BSC	-	-	X	-	-	-	-	M1
3735	BSC	-	-	X	-	X	-	S1	-
1800	BSC	-	-	X	X	X	-	S1	X
S/3	BSC	-	-	X	X	X	-	S1	X
S/7 134.5	SS	X	-	-	-	-	-	X	X
600	SS	X	-	-	-	-	-	X	X
3277 (Remote)	BSC	-	-	X	-	X	-	-	M1
3277 (Local)	L	-	-	X	-	X	-	-	-
3275	BSC	-	-	X	-	X	-	-	M1
3284/3286 (Remote)	BSC	-	-	X	-	X	-	-	M1
3284/3286 (Local)	L	-	-	X	-	X	-	-	-
3670	BSC	-	-	X	-	X	-	-	M1
3780†	BSC	-	-	X	X	X	-	S1, R	X
3741 Mdl 2, 4	BSC	-	-	X	X	X	-	S1, R2	X
3747	BSC	-	-	X	X	X	-	S1, R2	X

Notes: Channel Attachment: 1 = Supported on 2701 and M135 ICA only
 2 = Supported on 2701, 2703 and M135 ICA only
 4 = Supported on 2701, 2702 and 2703 only
 5 = Supported on 2702, 2703 and M135 ICA
 L = Supported on Local Channel
 X = Supported
 - = Not supported
 Access Method: X = Supported by Access Methods
 - = Not supported
 Programming Support: X = Supported by TCAM only
 - = Not supported
 T = Supported by TCAM only
 OT = Supported by QTAM & TCAM only

+ Autopoll is available on the 2701 and 2703 for terminals using a start-stop communication code and on the 2701 and 2703 for terminals using a BSC communication code.

* System/360 Models 40, 50, 65, 65MP, 67, 95, 91 and 195 (with 2701, 2702 or 2703).
 System/370 Models 135, 145, 155, 155 II, 158, . . ., 165 II, 168 and 195 (with 2701, 2702, 2703 or Model 135 ICA).

For details on terminal support when computer is used with 3704/3705, see 3704/3705 Programming Support Package.

** System/360 Models 25 and 30 with BOS/BPS or DOS; Models 40, 50, 65, 67, and 75 with BOS/BPS, DOS or OS; and Models 85, 91, 195 with OS. System/370 computers cannot operate as a terminal using OS TCAM if the central computer uses OS TCAM.

System/370 Models 145, 155, 155 II and 158 with DOS and OS; and Models 165, 165 II, 168 and 195 with OS. Model 135 with DOS or OS (MFT).

*** Not supported by System/360 Model 91.

† 3780 Supported and specified as a 2770 without component select.

Notes: SS = Start/Stop
 BSC = Binary Synchronous Communication
 L = Local Attachment (2715 Model 1 used BTAM PTP Non-switched programming support)
 X = Supported
 - = Not supported
 S1 = Group of terminals which can share the same phone number(s)
 M1 = Group of terminals which can operate on the same multipoint line
 R = RJE Work Stations (2770 and 2780 may not share the same line/phone number with Processor Work Stations)
 R1 = S/360 RJE Work Stations must use BOS/BPS RJE support
 R2 = When dialing in to a 3704/3705 in NCP mode, the 3741/3747 can use the same phone number as oth er terminals in the group with the following restriction: when a 3741/3747 is dialing in, the NCP must be configured with the 3741/3747 specified for that BSC line appearance. If a 3741/3747 is not dialing in, the NCP must not be configured with the 3741/3747 specified for that BSC line appearance.

* System/360 Models 40, 50, 65, 65MP, 67, 95, 85, 91 and 195 (with 2701, 2702 or 2703).
 System/370 Models 135, 145, 155, 155 II, 158, 165, 165 II, 168 and 195 (with 2701, 2702, 2703 or Model 135 ICA).

For details on terminal support when computer is used with 3704/3705, see 3704/3705 Programming Support Package.

*** Not supported by System/360 Model 91.

† 3780 Supported and specified as a 2770 without component select.

Telecommunication Terminals and Terminal Features (continued)

- 3270 Information Display Systems (Local and Remote)
- 3741 Model 2 Data Station, 3741 Model 4 Programmable Work Station Terminal Identification (#7850)
 Operator ID Card Reader (#5450)
 Data Set Attachment (#9120, 9121, 9122, 9123)
 Expanded Communications (#1680)
 Expanded Communications/Multipoint Data Link Control (#1685)
- 3747 Data Converter Communications Adapter (#1660)
 Data Set Attachment (#9120, 9121, 9122, 9123)

DEVICE SUPPORT

I/O Unit Support: The following units to a maximum of 768 devices are supported by the Operating System, for the indicated function.

Input/Output Units	Input Job Stream	MVT In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I	P	D
1052 Printer-Keyboard						X					
1285 Optical Reader								X18			
1287 Optical Reader								X19			
1288 Optical Page Reader								X20			
1403 Printer (Mdl N1, 2, 3 & 7)			X2			X5		X2			
1404 Printer (Mdl 2) (continuous form Printer support only)			X2			X5		X2			
1419 Magnetic Character Reader						X5		X20			
1442 Card Read Punch (Mdl N1)	X3		X3			X5		X			
1442 Card Punch (Mdl N2)			X			X		X			
1443 Printer (Mdl N1)			X			X5		X			
2150 Console						X					
2250 Display (Mdl 1, 3)						X12	X				
2260 Display						X12	X				
2280 Film Recorder								X16			
2282 Film Recorder/Scanner								X16			
2301 Drum (Mdl 65, 65MP, 75, 85, 91, 195 only, Note 9)	X1	X		X	X			X	X	X	X
2302 Disk Storage (Notes 4, 9 and 21)				X	X			X	X	X	X
2303 Drum Storage (Note 9)	X1	X		X	X			X	X	X	X
2305 FHSF (Mdl 85, 145, 155, 165 only, Notes 9,22,25)	X1, 23	X23		X	X23			X23	X23	X23	X23
2311 Disk Storage Drive (Notes 7 and 9)	X11	X		X	X			X	X	X	X
2319/2314 Disk Storage facility (Notes 7 and 9)	X11	X		X	X			X	X	X	X
2321 Data Cell Drive (Notes 9 and 11)	X1			X	X			X	X	X	X
3230-1, 2/3233-1 (S/360 - 85, 195, S/370 - All Models) (Notes 9 and 24)	X11, 23	X28		X23	X			X23	X23	X23	X23
2400 Magnetic Tape Units	X		X					X			
2415 Magnetic Tape Units	X		X					X			
2420 Magnetic Tape Units	X		X					X			
3410 Magnetic Tape Units (Note 26)	X		X					X			
3420 Magnetic Tape Units	X		X					X			
2495 Tape Cartridge Reader								X15			
2501 Card Reader	X		X			X5		X			
2520 Card Read Punch	X3		X3, 8			X5		X3			
2540 Card Read Punch	X6		X6, 8			X5		X			
2671 Paper Tape Reader								X			
2740 Communication Terminal	X13					X27					
2741 Communication Terminal	X13										
2780 Data Transmission Terminal (Models 1 and 2, EBCDIC Transparency Only)	X10		X10								
1050 Data Communication System (Keyboard/Printer)	X		X								
1130 Computing System	X10		X10								
2770 Data Communication System	X17		X17								
S/360 - 20, 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 195, System/370 All Models	X10		X10								
3211 Printer	X		X			X5		X11			
3505 Card Reader	X		X			X5		X			
3525 Card Punch	X3		X3, 8			X5		X			
3277 Display (Models 1 and 2)	X					X12					
3275 Display	X					X12					
3284 Printer			X			X12					
3286 Printer			X			X12					
2596 Card Read Punch								X			
3210 Printer Keyboard						X					
3215 Printer Keyboard						X					
3158 Processing Unit in 3215 Mode with 3213						X					
3158 Processing Unit in 3270 Mode						X					
3213 Output Printer						X12					
3060 System Console for 195						X12					
3066 System Console for 165, 165 II and 168						X12					
5450 for 85						X12					

Legend: C - Console - See console section for specific modes supported
 G - Graphic Programming Service
 S - Sequential Access Methods
 I - Indexed Sequential Access Method
 P - Basic Partitioned Access Method
 D - Basic Direct Access Method
 X - Function Supported

- Note:
- 1) MVT only.
 - 2) The Selective Tape Listing Feature is not supported.
 - 3) Support for read or punch, but not both simultaneously.
 - 4) Not supported by MVT.
 - 5) Composite Console only.
 - 6) Punch Feed Read is not supported.
 - 7) For message queues under QTAM.
 - 8) For use with the MVT Output Writer; not for system messages.
 - 9) File Scan not supported.
 - 10) As a work station for RJE.
 - 11) MVT and MFT only.
 - 12) Supported by DIDOCS in MFT and MVT.
 - 13) Supported only under Conversational Remots Job Entry.
 - 14) Supported when attached to a selector channel or when attached to a selector subchannel only if PCI fetch is not included in the system.
 - 15) A Data Set Utility (IEBCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
 - 16) PCP and MFT for model 85 only.
 - 17) As a work station for RJE.
 - 18) OSAM (device-dependent only).
 - 19) OSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents).
 - 20) BSAM (device-dependent only).
 - 21) Not supported by Checkpoint/Restart.
 - 22) Multiple Requesting supported.
 - 23) Rotational Position Sensing support.
 - 24) For message queues under TCAM.
 - 25) 168 for 2305-1
158 and 168 for 2305-2
 - 26) 155 and 158 only.
 - 27) Requires MCS (MFT and MVT only).
 - 28) Rotational Position sensing support (except Model 135)

SYSTEM GENERATION

This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses the Operating System and requires the following programs --

- Control Program
- Data Management: Data Set Control, BSAM, QSAM, BPAM
- Assembler
- Linkage Editor
- Utilities

PID will include the required libraries (Partitioned Data Sets) which contain the Operating System modules and the system generation macro-instructions needed for the system generation process when the above programs are ordered.

System Requirements

The minimum main storage requirement including the resident control program nucleus, is 128K bytes. The Operating System requires a minimum of one DASD device for system residence but for SYSGEN the minimum DASD requirements are:

2311 Disk Storage Module	1316 Disk Packs	2314 Disk Storage Module	2316 Disk Pack	3330/3333 Disk Storage Module	3336 Disk Pack
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To Generate:

	4	5	2	3	2	2
A Non-TSO System	4	5	2	3	2	2
A TSO System	4	6	2	3	2	2

Note: While SYSGEN can be performed with 1-2314/2319 disk storage module plus one other DASD device this is not recommended.

System Maintenance

The same "system requirements" are required for maintenance as for generations since some changes may require a new system generation.

Starter System 2311 Residence 360S-CI-514
2314/2319 Residence 360S-CI-534
3330 Residence 360S-CI-560

The standard "starter" system for S/360 and S/370 is an MFT system which operates in 128K bytes of core or more.

The Starter system has the basic elements necessary for system generation in a form that will be directly usable by a majority of customers. The starter system will function with a variety of different I/O units at "standard" addresses. Customers may use the starter system to perform system generation if there are appropriate matching units and addresses in their own configuration.

Customers whose configurations do not match closely enough to permit system generation should plan to do their initial system generation on some system having OS/360 already installed.

Customers should be encouraged to match unit addresses with those of the starter system to the greatest degree practical. Unit addresses are established as part of the normal physical planning and cable order process; therefore, physical installation plans should be reviewed where appropriate.

Starter System Configurations

The following table shows the devices supported by the Starter System, the system functions for which they may be used, and the three character address assigned to each unit. The MFT Starter System supports all the devices at the specified addresses.

I/O Unit	Address (Note 1)	System Function						
		Card Input	Punch Output	Printed Output	System Residence	Interchange (work) Storage (direct access)	Intra-Immediate (work) Storage (sequential)	
Operator Console (1) (Notes 8 and 9)	01F							
Operator Console (2) (Notes 8 and 9)	21F							
Operator Console (3) (Notes 8 and 9)	009							
Operator Console (4) (Notes 8 and 9)	209							
Operator Console (5) (Notes 8 and 9)	309							
2301 Drum Storage (Note 2) (1)	1C0				X	X	X	
2301 Drum Storage (Note 2) (2)	2C0				X	X	X	
2303 Drum Storage (Note 2) (1)	197				X	X	X	
2303 Drum Storage (Note 2) (2)	297				X	X	X	
2305 FHSF Model 1	1F0				X	X	X	
2305 FHSF Model 1	2F0				X	X	X	
2311 Disk Storage Drive (Note 2) (1)	190				X	X	X	
2311 Disk Storage Drive (Note 2) (2)	191				X	X	X	
2311 Disk Storage Drive (Note 2) (3)	192				X	X	X	
2311 Disk Storage Drive (Note 2) (4)	193				X	X	X	
2311 Disk Storage Drive (Note 2) (5)	290				X	X	X	
2311 Disk Storage Drive (Note 2) (6)	291				X	X	X	
2311 Disk Storage Drive (Note 2) (7)	292				X	X	X	
2311 Disk Storage Drive (Note 2) (8)	293				X	X	X	
2314/2319 Direct Access Stg (Note 2) (1)	130				X	X	X	
2314/2319 Direct Access Stg (Note 2) (2)	131				X	X	X	
2314/2319 Direct Access Stg (Note 2) (3)	132				X	X	X	
2314/2319 Direct Access Stg (Note 2) (4)	133				X	X	X	
2314/2319 Direct Access Stg (Note 2) (1)	230				X	X	X	
2314/2319 Direct Access Stg (Note 2) (2)	231				X	X	X	
2314/2319 Direct Access Stg (Note 2) (3)	232				X	X	X	
2314/2319 Direct Access Stg (Note 2) (4)	233				X	X	X	
2400/3400 Tape (Note 3) (1)	180	X	X	X				X
2400/3400 Tape (Note 3) (2)	181	X	X	X				X
2400/3400 Tape (Note 4) (3)	182	X	X	X				X
2400/3400 Tape (Note 4) (4)	183	X	X	X				X
2400/3400 Tape (Note 4) (5)	184	X	X	X				X
2400/3400 Tape (Note 3) (6)	280	X	X	X				X
2400/3400 Tape (Note 3) (7)	281	X	X	X				X
2400/3400 Tape (Note 4) (8)	282	X	X	X				X
2400/3400 Tape (Note 4) (9)	283	X	X	X				X
2400/3400 Tape (Note 4) (10)	284	X	X	X				X
2540 Card Read Punch (Reader) (1)	00C	X						
2540 Card Read Punch (Punch) (1)	00D		X					
2540 Card Read Punch (Reader) (2)	20C	X						
2540 Card Read Punch (Punch) (2)	20D		X					
1442-N1 Card Read Punch (Note 6) (1)	00A	X	X					
1442-N1 Card Read Punch (Note 6) (2)	20A	X	X					
1403 Printer (Note 7) (1)	00E				X	X		
1403 Printer (Note 7) (2)	20E				X	X		
1443 Printer (1)	009				X	X		
1443 Printer (2)	209				X	X		
2305 FHSF Model 2	1D0				X	X	X	
Model 2	2D0				X	X	X	
3211 Printer (1)	002		X					
3211 Printer (2)	004		X					
3330-1,2/3333-1 Disk Storage (Note 2)	150				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	151				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	152				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	153				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	250				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	251				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	252				X	X	X	
3330-1,2/3333-1 Disk Storage (Note 2)	253				X	X	X	
3505 Card Reader 1	012	X						
3525 Card Punch 1 (Note 6)	013	X	X					

1. Hexadecimal. The first digit represents the channel -
 - 0 Multiplexer Channel
 - 1 Selector Channel #1
 - 2 Selector Channel #2
 - 3 Selector Channel #3
2. Multiple system functions may be assigned to a single DASD to the extent that space is available. A minimum of four 2311s is required if 2311 Starter System is selected or two 2314/2319 disk storage modules if the 2314/2319 Starter System is selected or two 3330/3333 disk storage modules if the 3330/3333 Starter is selected.
3. 7-track with Data Conversion (Feature #3228 or #3236) or 7-track feature (#6407). (See also Note 5)
4. 9-track. (See also Note 5)
5. Magnetic tape units supported include 2401, 2402, 2403, 2415. (Models 1, 2, and 3, 4, 5, 6) 3410 (Models 1, 2, 3) and 3420 (Models 3, 5, 7).
6. May not be used for both input and output.
7. 1404 Printer, using continuous form only, may be substituted.
8. Operator Console may be one of the following:
 - 1052/2150 or
 - 3210 or
 - 3215 or
 - 3158 in 3215 mode with a 3213
9. The Starter System does not support the 3066 (165, 165 II, and 168 console) and the 3158 Console in 3270 mode nor Models 85, 91, 195 Display Consoles.

Basic Program Material

Machine Readable: OS is distributed as follows:

- For the 2311 user: Three 2400 foot reels of magnetic tape, either 9-track (800 bpi), or three 7-track (800 cpi Data Conversion Feature required), or two 9-track magnetic tapes (1600 bpi).
- For the 2314 user: Two 2400 foot reels of magnetic tape, either 9-track (800 bpi), or two 7-track (800 cpi Data Conversion feature required), or one 9-track magnetic tape (1600 bpi).
- For the 3330/3333 user: Two 2400 foot reels of magnetic tape, either 9-track (800 bpi), or two 7-track (800 cpi Data Conversion feature required), or one 9-track magnetic tape (1600 bpi).

Program components may be selected from the following list. Each component for which program documentation and maintenance material is required must appear on the program order form.

ALGOL	360S-AL-531
Assembler F	AS-037
ANS COBOL	CB-545
Control Program	CI-505
Starter System (2311 SYSRES)	CI-514
Starter System (2314 SYSRES)	CI-534
Starter System (3330 SYSRES)	CI-560
MVT	CI-535
Time Sharing Option (TSO)	CI-555
COBOL E	CO-503
Basic Telecommunications Access Method (BTAM)	CQ-513
Queued Telecommunications Access Method (QTAM)	CQ-519
Telecommunications Access Method (TCAM)	CQ-548
Primary Data Management	DM-508
Basic Direct Access Method (BDAM)	DM-509
SERO, SER1, and EREP for Mdl's 40, 50, 65, 75 (DNSERX)	DN-527
On-Line Test Execution Program (OLTEP)	DN-533
Recovery Management Model 65	DN-539
OS/360 Service Aids	DN-554
Linkage Editor F	ED-521
FORTRAN H	FO-500
FORTRAN G	FO-520
FORTRAN Syntax Checker	FO-550
Graphic Program Services	IO-523
Index Sequential Access Method (ISAM)	IO-526
Loader	LD-547
FORTRAN Library	LM-501
COBOL E Library	LM-504
PL/I F Subroutine Library	LM-512
ALGOL Library	LM-532
Graphic Subroutine Library	LM-537
1130/360 Data Transmission	LM-542
ANS Standard COBOL Library	LM-546
PL/I F	NL-511
PL/I F Syntax Checker	PL-552
Remote Job Entry (RJE)	RC-536
Graphic Job Processor	RC-541
Satellite Graphic Job Processor (SGJP)	RC-543
Conversational Remote Job Entry (CRJE)	RC-551
Report Program Generator (RPG)	RG-038
Sort/Merge and SORTLIB	SM-023
OS/360 Utilities	UT-506
Independent Utilities	UT-507
S/370 Mdl 135 Support	OS-588
S/370 Mdl 195 Support	OS-589
3410 Tape Unit	OS-590
3505 Card Reader	OS-591
3525 Card Punch	OS-592
2596 Card Read Punch	OS-593
3270 Display Unit (DIDOCs)	OS-594
3735 FD Macros and Utility	OS-596
3270 BTAM	OS-579
TSO/DCB Parameters	OS-586

Optional Program Material

The Optional program material is distributed with a condensed Symbolic Library. It is available from PID on 9-track magnetic tape (800 bpi or 1600 bpi) or 7-track magnetic tape (800 cpi) with the Data Conversion feature. Magnetic tape is the only distribution media.

Distribution Volume Number

<u>Distribution Volume Number</u>	<u>Program Component Name</u>	<u>Program Number</u>
1	PL/I F	360S-NL-511
2	PL/I F	NL-511
3	PL/I F PL/I Library PL/I Syntax Checker Graphic Job Processor Graphic Subroutine Program Graphic Program Services	NL-511 LM-512 PL-552 RC-541 LM-537 IO-523
4	FORTRAN G FORTRAN Syntax Checker FORTRAN Library FORTRAN H Service Aids	FO-420 FO-550 LM-501 FO-500 DN-554
5	ALGOL Library ALGOL ANS COBOL Library ANS COBOL Recovery Management - Model 65	LM-532 AL-531 LM-546 CB-545 DN-539
6	COBOL E COBOL E Library Satellite Graphic Job Processor (SGJP) Assembler F Linkage Editor F LOADER Queued Telecommunication Access Method (QTAM) 1130/360 Data Transmission	CO-503 LM-504 RC-543 AS-037 ED-521 LD-547 CQ-519 LM-542*
7	Sort/Merge and SORTLIB Report Program Generator (RPG)	SM-023 RG-038
8	Independent Utilities OS Utilities	UT-507 UT-506
9	OS Utilities Basic Telecommunication Access Method (BTAM) Basic Direct Access Method (BDAM) Indexed Sequential Access Method (ISAM)	UT-506 CQ-513 DM-509 IO-526
10	Primary Data Management	DM-508
11	Primary Data Management PVT MACS	DM-508 MACRO
12	SERO, SER1, and EREP for Mdl's 40, 50, 65, 75 (DNSERX)	DN-527
13	SERO/SER1 Control Program	DN-527 CI-505
14	Control Program	CI-505
15	Control Program On-Line Test Executive Program (OLTEP)	CI-505 DN-533
16	MVT Remote Job Entry (RJE) Conversational Remote Job Entry (CRJE)	CI-535 RC-536 RC-551
17	Time Sharing Option	CI-555
18	Time Sharing Option	CI-555
19	Time Sharing Option Telecommunications Access Method (TCAM)	CI-555 CQ-548
20	Telecommunications Access Method (TCAM)	CQ-548
21	SMP	CQ-548

Ordering Instructions

For new users the branch office must provide the Program Order Form. Current users of OS will receive a letter announcing availability of Release 21.0 and instructions to order the release through the branch office using an order form. Complete ordering instructions are provided in the OS Release Guide (GC28-6730) to be used for both new and current users.

Section 1, Line 01 (always complete this section):

- Column 3: 0 If you have already received the SRLs for this release via the SRL Subscription Service.
- 1 If you wish one copy of the SRLs that have changed with this release.

Note: It will be assumed that six weeks after the availability of a release, all SRLs are available through the SRL Subscription Service. After this period, no form numbered documents will be shipped by PID with the machine readable material.

Ordering Information System Number 360S

Note: Basic machine readable material for this system is ordered by specifying a "System Line" (Columns 1-7, 15-24) and "Com-

ponent Lines" (Columns 8-12) of the Program Order Form. Enter a separate Component Line for each component desired. Respecify the System Line for each different Program Number Extension.

If your customer is no longer a user of OS, please return the pre-printed order form to PID with a "D" in section 1, Line 1, column 14- This will help eliminate unnecessary distribution.

FORTRAN E •

Basic Program Material

Documentation: One copy of FORTRAN E Programmer's Guide (GC28-6603-3); FORTRAN IV Installation Guide (GC28-6430-0 including Basic Program Material List); Basic FORTRAN IV Language (GC28-6629-2).

Machine Readable Material: Object material for Fortran E.

Optional Program Material

Documentation: One copy of the Optional Program Material List.

Machine Readable Material: Source material for FORTRAN E

Ordering Information: Program Number 360SF0092

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Basic	none	DTR 7 DC/800 26	none
		DTR 9/800 28	none
		DTR 9/1600 29	none
Optional	none	MT 7 DC/800 26	1 reel
		MT 9/800 28	1 reel
		DTR 9/1600 29	none

TESTRAN •

Basic Program Material

Documentation: OS TESTRAN System Information Manual (GC26-3796-0).

Machine Readable Material: TESTRAN Component Library material.

Optional Program Material: None

Ordering Information: Program Number 360SPT516.

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Basic	none	DTR 7DC/800 26	none
		DTR 9/800 28	none
		DTR 9/1600 29	none

For microfiche and program logic manuals see System/360 and System/370 Bibliography, GA22-6822 and the Accumulative Index of Publications and Programs, GN20-0360.

Columns 15-20 Program Number Extension	21-22 Distribution Medium Type Code	23-24 User Volume Requirement
2311	MT 7DC/800 26	03
	MT 9/800 28	03
	MT 9/1600 29	02
2314	MT 7DC/800 26	02
	MT 9/800 28	02
	MT 9/1600 29	01
3330/3333	MT 7DC/800 26	02
	MT 9/800 28	02
	MT 9/1600 29	01
<u>Optional †</u>		
VOL 1 - VOL 21	MT 7DC/800 26	01
	MT 9/800 28	01
	MT 9/1600 29	01

† For each program number extension, VOL 1 to VOL 20 that is specified a separate reel of magnetic tape is required.

PROGRAMMING SERVICE CLASSIFICATION "C" COMPONENTS ORDERING PROCEDURE

Assembler E •

Basic Program Material

Documentation: One copy of Assembler E Programmer's Guide (GC28-6595-2); Assembler E Installation Guide (GC33-4014-0 Including Basic Program Material List).

Machine Readable Material: Object material for Assembler E.

Optional Program Material

Documentation: One copy of the optional program material list.

Machine Readable Material: Source material for Assembler E.

Ordering Information: Program Number 360SAS036

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Basic	none	DTR 7 DC/800 26	none
		DTR 9/800 28	none
		DTR 9/1600 29	none
Optional	none	MT 7 DC/800 26	01
		MT 9/800 28	01
		DTR 9/1600 29	none

Linkage Editor E •

Basic Program Material

Documentation: One copy of Linkage Editor and Loader (GC28-6538-8); Linkage Editor and Loader Installation Guide (GC28-6429-0 Including Basic Program Material List).

Machine Readable Material: Object material for Linkage Editor E.

Optional Program Material

Documentation: One copy of the Program Logic Manual (GY28-6601-2) and the Optional Program Material List.

Machine Readable Material: Source material for Linkage Editor E.

Ordering Information: Program Number 360SED510.

	Program Number Extension	Distribution Medium Type Code	User Volume Requirement
Basic	none	DTR 7 DC/800 26	none
		DTR 9/800 28	none
		DTR 9/1600 29	none
Optional	none	DTR 7 DC/800 26	none
		DTR 9/800 28	none
		DTR 9/1600 29	none

CALL-OS: CALL-OS is a time-sharing system which operates under the Operating System (OS) in either an MFT or MVT environment. Background jobs may execute concurrently with the CALL-OS task.

The CALL-OS Executive and Utilities Program (360A-CX-42X) offers the user a problem solving facility based on individual needs and timely availability. The system is designed to enhance the problem solver's capabilities by reducing the elapsed time between problem definition and problem solution. Programs can be entered from a user terminal and executed immediately. They can be retained in source or object form in one or more system libraries for subsequent, immediate use.

The needs of two classes of users, the non-professional programmer as well as the experienced computer user, were significant considerations in the design of CALL-OS. To respond to a wide spectrum of user problem complexity, the system offers three applications-oriented programming languages: CALL-OS BASIC, CALL-OS PL/I, and CALL-OS FORTRAN. The CALL-OS Batch Interface (COBI) option permits a user to prepare OS jobs, submit those jobs to the OS batch job stream, and print all or a portion of the output of submitted jobs at his terminal.

The CALL-OS system provides terminal users with an individualized computing capability which resembles that of a dedicated data-processing system. The terminal devices supported by the system are the IBM 2741 Communications Terminal (Correspondence or EBCD) and the Teletype*, Models 33 and 35**.

* Trademark of TELETYPE Corporation

** Terminals which are equivalent to those explicitly supported may also function satisfactorily. The customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied products or programs may have on such terminals.

CALL-OS is interrupt-driven. The system is highly responsive to terminal-originated activity. Interrupts are generated and serviced immediately to satisfy terminal user's requirements.

Languages: For the solution of his particular problem, the user has at his disposal a terminal command language and three programming languages: CALL-OS BASIC, CALL-OS PL/I, and CALL-OS FORTRAN. Since these languages have been designed to operate in a conversational computing environment, implementation differences exist between the OS PL/I and FORTRAN languages and the CALL-OS PL/I and FORTRAN languages. The CALL-OS languages are described in detail in three reference manuals (GH20-0699, GH20-0700, and GH20-0710 -- for CALL-OS BASIC, CALL-OS PL/I, and CALL-OS FORTRAN, respectively).

Terminal Command Language: The terminal command language facilitates communication between the terminal user and the computer. It provides commands that permit the terminal user to:

- Log on and sign off the system with password security
- Create, modify, and save source-program files
- Perform various edit operations on one or a number of source-program files
- Store programs in object format
- Define and redefine data files
- Protect program and data files placed by him in system libraries
- Purge program and data files from his library
- Obtain listings of program files
- Choose a language processor for compilations
- Compile and execute programs
- Obtain information relative to terminal connect time, CPU time, program files, and data files
- Use routines residing in CALL-OS system libraries
- Enter programs and data via paper tape
- Create paper tape output on-line
- Submit jobs from the terminal for OS batch processing
- Scan (print), inquire about, and keep or scratch all or a portion of the output from jobs submitted from a terminal to OS batch processing

Through the terminal command language, the user is able to access those resources, within the system, which are applicable to his particular computing problem. The language is structured so that the user may concentrate on problem solution and not on the intricacies of the computing machinery.

CALL-OS BASIC (360A-CX-44X)

The CALL-OS BASIC language is based upon the BASIC time-sharing language originally developed at Dartmouth College, Hanover, New Hampshire. This language was specifically designed to be easy to learn and easy to use. It is ideally suited as a first entry language for new users, and provides a wide range of capabilities for experienced programmers.

CALL-OS PL/I (360A-CX-45X)

For more complex programs, the powerful CALL-OS PL/I language is provided. This

language contains features for handling such diverse computing problems as substring processing and array manipulation. CALL-OS PL/I provides the user with many of the features of the full PL/I language, using the facilities of CALL-OS, via a remote terminal. The combination of language and system features provides many advantages to the user, including:

- Capability to handle a variety of data types, including character strings and complex numeric data
- Extended array facilities
- Flexible, stream-oriented, input/output facilities, including: list-directed, data-directed and edit-directed data specification
- A large number of built-in functions and subroutines
- User-controlled processing of program-generated interrupts

CALL-OS FORTRAN (360A-CX-46X)

FORTRAN is the most widely used and known of all higher-level scientific languages and provides language capability in a form convenient and familiar to the scientific/engineering, technical community. Through CALL-OS, a FORTRAN language is made available to this community for use in the personal computing environment.

CALL-OS Batch Interface: CALL-OS Batch Interface (COBI) is an optional feature of CALL-OS. When COBI is included, terminal users can prepare OS jobs and submit those jobs via terminal commands to the OS batch-processing environment. All or a portion of the output of submitted jobs can be saved for printing at a terminal. Terminal users can inquire about the status of submitted jobs or data sets and keep or scratch specific jobs or data sets.

Utilities: CALL-OS provides the user with several utility programs for the creation and manipulation of the direct access data sets employed by the system. These utilities are used to perform system build, data base creation and maintenance, and accounting functions.

The system build function refers to the initial establishment of CALL-OS under OS. For the user installation, this serves as a simplified means of allocating data set space and selecting a CALL-OS configuration. A final allocation of resources, depending on specific installation requirements, can be made at job initialization time.

Data base creation and maintenance is facilitated through use of CALL-OS utilities designed to run under OS in a batch-processing environment. Operations such as the following can be performed on a CALL-OS data base: formatting and maintaining the CALL-OS index data set, reorganization of the data base, recreating part or all of the data base from a backup tape, outputting CALL-OS files in OS format, punching files in card format with program files formatted to be compatible with OS batch compilers, listing files, deleting files, writing files to tape, and inserting or replacing files by means of tape, disk, or card input.

Under SYSLIB password authorization, one user or a range of users can be validated. Each validated user can, thereafter, upon specifying his user number and password, interact with CALL-OS.

On-line accounting routines provide statistics of processor and terminal connect time. The accounting utility supplements these statistics by monitoring disk usage and can provide a tape journal of usage information to be used, for example, as input to an installation's billing routine.

Performance: CALL-OS handles the high volume of diverse activity present in a problem solving environment, and provides the fast response required of an individualized computing system.

As is true in all multiprogramming environments, the performance of one task may be impacted by other tasks. CALL-OS specifically addresses this situation through internal features such as dynamic relocation of terminal user programs and dynamic reassignment of dispatching priorities. The system provides rapid response for those functions (for example, program statement entry) where fast response is required, while giving lower priority to those functions (for example, extensive calculation) where such response is not required.

Because of the dynamic nature of user problems, and the manner in which they are handled, no definitive statement may be made regarding the impact of CALL-OS on any other task in the system, or vice versa. For maximum performance, however, the CALL-OS task must have the highest dispatching priority within OS.

Highlights: Some of the highlights of the CALL-OS system follow:

- Highly responsive individual computing system under OS MFT or MVT
- Concurrent batch-processing capability under OS
- Dynamic assignment of dispatching priorities
- Extensive terminal command language
- Multiple programming languages:

CALL-OS BASIC
 CALL-OS PL/I
 CALL-OS FORTRAN

Structure designed for problem solving, including:

- Terminal checkout of CALL-OS user programs
- Ease of modification and editing of user programs
- Optional storing of programs (for example, frequently used application programs) in object format
- Multiprogramming within a single task area
- Compiler-generated, dynamically relocatable code

Facility to accept source programs, program-requested data, and system commands entered via paper tape, and to provide output on paper tape, formatted as required for reentrance into CALL-OS

Extensive CALL-OS data-base file manipulation and maintenance capabilities available via off-line (OS batch-oriented) CALL-OS utilities

Facility for terminal entry of OS batch jobs and subsequent printing of the output of submitted jobs at a user terminal via the CALL-OS Batch Interface (COBI) option

Main Storage Hierarchy support to provide segmented operation in either central processor storage and/or IBM 2361 Core Storage

Use: The CALL-OS system is initiated as a job through use of OS job control language (JCL) statements. Variations in the configuration of terminals and available libraries may be attained by the inclusion or exclusion of specific data definition (DD) statements at system initialization time.

When the system is in operation, a terminal user may communicate with the system by dialing the computer. A dialed call is answered automatically. The terminal command language provides data and program security to interactive users of CALL-OS and allows each user to initiate his own terminal activity.

Customer Responsibilities: The customer is responsible for performing the following functions:

- The ordering and satisfactory installation of all required communications equipment
 - The ordering and installing of at least one of the three language processors that function under this system (See "CALL-OS BASIC 360A-CX-44X," "CALL-OS PL/1 360A-CX-45X," and "CALL-OS FORTRAN 360A-CX-46X" on succeeding pages of this manual.)
 - Assuring that proper steps are taken to maintain the security of his confidential programs and data files
 - An OS System Generation to include support for CALL-OS devices, the storage protect function, the interval timer function, and one "user" SVC (provided with the CALL-OS system)
 - Allocating DASD space for the CALL-OS Executive and libraries
 - Building a CALL-OS Executive and data base
- If the CALL-OS Batch Interface (COBI) option is utilized, the customer is also responsible for:
- Building COBI data sets (via a COBI utility program)
 - Converting catalog procedures for use by COBI

If COBI is selected for use in an MFT environment, the OS subtasking option is required.

Note: A CALL-OS user (Version 1 Modification Level 1 or above) who already has a current version of one or more of the CALL-OS language processors need not order these processors when he orders the CALL-OS Executive and Utilities Program. The current language processors run under Version 2.

Programming Systems: CALL-OS is written in Assembler Language, employs EXCP for disk and terminal input/output operations, and uses an appendage restart exit for terminal input/output operations. To install CALL-OS, the user must have an MFT or MVT system with at least an OS Assembler, the Linkage Editor (L), and the OS Utilities IEHPRGM, IEHMOVE, and IEBUPDTE. The CALL-OS Executive interfaces to OS; there is no direct communication between OS and CALL-OS language processors. CALL-OS is non-refreshable. It does not support the Model 65 Multi-processing System (M65MP).

CALL-OS can run in an OS environment that also includes ASP or HASP.

Minimum Machine Configuration: The minimum central processing unit (CPU) on which CALL-OS can be executed is any one of the following:

- System/360 Model 50 HG
- System/370 Model 145H (393K) with:
3345 Main Storage Frame ... 4901 Main Storage Frame Adapter ... 3046 Power Storage.
- System/370 Model 155HG

The minimum peripheral equipment required for on-line operation with each of these CPU's is shown below.

- System/360 Model 50HG:
One selector channel ... One 2314 Storage Control Model A1 ... One 2312 Disk Storage Model A1 ... One 2702 or 2703 Transmission Control ... Two terminal consoles (see below)
- System/370 Model 145H (393K, as defined above):
One IBM 2319 Disk Storage Facility Model A1 ... One IBM Integrated-File Adapter feature (#4650) ... One IBM 2702 or 2703 Transmission Control ... Two terminal consoles (see below)
- System/370 Model 155HG:
One block multiplexer channel ... One 2314 Disk Storage Control Model A1 ... One 2312 Disk Storage Model A1 ... One 2702 or 2703 Transmission Control ... Two terminal consoles (see below)

The two terminal consoles are used for system communication. One serves as a command console from which the operator issues special system commands. The other serves as a communications console for recording system error messages and activity. The OS system console is used to initialize CALL-OS and may serve as the communications console, thus reducing to one the number of terminal consoles required.

Depending on the utility functions to be utilized, additional peripheral equipment may be needed. This equipment includes:

- One printer output unit, OS supported, with 120 print positions and graphics equivalent to the PN print arrangement
- One punched output unit (See OS minimum system requirements)
- One card input unit (See OS minimum system requirements)
- One OS-supported magnetic tape unit (any model)

CALL-OS is designed to operate with either the standard interval timer available on the System/360 Model 50 or 65 (16.667 millisecond resolution), or the standard interval timer available on the System/370 Models 145, 155, and 165 (3.3 millisecond resolution).

Since the execution of a job may be fragmented into many small pieces, some of which may be less than 16 millisecond duration, use of the standard resolution timer on the System/360 Model 50 or 65 could lead to failure to record such fragments during some executions. Therefore, the high-resolution timer (13.02 microsecond resolution) is recommended for repeatable program execution time and most accurate accounting on the System/360 Models 50 and 65. Appropriate RPQ numbers are E15092 and E43528 for the Model 50 and Model 65, respectively.

2702 Configuration

Type	Model or Feature	Description
2702		Transmission Control Unit
2741 Related Features	4615 9684 8055 3233 9696	IBM Terminal Control Type 1 Selective Speed 2741 Break Feature Data Set Line Adapter - 1 per line Terminal Control Base The above 2702 configuration can be expanded to handle up to 15 2741 lines by adding one 3233 per line.
TTY 33/35 Features	7912 RPQ-E62920 3233	Telegraph Terminal Control Type II CR interrupt on TTY To go to 15 TTY on 2702, add 1 3233 per TTY line.
	RPQ-E54838 RPQ-EA3120 9697	Immediate End (for TAPE mode) TTY II X-OFF modification Terminal Control Base
To go beyond 15 lines	7955	31 line expansion - to allow expansion from 15 to 31 lines.
Allow mix of 2741 and TTY	7935	Terminal Control Expansion

2703 Configuration

Type	Model or Feature	Description
2703		Transmission Control Unit
2741	7505	Start/Stop Base 1

Related Features Up to 8 lines	4619 4696 8055 4878 3205	IBM Terminal Control Base IBM Terminal Control Type 1 2741 Break Feature Line-Speed Option (134.5) Data Line Set
TTY Related Features Up to 8 lines	7905 7505 7912 4877 3205 RPQ-E62376 RPQ-Z16087	Telegraph Terminal Control Base Start/Stop Base 1 Telegraph Terminal Control Type II Line Speed Option (110) Data Line Set CR interrupt on TTY Immediate End (for TAPE mode)
To expand from 8 to 88	3206 3205	Data Line Set Expander Data Line Set. For each set of 8 lines beyond first 8, add for first 8 additional lines a 3206, for next 8 (lines 17-24) a 3205. This alternate use (3206, then 3205) continues to 88 lines.
To expand beyond 88 lines	1440 7505	Basic Expansion Start/Stop Base Type 1 additional Alternate 3205-3206 as above.

3705 Configuration

The IBM 3705 Communications Controller, with the emulator program (EP), can serve as a 2703 in a System/360 or System/370 configuration supporting CALL-OS. Feature code FC4711 or FC4714 should be used to attach either 2741 Communications Terminals or Teletype Units, Type 33 or 35, to the 3705 for use with CALL-OS.

Terminals: CALL-OS supports the following terminals:

- IBM 2741 Communications Terminal (Correspondence or EBCD)
- Teletype Units, Type 33 or 35

Any of the above terminals can be used as a user terminal, a command console, or a communications console. Not more than 255 terminals (including the command and communications consoles) can be simultaneously on-line with CALL-OS.

2741 Terminal Components-Correspondence Line Code

Type	Model or Feature	Description
2741	1	Communications Terminal (Correspondence)
	3255 (see notes)	Dial Up
	4708	Interrupt
	9104	Character Spacing; 10/inch
	9114 (see notes)	Data Set Attachment
	9435	Line Feeding; 6/inch
	RPQ-S30006 (see notes)	Printing Element and Keyboard Arrangement (RPQ)
	98XX	Line Voltage as appropriate

2741 Terminal Components-EBCD Line Code

Type	Model or Feature	Description
2741	1	Communications Terminal (EBCD)
	3255 (see notes)	Dial Up
	4708	Interrupt
	9104	Character Spacing; 10/inch
	9114 (see notes)	Data Set Attachment
	9435	Line Feeding; 6/inch
	RPQ-S30021 (see notes)	Printing Element and Keyboard Arrangement (RPQ)
	98XX	Line Voltage as appropriate

Notes:

1. For dial-up lines, feature #9114 is required.
2. Use of a leased line for the command and communications consoles is recommended. A four-wire IBM Line Adapter may be used. The Dial Up feature (#3255) is not required. Any one of several appropriate IBM Line Adapter feature codes may be specified. Compatible features must be included on the 2702 or 2703. If other than IBM line adapters are used, feature code #9115 must be specified.
3. The RPQ number is sufficient identification. No additional feature code to specify keyboard type is required.

If a 2741 Communications Terminal having all above features except RPQ S30006 or RPQ S30021 is currently installed, field conversion of the terminal can be performed. A CALL-OS Printing Element with

- Part No. 1167087 for the 2741 (Correspondence) or
- Part No. 1167643 for the 2741 (EBCD)

should be obtained. Terminal Character Decal GX20-1806 is desirable.

Teletype Units: Teletype units, Types 33 and 35, are standard units. Either terminal may be selected in any of three models: RO (Receive Only), KSR (Keyboard Send-Receive), and ASR (Automatic Send-Receive). RO terminals can be used on-v for output. KSR and ASR terminals can be used for keyboard input as well as output. In addition, ASR terminals provide capability for input of source programs, data, and system commands via punched paper tape. The Reader Control Arrangement feature is required if paper tape input is to be restarted automatically.

If a Teletype unit is used for either the command or communications console, the Type 35 is recommended. The Type 35 RO can be used only as a communications console. A Type 35 KSR or ASR can be used for either. With any model, use of a leased line for the command and communications console is recommended.

Core Requirements: The minimum partition or region size required for use of CALL-OS is 212K (217,088 bytes). This allows a configuration of two lines with the CALL-OS BASIC compiler and an object program size of 52K, as detailed below.

Fixed core requirement	59,420
2 lines	1,024
60 input buffers	1,440
5 output buffers	1,280
1 user group data set	132
1 system group data set	132
1 terminal type	160
1 translate table	512
1 work/swap data set	120
Overlay buffer	5,700
CALL-OS BASIC compiler	81,920
User program area (minimum)	53,248
OS core requirements	12,000
Total	217,088 bytes

A typical BASIC-language program of 300 statements could be expected to require 52K. Additional partition or region space is required for inclusion of the CALL-OS FORTRAN or CALL-OS PL/I compiler, larger user programs, larger terminal networks, or improved performance in a large network environment. When a system is initialized to include the CALL-OS Batch Interface (COBI) option, an additional 8K is required.

Basic Program Material (Version 2)

Documentation: Application Directory - The following SRL Publications are shipped by PID with each initial order: CALL-OS System Description Manual (GH20-0673), Terminal Operations Manual (GH20-0787), Operator's Manual (GH20-0788), Executive and Utilities Program Description Manual (GH20-0786), Terminal Command Language Reference Card (GX20-1830).

Machine Readable: The complete CALL-OS Executive and Utilities program including macros and source on magnetic tape.

Optional Program Material

Machine Readable: The optional program material is in machine-readable form. It consists of a listing of the combined cross reference tables of all CALL-OS Executive and Utilities modules.

Ordering Information: Program Number 360ACX42X

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	none	MT 7DC/800	26	01
		MT 9/800	28	01
		MT 9/1600	29	01
Optional	none	MT 7DC/800	26	01
		DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Support Material:

System Manual: CALL-OS Executive and Utilities System Manual*.

*The availability of a four-volume system manual will be announced in a PRL.

Education Material:

A self-study course will be available after July 15, 1972, from the IBM Distribution Center, Mechanicsburg. It includes:

CALL-OS Program Support Self-Study Course	SR27-9713
CALL-OS Program Support Supplementary Course Material	SR27-9714

Program Listings: CALL-OS program listings of the EXECUTIVE and UTILITIES are available on microfiche and may be ordered from the IBM Distribution Center, Mechanicsburg.

CALL-OS Executive and Utilities Microfiche	GYB0-0538
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CALL-OS BASIC: (360A-CX-44X) Is a language that functions within the time-sharing environment of the CALL-OS System. It is modeled after the BASIC language developed at Dartmouth College and is characterized by its ease of use. It is ideally suited as a first entry language for new users, being extremely simple to learn, and contains features useful to experienced programmers.

Description: The CALL-OS BASIC compiler (360A-CX-44X) operates within the CALL-OS System (360A-CX-42X) time-sharing environment. CALL-OS operates under the Operating System in either an MFT or MVT environment.

The CALL-OS System supports two additional compilers that operate in conjunction with CALL-OS BASIC; CALL-OS PL/I (360A-CX-45X) and CALL-OS FORTRAN (360A-CX-46X). The combination of compilers available within the system is an installation option.

All arithmetic computations in BASIC are performed on floating-point numbers. The user may specify either short-or long-form arithmetic, without having to change any of the statements in his BASIC program. Short-form floating point computation takes place when the user enters the command sequence, ENTER BASIC, prior to compilation and execution. The command sequence, ENTER BASICL, will result in long-form floating point computation.

Performance: To meet the objectives of fast response in a time-sharing, problem solving environment, the CALL-OS BASIC compiler is designed as a reentrant, one-pass compiler that produces relocatable object code for immediate execution. If errors are discovered during compilation, appropriate error messages are returned to the terminal user, and further handling of the user program is terminated.

Features: Short-and long-form arithmetic ... Three intrinsic constants: Pi, The natural number e, The square root of 2 ... Simple and precise control of printed output ... Data file storage ... A set of trigonometric and algebraic functions ... Statements for matrix manipulation.

Use: When the CALL-OS System is in operation, a terminal user may become attached to the system by dialing the computer. If a line is available, his call is automatically answered. Once the terminal user has 'signed on', he automatically has access to the BASIC language compiler as a system default option. If, however, the user has previously invoked either the CALL-OS PL/I or FORTRAN language compilers, he must then specifically request the BASIC compiler via the terminal command: ENTER BASIC. Compilation and subsequent execution of his program is then initiated by entry of the terminal command: RUN.

Customer Responsibilities: The customer is responsible for performing the following functions:

The ordering and installing of the CALL-OS Executive and Utilities System, 360A-CX-42X.

The ordering and installing of the CALL-OS BASIC Language Compiler, 360A-CX-44X.

Programming Systems: The CALL-OS BASIC compiler is written in the OS Assembler language. To install and maintain CALL-OS BASIC, the user must follow the requirements as stated for the CALL-OS System (Program Number 360A-CX-42X).

There is no direct communication between CALL-OS BASIC and OS.

Minimum Machine Requirements: For information regarding the machine requirements for CALL-OS BASIC, refer to sales manual for CALL-OS Executive and Utilities Program, 360A-CX-42X.

Basic Program Material

Documentation: Application Directory - The following SRL Publication is shipped by PID with each initial order: CALL-OS BASIC Language Reference Manual, GH20-0699.

If only the publications or if additional copies are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable: The complete CALL-OS BASIC Language compiler macros and source statements are distributed on one Distribution Tape Reel (DTR) at either 9-track (800 or 1600 bpi) or one 2400' reel of magnetic tape at 7-track (800 bpi Data Conversion feature required).

Ordering Information: Program Number 360ACX44X

Program Number	Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	MT 7DC/800	26	01
		DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Support Material:

Systems Manual: CALL-OS BASIC (GY20-0530).

Reference Material: The following reference material is available from the IBM Distribution Center, Mechanicsburg:

CALL-OS System Description Manual	GH20-0673
CALL-OS BASIC Language Reference Card	GX20-1811
CALL-OS Executive and Utilities Program Description Manual	GH20-0786

Program Listings: CALL-OS BASIC (GYB0-0540) program listing is available on microfiche and may be ordered from the IBM Distribution Center, Mechanicsburg.

RPQs will not be accepted at this time.

CALL-OS PL/I: (360A-CX-45X) Combines many features of the full PL/I-F language designed to cover a wide range of programming applications. A basic factor underlying the design of PL/I is that programmers have common problems, regardless of the different applications with which they are concerned. CALL-OS PL/I enhances this concept by presenting a problem solving facility in a convenient, terminal-oriented, time-sharing environment.

Description: The CALL-OS PL/I compiler (360A-CX-45X) operates within the CALL-OS System (360A-CX-42X) time-sharing environment. CALL-OS operates under the Operating System in either an MFT or MVT environment.

The CALL-OS System supports two additional compilers that operate in conjunction with CALL-OS PL/I; CALL-OS BASIC (360A-CX-44X) and CALL-OS FORTRAN (360A-CX-46X). The combination of compilers available within the system is an installation option.

A user's program consists of a single external procedure and the runtime library routines needed to support it. Although the external procedure may contain internal procedures, there are no facilities for linking separately compiled external procedures.

Differences between the full PL/I language and the CALL-OS PL/I language are identified in the CALL-OS PL/I Language Reference Manual, GH20-0700.

Performance: To meet the objectives of fast response in a time-sharing, problem solving environment, the CALL-OS PL/I compiler is designed as a reentrant one-pass compiler that produces relocatable object code for immediate execution. If errors are discovered during compilation, appropriate error messages are returned to the terminal user, and further handling of the user program is terminated.

Features: Capability to handle a variety of data types, including: character string and complex numeric data ... Extended array facilities ... Flexible, stream-oriented, input/output facilities, including: list-directed, data-directed and edit-directed data specification ... A large number of built-in functions ... User-controlled processing of program generated interrupts ... Free-form source language statement format.

Use: When the CALL-OS System is in operation, a terminal user may gain access to the system by dialing the computer. If a line is available, his call is automatically answered. Once the terminal user has "signed on", he may request the PL/I compiler by the terminal command: ENTER PL/I. He may then proceed to develop a PL/I program by entering his statements, via his keyboard, as specified in the CALL-OS PL/I Language Reference Manual, GH20-0700. Compilation and subsequent execution of his program is then initiated by the entry of the terminal command: RUN.

Customer Responsibilities: The customer is responsible for performing the following functions:

The ordering and installing of the CALL-OS Executive and Utilities System, 360A-CX-42X.

The ordering and installing of the CALL-OS PL/I Language Compiler, 360A-CX-45X.

Programming Systems: The CALL-OS PL/I compiler is written in the OS Assembler language. To install and maintain CALL-OS PL/I, the user must follow the requirements as stated for the CALL-OS Executive and Utilities Program, 360A-CX-42X.

There is no direct communication between CALL-OS PL/I and OS.

Minimum Machine Requirements: For information regarding the machine requirements for CALL-OS PL/I, refer to the sales manual for CALL-OS, 360A-CX-42X.

Basic Program Material

Documentation: Application Directory - The following SRL Publication is shipped by PID with each initial order: CALL-OS PL/I Language Reference Manual, GH20-0700.

If only the publications or if additional copies are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable: The complete CALL-OS PL/I Language Compiler, including macros and source statements, is distributed on one Distribution Tape Reel (DTR) at either 9-track (800 or 1600 bpi) or one 2400' reel of magnetic tape at 7-track (800 bpi Data Conversion feature required).

Ordering Information: Program Number 360ACX45X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	MT 7DC/800	26	01
		DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Support Material:

Systems Manual: CALL-OS PL/I Volumes I - IV (GY20-0567 thru 0570).

Reference Material: The following reference material is available from the IBM Distribution Center, Mechanicsburg:

CALL-OS System Description Manual	GH20-0673
CALL-OS PL/I Language Reference Card	GX20-1810
CALL-OS Executive and Utility Program Description Manual	GH20-0786

Program Listings: CALL-OS PL/I (GYB0-0542) program listing is available on microfiche and may be ordered from the IBM Distribution Center, Mechanicsburg.

RPQs will not be accepted at this time.

CALL-OS FORTRAN (360A-CX-46X):

Supports the availability of the most widely known and used of all higher level, scientific languages in a form familiar to

the scientific and engineering community, in a terminal-oriented, time-sharing environment.

Description: The CALL-OS FORTRAN compiler (360A-CX-46X) is designed to operate within the CALL-OS System (360A-CX-42X) time-sharing environment. CALL-OS operates under the Operating System in either an MFT or MVT environment.

The CALL-OS System supports two additional compilers that operate in conjunction with CALL-OS FORTRAN; CALL-OS BASIC (360A-CX-44X) and CALL-OS PL/I (360A-CX-45X). The combination of compilers available within the System is an installation option.

The CALL-OS FORTRAN compiler implements a proper subset of IBM System/360 FORTRAN IV, and contains a set of terminal-oriented extensions to FORTRAN IV (see Features paragraph below).

A program written to FORTRAN IV specifications will compile and execute on CALL-OS, unless the program uses certain features which are not available in CALL-OS FORTRAN. These features may be found in Appendix B of the CALL-OS FORTRAN Language Reference Manual, GH20-0710.

Performance: To meet the objectives of fast response in a time-sharing, problem solving environment, the CALL-OS FORTRAN compiler is designed as a re-entrant, one-pass compiler that produces relocatable object code for immediate execution. If errors are discovered during compilation, appropriate error messages are returned to the terminal user, and further handling of the user program is terminated.

Features:

Statement format, as entered from the terminal, is essentially free-form.

The characters percent (%), quote ("), and up arrow () have been added to the character set to denote continuation, comments, and exponentiation, respectively. The character hyphen (-) is also supported to designate continuation.

A syntactic variation of the READ and WRITE statements have been defined to allow free-formatted input/output for terminal and data files.

The characters , , , , and have been added to the character set to denote relational operations. The use of the character = has been extended to denote relational operation as well as assignment.

Use: When the CALL-OS System is in operation, a terminal user may become attached to the system by dialing the computer. If a line is available, his call is automatically answered. Once the terminal user has "signed on", he may request the FORTRAN compiler by entering the ENTER FORTRAN command. He may then proceed to generate a FORTRAN program by entering his statements, via his keyboard, as specified in the CALL-OS FORTRAN language Reference Manual, GH20-0710. Compilation and subsequent execution of his program is then initiated by the entry of the terminal command: RUN.

Customer Responsibilities: The customer is responsible for performing the following functions:

The ordering and installing of the CALL-OS Executive and Utilities System, 360A-CX-42X.

The ordering and installing of the CALL-OS FORTRAN Language Compiler, 360A-CX-46X.

Programming Systems: The CALL-OS FORTRAN compiler is written in the OS Assembler language. To install and maintain CALL-OS FORTRAN, the user must follow the requirements as stated for the CALL-OS Executive and Utilities Program, 360A-CX-42X.

There is no direct communication between CALL-OS FORTRAN and OS.

Minimum Machine Requirements: For information regarding the machine requirements for CALL-OS FORTRAN, refer to the sales manual for CALL-OS Executive and Utilities Program, 360A-CX-42X.

Basic Program Material

Documentation: Application Directory - The following SRL Publication is shipped by PID with each initial order: CALL-OS FORTRAN Language Reference Manual GH20-0710.

If only the publications or if additional copies are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable: The complete CALL-OS FORTRAN Language compiler, macros and source statements, are distributed on one Distribution Tape Reel (DTR) at either 9-track (800 or 1600 bpi), or one 2400' reel of magnetic tape at 7-track (800 bpi Data Conversion feature required).

Ordering Information: Program Number 360ACX46X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	MT 7DC/800	26	01
		DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Support Material:

Systems Manual: CALL-OS FORTRAN, GY20-0531

Reference Material: The following reference material is available from the IBM Distribution Center, Mechanicsburg:

CALL-OS System Description Manual	GH20-0673
CALL-OS FORTRAN Language Reference Card	GX20-1812
CALL-OS Executive and Utilities Program Description Manual	GH20-0786

Program Listings: CALL-OS FORTRAN program listings are available on microfiche and may be ordered from the IBM Distribution Center, Mechanicsburg.

FORTRAN GYB0-0541

RPQs will not be accepted at this time.

Real Time Monitor: The Real Time Monitor (RTM), 360A-SV-001, is co-resident with OS. It provides fast interrupt response for real-time, event-driven systems. Normal OS jobs continue to run while the monitor services real-time interrupts and schedules real-time jobs in priority mode. In addition, multiprogramming capability and OS facilities are provided for the real-time jobs.

The primary considerations in the development of the Real Time Monitor have been simplicity of usage without modification of OS, the ability to co-reside with MFT or MVT multiprogramming versions of OS, and the speed of response to real-time I/O requests. The Real Time Monitor is entered into an available partition or region as a normal job by means of existing JCL procedures. Once in execution, the Real Time Monitor takes control of hardware interrupts, monitors them, and directs them to the appropriate routines for servicing. Real-time interrupts that require fast response are handled by the Real Time Monitor at the time of their occurrence. Interrupts associated with OS non-real-time jobs are either held pending if a real-time job is in execution, or passed to OS for processing.

Highlights:

RTM offers the following capabilities within the OS environment:

- Simplicity of use.
- The ability to co-reside with MFT or MVT in an available partition or region and then only when needed.
- Service facilities for user to manipulate and control the job's execution. These are available via supervisor calls (SVC).
- A generalized I/O capability allowing the execution of user-written channel programs.
- High priority for real-time jobs.
- Multiprogramming of real-time work.
- Minimum response time for real-time devices.
- Facilities to interface user-written support for non-supported devices.

Specific support is contained in RTM for the following features on IBM announced configurations of S/360 and S/370.

- Channel-to-channel Adapter (#1850).
- S/360 Adapter on the 1800 DACS (#7720) when attached to S/360.
- The Priority Interrupt Subchannel (RPQ W30504), Half Duplex Subchannel (RPQ 882101) and High Resolution Timer Subchannel (RPQ 888183) of the 2909-3 Asynchronous Data Channel (RPQ F13299). Prerequisite RPQs are 888257 (#2075 attachment) or 888258 (#2065 attachment).
- External Interrupt (#3895) and Direct Control (#3274).

Use: Real-time problem programs are entered in the normal job stream and scheduled by OS with full use of OS facilities. These problem programs inform the Real Time Monitor of their presence in the system through the use of a FORTRAN subroutine or Assembler-Language macros. The problem programs have full use of the Real Time Monitor for scheduling real-time input/output and CPU time.

The Real Time Monitor, and thereby the real-time problem programs, are given top priority in contending for CPU time, with non-real-time jobs being scheduled by OS. Whenever data processing is not required by the real-time problem programs, the Monitor allows non-real-time processing to proceed under OS.

Within OS, the Real Time Monitor is viewed as a normal job. It is subject to all the rules of job operation in the OS environment. OS is viewed by RTM as an extension of RTM's own interrupt processors. The link between OS and RTM is via OS new Program Status Words (PSWs).

The Monitor is entered into the OS environment through the normal job stream. Once in execution, the Monitor goes through its initialization. First, it gains supervisor status by issuing a SVC call to an RTM-provided SVC routine included in a previous system generation and link edit of the OS nucleus. Then Monitor initialization disables all interrupts and replaces OS's new PSWs with its own, thus gaining control of the hardware interrupts. The original OS new PSWs are saved, with the problem program bit on, to provide the link between the Monitor and OS. Note: RTM, in running OS as a problem program will cause some degradation of the non-real-time work. All OS privileged, supervisor instructions will be intercepted and re-executed by RTM.

Jobs which are to be real-time jobs can be introduced into the OS job stream. These jobs can use the full complement of OS facilities. Once in execution the job identifies itself to the Monitor by issuing an RTOPN (real-time open) call. The job can then be considered to consist of two asynchronously operating parts. One part, called the OS

part, may use all the OS facilities when executing, since it is scheduled by OS. The other part, called the real-time part, may use only the Monitor facilities. The two parts can be synchronized through the available Monitor services.

The real-time part consists of from one to sixty-four routines called events. These events are viewed by the Monitor as singular units of work capable of asynchronous operation.

There may be up to 255 real-time devices in the system. Each device must be identified at the time the Monitor is assembled. Each reference to a device is through a logical unit number (1-255) assigned at assembly time. The external interrupts are treated by the Monitor as devices in the system.

The Monitor contains interrupt processors for the Channel-to-Channel Adapter (CCA), 1800-7720 feature, 2909 Priority Interrupt, 2909 Half Duplex and 2909 High-Resolution Timer devices. The user of other real-time devices can provide a user-written interrupt routine to be entered when an interrupt is detected, or use the RTM-provided generalized interrupt processor.

Those interrupts which occur and are not from a real-time device are either queued by RTM if a real-time job is in execution or passed to OS. OS is allowed to process only when there are no real-time events to be scheduled. Any queued OS I/O interrupts are dequeued during OS time as if they had just occurred.

User interrupt response time varies according to the method of interrupt processing assigned to a device and amount of channel operations in progress. When the user elects to process the interrupts directly, that interrupt routine is given control after the Monitor has executed approximately 30 instructions. When the Monitor-supplied interrupt processing routine is used, the time to enter the user routine varies according to other real-time activity in the system.

Customer Responsibility: The customer is responsible for the following --

Generating an RTM system by assembling the distributed program and setting the value of various parameters to reflect the user's configuration. A tape drive is required to install the program.

Writing device support for any real-time device except those devices explicitly supported by RTM - see highlights above.

Resolving conflicts between RTM and programs which contain time-dependent or time-critical coding. The performance of programs such as teleprocessing access methods or on-line diagnostics, for example OLTEP, might be influenced by RTM.

Ensuring that real-time events written in high-level language do not use OS facilities implicitly or explicitly.

Ensuring that overall system integrity is maintained when user-provided interrupt processors are executing (These routines execute in supervisor state).

Ensuring that RTM is loaded last and terminated first when operating with other systems which modify the new PSWs.

Programming Systems: RTM operates in an MFT or MVT environment (except MP65). The system configuration is dependent upon the OS requirements, plus the hardware requirements of the real-time application program. The program is written entirely in Assembler Language making extensive use of SETA variables to reflect the system configuration. Each proposed real-time system configuration should be analyzed individually to ensure optimum performance. The Monitor is structured to run in an MFT or MVT environment and to provide real-time services for one or more separate jobs. The program occupies a minimum of 15K bytes of storage. This requirement varies with the amount of queue space reserved for stacking of OS I/O interrupts and the number of real-time devices defined.

This program is released to work with OS Release 18 and all subsequent releases, versions, and modifications unless so stated in a future revision of this document.

This program operates on System/360 and System/370 configurations, subject to the compatibility constraints announced for System/370. (See A Guide to the IBM System/370 Model 145 (GC20-1734), A Guide to the IBM System/370 Model 155 (GC20-1729) and A Guide to the IBM System/370 Model 165 (GC20-1730). System/370 support will be available within three months of the availability of the OS release supporting System/370.

Basic Program Material:

Documentation - Program Description Manual (GH20-0876), Systems Manual (GY20-0599), Operations Manual and Programmer's Guide (GH20-0877).

Machine Readable - Source modules and sample problem.

Optional Program Material - None

Ordering Information: Program Number 360ASV001

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	None	DTR 7DC/800	26	None
		DTR 9/800	28	None
		DTR 9/1600	29	None
Optional	None	None		None

Additional Program Support Material - Introduction to the Real Time Monitor (GH20-0824).

**ASP - Asymmetric Multiprocessing System
(360A-CX-15X):**

of the IBM System/360 or System/370 Operating System (OS). The ASP system enhances the operational environment of the OS computer installation by automating many of the operator functions. ASP executes as a programmed operator of OS, providing an automated interface between the operator and OS. ASP is programmed to optimize the scheduling of the installation workload, including the support of a single centralized job queue. An improved operational environment, which enhances system workload capacity and reduces turnaround time, is achieved through operational control and scheduling of jobs on one or more distinct systems. This process results in a significant reduction in necessary operator intervention.

The ASP can logically recognize up to 32 distinct systems, however, physical planning and general configuration considerations usually become the limiting factor at four or five systems.

ASP is designed primarily for the user with a large job shop computing system. The primary programming system used by the application program is OS. ASP also supports remote job submission from binary synchronous communication (BSC) terminals via Remote Job Processing (RJP), and permits peripheral support and other background jobs to share Support Processor CPU time with the primary support functions.

The ASP uniprocessor or multiprocessor user will be able to progress in the virtual Multiprocessing environment by using JES3. JES3 is based upon ASP and the benefits of ASP are enhanced in JES3.

Description: The ASP Supervisor operates as a single-step job in the Support Processor under control of OS/MVT Release 21 or OS/VS2 Release 1.6. When ASP operates under VS2 on a Support Processor, ASP must run in the Virtual=Real environment. Any real Main Processor attached to the system must operate under either OS/MVT or OS/VS2. The ASP Supervisor schedules and initiates the various support and background functions. It is multiprogrammed within itself to minimize the overhead associated with the sharing of CPU and channel time. Other OS jobs can be scheduled by ASP on the machine containing the Support Processor to utilize excess CPU capacity. In this mode, the Support Processor contains a local Main Processor.

Additional CPUs may be attached to the system. These systems are called Remote Main Processors or simply Main Processors. The system input and output devices for the Main Processors are replaced by the channel-to-channel (CTC) connection with the Support Processor. This channel-to-channel connection is simulated in the local Main Processor configuration. Direct access storage devices for systems residence and program library are attached to the Main Processor, as are any input/output devices accessed during execution by the problem programs. The operating system in the Main Processor provides an environment for the problem program similar to a non-ASP system except that OS Reader/Interpreter, Writer, and DASD SYSIN/SYSOUT spooling functions are accomplished by ASP on the Support Processor by use of the CTC. The performance of the system is directly related to the throughput capability of OS on the Main Processor, with enhancement provided by ASPs improved scheduling and its handling of data by the CTC.

The ASP system accepts job streams from remote terminals over BSC transmission lines via Remote Job Processing (RJP). The RJP package supports two data formats for Remote Job Processing. One is compatible with the 2770, 2780, and 3780 Data Transmission Terminals, and the other is a compressed format that is designed for the System/360 and System/370, 1130, Model 20, 2922 and System/3 programmable workstations using an interleaved data format. Note that the ASP system does not include the computer programming that is necessary in the remote terminals; this is obtained by ordering the HASP system (370H-TX-001) and performing the necessary remote generation procedure.

As the installation workload grows, the capacity of the system can be increased by increasing the size of the local Main Processor and/or by adding additional remote Main Processors. In this configuration, termed a Multiple Main Processor system, Processors may be any combination of Processors including both System/360s and System/370s. Jobs will be distributed to the available system based upon job priority, Main storage availability, device requirements, and processor dependency. The application programmer will be responsible for specifying processor dependency (for example, processor speed dependency), via an ASP control card, if such a dependency exists.

The ASP system provides a single system image for the execution of many jobs concurrently on the local and remote Main Processors under the control of the ASP Supervisor. The ASP system maintains control of Main Processor execution, varying the depth of multiprogramming based upon the current job mix. An attempt is made to optimize the scheduling of jobs to balance the computer workload and to take maximum advantage of the available storage. This single system image provided by ASP allows for orderly and effective operation of multiple processors, each configured to best satisfy the needs of the installation. This single system image the machine room to be functionally organized independent of the number or size of the CPUs involved.

Highlights: The special features of the ASP system are increased system workload capacity; reduction of turnaround time; improved operating efficiency; and workload balancing between multiple System/360 and System/370 processors; a bridge between real and virtual storage systems.

These features are made possible by:

1. Computer-controlled execution of support functions in multiprogrammed mode on a lower cost Support Processor or in a region of OS on a larger Processor which provides:
 - a. Improved job scheduling

The ASP system provides a uniprocessor or multiprocessor operating system as an extension

- b. Automatic processing of system input and output datasets
- c. Concurrent processing of peripheral and other user programs, such as:

Card-to-Card	Tape labeling
Card-to-Printer	Tape-to-Printer
Card-to-Tape	Tape to Tape
Tape-to-Card	User-written background programs
Tape dumping	

2. Reduction of resource interference on Main Processor in terms of:
 - a. Main storage. Main storage buffering of Main Processor input and output datasets in the Support Processor.
 - b. CPU time. Multiplexer channel interference and interrupt service for peripheral input/output devices eliminated in Main Processor.
 - c. Data channels. Selector channel data flow time for system input and output on Main Processor reduced.
 - d. Input/output devices. Algorithm provided for efficient management of direct access storage devices for system input and output datasets.
3. Pre-execution fetch and setup of removable input/output volumes on Main Processors.
4. Early diagnosis of JCL errors by use of the OS Reader/Interpreter under ASP.
5. Support of pooled multiple operator consoles for functional organization of system operation.
6. Concurrent input/output and background processing on Support Processor during execution on the Main Processors.
7. Remote job processing using multi-leaved mode for programmable workstations and non-interleaved mode for 2770, 2780, and 3780 BSC terminals.
8. Internal job processing, which provides a generalized software interface to the ASP system during application program execution.
9. Automatic FAIL SOFT options, which enhance total system availability.
10. Network Job Processing for workload sharing between remote ASP systems.

Features of ASP Version 3:

OS Reader/Interpreter: The OS Reader/Interpreter (R/I) will be used by the ASP system on the Support Processor to examine a job's JCL prior to execution on a Main Processor. Erroneous JCL will cause a job to be cancelled and printed. The information extracted by the Reader/Interpreter will be used for job setup and scheduling. LCS hierarchy will not be supported.

Main Storage Fencing: Enables the user to structure Main storage into predefined areas called fences. Each fenced area is associated with a group of job classes. Provides improved Main storage utilization for long running jobs and semi-permanent allocation for Hot Jobs (OS-MVT Main Processors only).

POLYASP: Provides the ability to run more than one ASP program on a single CPU. This may be useful for testing user modifications without the need for system down time. POLYASP also provides the capability to transfer jobs from one ASP queue to another ASP queue. This is a useful transition aid in conversion from ASP Version 2 to ASP Version 3. Each POLYASP region supports its own main Processors and each remains separate and distinct.

Dependent Job Control: Allows submission of a string of interrelated jobs, such as month end processing in a large commercial system. ASP will conditionally schedule successor job(s) when predecessor job(s) complete. Extensive inquiry facilities are provided.

Deadline Scheduling: Deadline Scheduling is a facility, within ASP, which addresses those jobs that are considered critical and must be processed within a specific time. The expiration of the specified deadline causes the priority of the target job to be changed to a specified priority or incremented in priority. The job then competes for running on Main with all other jobs at that priority or above. The deadline expiration does not guarantee the job will automatically schedule for the Main Processor but does increase its chances.

Generalized Main Scheduling (GMS): Increases the scheduling options available to the installation. Allows ASP scheduling of Main Processors to be modified dynamically via operator command. Gives the installation the ability to schedule differently on each Main Processor. GMS allows the operations management to pre-define a scheduling strategy for their entire complex with the ability to make dynamic changes.

Hot Job Extensions: A Hot Job is a user job which must remain active across an ASP system failure (such as On-Line systems, IMS, etc.). Version 3 will schedule Hot Jobs which do not require the CTC adapter for input or output datasets.

Job Submission Extensions: ASP allows the system operator to invoke execution of jobs by console command. Jobs will be read from an installation defined partitioned data set and placed in the ASP job queue for execution. ASP Version 3 control cards are formatted similar to OS comments cards (i.e., /* in columns 1-3) may be used anywhere in the submitted job's JCL.

Common Procedure Library: Version 3 will allow jobs to be scheduled by ASP with no ASP dependent PROCLIB changes. The single PROCLIB must be maintained on the Support Processor.

Setup Extensions: Pre-execution setup has been extended to include:

Split Setup: Setup messages for direct access devices and tapes will be routed to the console located nearest each device. The job then waits for all operators involved to complete their required tasks before allowing the job to execute on a Main Processor.

Shared Setup: Multiple OS jobs may share direct access volumes based on specified dataset dispositions. This allows multiple jobs sharing a volume to be in execution simultaneously.

Remote Job Processing (RJP): A very large number of terminals and lines may now be specified to ASP, limited only by overall available storage and terminal names may be any 5-character combination. Tables used by RJP have been shortened and tables for dial-up terminals which are not actively signed-on to RJP are now disk resident providing considerable main storage savings to the user with a large number of dial-up terminals.

TSO Support: Jobs created using TSO to be submitted to ASP for scheduling with other batch work. Job output may be directed to an output class retrievable by TSO or may be directed to ASP print and punch service for processing. STATUS/CANCEL requests from TSO users will be processed by ASP with a response routed back to the TSO user. TSO jobs may be executed on any ASP Main Processor.

ASP Support of OS/VS2, Release 1.6: ASP support is provided for a configuration of mixed OS/MVT, OS/VS2 processors in any combination. When ASP operates under VS/2 on a Support Processor, ASP must run in the Virtual=Real environment.

The MAINTASK system task operating on a VS/2 Main Processor must also operate in the Virtual=Real mode.

In an intermixed environment it is the users responsibility to route jobs requiring programs and/or devices not supported by OS/VS2 to the appropriate OS/MVT processor.

Use of the ASP System: Operational control of the ASP system is exercised by the operator from the console typewriter or an alternate operator console on the Support Processor. An extensive command language is provided for controlling the entire ASP complex as if it were a single system. Both modify and inquiry capabilities are available to optimize and tune the system.

ASP provides a standard sequence of functions for each job in the Support Processor: Input Service, JCL Interpretation, SETUP (if required), Main Processor Service, Print Service, Punch Service, and Purge. Special control cards are not required for jobs using the standard sequence. The ASP control cards provide a simple means of altering this sequence for a particular job.

Customer Responsibility: A customer using ASP must take the following steps prior to installation to ensure that the use of the system will be satisfactory:

1. The customer must be responsible for ordering and installing satisfactorily all required communications equipment.
2. Appropriate training is recommended for the application programmers and system operators in OS in addition to training in the use and/or operation of ASP for maximum utilization of the system.
3. It is highly recommended that a customer system programmer become familiar with the internal operation of the System. This knowledge will enable him to customize the ASP system to the unique operational environment of his installation.
4. If the customer chooses to use the RJPWTR module, it is his responsibility to incorporate this generalized interface routine into any program or user task desiring to communicate with the ASP.
5. The customer should generate and maintain an assembly listing of all ASP modules, which should be available to all personnel servicing the program.
6. If multi-leaving terminal packages are required, the user must order HASP II (370H-TX-001) from PID and must generate the workstation packages he requires utilizing the HASP system; or alternatively, he must write his own workstation programs.
7. If the prospective new ASP user is not currently running MVT, it should be recommended to him that he first install MVT and then install ASP to ease the scope of effort in installing two major systems.

OS Hierarchy supported in Release 3.0 is no longer supported in Version 3.1

Programming Systems: The ASP system programs are written in OS Macro Assembler Language. Programs to provide additional functions, known as Dynamic Support Programs (DSPs), can be incorporated into the Support Processor by the customer at his installation. These programs also must be written in OS Macro Assembler Language. The minimum OS control program that will execute ASP includes the Multiprogramming with a Variable Number of Tasks (MVT) - 360S-CI-535, a linkage editor, and the OS Utilities - 360S-UT-506. The OS Macro Assembler program (F-level) must be available if program modifications are anticipated. The H-level Assembler program product may be used to assemble the ASP system.

ASP users must order these programming systems separately: OS and the HASP system if RJP terminal packages are to be used (370H-TX-001).

A release of ASP is considered current from the date of its initial availability from PID until the OS release with which it operates is no longer current.

ASP Version 3.1 supports OS/MVT Release 21 and OS/VS2 Release 1.6.

Minimum System Requirements: The configuration requirements for the Main Processor are identical with those of a stand-alone processor operating under OS, except that the channel-to-channel adapter replaces the normal system input and output devices. The modifications to the OS/MVT or OS/VS2 Control Program nucleus that are required for operation as an ASP Main or Support Processor increase the nucleus by approximately 3000 bytes. Most ASP functions required on the OS Main Processor are incorporated in the module MAINTASK, which operates as a system task on the Main Processor. MAINTASK size is approximately 35K without TSO support and 64K with TSO support.

Minimum Configurations:

Support Processor: The minimum OS/MVT Support Processor for execution is a System/370 Model 145HG with two selector channels, an Operator Console, one 2540 or 3525 and 3505 Card Read Punch, one 1403 or 3211 Printer, and two 2314 or two 3330 Disk Storage Drives. The OS/VS2 minimum is a Model 1451. The minimum Support Processor with a local Main Processor is a Model 145J. System capability can be expanded by attaching additional units of the following:

- Printers (1403, 3211)
- Card Readers and Punches (2501, 2540, 3505, 3525)
- Disk Storage Drives (2314, 3330, 3333)
- Magnetic Tape Units (2401, 2420, 3410, 3420)
- Communications Adapters (2701, 2703, 3705) properly configured for use with RJP.

The following devices are supported as auxiliary operator consoles in the ASP system:

IBM 2740 Model 1 Communication Terminal

Required Features:

- 4790 IBM Line Adapter
- 988X Voltage
- 9592 PTTC/EBCD Printing Element
- 9104 Character Spacing 10 Char/Inch
- 9435 or 9436 Line Feeding
- 9700 System Application

Permitted Features:

- 9509 Pin Feed Platen

Restricted Features:

- 6114 Record Checking (May be installed but should not be invoked with EOB when 2740 is being used for ASP)
- 1313 Automatic EOB
- 7479 Station Control
- 3255 Dialup
- 8028 Transmit Control

This console must be attached to a 2701, 2702, 2703, or 3705 (Emulator Mode) through a dedicated line as follows:

IBM 2701 Model 1 Data Adapter Unit

Required Features:

- 4636 IBM Line Adapter (one/console)
 - 4640 IBM Terminal Adapter Type I Model II (one/console)
 - 9581 Speed Selection (for #4640)
- Specify Voltage and Color

Permitted Features:

- 3851 Expanded Capability (for additional lines)
- 3855 Expansion Feature (for additional lines)

IBM 2702 Model 1 Transmission Control

Required Features:

- 4612 IBM Line Adapter (one/console)
 - 4615 IBM Terminal Control Type I
 - 9684 Speed Selection (for #4615)
 - 9696 Terminal Control Base
 - 9080 or 9081 Cabling
- Specify Voltage and Color

Permitted Features:

- 7955 31 Line Expansion

IBM 2703 Model 1 Transmission Control

Required Features:

- 7505 Start Stop Base Type I
- 4619 IBM Terminal Control Base
- 4696 IBM Terminal Control Type I
- 4688 IBM Line Set 2 (one/eight consoles)
- 4878 Line Speed Option
- 9080 or 9081 Cabling
- Specify Voltage and Color

Permitted Features:

- 1440 Base Expansion (#1440)

IBM 3705, Communications Controller (Properly configured)

The 2701, 2702, 2703, and 3705 (Emulator Mode) may include other features (i.e., adapters, speed selections, terminal controls) ONLY IF THEY ARE NOT associated with the ASP system consoles.

IBM 2260 Model 1 Display Station

Required Features:

- 4766 Alphameric Keyboard
- 9880 or 9881 Voltage
- Cables (ordered separately)

Permitted Feature:

- 9430 Long Cable Attachment

The 2260 must be attached through a local IBM 2747 Model 3 Display Control as follows:

IBM 2848 Model 3 Display Control

Required Features:

- 4787 Line Addressing
- 9011 Channel Adapter
- Specify Voltage, End Cover, Color, System Attachment

Permitted Features:

- 7928 Printer Adapter (Required for 1053 Model 4 [see below])
- 5340 (5341) Nondestructive Cursor (and Adapter)
- 3858 3859 Expansion Unit

Restricted Features:

- 4656 4657 IBM Terminal Adapter Type III

IBM 1053 Model 4 Printer (Available with the 2848)

- Specify Voltage, Print Element, Line Feed, Character Spacing
- 1006 Accelerated Carrier Return Permitted

IBM 1443 Model N1 Printer

- Specify Voltage, Print Arrangement, Type Size, Color
- All other features are permitted

IBM 1403 Models 2, 3, 7, or N1 Printer

Required Features:

- Specify Voltage, Print Chain/Train, Color
- 9709 Voltage Adapter (Model 2 or 3)
- 1416 Interchangeable Train Cartridge (Model 3 or N1)
- All other features are permitted

IBM 3211 Model 1 Printer (Version 3)

- Specify Voltage, Color, Train Arrangement
- All other features permitted

IBM 1052 Model 7 Printer Keyboard

Required Features:

- 9901 Voltage
- 7920, 7921 or 7922 1052 Adapter (if Direct Attachment to CPU).
- For Standalone systems console 1052 Model 7 Attaches to a 2150 as follows:

IBM 2150 Model 1 Console

Required Features:

- Specify Color and Voltage
- Attach to 1052 Model 7 (see above)

Permitted Features:

- 5475, 5476 Operator Control Panels

IBM 2250 Model 1 Display Unit

Required Features:

- 1245 Alphameric Keyboard
- 1498 or 1499 Buffer
- 1880 Character Generator
- Specify Voltage and Color

Permitted Features:

- 1002 Absolute Vectors and Control
- 4485 Graphic Design
- 4785 Light Pen
- 5475, 5476 Operator Control Panel
- 5855 Programmed Function Keyboard

IBM 3060 System/360 or System/370 Model 195 System Console

- Specify Voltage
- 5476 Operator Control Panel (second) is permitted

IBM 3066 System/370 Model 165 System Console

IBM System/360 Model 85 Feature #5450 Operator Console

- IBM 3210 Console Printer/Keyboard, Models 1 and 2

Required Features:

- Specify Voltage, Cabling
- 7844 Adapter for 145 or 155 (Model 1)
- 7845 Adapter for 145 or 155 (Model 2)

IBM 3215 Console Printer/Keyboard

Required Features:

- Specify Voltage, Cabling

Permitted Features:

- 9162 or 9167 Pin Feed Platen

IBM 3277 Model 2 Display Station

Required Features:

- 9098 EBCDIC Character Set
- 4630-4633 EBCDIC Keyboard
- Specify Voltage
- Order Cables Separately
- All other features are permitted
- Must be attached via 3272 Model 2 (see below)

(Reverse side is blank)

IBM 3272 Model 2 Control Unit (local attachment)

- Specify Voltage, System Attachment, Operator Console
- 3250 Device Adapter (one/four consoles (after the first four))

IBM 3284 Model 2 Printer (attached to 3272 Model 2 [see above])

IBM 3286 Model 2 Printer (attached to 3272 Model 2 [see above])

IBM 7412 Model 1 (RPQ) Printer/Keyboard (similar to 2150 but uses a 3215 type printer)

IBM System/370 Model 158 Operator's Console

ASP Region Sizes

Recommended minimum ASP region sizes are:

- Single Processor (No RJP) 170K
- Add for RJP 20K
- Add for each additional Main 20K

Detailed ASP Version 3 main storage requirements may be calculated from information contained in the ASP System Programmer's Manual (GH20-1292).

Note: These are complex configurations and must be reviewed according to established branch office assessment procedures.

Basic Program Package:

Documentation:* System Programmer's Manual (GH20-1292), Application Programmer's Manual (GH20-1291), Operator's Manual (GH20-1289), Message and Codes Manual (GH20-1290).

Machine Readable Material: Object code, source code, OS modifications, and macro definitions.

Optional Program Package: None.

Ordering Information: Program Number 360ACX15X (use form Z120-1957).

	Program Number Extension	Distribution Type	Medium Code	User Volume Requirement
Basic	None	MT	9/800 28	02
		MT	9/1600 29	01

Additional Program Material:

Logic Manual (GH20-1403)

Microfiche, Assembly Listings (GYB0-0854)

General Information Manual, ASP Version 3 (GH20-1173) is available from the IBM Distribution Center, Mechanicsburg.

ASP Version 3 Operator's Reference Card (GX20-1927).

*If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Model 20 Card configurations are supported by a set of standalone and card resident programs (CPS) which require at least 4K of core storage. The CPS programs support a maximum of 16,384 bytes of core storage. The CPS programs will run on a 24K or 32K System provided that not more than the first 16K of the available core storage is used.

Model 20 Card-Tape configurations are supported by a Tape Programming System (TPS) which is either card resident for a restricted number of programs or tape resident and requires 8K of core storage. In addition, a card-resident Basic Assembler (Tape) 4K and card-resident Utility Programs support card-tape configurations with 4K of core storage. The 8K TPS programs and card resident tape utility programs support up to 32,768 bytes of core storage. The card resident Basic Assembler (tape) supports a maximum of 16,384 bytes of core storage.

Model 20 Card-(Tape)-Disk configurations are supported by a Disk Programming System (DPS) which is either card resident for a restricted number of programs or disk resident and requires 12K of core storage (or 16K for PL/I). The DPS programs support up to 32,768 bytes of core storage.

Minimum system requirements for the tape and disk programs outlined below apply to program generation and execution. To handle the program distribution and maintenance, tape or disk, the following additional requirement applies -- one card punching device (2520, 2560, 1442).

Users of Model 20 configurations that do not satisfy this requirement must have access to an adequately configured Model 20 system if they desire to punch out contents of the IBM-supplied program distribution, tape or disk. For the tape system only, users receiving the program distribution tape may punch out the contents on System/360 Model 30 or higher.

Report Program Generator: RPG is the primary programming language for the Model 20 Card, Tape, and Disk systems. It is a problem oriented language in which the user furnishes to the Report Program Generator a set of specifications describing the input data, necessary calculations and desired output. Some outstanding features are: multiple input/output files, table look-up, user controlled indicators, GOTO (Branching), report headings, page numbering, and the ability to handle file organization for all sequential files and index sequential disk files. In addition, complete diagnostics are provided which indicate errors in file description, input specification, calculation specifications, output specifications, and file extensions.

The Report Program Generator is of the compile and go type. An option is available that allows punching of the object program into cards for future use. RPG Card, Tape, and Disk functions and minimum system requirements vary and are:

CPS (4K) RPG [360T-RG-010]

Provides for card file maintenance, calculations and input/output operations.

Minimum system requirements --

- For Submodel 1, 2, 5 or 6

For program generation: A 2020 Model B1, B2, C5 or C6 Processing Unit and one of the following input/output configurations (a) a 2560 Model A1 MFCM or (b) a 2520 Model A1 Card Read Punch or (c) 2501 Card Reader Model A1 or A2 and (d) if punching of the object programs is desired a 2560 Model A1 or a 2520 Model A1, A2 or A3 Card (Read) Punch or a 1442 Model 5 Card Punch and (e) if diagnostic messages and listings are desired a 1403 Model 2, 7, N1 or 2203 Model A1 Printer.

For object program execution: A 2020 Model B1, B2, C5 or C6 Processing Unit and one of the following input/output configurations (a) a 2560 Model A1 or (b) a 2520 Model A1 Card Read Punch or (c) a 2501 Model A1 or A2 Card Reader and if punching is specified, a 2560 Model A1 or 2520 Model A1, A2 or A3 Card (Read) Punch or 1442 Model 5 Card Punch and (d) if printing is specified, a 1403 Model 2, 7 or N1 Printer or 2203 Model A1 Printer.

- For Submodel 3 or 4

For program generation: A 2020 Processing Unit Model B3 or B4 ... a 2560 Model A2 and ... (optionally) a 2203 Model A2 Printer.

For object program execution: A 2020 Processing Unit Model B3 or B4 ... a 2560 Model A2 and ... if printing is specified, a 2203 Model A2 Printer.

The program will run independently of the EC-Level of model 20 machines presently in the field.

TPS (8K) RPG [360U-RG-148]

In addition to the functions provided by the CPS RPG, TPS RPG facilitates reading and writing tape records; and updating of existing tape files involving both card and magnetic tape input/output. The tape records can be fixed or variable, blocked or unblocked. Processing of multiple tape and card files as input and output is possible.

A maximum of three input files and three output files and a printer can be used. The TPS RPG provides for multiple reel processing with rewind and unload operations. The TPS RPG is tape resident.

The label checking and creation conforms to IBM System/360 standards. Non-

standard labels are bypassed. An exit is provided for user processing of additional user labels.

Minimum system requirements --

- For submodel 2, 5 or 6

For generation: A 2020 Processing Unit Model C2, C5, or C6 a 2415 Model 1 or 4 Magnetic Tape Unit (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only), the first drive must be 9-track, the second drive may be 9-track or 7-track with Data Conversion feature, a Card Reader (2501, 2520, 2560), a Printer (2203, 1403 for printing of diagnostic messages, a Punch (2520, 2560, 1442) if punching of the object deck is required.

For execution: A 2020 Processing Unit Model C2, C5, or C6 and I/O devices as specified by the user.

- For Submodel 4

For generation: A 2020 Processing Unit Model C4; a 2415 Model 1 or 4 Magnetic Tape Unit, the first drive must be 9-track, the second drive may be 9-track or 7-track with Data Conversion feature; a 2560 MFCM Model A2 for card reading, and punching if a punched object deck is required; a 2203 Model A2 Printer for printing of diagnostic messages.

For execution: A 2020 Processing Unit Model C4 and I/O devices as specified by the user.

DPS (12K) RPG [360W-RG-180]

In addition to the functions provided by the TPS (8K) RPG, the DPS (12K) RPG facilitates reading and writing disk records, and updating of existing disk files involving card, magnetic tape and disk input/output.

Version 4 of this program will supply five additional facilities.

CHAIN function -- allows immediate record retrieval from an indexed-sequential file.

EXCPT function -- allows multiple or exception records to be output during detail or total calculations.

Subroutines -- provides the facility to code RPG-written closed subroutines to avoid repetitive coding.

User date fields -- provides reserved words which make the date from the communication region of the monitor available to the user.

Edit codes -- simplifies editing of output fields through the use of codes.

Disk records may be fixed length, blocked or unblocked; tape records may be fixed or variable length, blocked or unblocked. Processing of up to 29 card, tape and disk file (input, output, update, combined, and table files) in any combination is possible. The DPS RPG provides for multiple tape reel processing with rewind and unload operations. The DPS RPG is disk resident.

The DPS RPG uses two types of file organization -- sequential and indexed sequential. The methods of file processing available are sequential processing of sequentially organized files, sequential processing of indexed-sequentially organized files and random processing of indexed sequentially organized files.

Sequential disk files can be created by DPS RPG.

Creation (load...) of new indexed-sequential files is possible. Reorganization can be done by reloading. New records can be added. Records to be deleted must be identified by a flag and can be omitted when the file is reorganized. The DPS RPG also provides for the random processing of sequential disk files by means of ADDROUT files that have been created by the Model 20 Disk Sort/Merge program.

Disk labels are mandatory. Disk and tape label checking and creation conforms to System/360 standards. Non-standard tape labels are bypassed on input files. Non-standard labels are not permitted on output files. An exit is provided for user processing of additional user tape labels.

Minimum system requirements --

- For Submodel 2, 5 or 6

For generation: A 2020 Processing Unit Model BC2, BC5, or BC6 with ... 2311 Disk Storage Drive Model 11 or 12, a Card Reader (2501, 2520, 2560), a Printer (2203, 1403) for printing of diagnostic messages, or a Punch (2520, 2560, 1442) if punching the object deck is required.

For execution: A 2020 Model BC2, BC5 or BC6 Processing Unit and I/O devices as specified by the user.

- For Submodel 4

For program generation: A 2020 Processing Unit Model BC4 ... a 2311 Disk Storage Drive Model 11 or 12 ... a 2560 Model A2 and ... a 2203 Model A2 Printer, if printing of diagnostic messages is desired.

For object program execution: A 2020 Processing Unit Model BC4 and I/O devices as specified by the user.

Punched-Card Utility Programs: A set of four programs specifically designed to assist users in the handling of punched card applications on the Model 20.

The programs are: Gangpunch/Reproduce, List/Summary Punch [360T-UT-100], and Collate, Merge Sort [360T-UT-101].

The programs enable users to arrange and prepare card files for further processing and to handle requests for unscheduled reports.

The programs can perform most of the functions that are now being performed by unit record machines.

Coding forms are furnished to record the specifications of a user's application and provide information for subsequent control card punching.

The programs are of the generate-and-go type with the option to punch out the object program for Gangpunch/Reproduce and List/Summary Punch.

Minimum system requirements--

- For submodel 1, 2, 5, or 6

For generation: A 2020 Processing Unit Model B1, B2, C5 or C6 and one of the following input/output configurations ... Collate - a 2560 MFCM and optionally a 2203 or 1403 Printer ... Gangpunch/Reproduce - a 2560 MFCM or 2520 Card Read Punch or 2501 Card Reader with a 2520 Card Punch or 1442 Card Punch and optionally a 2203 or 1403 Printer ... List-Summary Punch - a 2560 MFCM or a 2520 Card Read Punch or 2501 Card Reader and optionally a 2203 or 1403 Printer. If the object program is to be punched, a 2520 or 1442 Punch ... Merge-Sort - a 2560 MFCM and optionally a 2203 or 1403 Printer.

For execution: A 2020 Processing Unit Model B1, B2, C5 or C6 and one of the following input/output configurations ... Collate - a 2560 MFCM and optionally a 2203 or 1403 Printer ... Gangpunch/Reproduce - a 2560 MFCM or 2520 Card Read Punch or 2501 Card Reader with a 2520 Card Punch or 1442 Card Punch ... List-Summary Punch - a 2560 MFCM or 2520 Card Read Punch or 2501 Card Reader and optionally a 2203 or 1403 Printer. If punching is specified, a 2520 Card Punch, 1442 Card Punch ... Merge-Sort - a 2560 MFCM and optionally a 2203 or 1403 Printer.

- For submodel 3 or 4

For program generation: A 2020 Processing Unit Model B3 or B4 ... a 2560 Model A2 MFCM and ... (optionally) a 2203 Model A2 Printer.

For object program execution: A 2020 Processing Unit Model B3 or B4 ... a 2560 Model A2 MFCM and ... for List-Summary Punch, a 2203 Model A2 Printer.

Note: Printers classified "optional" are used to display program documentation diagnostic messages and error identification. A printer is, therefore, not required if these facilities are not desired.

Basic Utility Programs: They consist of a set of standardized utility routines that can be used in the running or testing of a user's object program. They are -- Clear Storage ... Absolute Program Loader ...

Relocatable Program Loader ... Print Storage ... Punch Storage ... Basic Trace.

The functions of these programs are -- to clear the core storage; to load assembled programs (absolute or relocatable); to produce a listing of the contents of core storage; to punch core storage contents into cards; and to test object programs during execution.

Minimum system requirements--

- For submodel 1, 2, 5, or 6

A 2020 Processing Unit Model B1, B2, C5, or C6 with a 2501 Card Reader, 2560 MFCM, 2520 Card Read Punch. For "Punch Storage" a 2560 MFCM, 2520 Card Read Punch or 1442 Card Punch. For "Print Storage" and "Basic Trace" a 2203 or 1403 Printer.

- For submodel 3 or 4

A 2020 Processing Unit Model B3 or B4 with a 2560 Model A2 and ... for "Print Storage" and "Basic Trace" a 2203 Model A2 Printer.

Except Trace	360T-UT-102
Basic Trace (4K)	360T-UT-103
Basic Trace (8K)	360T-UT-104
Basic Trace (12K)	360T-UT-107
Basic Trace (16K)	360T-UT-105

Tape and Disk Utility Programs: By providing generalized routines, the tape or disk utility programs will reduce the need for individual programming of certain unique frequently performed operations. The following separate programs are provided:

TPS

Card to Tape	360U-UT-131
Tape to Card	360U-UT-132
Tape to Printer	360U-UT-133
Tape to Tape	360U-UT-134
Initialize Tape	360U-UT-135

12K Disk

Initialize Disk	360W-UT-183
Alternate Track Assignment	360W-UT-184
Clear Disk	360W-UT-185
Disk-to-Disk	360W-UT-186
Disk-to-Tape	360W-UT-187
Tape-to-Disk	360W-UT-188
Disk-to-Card	360W-UT-189
Card-to-Disk	360W-UT-190
Disk-to-Printer	360W-UT-191
Tape-to-Tape	360W-UT-195
Tape-to-Card	360W-UT-196
Card-to-Tape	360W-UT-197
Tape-to-Printer	360W-UT-198
Initialize Tape	360W-UT-199
Disk Dump	360W-UT-204

These programs can be used to: prepare a disk or tape for proper use, copy a file, reblock a file, field select, and reblock and field-select. Tape and disk input and/or output can have multi-reel or multi-pack files. Under 4K Tape Utility Programs non-stop operation is provided if the next reel is mounted on an alternate tape drive. A Rewind-and-Unload option is provided. Sequence numbering of output cards and sequence checking for input cards is available.

With the Disk Dump Program parts of the contents of disk pack can be displayed on the printer.

Tape and disk label checking conforms to established System/360 standards. Non-standard Tape labels are bypassed. An exit is provided for user-processing of additional user standard labels and Sterling currency routines. The Utility programs are either card resident or tape resident in the 8K-Tape System (Tape Utilities) or card resident or disk resident in the 12K-Disk System (Disk Utilities). In the card-resident version the Tape Utilities can also be run in 4K.

Minimum system requirements (4K Tape)--

- For submodel 2, 5 or 6

A 2020 Processing Unit Model B2, C5, or C6 (for stand-alone version) or Model C2, C5, or C6 (for system version), a 2415 Magnetic Tape Unit (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only), a card reader (2501, 2520, 2560), a printer (1403, 2203), if printing is required and/or diagnostic messages are to be printed, a card punch (1442, 2520, 2560) is punching is required.

- For submodel 4

A 2020 Processing Unit Model B4 (for stand-alone version) or Model C4 (for system version), a 2415 Magnetic Tape Unit, a 2560 MFCM Model A2 for card reading, and punching, if punching is required, a 2203 Model A2 Printer, if printing is required and/or diagnostic messages are to be printed.

Minimum system requirements (12K Disk)--

- For submodel 2, 5 or 6

A 2020 Processing Unit Model BC2, BC5, or BC6, a 3211 Disk Storage Drive Model 11 or 12, a card reader (2501, 2520, 2560), a 2415 Magnetic Tape Unit (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only), if tape functions are required, a printer (1403, 2203), if printing is required and/or diagnostic messages are to be printed, a card punch (1442, 2520, 2560), if punching is required.

- For submodel 4

A 2020 Processing Unit Model BC4, a 2311 Disk Storage Drive Model 11 or 12, a 2560 Model A2 MFCM, a 2415 Magnetic Tape Unit, if tape functions are required, and a 2203 Model A2 Printer if printing is required and/or diagnostic messages are to be printed.

Basic Assembler (Card and Tape): A symbolic programming system to simplify the preparation of programs for the Model 20 Card/Tape system. Source programs written in the Assembler language are punched into cards and processed by the Basic Assembler processor to produce a machine language object program.

The IBM System/360 Model 20 Basic Assembler programming language is upward compatible with the Basic Assembler language for the IBM System/360 except where differences in machine design have made it necessary to include some features in the Model 20 Basic Assembler language that are not contained in the System/360 Assembler language. The features mainly concern Input/Output control. For details refer to the SRL Manual.

The Basic Assembler is one-for-one assembly program requiring two passes. The object program is punched in a condensed card format containing up to 56 bytes of text. It is in relocatable card deck format and can be loaded with absolute or relocatable program loader. The Basic Assembler, tape version program is a modification of the Basic Assembler, card version. It provides support for Model 20 customers with minimum tape configurations.

The tape language is identical to that of the card version. The operating characteristics differ in that the program uses tape as intermediate storage between passes. The program is loaded from cards; source deck input is from cards and object deck output on cards.

The Basic Assembler (Card or Tape Version) used to generate and assemble BSCA programs requires a 2020 Processing Unit with 8,192 bytes of core storage. It includes all features of the 4K Basic Assembler.

User written file definition statements become input to a generator program which extracts from the BSCA Library the functions required by the job. The output from the generator run can be assembled separately or jointly with the user program containing macro instructions -- i.e. READ or WRITE -- by the 8K Basic Assembler.

Minimum system requirements (Card)--

- For submodel 1, 2, 5 or 6

For generation: A 2020 Processing Unit Model B1, B2, C5 or C6 and one of the following input/output configurations ... a 2560 MFCM or 2520 Card Read Punch or 2501 Card Reader with a 2520 Card Punch or 1442 Card Punch and ... (optionally) a 2203 or 1403 Printer.

For execution: The input/output configuration depends upon processing requirements but must have, in addition to a 2020 Processing Unit Model B1, B2, C5 or C6 at least one read unit such as a 2560 MFCM or 2520 Card Read Punch or 2501 Card Reader.

- For submodel 3 or 4

For program generation: A 2020 Processing Unit Model B3 or B4 ... a 2560 Model A2 and ... (optionally) a 2203 Model A2 Printer.

For object program execution: The input/output configuration depends upon processing requirements but must have, in addition to a 2020 Processing Unit Model B3 or B4, a 2560 Model A2.

Note 1: The Basic Assembler (Card version) used to generate and assemble BSCA programs requires a 2020 Processing Unit with 8,192 bytes of core storage. See the section "Binary Synchronous Communications Adapter Input/Output Control System (BSCA IOCS)" to determine machine requirements for executing BSCA programs.

Note 2: A printer classified as "optional" is used to display program documentation diagnostic messages and error identification. A printer is, therefore, not required if these facilities are not desired.

[Card 360T-AS-001] [360T-AS-110 for generating and assembling BSCA programs]

Minimum system requirements (Tape)--

- For submodel 2, 5 or 6

A 2020 Processing Unit Model B2, C5 or C6 with a 2415 Magnetic Tape Unit Model 1 or 4 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) for intermediate pass output ... a card reader (2501, 2520, 2560) ... a card punch (2520, 2560, 1442) for output ... a printer (1403, 2203) used for diagnostic messages and program listing.

- For submodel 4

A 2020 Processing Unit Model B4 with a 2415 Magnetic Tape Unit Model 1 or 4 for intermediate pass output ... a 2560 MFCM Model A2 for card reading and card punching ... a 2203 Model A2 Printer, used for diagnostic messages and program listings.

Note 1: The Basic Assembler (Tape version) used to generate and assemble BSCA programs requires a 2020 Processing Unit with 8,192 bytes of core storage. See the section "Binary Synchronous Communications Adapter Input/Output Control System (BSCA IOCS)" to determine machine requirements for executing BSCA programs.

[Tape 360U-AS-130] [360U-AS-153 for generating and assembling BSCA IOCS programs].

Assemblers (TPS Tape and DPS Disk):

These languages are a major extension of the Model 20 Basic Assembler. The Assembler Language is designed to provide a powerful language for machine-oriented programming. It permits symbols of up to 8 characters, literals, control section definition, and various auxiliary functions. A macro language is provided to write macro definitions for possible generation of multiple machine or assembler instructions. The Assembler is tape resident under the 8K Tape System or disk resident under the 12K Disk System. The TPS Assembler accepts input from cards and provides for output in cards or on tape, the DPS Assembler additionally accepts input from tape and has output onto a special area of the system disk pack (parallel with output in cards or on tape) to provide for the Assemble-and-Execute function.

Diagnostics are performed on all source statements. An optional program listing and a symbol table (or, in the case of the DPS Assembler, a cross reference list) are provided.

Minimum system requirements (8K Tape)-- [360U-AS-149]

- For submodel 2, 5 or 6

For generation: A 2020 Processing Unit Model C2, C5 or C6, one card reading device one card punching device (if punching is specified), a printer (used for program listing and diagnostic messages) and one 2415 Magnetic Tape Unit, either Model 2 or 5 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only). Three drives are required for generation. One additional tape drive is required if literals are to be used in the source program, or if the object-program output on tape is desired. The Assembler resides on a 9-track system tape. The other tape drives may be either 7-track or 9-track. However, if 7-track tape is used, the Data Conversion feature is required.

For execution: Depends on user's program. All tape system configurations are supported.

- For submodel 4

For generation: A 2020 Processing Unit Model C4, a 2560 MFCM Model A2 for card reading, and punching if punching is specified, a 2203 Model A2 Printer (used for program listing and diagnostic messages) and one 2415 Magnetic Tape Unit, Model 2 or 5. Three of the available drives are required for generation. One additional tape drive is required if literals are to be used in the source of program, or if the object program output on tape is desired. The assembler resides on a 9-track system tape. The other drives may be either 7-track or 9-track. However, if 7-track tape is used, the Data Conversion feature is required.

For execution: Depends on users program. All tape system configurations are supported.

Minimum system requirements (12K Disk)-- [360W-AS-181]

- For submodel 2, 5 or 6

For generation: A 2020 Processing Unit Model BC2, BC5 or BC6, an IBM 2311 Disk Storage Drive Model 11 or 12, a card reader (2501, 2520, 2560), a card punch (1442, 2520, 2560), if punching is required, a 2415 Magnetic Tape Unit (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) if tape input and/or output is required, a printer (1403, 2203) for program listing and diagnostic messages.

For execution: Depends on user's program. All Model 20 configurations are supported.

- For submodel 4

For program generation: A 2020 Processing Unit Model BC4, a 2311 Disk Storage Drive Model 11 or 12, a 2560 Model A2, a 2415 Magnetic Tape Unit if tape input and/or output is required, and a 2203 Model A2 Printer for program listings and diagnostic messages.

For object program execution: Depends on users program. All Model 20 configurations are supported.

Input/Output Control System (IOCS):

IOCS routines are provided for System/360 Model 20 Card, Tape and Disk systems. The Input/Output Control System (IOCS) re-

lieves the user of much of the programming required for utilization of the System/360 Model 20 I/O units.

IOCS provides the user with macro-instructions to avoid the coding of complete input/output routines including data and error checking. DTF type statements define the device, the function, data format and other special requirements.

The Input/Output areas as well as the exit-routines referred to by the definition statements must be defined in the source program.

Card IOCS

The CPS IOCS provides routines that perform the following functions:

- Input/Output functions and scheduling to optimize CPU time-sharing ability
- Error detection and restart procedures
- CPU interruption handling

The DTF statements are input to a generator program. From the information in these statements, the necessary coding in symbolic language for the different routines is generated and then assembled in conjunction with the main source program or separately.

The macro-instructions inserted in the source program is processed by the Basic Assembler.

The CPS IOCS can be used in conjunction with the System/360 Model 20 IOCS for the Communications Adapter (CIOCS), Model 20 Binary Synchronous Communications Adapter IOCS (BSCA IOCS), and/or the System/360 Model 20 IOCS for the 1419 Magnetic Character Reader.

Minimum system requirements-- [360T-10-002]

- For submodel 1, 2, 5 or 6

For generation: The requirements are the same as those for the Basic Assembler. Note: In a system that has only a 2520 Card Read Punch as card unit, only program routines referring to this unit and to a printer may be generated.

For object execution: The input/output configuration depends upon processing requirements. In addition to a 2020 Processing Unit Model B1, B2, C5 or C6, at least one reading device such as a 2560 MFCM or 2520 Card Read Punch or 2501 Card Reader must be available.

- For submodel 3 or 4

For program generation: The requirements are the same as those for the Basic Assembler.

For object program execution: The input/output configuration depends on processing requirements. In addition to a 2020 Processing Unit Model B3 or B4, a 2560 Model A2 MFCM must be available.

8K Tape and 12K Disk IOCS

The IOCS consists of a set of macro definitions contained in the macro library of the Tape Assembler (8K Tape) or Disk Assembler (12K Disk). By means of DTF statements the assembler generates a set of specialized input/output routines. GET and PUT type macro instructions included in the problem program are translated into linkages to the appropriate input/output routines. The input/output routines for tape and disk files make use of the I/O routines of a monitor. Therefore, all programs processing tape or disk files using IOCS must run under a Monitor.

In addition to the features provided by IOCS for punched-card equipment, Tape (8K) and Disk (12K) IOCS handles:

8K Tape

- Opening and closing of tape files.
- Writing, reading and transferring of blocked or unblocked tape records of fixed or variable length.
- Blocking and deblocking of tape records.
- Checking and creation of standard tape labels (an exit is provided for checking and creation of additional user standard labels).
- Read backwards.
- Tape I/O error checking and recovery procedures.

12K Disk

- All functions of 8K Tape IOCS
- Opening and closing of disk files.
- Writing, reading and transferring of blocked or unblocked records of fixed length disk records.
- Blocking and deblocking of Disk records.
- Organize and maintain sequential, indexed sequential and random disk files.
- Sequential access processing, which provides for serial processing of card, printer, tape and disk records.
- Direct access method of processing, which provides for random processing of disk records.
- Indexed-sequential file processing which provides for both serial and random processing of disk records.
- Disk I/O error checking and recovery procedures.
- Checks and creates disk labels conforming to S/360 standards.

Minimum system requirements (8K Tape)-- [360U-10-151]

The minimum requirement for assembly of programs containing IOCS macro instructions is that configuration required by the Tape Assembler.

The minimum configuration for program execution depends on processing requirements.

Minimum system requirements (12K Disk)-- [360W-10-192]

The minimum requirement for assembly of programs containing IOCS macro instructions is that configuration required by the Disk Assembler.

The minimum configuration for program execution depends on processing requirements.

Input/Output Control Systems for 1255/1259/1419 Magnetic Character Readers (MCR IOCS): TPS/DPS Macro Definitions provide the user with efficient and tested routines which by

means of macro instructions and interrupt routines control and optimize Magnetic Reader input and printer output. It provides linkage to I/O routines for card, tape and disk devices.

This program consists of a set of macro definitions, to be included in the macro library of the system tape/pack. If the TPS/DPS I/O and Monitor Macro Definitions are expanded by these macro definitions the TPS/DPS Assembler will generate routines for the 1419, 1255 or 1259 as well as for card, tape and disk devices when encountering macro instructions in the user's source program.

The routines for the Magnetic Character Reader perform the following functions:

- Engaging and disengaging the MCR
- Document reading
- Document sorting (1419 only)
- Control of document input buffer
- Interrupt servicing
- Testing of field validity indicators and I/O error checking
- Optimized printer output
- Selective tape listing features control (1403 only)
- Programmable pocket light and batch numbering control (1419 optional features)
- Suspension of document feeding and reading to allow magnetic tape or disk operations

The user has to provide a routine for pocket selection, which is entered by the MCR routines under interrupt control. The user is provided a GET macro to retrieve document data from the input buffer. Document data is available sequentially to GET requests. Field error indications and pocket selection codes are associated with the corresponding document data.

Performance Data: For performance data refer to the SRL publication "IBM System/360 Model 20, Disk and Tape Programming Systems, Input/Output Control System for the IBM 1419 or 1259 Magnetic Character Reader" (C33-6001).

Limitations: The program is not upwards compatible with System/360 Model 30 and higher models.

Documents in the 1419 will reject and the 1255/1259 readers will stop with the stacker command light on if user pocket selection routines exceed the time limits described in the performance section of the above mentioned SRL.

Document rejects may occur if any single user instruction exceeds 2.7 milliseconds. More time-consuming instructions must be split.

Document sorting (1419 only) must be based on fields read in the first 6.2 inches of the document.

Prerequisites: The DPS System/360 Model 20 I/O and Basic Monitor Macro Definitions (360W-10-192) must be contained in the macro library of the system pack and must be on current level.

CPS 1419 IOCS

The CPS 1419 IOCS provides tested routines for control of the printer and the reader sorter for typical banking applications. DTF statements are used to tailor this set of routines to the user's requirements. Input/Output operations are controlled by user-written macro instructions.

The DTF statements are input to a generator program. From the information in these statements, the necessary coding in symbolic language for the different routines is generated and then assembled in conjunction with the main program or separately.

The macro-instructions inserted in the source program is processed by the Basic Assembler.

The CPS 1419 IOCS can be used in conjunction with the CPS IOCS and/or CPS CIOCS, or the CPS BSCA IOCS.

Minimum system requirements: Card 1419 IOCS [360T-10-029]

- For submodel 2, 5 or 6

For program generation and assembly: A 2020 Processing Unit, Model B2, C5 or C6, one card reading device, one card punching device. In addition, the printer attached to the system must be used if printing a listing of the generated routines and/or diagnostic messages is desired.

For Object Program Execution: A 2020 Processing Unit Model B2, C5 or C6 with Serial I/O Channel (SIOC), one card reading device, the 1419 Magnetic Character Reader.

The 2020 CPU with 4,096 bytes of core storage may be sufficient for execution of a limited number of 1419 IOCS functions. For execution of the majority of programs

containing 1419 IOCS routines a 2020 CPU with 8,192 bytes of core storage is required. The use of any additional input/output devices is dictated by the requirements of the main program.

Minimum system requirements: Tape 1255/1259/1419 IOCS [360U-10-152]

- For submodel 2, 5 or 6

For program assembly: The requirements for assembly of programs containing 1255/1259/1419 MCR IOCS routines are the same as those for the TPS Assembler.

For object program execution: A 2020 Processing Unit Model C2, C5 or C6 with Serial Input/Output Channel (SIOC) ... one card reading device (2501 Model A1 or A2, 2520 Model A1 or 2560 Model A1) for object program loading or for initial program loading of the tape resident system.

Devices Supported:

IBM 1419 Magnetic Character Reader Model 1 and these features:

- Batch Numbering
- Programmable Pocket Lights
- 51 Column Sorting
- EC Level of 1419 must be 127384 (ECA 170) or higher

IBM 1255 Magnetic Character Reader Models 1, 2, 3.

IBM 1259 Magnetic Character Reader Model 1.

IBM 1403 Printer Models 2, 7, N1 and these features:

- Interchangeable Chain/Train Cartridge
- Selective Tape Listing
- Universal Character Set

IBM 2203 Printer and Additional Print Positions feature.

Minimum System Requirements: Disk 1255/1259/1419 IOCS [360W-10-193]

- For submodel 2, 5 or 6

For program assembly: The requirements for assembly of programs containing 1255/1259/1419 MCR IOCS routines are the same as those for the DPS Assembler.

For object program execution: A 2020 Processing Unit Model BC2, BC5 or BC6 with Serial Input/Output Channel (SIOC) ... one card reading device (2501 Model A1 or A2, 2520 Model A1, 2560 Model A1) for object program loading or for initial program loading of the disk resident system.

Devices Supported:

IBM 1419 Magnetic Character Reader Model 1 and these features:

- Batch Numbering
- Programmable Pocket Lights
- 51 Column Sorting
- (EC Level of 1419 must be 127384 (ECA 170) or higher.)

IBM 1255 Magnetic Character Reader Models 1, 2, 3.

IBM 1259 Magnetic Character Reader Model 1.

IBM 1403 Printer Models 2, 7, N1 and these features:

- Interchangeable Chain/Train Cartridge
- Selective Tape Listing
- Universal Character Set

IBM 2203 Printer and Additional Print Positions feature.

Input/Output Control System for the Communications Adapter (CIOCS):

Communications Adapter. [360T-CQ-003]

The CIOCS relieves the user of much of the programming required for efficient utilization of the System/360 Model 20 Commun-

The Communications IOCS provides routines that perform the following functions:

- STR transmission of data (BCD-characters) between a Model 20 CPU with Communications Adapter and one of the following remote terminals:

- 1009 Data Transmission Unit (for Communication with IBM 1400 series)
- 1130 Computing System equipped with Synchronous Communication Adapter
- 1013 Card Transmission Terminal.
- 2701 Data Transmission Unit (for Communication with System/360 Model 30, 40, 50, 60, 62, or 70).
- 7701 or 7702 Magnetic Tape Transmission Terminal.
- 7710 or 7711 Data Communication Unit.
- 2020 Processing Unit with Communications Adapter.

Scheduling of TRANSMIT and RECEIVE operations to optimize CPU time sharing ability.

Error detection and restart procedures

CIOCS provides the user with macro instructions to avoid the coding of complete out-lines for data transmission. DTTSR statements define the type of transmission, the function, data format and other special requirements.

The macro instructions inserted in the source program will be processed by the Basic Assembler.

The definition statements (DTTSR) are input to a generator program. From the information in these statements the necessary coding in symbolic language for the different routines servicing the Communications Adapter and the overall monitoring CIOCS routine are developed. The CIOCS is normally used in conjunction with the Model 20 and may be used in conjunction with the Model 20 CPS IOCS for the 1419 Magnetic Character Reader. The user may assemble his symbolic IOCS/CIOCS/1419 IOCS program and his source program either separately or jointly.

Minimum System and EC-Level Requirements:

For generation and assembly of CIOCS routines: A 2020 Processing Unit, Model B1 or B2, one card reading device; one card punching device. In addition, the printer attached to the system must be used if printing of generated routines and/or diagnostic messages is desired.

For execution of object programs: A 2020 Processing Unit, Model B2, with one card reading device, the Communications Adapter, and a remote terminal connected through Data Sets appropriate to desired speed of operation.

The 2020 Processing Unit, Model B2 (4096 bytes) permits the execution of only a limited number of IOCS/CIOCS functions. For execution of the majority of programs containing IOCS/CIOCS routines a model C2 (8192 bytes) is required.

The use of any additional input/output devices is dictated by the requirements of the main program.

Generation and assembly of CIOCS as well as execution of object programs for transmission in binary mode are not dependent on EC levels.

Proper execution of object programs for transmission in BCD-mode requires EC 12100 of the Processing Unit.

Sort/Merge Programs:

The Sort/Merge programs are generalized, non-generative programs which require mnemonic control information to describe the file parameters of each sort or merge. They permit insertion of user-provided routines for additional record processing in the input and output phases, e.g. deletion, alteration, translation, etc., and provide for check-point and restart. The programs sort or merge according to control data contained in up to 12 fields of a record in ascending or descending sequence with a 256 byte total for all control fields. Control data may be alphameric, packed or unpacked decimal, fixed point or absolute binary format. Standard label processing is provided. Non-standard labels are bypassed.

TPS Tape Sort/Merge: This program sorts or merges on three or more tapes. It is either card resident or tape resident in the 8K tape system. The program sorts records of fixed or variable length, blocked or unblocked, and/or merges 2-5 pre-sequenced files. It allows multi-reel input and output, multi-reel processing, and alternate tape drive assignment.

Minimum system requirements: [360U-SM-150]

- For submodel 2, 5 or 6

A 2020 Processing Unit Model C2, C5 or C6, a card reader (2501, 2520, 2560), a 2415 Model 2 or 5 Magnetic Tape Unit (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only), and a printer (1403 or 2203) (for error and diagnostic messages).

- For submodel 4

A 2020 Processing Unit Model C4, a 2560 MFCM Model A2 for card reading, a 2415 Model 2 or 5 Magnetic Tape Unit and a 2203 Model A2 Printer for error and diagnostic messages.

DPS Disk Sort/Merge: Sorts or merges on one or up to four disks. It is either card resident or disk resident in the 12K disk system. It handles sequentially organized files with fixed length, blocked or unblocked records and provides for merging 2-4 pre-sequenced files. Input and output may be in punched cards, magnetic tape or disk packs. Multi-pack and multi-reel input and output are provided with alternate tape drive assignment. The program provides for card input combined with either tape or disk and for card output parallel with either tape or disk. It contains an ADDRROUT option which allows the user to produce a record-address file that can be used in programs written in the Model 20 RPG language. A sort-time estimating option permits the user to calculate time estimates for sort operations performed with this program. (This option does not apply to submodel 4 or 6 Tape/Disk systems.)

Minimum system requirements: [360W-SM-182]

- For submodel 2, 5 or 6

A 2020 Processing Unit BC2, BC5 or BC6, a card reading device (2501, 2520, 2560), one 2311 Disk Storage Drive Model 11 or 12, a printer (1403 or 2203) (for error and diagnostic messages), a card punching device (1442, 2520, 2560), if card output is desired, a 2415 Magnetic Tape Unit (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only), if tape input/output is desired.

- For submodel 4

A 2020 Processing Unit Model BC4, a 2560 Model A2, one 2311 Disk Storage Drive Model 11 or 12, a 2415 Magnetic Tape Unit if tape input and/or output is required, a 2203 Model A2 Printer (for error and diagnostic messages).

DPS Tape Sort/Merge Allows the sorting of tape files into ascending and/or descending sequence and the merging of presequenced tape files. [360W-SM-194]

For object program execution, the operator supplies the required control information in the form of control cards.

The DPS Tape Sort/Merge program is an adaptation of the TPS Sort/Merge program, 360U-SM-150, to run under the DPS. It sorts binary data (including alphanumeric characters), fixed-point integers, packed or unpacked decimal numbers contained in blocked or unblocked records of fixed or variable length in an ascending or descending order. It also merges presequenced files (2-5 files). Operations are performed according to control data contained in up to 12 fields of each record, with a maximum length of 256 bytes for all control fields. When using the Merge functions, the sequence of all files (1-5 files) is checked. The program provides for exits to user-written routines as well as for checkpoints and restart. Tape input and output files can be

1. contained in more than one reel.
2. selected from or written on a reel containing more than one file.

Tape label checking conforms to established System/360 standards and non-standard labels are bypassed. An exit is provided to allow new processing of additional standard labels of the user. The program runs under supervision of the control programs for either the card or the disk-resident system.

Minimum system requirements:

- For submodel 2, 5 or 6

A 2020 Processing Unit Model BC2, BC5 or BC6 ... One 2501 Card Reader Model A1 or A2, 2520 Read Punch Card Model A1 or 2560 MFCM Model A1 ... One 1403 Printer Model 2, 7 or N1 or 2203 Printer Model A1 for printing of error, and diagnostic messages ... One 2415 Magnetic Tape Unit Model 2 or 5 (at least three tape drives are required) ... One 2311 Disk Storage Drive, Model 11 or 12.

- For submodel 4

A 2020 Processing Unit Model BC4, a 2560 MFCM Model A2, a 2203 Model A2 Printer for printing of error and diagnostic messages, one 2415 Magnetic Tape Unit Model 2 or 5 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) (at least three drives are required), one 2311 Disk Storage Drive Model 12.

Restrictions on tape drive configurations:

With 9-track input tapes and/or 7-track input tapes, that were created with the Data Conversion feature turned on, output tapes must be 9-track tapes and/or 7-track tapes with the Data Conversion feature turned on. Sorting requires 9-track tapes.

With 7-track input tapes that were created with the Data Conversion feature turned off, output tapes can be either 9-track or 7-track tapes. For sorting work tapes may be either track.

All 7-track tapes used in a given Sort or Merge operation must have the same characteristics. For example, if the translate capability of the Compatibility special feature is used when 7-track input tapes are created, it must be used with all 7-track work or output tapes.

Files of variable length records to be sorted or merged must be created on 9-track tapes or on 7-track tapes with the Data Conversion special feature turned on. Therefore, 9-track work tapes must be used when sorting variable-length records.

Checkpoint records are written only on 9-track work tapes or 7-track work tapes with the Data Conversion feature.

System Control and Service Programs (8K Tape and 12K Disk): The System Control and Service programs are designed to generate and maintain a tape resident (8K Tape) or disk resident (12K Disk) system which facilitates the assembly, generation and execution of programs.

The control programs for 8K-Tape consist of either card- or tape resident versions, which include Initial Program Loader, Basic Monitor and Job Control.

The control programs for 12K Disk consist of card or disk resident versions of the Initial Program Loader, Job Control and the Monitor which can be a standard or a generated one.

The control programs provide the user with the advantages of:

- reduced card handling
- automatic job-to-job transition
- selective retrieval of programs contained on the system tape (8K Tape)
- selective retrieval of programs contained on the system pack (12K Disk)
- functional ability of expanded core storage (program overlay)
- general over-all ease of operation
- tape-drive assignment at object time (8K Tape)
- tape and disk drive assignment at object time (12K Disk)
- card device assignments for system programs at object time.
- generate a tailored monitor.

DPS Monitor Generation Macro Definitions

User may generate card or disk resident DPS Monitor tailored to needs of his installation.

Optional Monitor transient area saves core storage by providing area in which infrequently used monitor routines may be executed after being fetched from disk.

Minimum System Requirements:

- For submodel 2, 5 or 6

The minimum features required for generation and object program execution are the same as those required for DPS (12K), IOCS, and PL/1 a 2020 Processing Unit Model BC2 BC5 or BC6 ... one card reading device (2501, 2520, 2560-A1) ... one 2311 Disk Storage Drive Model 11 or 12 ... one Printer (1403 or 2203-A1) ... a card punching device (1442, 2520, 2560-A1) if required.

Machine Features Supported:

Up to 32,768 bytes of core storage ... card reading devices (2501, 2520, 2560-A1) ... card punching devices (1442, 2520, 2560-A1) ... 2415 Magnetic Tape Units, Models 1-6 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) (7- or 9-track) ... four 2311 Disk Storage Drives, Models 11 or 12 ... one Printer (1403 or 2203-A1) ... one 2152 Printer-Keyboard ... one MCR device (1419, 1255 or 1259). BSCA (Feature =2074).

- For submodel 4

The minimum features required for generation and object program execution are the same as those required for DPS (12K), IOCS, and PL/1 2020 Processing Unit BC4 ... a 2560 A2 MFCM ... one 2311 Disk Storage Drive Model 12 ... one 2203 Model A2 Printer.

Machine Features Supported:

Up to 16,273 bytes of core storage ... a 2560 Model A2 MFCM ... 2415 Magnetic Tape Unit, Models 1 - 6 (7- or 9-track) ... two 2311 Disk Storage Drives Model 11 or 12 ... one 2203 Model A2 Printer ... one 2152 Printer-Keyboard ... BSCA (Feature =2074).

The service programs allow to produce, maintain and service the system tape or the system pack which contain the core-image and macro library.

The principal functions of these programs are:

- Load System program: To build a system tape or system disk pack by IBM and/or user-written programs.
- Core-image-maintenance program: To add, delete or replace IBM and/or user-written macros to or from the macro library of the system tape or system disk.
- Macro Maintenance program: To add, delete or replace IBM and/or user-written macros to or from the macro library of the system tape or system disk.
- Directory and Core Image Library Services Programs: To print or punch or write on tape or disk the contents of the core image library and to print the contents of directories (12K Disk only).
- Macro Library Service Program: To print or punch or write on tape or disk the contents of the macro library in either source or internal format.
- Library Allocation Organization program: To re-define the limits of the libraries and directories of the system disk (12K Disk only).
- Physical and Logical Unit Tables Service program: To (1) display and/or change the permanent device assignments, and (2) to display the features of the monitor and configuration of system pack.
- Linkage Editor: To link together separately assembled program sections and/or subroutines into a single program to relocate programs so that they can be executed without new assembly.
- Copy System: To copy the system file from the system disk pack onto another pack.
- Disk Backup and Restore (12K Disk): to (1) create a backup tape from a disk pack and (2) restore a disk pack from a backup tape. In addition card files can be included in the tape and be restored on disk.

Distribution Package Retrieval Program (8K Tape): To create system tapes that may contain IBM and/or user's programs and macro definitions in any combination.

Minimum system requirements (Tape)--

Basic Requirements: A 2020 Central Processing Unit Model C2, C4, C5 or C6 ... one card reader ... one Printer for printing diagnostic messages, logging of Job Control Cards, displaying contents of directories, etc.

Additional Requirements: For the control programs for a tape-resident system and for the following service programs. Load System Tape, Copy System Tape, and Directory Service. One 2415 Magnetic Tape Unit Model 1 or 4 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) ... one of the two tape drives must contain a 9-track read/write head. If the second head is 7-track, the Data Conversion feature is required.

For the following service programs, Core Image Maintenance, Macro Maintenance,

and Linkage Editor: One 2515 Magnetic Tape Unit Model 2, 3, 5, or 6 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) ... with three 9-track read/write heads. If the Data Conversion feature is installed, only one 9-track head is required. For the service programs core-image service and Macro service one card punch if punching is specified.

For the Linkage Editor Program: One card punch if output is on cards.

Execution of user's problem programs: One 2415 Magnetic Tape Drive (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) with a 9-track read/write head. This magnetic tape drive is not required if the user's programs are executed under supervision of the control programs for a card-resident system.

TPS Control and Service Programs

Load System Tape	360U-SL-142
Copy System Tape	SL-143
Directory Service	SL-144
Core-Image Maintenance	SL-145
Macro Maintenance	SL-146
Linkage Editor	SL-147
Core-Image Service	SL-155
Marco Service	SL-156
Card Resident Control Programs	CL-157
Initial Program Loader for Tape-Resident System	CL-158
Tape-Resident Control programs	CL-159

Minimum system requirements (Disk)--

- For submodel 2, 5 or 6

A 2020 Processing Unit, Model BC2, BC5 or BC6 ... one (two for the Copy System Program) a 2311 Disk Storage Drive Model 11 or 12, a card reader (2501, 2520, 2560), a printer (1403, 2203), for diagnostic messages and printing of directories, etc., a card punch (1442, 2520, 2560), if card output of Library Service programs and/or Linkage Editor is required or a bootstrap card is to be punched by the backup and restore program, a 2415 Magnetic Tape Unit with at least one 9-track head or, if all heads are 7-track, the Data Conversion feature, if tape input and/or output is required.

- For submodel 4

A 2020 Processing Unit Model BC4 ... one (two for the Copy System Program) 2311 Disk Storage Drive Model 11 or 12, a 2560 Model A2, a 2203 Model A2 Printer (for diagnostic messages and printing of directories, etc.), a 2415 Magnetic Tape Unit with at least one 9-track head or, if all heads are 7-track, the Data Conversion Feature, if tape input and/or output is required.

DPS Control and Service Programs

Disk-Resident Control Programs	360W-CL-171
Load System Disk	SL-172
Library Allocation Organization	SL-173
Physical and Logical Unit Tables Service Program	SL-174
Core Image Maintenance	SL-175
Macro Maintenance	SL-176
Directory and Core Image Library Service	SL-177
Backup and Restore	SL-178
Linkage Editor	SL-179
Monitor Generation Macro Defin.	IO-200
Copy System Program	SL-205
Macro Library Service Program	SL-206

Universal Character Set Utility Program: This program will be used whenever a new chain or train is mounted on the 1403 Model 2 or N1 Printer with Universal

Character Set Feature. The program loads the 240-character UCS buffer with the 8-bit codes that correspond one-to-one with the 240 graphic positions on the printer-chain/train. Upon completion of buffer loading, the program prints several lines so that the user can visually verify that the correct chain/train was installed. The program supports the folding and dualing capability.

The program is a stand-alone program and accepts as control information four chain-image cards, each consisting of 60 characters.

Minimum system requirements

A 2020 Processing Unit Model B2, C5 or C6 with Universal Character Set Adapter ... A Card Reading Device, and a 1403 Printer Model 2 or N1 with Universal Character Set Feature. [360T-UT-108]

Basic Program Material

- SRL Publication -- System/360 Model 20 Universal Character Set Utility Program, C26-3812.
- Documentation -- Program Material List.
- Machine Readable -- Object deck available in card form.

Sterling Currency Processing Routines: Provides Model 20 users with a convenient means of processing sterling currency in arithmetic and editing functions.

These routines are included in the user's program by means of special linking sequences. The sterling routines are assembled with the user's source program.

Note: The routines delivered are to be used only with assembler and PL/I programs. RPG and PCU processor decks already contain sterling routines.

Minimum system requirements: There are no additional machine requirements for the use of these routines, beyond requirements for BAL. [360T-LM-015]

2152 Printer-Keyboard: The Model 20 Disk Programming System supports the 2152 Printer-Keyboard ... (1) as an inquiry device and ... (2) as an input/output unit.

A new and more flexible Model 20 DPS Monitor is also supported.

2152 Printer-Keyboard [360W-IO-202]

- For inquiry, user may interrupt main line programs to request and display information from disk files.
- When inquiry is requested, main line programs are suspended only for length of time necessary to retrieve and format information desired.
- User writes inquiry processing programs in RPG, Assembler/IOCS or PL/I to suit his particular requirements.
- Any number of different inquiry programs, up to the limits of the core image library may be stored on disk to be called when requested from the 2152.
- Use of the Printer-Keyboard as an input/output device is fully supported in RPG, Assembler/IOCS or PL/I.
- Carriage Control tape can be simulated for output on the 2152 Printer in RPG.

Minimum System Requirements:

- For submodel 2, 5 or 6

The minimum features required for generation and object program execution are the same as those required for DPS (12K), IOCS, and PL/I with the addition of the 2152: a 2020 Processing Unit Model BC2, BC5 or BC6 ... one card reading device (2501, 2520, 2560-A1) ... one 2311 Disk Storage Drive Model 11 or 12 ... one Printer (1403 or 2203-A1) ... a card punching device (1442, 2520, 2560-A1) if required ... and a 2152 Printer-Keyboard.

Machine Features Supported:

Up to 32,768 bytes of core storage ... card reading devices (2501, 2520, 2560-A1) ... card punching devices (1442, 2520, 2560-A1) ... 2415 Magnetic Tape Units, Models 1-6 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) (7- or 9-track) ... four 2311 Disk Storage Drives, Models 11 or 12 ... one Printer (1403 or 2203-A1) ... one 2152 Printer-Keyboard ... one MCR device (1419, 1255 or 1259) ... BSCA.

- For submodel 4

The minimum features required for generation and object program execution are the same as those required for DPS (12K), IOCS, and PL/I with the addition of the 2152: 2020 Processing Unit BC4 ... a 2560 Model A2 MFCM ... one 2311 Disk Storage Drive Model 11 or 12 ... one 2203 Model A2 Printer and a 2152 Printer-Keyboard.

Machine Features Supported:

Up to 16,384 bytes of core storage ... a 2560 Model A2 MFCM ... two 2311 Disk Storage Drives Model 11 or 12 ... 2415 Magnetic Tape Unit, Models 1 - 6 (7- or 9-track) ... one 2203 Model A2 Printer ... one 2152 Printer-Keyboard.

Inquiry Considerations

- Disk resident monitor with transient area is required for inquiry operations.
- Inquiry is not performed when any one of the following is in progress:
 - Another inquiry
 - A program which was assembled or compiled under either the current version of Model 20 DPS or the new Model 20 DPS with explicit exclusion of inquiry.
 - CMAINT, AORGZ, Job Control, COPSYS, DDUMP, ATASGN + Sort Merge. (With limitations, all other system programs are interruptable.)
- With limitations all file processing is interruptable.
- An inquiry program must be indicated as such during compilation or assembly.
- Files with Standard tape labels cannot be processed in an inquiry program.
- The system pack must be on line during inquiry.

Binary Synchronous Communications Adapter Input/Output Control System (BSCA IOCS):

The BSCA IOCS consists of a set of pretested macro routines which relieve the user of much of the programming necessary to properly control the exchange of messages on a transmission line.

The BSCA IOCS will be integrated into, and can be used in conjunction with, Model 20 Card, Tape and Disk Assembler/IOCS programming support. The communications program may use all the features of these IOCS packages, plus 1255, 1259 or 1419 IOCS. When a program using BSCA IOCS is being executed, the Model 20 System will be dedicated to the telecommunications job.

In the Card Programming Support, user written file definition statements become input to a special generator program which extracts from the BSCA Card Library the functions required by the job. The output from the generator run can be assembled separately or jointly with the user program containing macro instructions -- i.e. READ or WRITE -- by a card assembler requiring 8,192 bytes of core. This assembler includes all features of the 4K Basic Assembler. BSCA IOCS under CPS will be supported up to 16K. The BSCA IOCS will run under CPS on 24K/32K systems provided that not more than the first 16K of the available core storage is used.

In TPS and DPS the BSCA IOCS file definition statements and macro instructions are expanded into an appropriate set of symbolic machine instructions and are assembled with the users program by the TPS/DPS Assembler.

The following Data Link Configurations are supported:

Leased (unswitched) Line -- Communication with another Model 20 whose program also uses BSCA IOCS or with a System/360 Model 25/30/40/50/65/67 (operating in 65 mode)/75/85/195 equipped with a 2701 or 2703 (with BSC) (or System/360 Model 25 with ICA) and program supported with DOS BTAM or OS BTAM (Model 25 DOS only; Model 85/195 OS only) or with an 1130 Computing System with the 1130 Communication Subroutine, an 1800 Data Acquisition and Control System with the 1800 Multiprogramming Executive System Version 2, a 2770 Data Communication System or a 2780 Data Transmission Terminal.

Note: S/360 Model 20 (Submodel 2, 4, 5 or 6) Type I programming support will not include the Edit Macro for the 2770's Model 50 Magnetic Data Inscrber. Therefore, if communication with the 2770s Model 50 MDI is desired, the customer will have to supply his own edit routine.

Switched Network -- Communication via switched public networks with another Model 20 (Submodels 2, 4, 5 or 6) with similar support or with a System/3 with BSCA and program supported by the Card Disk RPG II Telecommunication feature, or with a System/360 Model 25 with ICA and Models 25, 30, 40, 50, 65, 67 (working in 65 mode), 75, 85 via a 2701 equipped with SDA-Type II or a 2703 equipped with Binary Synchronous features with DOS/OS BTAM support (DOS only on Models 25 and 30, OS only on Model 85).

Centralized Multipoint Line -- The model 20 using BSCA IOCS operates as a slave station only. The master station is a System/360 Model 25/30/40/50/65/67 (operating in 65 mode)/75/85/195 with a 2701 or 2703 (with BSC) (or System/360 Model 25 with ICA) and program supported with DOS BTAM or OS BTAM (Model 25 DOS only; Model 85/195 OS only).

Minimum System Requirements -- Card Programming Support (CPS) 360T-CQ-111
For submodel 2, 4, 5 or 6

Generator Program

2020 Processing Unit Model C2, C4, C5 or C6.
One card reading device (2501, 2520, 2560, Model A1 or A2).
One card punching device (1442, 2520, 2560, Model A1 or A2).
One printer (1403 or 2203, Model A1 or A2) if diagnostic messages are to be printed or the generated program is to be listed.

Assembly of a program containing BSCA IOCS macros in the Card Programming Support.

2020 Processing Unit Model C2, C4, C5 or C6.
Input/Output units as required by the Basic Card Assembler (BK).

Additional features supported during generation and assembly.
12,288 and 16,384 bytes of core.

For object program execution.

2020 Processing Unit Model C2, C4, C5 or C6 with Binary Synchronous Communications Adapter (2074).
One remotely connected Model 20 with Binary Synchronous Communications Adapter (2074) or one System/3 with BSCA (2074), or one System/360 Model 25 or above with 2701 or 2703 with BSC.
Input/Output units as required by the problem program.

Features and units supported for object program execution.

12,288 and 16,384 bytes of core.
Card reading devices (2501, 2520, 2560, Model A1 or A2).
Card punching devices (1442, 2520, 2560, Model A1 or A2).
Printer (1403, 2203, Model A1 or A2).
1419 Magnetic Character Reader.

Minimum System Requirements -- Tape System (TPS) and Disk System (DPS).
360U-CQ-154 360W-CQ-201

For submodel 2, 4, 5 or 6

For program assembly

2020 Processing Unit Model C2, C5 or C6 (Tape System).
2020 Processing Unit Model BC2, BC4, BC5 or BC6 (Disk System).
Input/Output units as required for the Tape or Disk Assembler.

For program execution, Tape and Disk Systems.

2020 Processing Unit Model BC2, BC4, BC5 or BC6 with Binary Synchronous Communications Adapter (2074).
One remotely connected Model 20 with Binary Synchronous Communications Adapter (2074) or one System/3 with BSCA (2074), or one System/360 Model 25 with 2701 or 2703 with BSC.
Input/Output units as required by the TPS or DPS and the problem program.

Features supported for object program execution, Tape and Disk Systems.

Up to 32,768 bytes of core storage.
Card reading device (2501, 2520, 2560, Model A1 or A2).
Card punching devices (1442, 2520, 2560, Model A1 or A2).
Printer (1403 or 2203, Model A1 or A2).
2415 Magnetic Tape Unit (Model 1-6) (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only).
1419, 1255, 1259 Magnetic Character Readers.

Additional features supported for object program execution -- Disk System only.

Four 2311 Disk Storage Drives (Models 11 or 12).
2152 Printer-Keyboad

BSCA IOCS Error Statistics Printout Program (360T-UT-112)

A special Utility program in Model 20 CPS is available for printing of BSCA IOCS error statistics. The program should be loaded and executed immediately after executing the BSCA IOCS program.

Remote Job Entry (RJE) Work Station Programs:

Permit a System/360 Model 20, equipped with a Binary Synchronous Communications Adapter to

submit OS/360 jobs over communications facilities to a Central System/360, Model 40, 50, 65, 67 (65 mode), 75, 85, 195, for execution, and to receive output from the Central System upon completion of the job. Output may also be received at the work station on a deferred basis if so desired. Users at work stations other than the senders may also be designated as recipients for job output.

Model 20 RJE support is provided under CPS, TPS and DPS. The Central System operates under OS/360 (MVT and MFT-II). The Job Entry Control Language (JECL) used by Model 20 RJE programs is compatible with JECL for other work stations.

The Model 20 RJE programs provide the following functions:

- Input of OS/360 jobs and RJE commands through an input device.
- Data transmission to and from the Central System.
- Output to an attached output device.

In CPS, TPS and DPS, input of OS/360 jobs is provided through the card reading device attached to the Remote Work Station. Output is provided through the attached card punching device and line printer.

Additionally, in TPS and DPS input of OS/360 jobs, and output from the Central System may be on magnetic tape. In DPS only, input/output is provided on disk or the 2152 Printer-Keyboad.

Transmissions to and from the Central System/360 are via the Binary Synchronous Communications Adapter (connected over 600 to 50,000 bps non-switched or over multipoint lines, and switched lines up to speeds limited by these lines) in EBCDIC, and in transparent text. Model 20's can be intermixed with 1130 devices on the same leased multidrop line.

A facility is provided in TPS and DPS whereby the user may create tape or disk data files acceptable to the RJE program, or print or punch tape or disk data files created by the RJE program.

When the Remote Job Entry programs are used, the Model 20 is dedicated to the communications job.

All input is read as 80 character records. Job entries or JECL commands can be read from the card reader, a tape drive or a disk drive. Only JECL commands are allowed through the Printer-Keyboad. The RSTART command, used for work station start-up, must be submitted through the card reader, and must have a valid terminal identification.

It is possible to read data files from one tape drive and/or disk drives.

Output at the work station consists of RJE messages and job output. Job output, consisting of SYSOUT data sets created by the job, is directed to the printer, punch or the device specified for user exit. The data directed to user exit can be punched, printed, written on tape or disk, or deleted.

By means of user-written routines, the user can have access to input data before trans-

mission and received output data for editing and/or rerouting.

RJE messages can be written on the Printer-Keyboard if one is attached to the Model 20; otherwise they are printed on the line printer.

Error messages are provided by the RJE program to indicate line errors, invalid RJE commands, tape and disk I/O errors, etc. If a Printer-Keyboard is available and logically attached, the message codes appear on it, otherwise they are displayed in the ESTR registers.

The RJE programs are modularly constructed. By means of the RJE macro statement, unwanted code is removed and the program is tailored to the user's requirements. The RJE macro statement consists of keyword entries which describe the I/O devices to be used and the features to be included. This statement is input for the generator program distributed with the CPS RJE program, or for the TPS and DPS macro assemblers.

The RJE programs use the Binary Synchronous Communications Adapter Input/Output Control System (BSCA IOCS) for control of message and data exchange on the transmission line including error recovery. They also use the existing IOCS programs for control of input/output operations. Card I/O and printer functions are supported under CPS, TPS and DPS; tape functions are supported in TPS and DPS. Disk and Printer-Keyboard functions are supported under DPS only.

In CPS the RJE program operates as a stand-alone program. In TPS and DPS it operates in a batch-job environment, under control of the applicable Monitor and Job Control Programs.

RJE under CPS will be supported up to 16K. The RJE will run under 24K/32K systems provided that not more than the first 16K of the available core storage is used.

Minimum System Requirements:

Card input/output and printer capability is provided in CPS, TPS, and DPS in 12,288 bytes of core storage. In TPS and DPS, tape input/output, disk input/output or the 2152 Printer Keyboard will require 16,384 bytes of core storage.

Card Programming Support (CPS) 360T-CQ-113

For Generation and Assembly --

- For submodels 2, 5 or 6 only

2020 Processing Unit Model C2, C5 or C6 ... A Card Reading Device (2501 Model A1 or A2; a 2520 Model A1 or a 2560 Model A1) ... A Card Punching Device (1442 Model 5; a 2520 Model A1 or A2, one 2560 Model A1 ... a Printer (2203 Model A1, 1403 Model 2, 7 or N1).

- For submodel 4

A 2020 Processing Unit Model C4 ... A 2560 Model A2 ... A 2203 Printer Model A2

For Program Execution --

All systems require a Binary Synchronous Communications Adapter (Feature #2074) with EBCDIC and Full Transparency Text Mode.

- For submodel 2, 5 or 6

A 2020 Processing Unit Model BC2, BC5 or BC6 ... A Card Reader ... A Line Printer ... Optional BSCA features as required by the user program.

Devices and Models Supported

2020 Processing Unit Models BC2, D2, BC5, D5, DC5, E5, BC6, D6 ... Card Reading Devices (2501 Models A1 and A2, 2520 Model A1, 2560 Model A1) ... Card Punching Devices (1442 Model 5, 2520 Models A2 and A3, 2560 Model A1) ... Printers (2203 Model A1, 1403 Models 2, 7 and N1).

- For submodel 4

A 2020 Processing Unit Model BC4 ... A 2560 Model A2 ... A 2203 Model A2 ... Optional BSCA features as required by the user program.

Devices and Models Supported

2020 Processing Unit Models BC4, D4

Tape Programming System (TPS) 360U-CQ-160

- For submodels 2, 5 or 6 only

For Assembly --

A 2020 Processing Unit Model BC2, BC5 or BC6 ... a 2415 Magnetic Tape Unit Model 2 or 4 (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) (at least one drive must be equipped with 9-track heads). If seven track tapes are used, the data conversion feature is required ... A Card Reading Device (2501 Model A1 or A2, a 2520 Model A1, a 2560 Model A1) ... A Card Punching Device (1442 Model 5, 2520 Model A2 or A3, 2560 Model A1), if punching of the object deck is specified ... A Printer (2203 Model A1, 1403 Model 2, 7 or N1), if program listings and diagnostic messages are required.

For Program Execution --

All systems require a Binary Synchronous Communications Adapter (Feature #2074) with EBCDIC and Full Transparency Text Mode.

A 2020 Processing Unit Model BC2, BC5 or BC6 ... A Card Reader ... A Line Printer ... Optional BSCA features as required by the user program.

Devices and Models Supported

2020 Processing Unit Models D2, D5, DC5, E5 or D6 ... Card Reading Devices (2501 Model A1 or A2, 2520 Model A1, 2560 Model A1) ... Card Punching Devices (1442 Model 5, 2520 Models A2, A3, 2560 Model A1) ... A Printer (2203 Model A1, 1403 Model 2, 7 or N1), if printing is specified ... 2415 Magnetic Tape Unit Models 1-6* (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only).

- For submodel 4

For Assembly --

A 2020 Processing Unit Model BC4 ... a 2415 Magnetic Tape Unit Model 2 or 4 (at least one track must be equipped with 9-track heads). If 7-track tapes are used, the data conversion feature is required ... a 2560 MFCM Model A2 for card reading, and punching, if punching of the object deck is specified ... a 2203 Model A2 Printer, if program listings and diagnostic messages are required.

For Program Execution --

All systems require a Binary Synchronous Communications Adapter (Feature #2074) with EBCDIC and Full Transparency Text mode.

A 2020 Processing Unit Model BC4 ...
A 2560 MFCM Model A2 for card reading ...
A 2203 Model A2 Printer ...
Optional BSCA features as required by the user program.

Devices and Models Supported --

2020 Processing Unit Models BC4 and D4 ... A 2560 MFCM Model A2 ... a 2203 Model A2 Printer ... 2415 Magnetic Tape Units Models 1-6.

Disk Programming System (DPS) 360W-CQ-203

For Assembly --

- For submodel 2, 5 or 6

A 2020 Processing Unit Model BC2, BC5 or BC6 ... A Card Reading Device (2501 Model A1 or A2, a 2520 Model A1, a 2560 Model A1) ... A Card Punching Device (1442 Model 5, a 2520 Model A1 or A2, a 2560 Model A1), if punching of the object deck is specified ... A Printer (2203 Model A1, a 1403 Model 2, 7, or N1), if program listings or diagnostic messages are required ... A 2311 Disk Storage Drive (Model 11 or 12).

- For submodel 4

A 2020 Processing Unit Model BC4 ... A 2560 Model A2 ... A Printer (2203 Model A2), if program listings and diagnostic messages are required ... A 2311 Disk Storage Drive Model 11 or 12.

For Program Execution --

All systems require a Binary Synchronous Communications Adapter (Feature #2074) with EBCDIC and Full Transparency Text mode.

- For submodels 2, 5 or 6

A 2020 Processing Unit Model BC2, BC5 or BC6 ... A Card Reader ... A Line Printer ... A 2311 Disk Storage Drive Model 11 or 12 ... Optional BSCA features as required by the user program.

- For submodel 4

A 2020 Processing Unit Model BC4 ... A 2560 MFCM Model A2 ... A 2203 Model A2 Printer ... A 2311 Disk Storage Drive Model 11 or 12 ... Optional BSCA features as required by the user program.

Devices and Models Supported

- For submodel 2, 5 or 6

A 2020 Processing Unit Model D2, D5, DC5, E5 or D6 ... Card Reading Devices (2501 Model A1 or A2, 2520 Model A1, 2560 Model A1) ... Card Punching Devices (1442 Model 5, 2520 Model A1 or A2, 2560 Model A1) ... A Printer (2203 Model A1, 1403 Model 2, 7 or N1) ... 2311 Disk Storage Drives -- Models 11 or 12 (two on Submodel 2, four on Submodel 5) ... 2152 Printer-Keyboard* ... 2415 Magnetic Tape Units Models 1-6* (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only).

- For submodel 4

A 2020 Processing Unit Model D4 ... A 2560 Model A2 ... A Printer 2203 Model A2 ... Two 2311 Disk Storage Drives Model 11 or 12 ... 2152 Printer-Keyboard ... 2415 Magnetic Tape Unit Models 1 - 6.

*Note -- If tape I/O or disk I/O or 2152 Printer-Keyboard is specified, a 2020 Processing Unit with 16,384 bytes of core storage will be required.

Model 20 PL/I -- A problem-oriented, high level language that provides the user with the means for programming commercial, scientific and engineering applications in the same language. Its facilities are far wider than RPG and it enables a better utilization of programmer resources than does the Assembler Language.

Model 20 PL/I is disk resident, requires a minimum of 16K bytes of core storage and consists of a compiler and a set of core-image library subroutines used at object-time. It operates under control of the DPS monitor, in either a single job or job stream environment.

Features

- Both commercial and scientific/engineering programs can be written in PL/I.
- Free form input.
- Sequential and indexed sequential disk file organization.
- Fixed or variable length, blocked or unblocked and undefined tape records.
- Fixed length, blocked or unblocked disk records.
- Disk and tape label checking and creation conform to System/360 standards.
- Record and Data Stream transmission capability.
- Inquiry using the 2152 Printer-Keyboard.
- Ability to process character strings, fixed and floating point data.
- Data structures up to 8 levels.
- Arrays up to 3 dimensions.
- Arrays of structures.
- Built-in functions such as: SQRT, DATE, SIN, COS.
- Static and automatic storage allocation.
- Comprehensive compiler diagnostics.
- Extensive debugging aids, such as printing the source statement number for an object-time error.

Minimum System Requirements

- For submodel 2, 5 or 6

For compilation: A 2020 Processing Unit Model D2, D5 or D6 with ... 2311 Disk Storage Drive Model 11 or 12, a Card Reader (2501, 2520, 2560), a Printer (2203, 1403), or a Punch (2520, 2560, 1442), if punching the object desk is required.

For execution: A 2020 Model D2, D5 or D6 Processing Unit with a 2311 Disk Storage Drive Model 11 or 12 and I/O devices as specified by the user.

- For submodel 4

For compilation: A 2020 Processing Unit Model D4 with ... a 2311 Disk Storage Drive Model 11 or 12, a 2560 Model A2, and a 2203 Model A2 Printer.

For execution: A 2020 Processing Unit Model D4 with a 2311 Disk Storage Drive Model 11 or 12 and I/O devices specified by the user.

Additional devices supported (depending on Submodel):

2020 Processing Unit Models DC5 and E5 ... up to 3 additional 2311 Disk Storage Drives ... 2415 Magnetic Tape Units (1 to 6 drives) (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) ... 2152 Printer-Keyboard ... one additional card reader ... one additional card punch.

ADDITIONAL PROGRAM MATERIAL

Program Logic Manuals

Card Programming Support (CPS)

Basic Utilities	GY24-9000
IOCS	GY24-9001
RPG	GY24-9002
Basic Assembler	GY24-9003
Punched Card Utilities	GY24-9004
CIOCS	GY24-9005
1419 IOCS	GY24-9006
UCS	GY26-3712

Tape Programming System (TPS)

IOCS for 1419	GY33-9009
I/O Control System	GY33-9003
Sort/Merge	GY33-9005
Utilities Programs	GY33-9006
Report Program Generator	GY33-9001
Assembler Language	GY33-9002
Basic Assembler	GY33-9004
Control and Service	GY33-9000
BSCA IOCS	GY33-8004
RJE	GY33-8006

Disk Programming System (DPS)

Assembler Language	GY33-9014
Control and Service Programs	GY33-9008
I/O Control System	GY33-9007
Report Program Generator	GY33-9015
Sort/Merge	GY33-9016
Utilities Programs	GY33-9017
IBM System/360 Model 20 Disk or Tape Programming -- System for the IBM 1419	GY33-9009
Tape Sort/Merge Program	GY33-9005
Tape Utilities Program	GY33-9006
IOCS For Binary Synch. Comm. Adapter	GY33-8004
PL/I Volume 1	GY33-9060
Volume 2	GY33-9061

Program Listings: Available on microfiche from the IBM Distribution Center, Publications Order Department, Mechanicsburg, Pennsylvania, in the following groups:

- Specify Group Code 4000 for S/360 Model 20 Card.
- 4100 for S/360 Model 20 Tape.
- 4200 for S/360 Model 20 Disk.

CPS

BASIC PROGRAM PACKAGE

The following documentation and machine readable are shipped with each Model 20 CPS program.

Documentation -- Program material list ... and (only) the SRLs appropriate to the program as indicated:

360T-AS-001, 100	Basic Assembler Language manual C26-3602, Operating procedure manual C26-3802.
AS-110	
360T-CQ-003	CIOCS manual C26-3606; Operating procedure manual C24-9004
360T-CQ-113	Remote Job Entry Work Station C33-4003.
360T-CQ-111	IOCS for BSCA C33-4001; IOCS for BSCA Operating Procedures C33-4002.
360T-IO-002	Input/Output Control System C26-3603; Operating procedure C26-3803.
360T-IO-029	IOCS for the 1419 manual C26-3607; Operating procedure C24-9008.
360T-LM-015	Starling Currency Processing Routines C26-3605.
360T-RG-010	RPG for Punched-Card Equipment C26-3600; Operating procedure C26-3800.
360T-UT-100,101	Punched-Card Utility C26-3601; Operating procedure.
360T-UT-102, 103, 104, 105, 107	Basic Utility, Functions and Operating procedure C26-3604.
360T-UT-108	Universal Character Set Utility, C26-3812.

Machine Readable -- Program and sample decks. Exceptions are further explained below.

360T-AS-110	Object code and sample problem.
360T-CQ-003	Program deck (Generator and library) and two sample decks (one for transmit and one for receive operations).
360T-IO-029	Program deck (Generator and library) and one sample deck.
360T-LM-015	Symbolic subroutines in lieu of program and sample deck.
360T-CQ-111	Object code (Generator and library) and two sample problems.

OPTIONAL PROGRAM PACKAGE

The following documentation and machine readable are shipped with each Model 20 CPS program if optional material is requested.

Documentation -- Optional program material list; attachments I, II and III.

Machine Readable -- Source code for all CPS (360T) programs, except 360T-LM-015, UT-104, UT-105 and UT-107, is contained on one 9-track DTR (800 or 1600 bpi).

TPS

BASIC PROGRAM PACKAGE

Documentation -- Program Material List ... Attachment I -- Operating Procedures C24-9009-3. Performance Estimates C24-9010-3, Basic Assembler Language C26-3602-4 and TNLs N33-8523, N33-8554, Basic Assembler/Tape Procedures C24-9011-1 and TNL N33-8553 Utility Programs C26-3808-3 and TNLs N33-8559, N33-8588 Control and Service Programs C24-9000-4, Report Program Generator C24-9001-4 and TNL N33-9052, Assembler Language C24-9002-4 Tape Sort/Merge Program C26-3804-2 and TNLs N33-8535, N33-8558, N33-8561, IOCS C24-9003-4, IOCS for 1419/1259 C33-6001-3 and TNL N33-9043, IOCS for Binary Synchronous Communications Adapter C33-4001-3.

Machine Readable -- Object code for following Tape Programming Systems Components (360U) are available on one functional volume. The bootstrap card has not been changed. (V=Version, M=Modification Level).

Basic Assembler (Tape) 4K	360U-AS-130
Tape-to-Tape Utility	UT-131
Tape-to-Card Utility	UT-132
Card-to-Tape Utility	UT-133
Tape-to-Printer Utility	UT-134
Initialize-Tape Utility	UT-135
Load System Tape	SL-142
Copy System Tape	SL-143
Directory Service	SL-144
Core-Image Maintenance	SL-145
Macro Maintenance	SL-146
Linkage Editor	SL-147
Report Program Generator	RG-148
Assembler	AS-149
Sort/Merge	SM-150
Input/Output and Basic Monitor	
Macro Definitions	IO-151
Input/Output	
Macro Definitions for the IBM 1419/1259 Magnetic Character readers	IO-152
Basic Assembler (Tape) 8K	AS-153
Input/Output Macro Definitions for the Binary Synchronous Communications Adapter	CQ-154
Core-Image Service	SL-155
Macro Service	SL-156
Card-Resident Control	CL-157
Initial Loader for Tape-Resident System	CL-158
Tape-Resident Control Programs	CL-159
Macro Definition for RJE	CQ-160

OPTIONAL PROGRAM PACKAGE

Documentation -- Optional Program Material List ... Attachment I.

Machine Readable -- Source code for all Tape Programming Systems Components (360U) is available on one (1) functional volume except I/O and Basic Monitor Macro Definitions, 360U-IO-151, the I/O Macro Definitions for the 1419 and 1259, 360U-IO-152, the I/O Macro Definitions for the Binary Synchronous Communications Adapter, 360U-CQ-154 and the Remote Job Entry Work Station Program, 360U-CQ-160.

DPS

BASIC PROGRAM PACKAGE

Documentation -- Basic Program Material List -- The following SRL Publications appropriate to the components ordered are shipped by PID with each initial DPS order.

SRL Publications -- DPS System Generation and Maintenance, GC33-6006-3 with TNLS GN33-9104, 9120; DPS Operating Procedures, GC33-6004-4 with TNLS GN33-9100, 9114; DPS Control and Service Programs, GC24-9006-5 with TNLS GN33-9098, 9118; DPS Disk Utility Programs GC26-3810-3 with TNLS GN33-9102, 9115; DPS and TPS Report Program Generator, GC24-9001-6 with TNLS GN33-9097, 9116; DPS and TPS Assembler Language, GC24-9002-5 with TNLS GN33-9096, 9121; DPS Disk Sort/Merge Program, GC26-3806-5 with TNL GN33-9099*, DPS Input/Output Control System, GC24-9007-6 with TNL GN33-9119.

If only the publications or if additional copies are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- The different systems are available on disk packs* or magnetic tapes**

System A (200 cylinder users only) -- contains object code of all the following components: To order specify program extension number OPTA.

System B (200 and/or 100 cylinder users) -- contains object code of all the following components except IOCS BSCA, RJE (IO-192,193, 202, CQ-201, 203): To order specify program extension number OPTB.

System C (200 and/or 100 cylinder users) -- contains object code of all the following components except PL/I (PL-207): To order specify program extension number OPTC.

Program Name	Program Number	V M
Disk Resident Control Programs	360W-CL-171	3/3
Load System Disk Program	SL-172	3/1
Library Allocation Organization Program	SL-173	4/2
Physical and Logical Unit Tables Service Program	SL-174	3/1
Core Image Maintenance Program	SL-175	6/2
Macro Maintenance Program	SL-176	3/4
Directory and Core Image Library Service Programs	SL-177	4/3
Disk Backup and Restore Program	SL-178	3/4
Linkage Editor Program	SL-179	3/1
Report Program Generator	RG-180	4/2
Assembler Program	AS-181	3/4
Disk Sort/Merge Program	SM-182	5/2
Initialize Disk Utility Program	UT-183	3/3
Alternate Track Assignment Utility Program	UT-184	3/0
Clear Disk Utility Program	UT-185	3/2
Disk-to-Disk Utility Program	UT-186	3/3
Disk-to-Tape Utility Program	UT-187	3/1
Tape-to-Disk Utility Program	UT-188	3/3
Disk-to-Card Utility Program	UT-189	3/1
Card-to-Disk Utility Program	UT-190	3/2
Disk-to-Printer Utility Program	UT-191	3/1
Input/Output and Monitor Macro Definitions	IO-192	3/4
Input/Output and Monitor Macro Definitions	IO-193	4/3
Tape Sort/Merge Program	SM-194	3/3
Tape-to-Tape Utility Program	UT-195	3/1
Tape-to-Card Utility Program	UT-196	3/2
Card-to-Tape Utility Program	UT-197	3/1
Tape-to-Printer Utility Program	UT-198	3/1
Initialize-Tape Utility Program	UT-199	3/1
Monitor Generator Macro Definitions	IO-200	2/4
Binary Synchronous Communications Adapter Macro Definitions	CQ-201	3/2
2152 Printer-Keyboard Macro Definitions	IO-202	2/1
I/O Macro Definitions for Remote Job Entry Work Station Program	CQ-203	1/2
Disk Dump Program	UT-204	1/2
Copy System Program	SL-205	1/2
Macro Library Service Program	SL-206	1/4
360 Model 20 DPS PL/I Compiler Program	PL-207	1/2

* - The 1316 Disk Pack returned from the program library contains a running system as well as sample decks in card-image format to be punched. It is accompanied by three disk IPL cards to be used for initializing the loading of the running system, which is referred to as the DPS disk pack.

** - Users with 2415 Magnetic Tape Units (or a like number of 2401 Magnetic Tape Units, Model 1, 2 or 4 in lieu of 2415s on the Submodel 5 only) attached should request the programs on tape. The tape contains the Backup and Restore Program (360W-SL-178) to be activated by one bootstrap card distributed with the tape. The Restore Program initializes the 1316 Disk Pack ... copies a running System as well as sample programs in card image format on 1316 Disk Pack ... punches the cards for initializing the loading of the Disk Programming System

OPTIONAL PROGRAM PACKAGE

Documentation -- Optional Program Material list and Attachment I.

Machine Readable -- Source code for all disk programming system components (360W except macros which can be obtained by using MSERV program with option SOURCE) is contained on two (2) functional volumes.

Option 1 - 360W-CL-171 to 360W-SM-182 and is specified by using program number extension OPT1.

Option 2 - 360W-UT-183 to 360W-UT-191 ... 360W-SM-194 to 360W-UT-199 ... 360W-UT-204 to 360W-PL-207 and is specified by using program number extension OPT2.

Optional program material is not available for the following: 360W-IO-192, IO-193, IO-200, CQ-201, IO-202, CQ-203.

CURRENT USERS:

Current users will receive a preprinted Program Order Form and a letter announcing the availability of the new release. The letter instructs them to order the new release through the branch office using the preprinted form.

Each user of record may order either a total replacement for his current DPS, or a maintenance package which is applied to his existing DPS. The detailed ordering instructions supplied to each user of record describe how one package or the other is explicitly requested.

Note: The maintenance package is available on a 1316 Disk Pack or one DTR for 9/800, 7DC/800, or 9/1600. The user should specify one of the medium codes on the preprinted program order form. The maintenance package will be available for 60 days from the date of this announcement. USER VOLUME REQUIRED IS 01 FOR 1316 DISK ONLY.

REFERENCE MATERIAL:

IBM S/360 Model 20 Guide to DPS, GC33-6000-3 with TNL GN33-9103 ...
IBM S/360 Model 20 PL/I User's Guide, GC33-6007-2 with TNL GN33-9095 ...
IBM S/360 Model 20 DPS Master Index, GC33-6008-1 ... IBM S/360 Model 20 IOCS for the BSCA, GC33-4001-4 ... S/360 Model 20 Performance Estimates, GC33-6003-3 with TNL GN33-9101.

PLMs -- IBM S/360 Model 20 Control and Service, GY33-9008-3 ... IBM S/360 Model 20 DPS Disk Sort/Merge, GY33-9016-1 with TNL GN33-9106 ...
IBM S/360 Model 20 DPS Disk Utilities, GY33-9017-0 ... IBM S/360 Model 20 DPS RPG, GY33-9015-2 ... IBM S/360 Model 20 DPS PL/I Volume 1, GY33-9060-0 with TNL GN33-9094.

General

IBM Type II application programs are described in this section. The descriptions are general and are not intended to be exhaustive. For more information, see the supporting Systems Reference Library (SRL) publications.

Program Identification

Each program is assigned a nine-character identification code. The first four digits identify the computer on which the program will run. The next two characters are a functional mnemonic describing the program class. The last three characters are a sequence number. That number is two digits plus an X, R, or L.

The System/360 four-digit identification code includes an alphabetic character which designates:

- 360A: All Type II Application Programs except Model 20
- 360V: System/360 Model 20 application programs

IBM application programs perform specific tasks, such as demand deposit, lens design, etc. Application programs are usually classified as industry-oriented or industry-independent programs. They are produced by both marketing and product divisions. Functional mnemonics for these programs are:

Industry-oriented Programs

Distribution

- DP: Publishing
- DR: Retail
- DW: Wholesale
- DX: Other

Finance

- FB: Banking
- FF: Finance Companies
- FI: Brokerage and Investment
- FX: Other

Federal Government

- GF: Government, Federal

Insurance

- IB: Blue Cross and Blue Shield
- IF: Fire and Casualty
- IL: Life
- IX: Other

Manufacturing

- MA: Aerospace
- MD: Drug, Food, Chemical Products
- ME: Electrical and Machinery
- MF: Fabrication and Primary Metals
- MP: Petroleum & Industrial Chem
- MR: Transportation Equipment
- MT: Textiles and Paper
- MX: Other

Service

- SC: Communication
- ST: Transportation
- SU: Utilities
- SX: Other

Universities and Government

- UC: Colleges and Universities
- UG: Government, State & Local
- UH: Hospital and Medical
- US: Secondary Schools
- UX: Other

Industry-independent Programs

Cross Industry Group

- CA: Statistical Applications
- CC: Process Control
- CM: Mathematical Applications
- CN: Numerical Control Applications
- CO: Operations Research
- CP: Critical Path Scheduling
- CR: Information Retrieval
- CS: Simulators
- CX: Other

Engineering

- EC: Civil Engineering
- EE: Electrical Engineering
- EH: Chemical Engineering
- EM: Mechanical Engineering
- EN: Nuclear Codes
- EO: Optics
- EX: Other

Exploratory

- XP: Mathematics and Applications

SMTD

- SE: System Marketing Techniques

Use of Index

The list of programs on the following pages is divided into six columns. The left-hand column lists the program name. The second column indicates the program number. The third column contains the recommended best reference for that particular program, component, or feature. The fourth column lists the current Version (V) and Modification (M). The fifth column indicates the date of latest change. If the modification number is zero, then no corrections have been issued since the announcement of the last version, in this case, the data given is the date of the last version. The sixth column shows the current programming service classification.

Availability Dates

Program availability dates appear throughout the programming section. These availability dates are defined as the dates on which the first program shipment can be made by PID.

When planning for an installation's needs you must consider: the time required to receive the availability notification ... the time for placing the order, which may include the shipping of volumes to PID ... PID processing time ... and the time for returning the processed volumes.

These steps should not be overlooked in scheduling the installation's use of a program.

Response Time

When planning and scheduling the receipt of a program consider these facts:

The normal turnaround time for a program order to be shipped to PID and the order received at the user location may be calculated from the following table:

Action	Time in Days
Order sent to PID	Average - 4 calendar days in transit
Order processed at PID	Average - 8 working days at PID
Order sent from PID	Average - 4 calendar days in transit

Thus, considering weekends, three weeks should be allowed for ordering Type II programs from PID.

Programming Services

The programs described in this section have one of three service classifications associated with them:

- A - Central and FE Programming Services
- B - Central Programming Service
- C - Local Programming services available at a charge

The Service Classification for Type II programs are on the following pages.

Withdrawn Program

Type II programs that are withdrawn from the program library will be retained with its documentation in archival storage. They may be identified by reference to the special supplement to the Catalog of Programs containing a list of these deleted programs (instructions were given to branch offices to keep this supplement for future reference).

If a customer requires these programs and documentation, submit the regular order form and a letter of request signed by your branch manager.

A base charge of \$100 plus reproduction and distribution fee will be billed to the customer.

Catalogs of Programs

Systems	Form Number
System/360 Model 25 and above	GC 10-1613
System/360 Model 20	GC20-1691
1130, 1800	GC20-1630
1240, 1401, 1420, 1440, 1460	GC20-1601
700 Series, 1410, 7000 Series	GC20-1602
1620/1710	GC20-1603

Program Name	Program Number/ Availability	Information	Status V M R	Date of Last Change	Programming Service Class.
<u>System/360 Application Programs</u>					
Data Conv & Label Proc Sub (TOC/DOS/OS)	360A-SE-23X	PA 360.6	2 6	1-14-69	C
Data Conversion Utility II (OS)	360A-SE-20X	PA 360.1	3 3	2-18-69	C
Decision Logic Translator (DOS)	360A-CX-32X	PA 360.30	1 1	2-14-69	C
Demand Deposit Accounting (DOS)	360A-PB-15X	PA 360.7	1 5	2-3-70	C
Document Processing System (OS)	360A-CX-12X	PA 360.24	1 3	1-29-70	C
FLOWCHART (DOS)	360A-SE-22X	PA 360.2	1 1	8-8-68	C
1400 Autocoder to COBOL Conv Aid	360A-SE-19X	PA 360.19	1 2	7-2-68	C
Numerical Control Processors					
AUTOSPOT (DOS)	360A-CN-08X	PA 360.9	2 4	6-3-70	B
AD-APT/AUTOSPOT (DOS)	360A-CN-09X	PA 360.9	2 5	6-25-71	B
Optimum Bond Bidding (DOS)	360A-FY-06X	PA 360.3	1 0	7-22-66	C
Problem Language Analyzer (PLAN) (DOS)	360A-CX-26X	PA 360.38	1 0	7-15-69	C
Product Structure Retrieval (DOS/DOS)	360A-ME-07X	PA 360.16	1 1	6-20-69	C
Program for Optical System Design/II (OS)	360A-EO-15X	PA 360.13	1 2	1-5-72	C
Remote Access Computing (BPS)	360A-CX-17X	PA 360.14	4 3	11-9-71	C
Student Scheduling					
Scheduler (DOS)	360A-US-07X	PA 360.5	1 0	5-11-66	C
Tally and Conflict Matrix (BPS/BOS)	360A-US-06X	PA 360.2	1 0	3-25-66	C
Synch Transmit-Receive Access Method (OS)	360A-SE-33X	PA 360.6	1 5	1-19-70	C
Text Processor					
COMPOSITION/360 (DOS)	360A-DP-08X	PA 360.20	2 1	3-34-72	C
Vehicle Scheduling (DOS)	360A-ST-06X	PA 360.22	1 1	6-17-69	C
<u>System/360 and System/370 Application Programs</u>					
Administrative Terminal System (OS)	360A-CX-19X	PA 360.18	1 2	2-10-72	B*
Administrative Terminal System (DOS)	360A-CX-18X	PA 360.22	1 3	6-15-70	B*
Advanced Life Information System (DOS)	360A-IL-09X	PA 360.16	1 4	6-15-70	B
Bill of Material Processor (DOS/DOS)	360A-ME-06X	PA 360.31	2 4	11-10-70	C
Coursewriter III	360A-UX-01X	PA 360.28	2 4	9-22-71	C
Inventory Control (DOS)	360A-MF-04X	PA 360.29	1 1	6-20-69	B
Linear Programming System (DOS)	360A-CO-18X	PA 360.8	1 0	3-28-69	C
Numerical Control Processors					
AD-APT/AUTOSPOT (OS)	360A-CN-12X	PA 360.9	1 3	11-24-71	B
APT (OS)	360A-CN-10X	PA 360.9	4 3	9-30-71	B
PLAN Graphic Support for 2250 (OS)	360A-CX-34X	PA 360.27	1 0	4-30-69	C
Problem Language Analyzer (PLAN) (OS)	360A-CX-27X	PA 360.26	1 1	2-19-70	B
Project Control System (DOS)	360A-CP-06X	PA 360.3	2 4	3-4-71	C
Property and Liability Info System (DOS)					
Basic	360A-IF-10X	PA 360.17	1 3	2-4-70	B
Automobile	360A-IF-11X	PA 360.17	1 3	2-4-70	B
Other Lines	360A-IF-13X	PA 360.17	1 3	2-4-70	B
Retail IMPACT System					
Fashion (OS)	360A-DR-04X	PA 360.4	1 1	6-26-68	C
Staple (OS)	360A-DR-05X	PA 360.4	1 0	1-2-69	C
Staple (DOS)	360A-DR-09X	PA 360.4	2 0	4-30-69	C
Fashion (DOS)	360A-DR-08X	PA 360.4	1 0	1-15-69	C
Requirements Planning (DOS)	360A-IF-05X	PA 360.12	1 0	12-20-68	D
Text Processor					
INTERACTION/360 (DOS)	360A-DP-07X	PA 360.21	1 1	4-8-69	C
Shared Hospital Accounting System (SHAS) (DOS)	360A-UH-11X	PA 360.25	2 1	5-26-70	B*
Wholesale IMPACT (DOS/BOS/OS)	360A-DW-05X	PA 360.8	2 2	2-4-70	C
<u>System/360 Model 20 Application Programs</u>					
Bill of Material Processor	360V-ME-08X	PA 360.102	1 1	10-8-70	C
Hospital Accounts Receivable	360V-UH-09X	PA 360.105	1 0	10-31-68	C
Hospital Patient Billing	360V-UH-16X	PA 360.103	1 0	12-16-68	C
Requirements Planning and Inventory Control	360V-MF-10X	PA 360.104	1 0	4-7-69	C
Wholesale IMPACT	360V-DW-06X	PA 360.102	1 1	9-29-70	C

* Effective March 15, 1974 will be changed to "C".

Program Name	Program Number/ Availability	Information	Status			Date of Last Change	Programming Service Classification
			V	M	R		
<u>1130 Computing System</u>							
<u>Application Programs</u>							
Automated Chemistry Programs	1130-UH-13X	PA 1130.1	2	0		6-16-69	C
Commercial Subroutine Package	1130-SE-25X	PA 1130.9	3	1		10-11-68	C
Control Optimization	1800-CC-01X	PA 1800.1	2	0		6-6-69	C
Data Presentation System	1130-CX-14X	PA 1130.12	2	1		11-8-71	C
Mechanism Design System Springs and Gears	1130-EM-01X	PA 1130.3	2	0		6-16-69	C
Model 2 Civil Engineering Coordinate Geometry (COGO)	1130-EC-02X	PA 1130.9	1	3		9-24-68	C
Numerical Surface Techniques to Contour Map Plotting	1130-CX-11X	PA 1130.2	2	0		4-30-69	C
Petroleum and Engineering							
Economic Eval. Petroleum Projects	1130-MP-01X	PA 1130.11	2	0		4-30-69	C
Decline Curve Analysis	1130-MP-03X	PA 1130.3					
Schilthuis Material Balance	1130-MP-05X	PA 1130.4					
Two-Dimen. Water Flooding	1130-MP-06X	PA 1130.4					
Gas Deliverability	1130-MP-07X	PA 1130.5					
Multi-Stage Flash Calculation	1130-MP-08X	PA 1130.5					
Velocity Functions from Time-Depth Data	1130-MP-09X	PA 1130.6					
Wave-Front Ray-Path Determination	1130-MP-10X	PA 1130.6					
Synthetic Seismogram	1130-MP-11X	PA 1130.6					
Gravity and Magnetic Continuations							
Derivatives Residuals	1130-MP-12X	PA 1130.7					
Theoretical Gravity of a 3-D Mass	1130-MP-13X	PA 1130.7					
Quantitative Log Analysis	1130-MP-14X	PA 1130.8					
Dipmeter	1130-MP-15X	PA 1130.8					
Problem Language Analyzer (PLAN)	1130-CX-25X	PA 1130.11	1	2		11-8-71	C
Rigid Frame Selection Program (RFSP)	1130-EC-09X	PA 1130.1	1	1		6-24-69	C
Scientific Subroutine Package	1130-CM-02X	PA 1130.9	1	2		12-19-68	C
Statistical System	1130-CA-06X	PA 1130.10	1	1		11-15-68	C
STRESS	1130-EC-03X	PA 1130.2	2	2		9-24-70	C
Type Composition	1130-DP-04X	PA 1130.10	1	2		11-15-67	C
Type Composition 8-Channel Paper Tape	1130-DP-06X	PA 1130.11	1	1		9-27-67	C
<u>1800 Programming System</u>							
<u>Application Programs</u>							
Traffic Control	1800-UG-06X	PA 1800.1	2	0		3-29-68	C
Control Optimization	1800-CC-01X	PA 1800.1	2	0		6-6-69	C
PROSPRO	1800-CC-02X	PA 1800.2	1	2		8-16-68	C
Key-Word-in-Context KWIC	1401-CR-02X	Catalog	2	1		6-9-65	C
Bank Sort	1401-FB-06X		1	1		12-4-63	C
Bond Trade Analysis for a Bank	1401-FB-09X	of	1	5		8-16-66	C
1401 Portfolio Selection	1401-FI-04X		1	1		5-19-65	C
1962 CFO (Consolidated Functions Ordinary)	1401-IL-01X	Programs	2	1		6-1-66	C
62 CFO	1401-IL-02X		1	18		5-27-69	C
Valuation Programs	1401-IL-03X		1	13		5-1-68	C
Documentation Aids System (for S/360)	1401-SE-12X		2	0		3-4-66	C
Mortgage Loan Accounting for 1440 & 1450	1440-FB-04X		1	6		5-2-66	C
Electronic Circuit Analysis	1620-EE-02X		1	0		6-8-65	C

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Data Conversion Utility II: Provides an effective and flexible capability for customers to convert their current IBM system data files to System/360 data sets under control of

OS/360. (360A-SE-20X)

Designed as a general-purpose program, it will accept as input data sets in the format used with the IBM 705/1410/7010 and 7000 series systems. System/360 data sets are also accepted as input as indicated below. The program produces as output the data format desired for System/360 tape or DASD. The program has data transformation capability that allows the user flexibility in "resystematizing" his data sets for System/360.

The Data Conversion Utility II Program accommodates the three general considerations in data conversions:

1. The physical characteristics of the I/O device (i. e., 7-track tape format).
2. Current IBM Programming Systems standards (i. e., labels, padding characters, checkpoint records).
3. Optimization of data representation (i. e., floating point, binary, packed decimal).

Description: Data Conversion Utility II is a set of special-purpose macros, subroutines, and modules. These may be combined in a large variety of ways to create a specific data conversion program that meets the exact requirements of the user's data set to be converted from current IBM system formats to System/360 formats.

There are two steps involved in using Data Conversion Utility II --

1. Creating a specific Data Conversion Utility II program.
2. Executing this specific Data Conversion Utility II program.

To perform the first step, the user creates a Data Conversion Utility II controller by combining in assembly language --

1. Three controller macros.
2. Data move/transform macros as required to perform field transformations.
3. Test macros as required for record selection, etc.
4. A common table macro that provides specific information about the input and output files that cannot be furnished via the DD card, such as 7070/7074 Form 3 records 35 words or less in size, etc.
5. User code as required.

The controller is combined with an input module and an output module by use of the linkage editor to create the unique Data Conversion Utility II program.

The second step is performed by executing the utility program created in Step One. This is done by providing the IBM Operating System/360 with the necessary job control cards and the data set to be converted.

During program execution, Operating System/360 can make use of a set of modules provided with this program to simplify processing of current IBM system standard labels on input tapes, which are considered non-standard by System/360. In addition, linkage is provided to user-written header and trailer label modules if processing of current IBM system non-standard labels is required. These label checking modules also provide linkage for user-written label checking modules.

Input Module: For a particular data conversion run, the input module that is best suited to process the input data file is selected from --

Card Data File Input - These modules read data cards on an 80/80 basis. They are intended to assist in converting card data files, such as tab files, to System/360 tape or DASD data sets. There are two card input modules: one is provided to process Hollerith/EBCDIC cards, and the other handles column binary card input.

705/1410/7010/7080 BCD Variable-Length Tape Record Input - Three types of modules are provided to GET even-parity BCD variable-length records written on 7- or 9-track tape. The first type locates blocked or unblocked logical records whose length is established by terminal record marks. The second locates blocked or unblocked logical records of the size specified by a BCD length counter within the logical record. The third will locate an unblocked logical record where the record requires neither a terminal record mark nor a BCD length counter. All module types will bypass applicable checkpoint records.

BCD Fixed-Length Tape Record Input - This module will GET even-parity BCD fixed-length records written on 7- or 9-track tape. Interspersed checkpoint records or segment mark records will be deleted. The input tape may be zero-suppressed or non-zero-suppressed.

Mixed Mode Tape Record Input - This module will GET all binary or intermixed even parity BCD records and odd parity binary records. Records may be either variable-length unblocked or fixed-length blocked or unblocked.

Sequential System/360 Tape/DASD Record Input - This module will GET records from any System/360 sequential data set. Records may be either fixed or variable, blocked or unblocked.

Output Modules:

System/360 Sequential Tape/DASD Output - Fixed or variable-length, blocked or unblocked logical records can be created on System/360 tape or DASD with this module. The data records may then be processed sequentially by the application program.

System/360 Direct Access DASD Output - Fixed or variable-length unblocked records can be created on System/360 DASD with this module. The BDAM method is used to write the records; therefore, if blocking of records is to be done, the user has to set up the blocked physical record before calling the Direct Access Output module.

System/360 Indexed Sequential DASD Output - Fixed-length, blocked or unblocked logical records can be created on System/360 DASD with this module. The records can then be retrieved sequentially or directly.

Features: Provides the IBM System/360 users with a facility to reduce substantially the difficulties, time, and costs of performing the required data conversions ... allows greater flexibility for scheduling user manpower in new application areas where potential savings may be made; more of the manpower can be concentrated on the solution to the application problem, rather than the nature of the data ... encourages the user to write his IBM System/360 application programs using record organization and data formats which are optimum for the IBM System/360 ... encompasses the requirements of current IBM system users, regardless of the machine size and configuration ... provides comparable data conversion facilities to users, regardless of the IBM System/360 language used ... is designed to allow the user to tailor the program to his individual requirements through modular program organization and the data move/transform and test macros.

Use: The program can be used for the permanent conversion of current IBM system data sets into System/360 sets and can also be used to obtain "live" text data from current IBM systems for use in testing System/360 application programs. Since input data may be on 7- or 9-track tape, customers whose initial conversion to System/360 is planned around emulation will be able to use the Data Conversion Utility II Program to convert their even parity BCD 9-track emulator data sets when they convert their programs to System/360.

Customer Responsibilities: The object decks and the macro definitions which make up part of the Data Conversion Utility II package must be cataloged in a link library and the macro library respectively. Users of Version 2 must delete the old Data Conversion Utility II macros before cataloging the new macros. The NSL modules must be cataloged in the SYS1.SVCLIB library. The user then writes the necessary Data Conversion Utility II macro statements (and user routines if required) to specify the desired data conversion program. The user also has to specify in the linkage editor run which input and output modules to include.

Programming Systems: The program is written in the IBM Operating System/360 Assembler Language as described in C28-6514. It is designed to run under control of the IBM Operating System/360, and uses the Operating System/360 Input/Output capability.

Machine Configuration: A System/360 Model 30 or above with Decimal Arithmetic. Storage requirements are dependent on the size of the OS/360 supervisor used, the Data Conversion Utility modules selected, the maximum input physical record size, the maximum output physical record size, the maximum work area size (required for 7070 input module), the area used for the requested move/transformations (instructions, conversion subroutines, subroutine linkages, constants and literals), and user routines.

The OS/360 requirements for system operation and program assembly must be utilized to create a specific data conversion utility program.

For executing the created utility, the devices of OS/360 system operation are required; in addition, the following input/output devices may be used:

1. 2400 series tape drive(s) for the input data set
2. 2540/2501 for data card input
3. DASD for input of S/360 Sequential Data Set
4. 2400 series tape drive(s) for the output data set
5. DASD for the output data set

Note: The 2400 series tape drives can be 9-track, unless they interface with 729 tape drives, in which case the 7-track Read/Write Head feature and a 7-track Compatibility feature are required.

Basic Program Material: Documentation -- Programmer's Manual (H20-0313-1) ... Operator's Manual (H20-0314-1) ... Application Director. If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- Object cards, macro definition cards, source cards, and sample problems may be obtained on one 9-track or 7-track DTR (Data Conversion feature required). Indicate whether 9-track or 7-track is required. If not specified, 9-track DTR will be forwarded. DTRs will be supplied by PID; no tape submittal is required.

Optional Program Material: One 9-track or 7-track (Data Conversion feature required) tape containing assembly listings. (When ordering optional material, submit one 2400' reel of magnetic tape to PID.)

Reference Material: Application Description (H20-0194-1) ... Systems Manual (Y20-0067).

FLOWCHART: A program for generating printed program flowcharts from statements written in a specially designed input language. Only a general understanding of flowcharting is needed by the user of this program. It can be used readily by non-programmers as well as programmers. The input language is easy to learn, simple to use, and will describe flowcharts for any system. (360A-SE-22X)

Advantages: System/360 FLOWCHART will help you and your customers by -- providing an easy-to-use method of producing flowcharts ... reducing total program effort by minimizing the time required for producing and maintaining necessary program documentation ... facilitating program maintenance in a dynamic environment by providing a cross-reference listing which gives all references to a block shape ... providing wide flexibility for drawing flowcharts to specific user requirements ... providing flowchart uniformity.

Although the input language has been simplified considerably and is entirely different, the output format is similar to the 7070/74 Autochart program.

Description: The program uses data processing methods to facilitate the production of program flowcharts and certain other graphic information. The user prepares the original input in System/360 FLOWCHART language. This language is very simple and is machine independent. It can be used to prepare flowcharts for any system. The computer processes this input to produce a file of charts on the 1403 Printer.

If a flowchart is to be produced, it will: describe the type of blocks, symbolically direct non-sequential flow, and supply any other information desired, such as labels, exit conditions, text within blocks, etc. The language can also be used to describe lines other than flowlines and any other textual information.

The flowchart pages, each of which can have up to 50 blocks, are planned automatically by System/360 FLOWCHART. Flowlines are drawn where possible, and where they cannot be drawn, connectors are generated.

All block shapes used in System/360 FLOWCHART are combinations of printer characters to approximate conventional flowchart symbols. An option is provided so that either the Autochart Symbols or the Flowchart Symbols for Information Processing (X3.5-1966) as approved by the United States of America Standards Institute on June 8, 1966 may be specified.

There are six basic operator types for input; one is required for every statement. They are:

1. Headings, used to generate new headings and page numbers.
2. Block-shape operators to designate the type of block desired.
3. Branching or flowline control, to designate conditions and symbolic line destinations when the flow is non-sequential.
4. Spacing, used to skip blocks or columns or eject a page.
5. Comment and Draw operators to add comments and lines.
6. End of Job operator, which is required.

Use: System/360 FLOWCHART is multi-phase program; the output of each phase becomes input to a later phase. The input can be cards or tape in card-image format. The final output will be printed charts or charts on tape. In addition to the machine-generated flowcharts, the output will include:

1. A diagnostic listing of the analyzed source decks.
2. A Label Table listing.
3. A Cross-Reference listing.
4. Various error reports
 - a. Blank labels
 - b. Undefined labels
 - c. DRAW errors
 - d. COMMENT errors

Features: Ease in preparation of input data which may be in free or fixed format ... automatic page planning facilities ... direction of branch flowlines by symbolic reference ... striping any block to indicate subroutines ... automatic footnoting of overflow block text ... up to three lines (of 120 characters each) of header information ... automatic or user designated pagination of printed charts ... automatic dating of charts ... sequenced label table listing ... cross-reference listing ... diagnostic listing of input with error flags ... high quality output with powerful line searching abilities ... on and off-page connectors generated automatically ... automatic branch table generation ... reduced key punching requirements ... easy flowchart modification ... autochart symbols or the Flowchart Symbols for Information Processing (X3.5-1966) as approved by the United States of America Standards Institute can be specified ... unrestricted placement of lines or comments at any location.

Programming Systems: The program will operate in conjunction with the IBM Disk Operating System/360 (DOS/360) and is used to produce flowcharts. The source language is DOS/360 Assembly language and uses the EBCDIC character set.

Minimum System Requirements: System/360 Model E30 (32K) with standard instruction set ... two 2311 Disk Storage Drives (one for systems residence and one for work file) ... one 2540 Card Read Punch ... one 1052 Printer-Keyboard ... one 1403 Printer with 132 Print positions using the PN or QN chain arrangement (PL/I).

[Note: If a PN or QN chain is not available, the following delimiter characters may either not print or else print as different characters: Percent (%), colon (:), semi-colon (;) and number sign (#).]

Optional Devices: One 2400 series tape drive for System/360 FLOWCHART language input; one 2400 series tape drive for output.

Basic Program Material: Documentation -- Application Directory, Users Manual H20-0293, and Operator's Manual H20-0294.

If only the form numbered manuals (basic documentation) supporting this program are required, they should be ordered through the normal publication distribution channels and not from PID.

Machine Readable -- Consisting of object modules, sample catalog control cards, job control cards, and sample problem cards may be obtained in card form or on one 9-track or 7-track (Data Conversion feature required) DTR.

If not specified, a 9-track DTR will be forwarded. The DTR will be supplied by PID; no tape submittal is required.

Optional Program Material: Documentation -- Systems Manual Y20-0062

Machine Readable -- Source cards, assembly listings and flowcharts may be ordered on one 9- or 7-track (Data Conversion feature required) tape -- one 800 bpi 2400' reel of tape must be submitted to PID for this material -- or one 9-track DTR (1600 bpi).

Reference Material: Application Description (GH20-0199).

The Tally and Conflict Matrix: Used to furnish the school Administrator with data pertinent to master schedule creation. (360A-US-06X)

Description: The program accumulates the number of student requests for each course offered in the school curriculum. Two options are provided -- Course totals by male-female breakdown only ... Course totals by male-female breakdown and by grade. A maximum of 500 courses may be tallied in any one run.

The Conflict Matrix Program points out potential scheduling conflicts. It counts all paired combinations of student requests for courses and displays these counts in Matrix reports. Two options are provided -- A Conflict Matrix ... A Conflict Matrix with identification of the students who have the potential conflicts entered into the Matrix.

A student's identification is printed only with those requested courses that are Matrix entries.

A maximum of 250 courses may be entered into the Matrix.

Features: One-pass runs for both Tally and Conflict Matrix ... variable length grade titles (one to four characters, alphanumeric) ... variable length course codes (three to six characters, alphanumeric) ... packing of course codes on student request cards ... blank course code fields acceptable ... common course card addition of up to 10 course requests to requests made in normal fashion ... specification and checking of maximum number of requests allowed per student ... continued later usage of master schedule cards used for Conflict Matrix input ... input sequence not disturbed by errors -- no stacker selection ... a maximum of 40 course requests allowed per student.

Use: Both the Tally and the Conflict Matrix Programs are used to furnish data a school organization needs to create the best possible master schedule of course and section offerings. The programs are employed prior to the use of the Scheduler Program of Student Scheduling System/360.

Customer Responsibilities: Select the courses to be offered in the curriculum ... develop student request and master schedule files ... from Tally output, determine those courses to be run with the Conflict Matrix.

Programming Systems: The Assembler Language with Input/Output Macros (8K Disk) is used (360B-AS-309). Both programs can run under control of the Basic Operating System/360, 8K Disk, or under the System/360 Basic Programming Support.

Minimum System Requirements: A 2030 Processing Unit, Model F with Decimal Arithmetic (#3237) ... 1051 Attachment (#7915) ... 1051 Control Unit Model N1, CPU Attachment (#3130), First Punch Attachment (#4410), First Reader Attachment (#4411) ... 1052 Printer-Keyboard Model 6 ... 2821 Control Unit Model 1 ... 1403 Printer Model 2 ... 2540 Card Read Punch Model 1.

The Tally Program will run in 32K, provided that the Supervisor being used does not exceed 5,200 bytes, and the Conflict Matrix Programs may be easily modified by the user to run in 32K with a reduce course capacity in the Matrix.

Basic Program Material: Documentation -- Application Description, H20-0202 ... Technical Newsletter, N20-0059 ... User's Manual, H20-0220 ... Application Directory ... System Manual.

Machine Readable -- Object Card Decks and Sample Problem Decks.†

Optional Program Material: Machine Readable -- Source Card Decks.†

† Customers may elect to receive the programs in card-image form on either 7- or 9-track Distribution Tape Reels (DTR), instead of cards. The user will receive 9-track DTR unless he requests a 7-track DTR. Both are written at 800 bpi.

The user who orders 7- or 9-track DTR tape from PID will require one 2400 series tape unit, with its associated control unit. The data conversion feature is required, if 7-track tape is to be used.

The DTRs are solely for the purpose of punching out the required program decks. A tape unit is not required for system operation. DTRs will be supplied by PID -- no tape submittal is required.

Optimum Bond Bidding: The program has been designed for bond underwriters to assist them in determining the coupon schedule and associated values for a bid on a new bond issue. A mathematical procedure is used which develops an optimal set of coupon rates. The optimization procedure minimizes the net interest cost or effective rate, whichever is applicable, while remaining within the constraints established by the issuer and the constraints established by the underwriter. The program is flexible in that a number of options are provided which aid the user in obtaining bidding information for issues with various characteristics. (360A-FI-06X)

Description: New municipal bond issues, usually serial in nature, are normally offered for competitive bidding. The issue is, therefore, awarded to the underwriter whose bid results in the lowest cost to the municipality. Other types of bond issues, such as corporate or foreign issues, may be either offered for competitive bidding or negotiated for private placement. Regardless of the nature of the issue or the method of placement, the Optimum Bond Bidding Program will prove to be a valuable aid. To bid for a serial bond issue, it is necessary for the user to decide upon a yield for bonds of each maturity, a spread which covers the expense and profit of the underwriter, and a range of coupon rates acceptable for each maturity. The program then constructs a set of figures which satisfies all constraints of the issue and which sets a coupon rate for each maturity so that a relatively low net interest cost or effective rate, whichever is applicable, is obtained. The Optimum Bond Bidding Program replaces the manual methods commonly used to obtain bid figures for a serial bond issue. The program utilizes a mathematical procedure to develop an optimal set of coupon rates which minimize either the net interest cost or the effective rate depending upon the basis for the award of the issue. Many possible combinations of constraints can be quickly and accurately analyzed by the use of the Optimum Bond Bidding Program prior to submitting a bid.

Features: OPTIMIZE a bid for a serial bond issue on the basis of net interest cost ... OPTIMIZE a bid for a serial bond issue on the basis of effective rate ... OPTIMIZE two possible bids without premium to produce spreads in juxtaposition above and below the desired spread ... OPTIMIZE all possible net interest cost bids without premium which produce spreads within a range of acceptable spreads ... OPTIMIZE a bid predicated upon a desired bid price other than par; this permits a controlled premium or discount on the issue ... OPTIMIZE a bid while using only authorized coupon multiples ... OPTIMIZE or EVALUATE a bid, taking into consideration stated call provisions in the computation of the selling price of the bond ... OPTIMIZE or EVALUATE an issue with bonds maturing at either six month or twelve month intervals ... EVALUATE either a serial or term bond issue to determine spread ... EVALUATE either a serial or term bond issue to determine bid price ... both the optimization and evaluation procedures adjust for an irregular first interest payment period ... both the optimization and evaluation procedures base the selling price on delivery date rather than on issue date ... control of the desired spread may be achieved in the optimization mode; a single bid may be generated to produce an exact spread, or, multiple bids may be generated to produce spreads for stated intervals within a range of acceptable spreads; for example, if the range of acceptable spreads is from \$1.00 to \$1.50 per \$100 of par value and the stated interval is 10¢, six separate bids would be generated; the first bid would produce a spread of \$1.00, the second \$1.10, and so on in 10¢ intervals to \$1.50; it is to be noted that when an exact spread is produced, a premium will frequently occur ... coupon structure limitations are checked automatically and any violation is reported in a warning message; the limitations are maximum coupon rate, maximum number of different rates, maximum number of times rate may change, and maximum range between high and low rate ... the effective or "Canadian" rate of interest to the issuer is computed for each bid ... accrued interest per day on the entire issue is computed for each bid05 EQUALS is computed on the basis of the actual amount production decreases when each yield is increased .05% ... the weighted average yield and the weighted average maturity of the entire bond issue are computed ... control and descriptive information is printed at the top of each output page ... a complete listing of input is printed, if desired; this listing includes a schedule of bond year values ... complete data is provided for each maturity on an output report ... abbreviated output reports may be obtained if desired ... all essential information concerning the bid is summarized at the bottom of each report ... an interest and principal payment schedule is printed, if desired. This cash-flow report will be of particular value in the calculation of bids requiring level-debt service; annual totals may be generated on either a calendar year or fiscal year basis.

Use: Basic data concerning the bond offering are transcribed from an information sheet describing the issue onto a worksheet. Then, the analyst decides upon a yield for bonds of each maturity, a spread or margin which covers the expense and profit of the underwriter, and a range of coupon rates acceptable for each maturity. After these decisions have been made, this data is indicated on the worksheet. Input cards are then punched from the data on the worksheet and entered into the computer. The program then produces the desired reports.

Programming Systems: IBM Basic Operating System/360 (8K Disk) is required. Assembly - Assembler with Input/Output Macros (8K Disk) (360B-AS-309), Monitor System - Control Program (8K Disk) (360B-CL-302); Consecutive Processing Macros (360B-IO-303); ISF MS Macros (360B-IO-304); Utility Programs (8K Disk), Card to Disk, Clear Disk, (360B-UT-300).

Minimum System Requirements: 32K System/360 Central Processing Unit with Decimal Instruction Set, Printer (any of those available with 120 or more print positions), Card Reader/Punch (any of those available), Direct Access Storage (one 2311 Disk Storage Drive), and Console Typewriter for Operator/Program Communication (optional).

Program Material: Basic Program Material: Application Directory, Users Manual (E20-0228), object decks and a sample problem deck. The object decks and sample problem can be ordered on 9-track DTR, 7-track DTR, or in card form. Optional Program Material: Source decks on either 9-track or 7-track DTR, and Systems Manual. 9- and 7-track DTRs are written at 800 bpi. The Data Conversion

feature is required if 7-track DTR is used.

Reference Material: Information about the System/360, the assembly language, the operating system, and the utility programs, may be found in: IBM System/360 Principles of Operation, A22-6821; IBM Basic Operating System/360, Assembler with Input/Output Macros (8K Disk), C24-3361; IBM Basic Operating System/360, Programmers Guide (8K Disk), C24-3372; IBM Basic Operating System/360 and IBM System/360 Basic Programming Support, Macro Definition Language (8K Disk/Tape), C24-3364; IBM Basic Operating System/360, Utility Programs, C24-3409.

Operating Instructions for the Basic Operating System, the Assembler, and the Utility Programs may be found in: IBM Basic Operating System/360, Operating Guide, Control Programs and Assembler (8K Disk), C24-3450; IBM Basic Operating System/360, Operating Guide, Utility Programs, C24-3455.

Project Control System: This program provides the advanced tools needed by management to fulfill its responsibilities in the planning, supervising and controlling of project-oriented work by providing extensive capability in the following operations or techniques: (1) Planning ... (2) Scheduling ... (3) Report Preparation. While it provides some capability for resource allocation and cost estimating, PCS/360 does not directly cover these techniques. (360A-CP-06X)

For critical path networks, PCS/360 will process 5,000 activities either in the form of precedence lists or in PERT/CPM notation. Its design permits a very simple approach to networking, but also offers many of the sophisticated features normally found only in programs designed for larger configurations.

Use: The use of PCS/360 is in the areas of government and industry concerned with construction or maintenance. The needs in these areas determine the title and format of the field report and the format of the various input cards. However, intensive investigation has revealed that there are no essential differences among the needs of all critical path users. For this reason, PCS/360 can provide critical path capability for a broad range of DOS/360 users, regardless of industry.

Sample Applications are:

Manufacturing and Distribution Industries -- network techniques have been used to schedule construction operations, aerospace research and development projects, the use of mining equipment, crude petroleum manufacturing, natural gas operations, construction, repair and maintenance, pulp mill operations, paper and paperboard manufacturing, book preparation and printing and blast furnace maintenance.

Science Industries -- network techniques have been used to schedule applied research projects and computer program development.

Service Industries -- network techniques have been used to schedule power plant operations, bank clearing-house operations, dividend check distribution and insurance report preparation.

GEM Accounts -- network techniques have been used for internal management control as well as for contractor control, test production of biological products, experimentation with drugs, and university and college curricula and facilities usage.

Transportation Industry -- network techniques have been used to schedule freight forwarding operations, terminal and service facilities, and the repair and maintenance of equipment.

In addition, these project control techniques are extensively used for controlling the design and implementation of data processing systems in virtually all industries.

Features: Ability to store and retrieve up to 52 networks on disk ... a significant throughput improvement in network generation, milestone processing, updating and report printing ... hours per work day specified by the user ... less disk space required for processing ... milestones can be tied to both the start and finish of a work item ... automatic updating of current duration for in-progress work items when no progress is reported in current run ... suppression of printing of zero duration work items on selected reports ... option to remove actual data from files ... addition of Type IV and V schedule dates to permit more extensive float analysis ... 5,000 work items (or PERT/CPM activities) ... 12,500 precedence relationships ... each precedence relationship can be lagged ... the number of days in the work week can be specified for each item ... for in-progress work items, progress can be reported as a percent completion, or as a number of work days remaining ... scheduled and actual dates can be assigned to both the beginning and end of each work item ... arbitrary non-work days can be incorporated into the calendar ... basic resource scheduling and cost summarization capability is provided ... tabular and graphic reports are available.

Customer Responsibilities: Current users of critical path programs will have to prepare new data cards to use the IBM Project Control System/360. However, data cards for use by PCS/1130 are directly usable. Networks generated under Version I will have to be regenerated under Version II.

All users should learn the particular features of this system before attempting to use it for actual project control. New users will have to learn the fundamentals of the critical path techniques before they can prepare input.

DOS/360 Version 3 must be used to properly implement PCS/360. When running PCS/360 on a 32K machine, a 6K DOS supervisor must be used.

Programming System: The program is written in a combination of FORTRAN and Assembler Language to operate under the Disk Operating System. While the program is designed to meet the needs of most users without modification, it is recognized that special individual requirements do arise. Therefore, the elements of the program written in FORTRAN are those that the user is most likely to modify to suit his application.

Minimum Machine Configuration: A 32K S/360 (E) Processing Unit with Floating Point (#4427), a 1052 Console, a card read/punch, a printer, and two 2311 Disk Storage Drives.

Basic Program Material:

Publications -- Application Directory ... Program Description and Operations Manual (H20-0376-1). If only the form numbered manual is required, order from the IBM Distribution Center, Mechanicsburg -- not PID.

Machine Readable* -- Relocatable object program modules and sample problem including sample job control statements are available on one Distribution Tape Reel (DTR) either 9-track (800 or 1600 bpi) or 7-track (800 cpi, Data Conversion feature required) or on one 1316 Disk Pack.

Optional Program Material:

Source statements are available on one 9-track DTR (800 or 1600 bpi) or one 7-track 2400' MT (800 cpi), Data Conversion feature required.

Ordering Procedure:

*If the distribution medium is not specified on the back of the program order card, 9-track at 800 bpi will be forwarded.

DTRs are provided by PID; no tape submittal is required.

Magnetic Tape (2400') may be forwarded or ordered (the program order card should accompany the tape order form); disk packs must be forwarded to PID with the program order card.

Additional Program Support Material: Application Description (H20-0222) ... System Manual and microfiche program listings (availability and number will be announced in a Publication Release Letter).

†Supports S/370 configurations also.

Features -- A comprehensive Control Subsystem which provides for automatic reorder of forecasted items and items with ordering parameters specified by store personnel ... purchase order creation ... vendor lead time control by signaling irregular lead time ... generalized transactions which allow for file updating for a group of items with only one input transaction for size, color, style, store and/or department ... source records available for additional reports ... continual system monitoring of service level, inventory investment and sales ... store performance report for each department.

An advanced Forecasting System which employs adaptive forecasting, probability and statistical analysis for determining trends and seasonal behavior, editing "bad" data, and handling high and low volume items ... initial forecasting "models" developed automatically from sales history, buyer estimates, or by adapting models taken from similar items ... automatic adjustment of forecasting models, weighted according to currentness of data ... signaling of significant variation in item sales patterns ... scientifically determined decision rules based on forecasted sales, desired level of service, pack size, etc. ... forecast model by item, or by group of items.

An advanced Simulation Subsystem which determines the effects of alternative management policies -- before and after installation ... the ability to anticipate the inventory status at specified intervals during the year, number and value of purchase orders placed, and expected level of service ... analysis of vendor lead times including averages, deviations, correlations with quantity ordered and season.

Fashion System:

Description -- This system uses probability science to help the buyer respond quickly to styles performing significantly above or below other similar styles, based on their profitability. The maintenance of complete records at the style level eliminates tedious and sometimes inaccurate updating of manual records. Appropriate documentation and interfaces are provided for the user who wishes to maintain size and color detail. The combination of exception reporting and automatic maintenance of style records reduces the amount of clerical effort on the part of the buyer and his staff and enables them to achieve optimum results by concentrating on the creative aspects of fashion merchandising.

Features -- Automatic recommendations for reorder, return, markdown, and transfers based on sophisticated statistical techniques which accurately analyze the potential of a style early in its life ... the basic yardsticks used for making recommendations are dynamic class (or group) standards, based on profitability (which reflects the interaction of turnover and markup) to respond to the overall seasonal changes ... automatic maintenance of files to replace manual records at the style level ... status inquiry at buyer request (vendor status, etc.) ... various merchandise management reports can be created from the style master records (aging, stock status, etc.).

Use: These systems are designed to initialize and operate a complete department. The library programs do both the initializing and regular operation. The user does not have to write any programs to use the systems. However, the user may desire to modify the operational programs in the Staple Control Subsystem and Fashion reporting areas and will probably write additional programs to extend the reports produced by the system.

Additionally the user may wish to employ the Forecasting Subsystem to aid in developing seasonal forecasts as inputs to the planning process at the department and class level. Appropriate documentation and interfaces to the Forecasting Subsystem are provided.

Customer Responsibilities:

1. **Program Requirements --** In general, the Staple and Fashion Systems are complete systems. However, since some users may have unique requirements in the way of significant transactions or reports, etc., some minor additions to the Retail IMPACT programs may be necessary. The following represent areas where user-generated programs may be required.

Changes to existing outputs of Retail IMPACT -- as an example, a basic purchase order is provided as part of the Staple System. If the user desires his own purchase order format, a program must be provided by the user to print in his format from the files that contain the Retail IMPACT purchase order information.

Additional merchandise management reports -- the user may wish to produce merchandise management reports beyond the basic reports provided by the Staple and Fashion Systems. The use of report generation techniques make the production of many additional reports feasible.

Any modification to the standard Retail IMPACT programs -- as an example, any transaction unique to a particular user -- would require a user-written modification. Users of the Fashion System who desire complete Black Book replacement or maintenance of summary records, users of the Staple System who desire stock count inputs, and users who wish to employ the Forecasting Subsystem to aid in developing planning forecasts will need to write required I/O and file maintenance routines. Appropriate flow charts and interfaces to the Staple Control Subsystem, the Forecasting Subsystem and the Fashion System are provided.

2. **Staffing --** Capable user personnel are requisite to positive results. Needed to insure Retail IMPACT System benefits are Top Management Representative ... Project Director ... Systems Analyst ... System/360 Programmers ... Administrative.

The description of their qualifications and duties is detailed in the Application Description Manual (E20-0188).

Retail IMPACT System: Retail IMPACT is an inventory management system designed specifically for the retail industry. Two independent systems are provided: one applies to staple merchandise and the other, to fashion. These two systems enable retail management to increase the opportunity for sales by increasing the availability of merchandise and at the same time to maintain a balanced inventory consistent with management objectives. They also provide for effective highlighting of items requiring action to maximize the profit potential in a department.

OS Fashion System	(360A-DR-04X)
OS Staple System (control, forecasting, and simulation subsystems)	(360A-DR-05X)
DOS Fashion System	(360A-DR-08X)
DOS Staple System (control subsystem 65K plus forecasting and simulation 131K subsystems).	(360A-DR-09X)

Staple System:

Description -- This system uses an advanced forecasting subsystem which employs adaptive forecasting, probability, and statistical science with appropriate decision rules to forecast demand, determine order points, and order up to levels. An advanced control subsystem is tailored to the needs of the retail industry. It may be used to create purchase orders, control merchandise on order, and monitor the performance of the system in terms of inventory and level of service.

This system also allows the simulation of a number of management policies, as well as for projecting demand and inventory behavior over an extended period, resulting from a particular policy or set of policies. With this feature, management will be able to establish a priority for departments to be implemented and obtain an estimate of the system's potential in these departments. The system reduces the difficulty of maintaining large inventories in multiple locations, typical of today's retail industry.

Optimum use of the system is achieved through the capture of daily sales information at the point of sale. For those few classes of merchandise or departments where the direct capture of daily SKU data is not feasible, the user may wish to employ stock counts to derive periodic sales.

Appropriate documentation is provided so that the Retail IMPACT Staple System can be used in conjunction with the customer's own stock counting procedures. Certain types of output, such as daily service measurement, cannot be provided if stock counting is employed.

3. **Education** -- Knowledge of the Retail IMPACT System, its implementation requirements, and its operation are achieved by user personnel through attendance in the following schools -- 2½-day Retail IMPACT System - Fashion ... 5-day Retail IMPACT System - Staple. Class dates listed in the Consolidated Industry Education Schedule.
4. **Evaluation** -- A very important responsibility of the customer is to establish a base for comparison of Retail IMPACT System results with those of the system replaced. Sales, inventory, and level of service represent minimum parameters for comparison. Further information regarding the need to evaluate and techniques for evaluation is detailed in the Application Description Manual (E20-0188).

Programming Systems: The programs are designed to operate under the OS/360, PL/I Level F; or DOS/360, PL/I. The programs also operate in V=R mode under DOS/VS, OS/VS1 or OS/VS2.1. The programs are not supported under OS/VS2.2. The DOS PL/I Optimizing Compiler is supported.

Minimum System/360 Configuration for Fashion under OS/360, PL/I and Staple Control Subsystem under DOS/360, PL/I: System/360 Model F30 (64K) with Decimal Arithmetic (#3237)***, Floating Point Arithmetic (#4427), 1051 Attachment (#7915) ... 1051 Control Unit Model N1 with CPU Attachment (#3130) ... 1052 Printer-Keyboard Model 8 ... 1442 Card Read Punch Model N1 ... 1443 Printer Model N1 with Selective Character Set (#6402) and the 63 Character Set Type Bar (#9089)* ... 24 Additional Print Positions (#5558) ... 2841 Storage Control ... 2311 Disk Units (4 required) ... 2415 Tape Unit Model 1.**

Minimum System/360 Configuration for Fashion under DOS/360, PL/I: System/360 Model ED25 (48K) with Floating Point Arithmetic (#4427)****, 1052 Printer-Keyboard Model 7, Selector Channel (#6960), 1442 Card Read Punch Model N1, 1443 Printer Model N1 with Selective Character Set (#6402) and 63 Character Set Type Bar (#9089)* ... 24 Additional Print Positions (#5558), Integrated 2311 Attachment (#4598), 2311 Disk Storage Drives (4 required),** 2415 Magnetic Tape Unit and Control Model 1.

Minimum System/360 Configuration for Staple Under OS/360, PL/I and Staple Forecasting and Simulation Subsystems under DOS/360, PL/I: System/360 Model G 40 (128K) with Decimal Arithmetic (#3237)****, Floating Point Arithmetic (#4427), 1052 Adapter (#7920) ... 1052 Printer-Keyboard Model 7 ... 1442 Card Read Punch Model N1 ... 1443 Printer Model N1 with Selective Character Set (#6402) and the 63 Character Set Type Bar (#9089)* ... 24 Additional Print Position (#5558) ... 2841 Storage Control ... 2311 Disk Units (4 required) ... 2415 Tape Unit Model 1.

Minimum System/370 Configuration: System/360 I/O devices listed above or comparable System/370 equipment must be used. The minimum partition (or region) size is identical to System/360 requirements except that Staple requires 116K bytes under the supported OS/VS systems.

- *Users ordering a 1403 Printer will require a QN2 or PN2 print train.
- **Users operating the Fashion System who do not intend to implement "Black Book" replacement, summary files, or the Staple System will require one less disk or tape.
- ***A minimum partition or region of 48K bytes is required for Fashion under OS and 56K for Staple under DOS.
- ****A minimum partition of 40K bytes is required for Fashion under DOS.
- *****A minimum partition or region of 114K bytes is required for Staple under OS and 96K for Staple Forecasting and Simulation Subsystems under DOS.

Basic Program Package for Fashion System/OS (360ADR04X):

Documentation -- Application Directory ... Program Description Manual (H20-0480, N20-1084) ... Operations Manual (H20-0481).

Machine Readable -- Source code, narrative, and sample problem.

Optional Program Package for (360ADR04X):

Machine Readable -- Flow charts.

Ordering Information: Program number 360A-DR-04X

	Program Number Extension	Distribution Type	Medium		User Volume Requirement
			Code		
BASIC	none	DTR	7DC/800	26	none
			9/800	28	none
			9/1600	29	none
OPTIONAL	none	DTR	7DC/800	26	none
			9/800	28	none
			9/1600	29	none

Basic Program Package for Staple System/OS (360ADR05X):

Documentation -- Application Directory ... Program Description Manual (H20-0591) ... Operations Manual (H20-0593).

Machine Readable -- Source code, narrative, sample problem, and flow charts.

Ordering Information: Program number 360A-DR-05X

	Program Number Extension	Distribution Type	Medium		User Volume Requirement
			Code		
BASIC	none	MT	7DC/800	26	01
			9/800	28	01
			9/1600	29	01

Basic Program Package for Fashion System/DOS (360ADR08X):

Documentation -- Application Directory ... Program Description Manual (H20-0540) ... Operations Manual (H20-0541).

Machine Readable -- Source code, narrative, and sample problem.

Optional Program Package for (360A-DR-08X):

Machine Readable -- Flow charts.

Ordering Information: Program number 360A-DR-08X

	Program Number Extension	Distribution Type	Medium		User Volume Requirement
			Code		
BASIC	none	DTR	7DC/800	26	none
			9/800	28	none
			9/1600	29	none
OPTIONAL	none	DTR	7DC/800	26	none
			9/800	28	none
			9/1600	29	none

Basic Program Package for Staple System/DOS (360A-DR-09X):

Documentation -- Application Directory ... Program Description Manual (H20-0599-1) ... Operations Manual (H20-0592-1).

Machine Readable -- Source code, narrative, sample problem, and flow charts.

Ordering Information: Program number 360ADR09X

	Program Number Extension	Distribution Type	Medium		User Volume Requirement
			Code		
BASIC	none	MT	7DC/800	26	01
			9/800	28	01
			9/1600	29	01

Additional Program Support Material: Application Description Manual (E20-0188).

If only the form numbered manuals that are a part of the Basic Program Package are required, order from Mechanicsburg -- not from PID. All other form numbered manuals are available only from Mechanicsburg.

The Scheduler:

Is the class section assignment program for student scheduling in secondary schools, vocational schools, and junior colleges. (360A-US-07X)

Description: Using a Master Schedule prepared by the school, Student Scheduling System/360 processes student course requests to create Student Schedules, Class Lists, and an Updated Master Schedule. Two auxiliary programs, the Tally and Conflict Matrix Programs, 360A-US-06X, are used to furnish the school administrator with data pertinent to Master Schedule creation. These programs are already available.

Features: Variable length alphanumeric course codes (three to six characters) ... Increased period, section, semester, and days capacity ... Increased course description fields ... unique descriptions for each period of blocked courses ... common course request input ... improved pre-scheduling editing ... female - male balancing of classes ... alternate course scheduling ... partial scheduling for students with conflicts ... reject matrix output for students with conflicts ... daily study hall class lists ... independent editing of punched and printed output ... sub-heading lines may be added on printed reports ... use of on-line disk storage increases the efficiency of the program ... core storage is employed for table structuring; it is also used to contain part or all of the Master Schedule, reducing processing time ... the Scheduling program is modular in construction, consisting of five distinct phases; the input, Student Schedule output, and class list output phases may be run individually ... the Linkage Editor function within the Basic Operating System/360 8K Disk version can be used to link the standard Scheduling program to special output routines.

Use: The Scheduler reads all types of scheduling input, creates student schedules, and updates the Master Schedule. The student schedules are stored on disk and may be sorted into class list sequence, which are stored on a second disk pack. Updated master schedule, student schedule, and class list output may be punched and/or printed; student schedule and class list output may be saved on disk for use at a later date.

Customer Responsibilities: A thorough knowledge and understanding of the system before use ... use Tally and Conflict Matrix programs to design optional master schedule ... create error-free input files.

Programming Systems: The Basic Operating System/360, 8K Disk Version, is used to control the Scheduling program. The scheduler is written in the IBM Basic Operating System/360 Assembler with Input/Output Macros (8K Disk). If Class List output is desired, the Basic Operating System/360 SORT/MERGE (8K Disk) Program is required.

Minimum Systems Requirements: A 2030 Processing Unit Model F with Decimal Arithmetic (#3237) and 1051 Attachment (#7915) ... 1051 Control Unit Model N1 with CPU Attachment (#3130), First Punch Attachment (#4410), and First Reader Attachment (#4411) ... 1052 Printer-Keyboard Model 6 ... 2841 Storage Control Model 1 ... three* 2311 Disk Storage Drives Model 1 ... 2821 Control Unit Model 1 ... 1403 Printer Model 2 ... 2540 Card Read Punch Model 1.

*Two Disk units are required for the Scheduler Program in addition to the One Disk unit required for the 8K Disk Basic Operating System and other non-scheduling data. If no class lists are desired, only one extra disk unit is needed.

Basic Program Material: Documentation -- Application Description "Student Scheduling System/360" (H20-0202) ... User's Manual (H20-0239) ... Application Directory.

Machine Readable -- Object Program, Job Control card decks and sample problem on one 7- or 9-track DTR or in card form.

Optional Program Material: Documentation -- System Manual

Machine Readable -- Source program on one 7- or 9-track DTR or one 1316 Disk Pack.**

Programs ordered on tape are in card-image form on either 7- or 9-track Distribution Tape Reels (DTR). The user will receive 9-track DTR unless he specifically requests a 7-track DTR. Both are written at 800 bpi. The user who orders 7- or 9-track DTR from PID will require one 2400 series tape unit, with its associated control unit. The data conversion feature is required, if 7-track tape is to be used. The DTRs are solely for the purpose of punching out the required program decks. A tape unit is not required for system operation. DTRs will be supplied by PID; no tape submittal is required.

** Disks: The requester may forward one 1316 Disk Pack in accordance with current ordering procedures to receive the Optional package (source program) on disk. The basic package (object deck) may be received only on cards or DTR.

Synchronous Transmit-Receive Access Method for OS/360: Provides a macro-instruction level of support for the transmission and reception of data using the IBM 2701 Synchronous Data Adapter - Type I. The access method provides Telecommunications support for Synchronous Transmit-Receive terminals including CPU to CPU transmission. (360A-SE-33X)

Description: The access method provides a macro language at the assembler level to provide Environment Definition ... Line Control ... READ/WRITE level transmission ... GET/PUT level transmission ... Buffer Management ... Data Translation ... Error Recovery and Restart ... Multiple Event WAIT with Error Checking.

The program utilizing the STR Access Method occupies one partition. The remaining partitions can be used by other programs within the scope of OS/360. User type macros and routines are provided to interface the Operating System, maintain line control, diagnose and recover from transmission error, execute data transmission, convert code, and handle buffers.

Features: The access method extends the Tele-processing support of OS/360 to include STR type terminals ... line speed is under program control, allowing data transmission at speeds ranging from 1200 bps to 40,800 bps ... CPU to CPU transmission is supported ... automatic answer, manual dial, manual answer, and leased line operations are supported ... Autocall (#1302 or #1303) is supported ... the Dual Communications Interface feature (#3461 or #3462) is supported ... the support is at the assembly language level, which allows maximum flexibility of use.

Use: Typical use might involve the writing of communications programs to service remote terminals for input and transmit processed data to the remote terminals. Data can be brought in from remote locations, processed, and returned to the same or other remote locations.

Customer Responsibilities: A thorough knowledge of the operation of the STR terminals to be included within his system ... a thorough knowledge of the macro language provided by the STR Access Method ... write a tailored program, using the macros provided, to handle his application ... provide space in SVCLIB for the STR Access Method load routines and error routines ... provide space in LINKLIB for the STR Access Method LINK routines.

Programming Systems: Operating System features required are OS/360 Option 2 (MFT) Release II or later ... BTAM ... UCBs defined at SYSGEN for the 2701 Synchronous Data Adapter Units; the STR Access Method System Manual (Y20-0097) contains instructions for providing these UCB's; the executable routines provided by the access method are distributed as pre-assembled modules to be placed in the user's LINKLIB and SVCLIB; the Assembly Language Macro-definitions are to be placed in the user's MACLIB; the access method can then be used as though it were part of his OS/360 System support.

Minimum System Requirements: System/360 Model 30F, or larger ... one or more 2701s with Synchronous Data Adapter - Type I (#7695 or #7696) ... as terminals one or more System/360 Model 30 or larger with 2701 Synchronous Data Adapter-Type I (#7695 or #7696); Model 20 with Communications Adapter; 1978 Terminal (RPQ) Models 1, 2, and 3; 1009 Data Transmission Unit; 7701/7702 Magnetic Tape Unit; 7711 Data Communications Unit - Magnetic Tape; 1974 Terminal (RPQ) Model 2; 1013 Card Transmission Terminal.

Basic Program Material:

Publications* -- Users Manual (H20-0349) ... Operators Manual (H20-0350) ... Systems Manual (Y20-0097).

Documentation -- Application Directory.

Machine Readable** -- OS/360 Job Stream on one 9-track Distribution Tape Reel (DTR), 800 or 1600 bpi, or one 7-track (Data Conversion Feature required) DTR at 800 cpi.

Optional Program Material:

Machine Readable** -- Source Modules on one 9-track DTR at 800 or 1600 bpi, or one 7-track (Data Conversion Feature required) DTR at 800 cpi.

Additional Program Support Material: Application Description (H20-0242).

Reference Material: IBM 2701 Data Adapter Unit - Principles of Operation (A22-6864).

*If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID;

**When ordering this program, the requester should indicate the distribution medium required on the back of the program order card. If not specified, 9-track at 800 BPI will be forwarded.

Data Conversion and Label Processing Subroutines: The data conversion subroutines provide character translation from one character set to another character set. They also provide conversion for floating point, binary, zoned decimal, packed decimal, and double digit numbers. Conversion subroutines operate on current system number representations to produce System/360 number representations and also perform the reverse conversions, i.e., System/360 representations to current system representations. The label processing subroutines perform reading and checking of current system standard IBM labels. They will also generate and write current system standard IBM labels. Data files from the 1401, 1440, 1460, 1410, 7010, 1620, 705, 7080, 7070, 7072, 7074, 7040, 7044, 7090, and 7094 may be processed.

Typical use of these subroutines might involve the gradual conversion of a large current system application to the System/360, wherein one or more data files must be shared between the two computers. (360A-SE-23X)

The data conversion subroutines may be called by Assembly Language, COBOL, or DOS/360 Basic FORTRAN IV call statements. The label processing subroutines are implemented for usage at the non-standard label exits of TOS/360 and DOS/360 Logical IOCS, and the non-standard label exit of OS/360.

Features:

- Allows user to continue to process current systems files alone or mixed with System/360 files on a System/360.
- Provides facility for file interchange between current system and System/360.

Customer Responsibilities: Reading and writing are responsibilities of the user (with the exception of label processing) since the data and character transformation performed by these subroutines is done with data as it appears in storage.

Programming Systems: The subroutines are written in either System/360 Assembly Language or E Level COBOL. The subroutines may be assembled or compiled and entered into the TOS/360 or DOS/360 or OS/360 subroutine library.

Minimum System Requirements: The minimum system requirements are the same as the minimum system configuration for the operating system that is used. The label processing subroutines require at least one 2400 Magnetic Tape Unit either 9-track or 7-track with the compatibility feature, and the floating point subroutines require the floating point instruction set. The label routines require the decimal arithmetic feature.

Basic Program Material: Application Directory ... Program Reference Manual (H20-0319) contains Application Description, User's and Operator's Information ... the source and object decks may be obtained on one 9-track or 7-track DTR (Data Conversion feature required). DTRs will be supplied by PID; no tape submittal is required.

Optional Program Material: One 9-track or 7-track tape containing listings and flow-charts. The requester may forward or order magnetic tape

Orders for basic documentation only for this program will not be accepted at PID. Form numbered manuals should be ordered through the normal publication distribution channels.

Demand Deposit Accounting: Gives support to commercial banks using System/360. The objective of the application program is to meet the customer's programming requirements for installing Demand Deposit Accounting. (360A-FB-15X)

Description: The program package covers three areas: demand deposit accounting, analysis, and conversion.

Demand Deposit Accounting -- The application accepts transactions in the form of MICR documents or punched cards, converts these transactions to disk storage, and sorts the transactions into sequence for processing. The transaction file is run against a stop-hold file and stop-hold suspects are recorded in disk storage. Control totals are added to the transaction file and high volume activity summarized. This edited and summarized transaction file is used to post to customer accounts. During posting, a trial balance or journal trial balance is prepared. Exception conditions are recorded on disk storage in the reports file. At the completion of posting, today's transactions file is merged with an accumulated transaction file. Statements are cycled and printed in any of three optional print formats. Eight exception reports are printed from the reports file. A ledger control recap report is included as a separate report.

Analysis -- The optional analysis processing accumulates a history file of balance and transaction activity for selected accounts. Included are programs to create, periodically reorganize, and update this file. The Analysis Report Program prepares, on user request, a comparative analysis of accounts or groups of accounts; its use is optional.

Conversion -- The conversion processing portion of the application program package provides programs to assist users in the creation of initial data files (balances and name and addresses). These programs accept as input: (1) the Name and Address File tapes and Balance File tape formatted as used by the 1401 Demand Deposit Accounting Application Program, 1401-FB-01X; and (2) 1311 Master File as formatted by the 1440 Demand Deposit Accounting Applications Programs, 1440-FB-03X.

Features: All processing can be accomplished on a multi-bank basis; in multi-bank processing, the data for all banks is processed through one application program before proceeding to the next ... all accounting controls are organized together on a single report printed daily ... data for single and related groups of accounts may be collected, organized into a historical file, and processed to determine account profitability; a comparative report based on flexible criteria is printed on demand ... the account balance file is organized so that future inquiry can be accomplished without requiring extraordinary disk drive capacity; approximately 48,000 accounts are recorded on one 1316 Disk Pack ... the account name and address file is organized to keep significant data only; this reduces disk pack requirements and speeds throughput ... the IBM 1419 and 1412 Magnetic Character Readers are programmed to operate in conjunction with 8K Basic Operating System ... a generalized service charge calculation routine is provided; this routine will meet all the requirements for many users and provide a guide for those which require additional programming ... the programs contain a series of options at both the overall system and the individual bank level among them are -- 3 Reader sorter distribution routines, 2 self check account number routines, the ability to maintain the Stop-Hold file in both disk and cards, provision for a 2-up Trial Balance or a combined Trial Balance - Transaction Journal, flexible overdraft policy criteria, formats of customer statements, and 4 criteria for statement selection.

Customer Responsibilities: A thorough knowledge and understanding of the system before installation ... creation of Balance and Name and Address files if conversion programs are not utilized ... parallel operation of new and present systems or a satisfactory alternative to verify validity of any modifications made to package programs ... customized pre-printed forms if user chooses various pre-printed options ... in-house training of operator personnel and data capture personnel ... write routines required for insertion to package programs to tailor the system to user's requirements ... write programs that user determines necessary to increase the scope of the Demand Deposit Accounting Programs ... write program modifications required to tailor or increase the scope of IBM package program.

Programming Systems: The following features of the IBM System/360 Basic Operating System (System Release 8) are used:

Basic Control Program 360B-CL-302, Change level 1-7.

Input Output Control System (IOCS)

- Consecutive Processing (DTFSR) 360B-IO-303
- Index and Sequential File Management System (ISFMS) 360B-IO-304

IBM Basic Operating System/360 Sort Merge Program (8K Disk) 360B-SM-308

IBM Basic Operating System/360 Assembler with I/O Macros 360B-AS-309

IBM System/360 Basic Operating System (8K Disk) Utilities, Group I 360B-UT-300

IBM System/360 Basic Programming Support Utility Program Initialize Disk 360P-UT-069

IBM 1401/1440/1460 Autocoder (on Disk) 1401-AU-008

System Requirements: Many system configurations are possible. All, however, must include: A 2030 Model D or 2040 Model D Processing Unit with Decimal Arithmetic (#3237), Selector Channel (#6960), 1051 Attachment (#7915) ... 1051 Control Unit Model N1 ... 1052 Printer-KeyBoard ... Processor Attachment (#3130) ... Adapter for First Punch (#3410) ... Adapter for First Reader (#4411) ... 2841 Storage Control Reader ... three 2311 Disk Storage Drives ... one Reader Punch selected from 1442 Card Read Punch Model N1, 2540 Card Read Punch, 2520 Card Read Punch Model A1, or one Reader and one Punch selected from 2501 Card Reader Model B1 or B2, 2520 Card Punch Model B2 or B3, 1442 Card Punch Model N2 ... one Printer and the Associated Control Unit if the latter is required: 1403 Printer Model 2, 3, or N1 with 2821 Control Unit, Models 1, 2, 3, 5, and 1416 Interchangeable Train Cartridge, or 1443 Printer Model N1 with 24 Print Positions Additional (#5558), Selective Character Set for 13 Character Bar (#6402), and Preferred Character Set Feature (#9562 or 9564) ... one Magnetic Character Reader with Attachment 1412 Magnetic Character Reader with 7720 Adapter or 1419 Magnetic Character Reader with 7720 Adapter).

The conversion of 1440 combined master file program requires the following machine configuration or its equivalent in S/360 with compatibility. One 1441 Processing Unit Model A4 ... one Card Reader and associated control unit ... one Printer and associated control unit ... one 1311 Disk Storage Drive and Disk Storage Control Unit (#3321) ... two 7335 Magnetic Tape Units and 7802 Tape Adapter.

Basic Program Material: Documentation -- Application Directory, Application Description Manual (E20-0246), Programmer's Manual (H20-0263), Operator's Manual (H20-0262), Sample Problem Manual.

Machine Readable -- One 9-track DTR (800 or 1600 bpi) or 7-track Magnetic Tape containing System/360 Assembler Language source decks, System/360 Object decks (some utility functions), System/360 Sample Problem Job Control decks, Sample Problem data decks, 1440 Autocoder Source deck.

Optional Program Material -- Systems Manual.

Note: The program is available on magnetic tape or disk pack. All submitted tapes must be 800 bpi, 2400 foot reels. 7-track tapes require the data conversion feature. One magnetic tape reel per order or one 1316 Disk Pack, vented hub model, per order will be required.

Linear Programming System/360 (LPS/360):† Provides the System/360 DOS user with a simple, easy to understand, easy to use means of solving linear

programming problems (360A-C0-18X).

Description: Mathematical optimization is any mathematical technique for determining the optimum use of various resources - capital, raw materials, manpower, plant, or other facilities - to attain a particular objective such as minimum cost or maximum profit, when there are alternate uses for the resources. Linear Programming is the most widely used of these techniques and has been used to allocate, assign, schedule, select, or evaluate the uses of limited resources for such jobs as blending, mixing, cutting, trimming, bidding, pricing, purchasing, planning, and the transportation and distribution of raw materials and finished products.

LPS/360 processes up to 200 row problems on a 32K System/360 and up to 1500 row problems on 64K and larger System/360s. The number of columns is limited only by the amount of disk space available.

Features: Large problem capacity (1500 rows on a 64K System and 200 rows on a 32K system) ... simple flexible processing control (optional conditional control of processing sequence) ... simple problem definition (easy-to-use format and extensive data maintenance functions, specification of starting solution basis, combination of problems to form master problems) ... advanced mathematical methods - automatic iterative input scaling for accuracy, revised simplex method (product form of inverse), bounded variable feature for range (and) constraints and bounded variables to simplify problem description and to increase problem capacity and solution speed ... multiple pricing ... efficient triangularization inversion method for accuracy ... extensive post-optimal analysis options (discrete parametric analysis for all problem data and activity-cost-bound relationships for all variables) ... extensive checking (input check for duplicate entries, solution processing check to test for need of early inversion and automatic solution check).

Use: LPS/360 is governed by procedure control cards which specify the solution sequence. Input data may originate on cards and be stored on disk for subsequent processing. Several problems may be stored on the disk and updated, rerun, or combined. For example, a corporate model can be formed from divisional models; or a total production plan, from the plans for individual products.

Reports may be on cards or printer. Output options include a full solution report, comprehensive solution analysis and parametric analysis reports.

Special Sales Information: The design emphasis of LPS/360 is on ease of learning, ease of use, large problem capacity on a small computer, and use under DOS/360.

The design goals of MPS/360 (360A-C0-14X) are high performance on large computing systems and use under OS/360.

For those installations at which either LPS/360 (DOS) or MPS/360 (OS) could be used (64K systems or larger), the greater efficiency of MPS must be weighed against the greater problem size capacity and the ease of use of LPS.

MPS will not operate on a 32K System/360. However, on a 64K Model 30, typical LP problems in the size range which can be handled by MPS (less than 300 rows) will run as much as three times faster with MPS than with LPS. On the other hand, LPS is capable of handling problems with as many as 1500 rows.

Customer Responsibility: A thorough knowledge of DOS/360 is required for installation of LPS. Since the LPS program documentation is written in tutorial fashion, little mathematical background or linear programming experience is needed.

Programming Systems: LPS/360 operates under control of System/360 Disk Operating System (DOS). The source language is primarily FORTRAN IV (level E) with some Assembler (level F) routines.

Machine Configuration: A minimum configuration for LPS/360 includes a System/360 Model 25E (32K) with Floating Point Feature (#4427), a 1052 Printer-Keyboard console, a card reader (1442, 2501, 2520, or 2540), a card punch (1442, 2520, 2540), a printer (1403 or 1443), and a 2311 Disk Storage Drive. A 2400 series tape unit and/or an additional 2311 is required for installing and maintaining LPS/360, but not for actual program operation. Also, a 2400 series tape drive is required for compiling and assembling the distributed source code.

The System/360 recommended for best performance and simplest operation includes a System/360 Model 30F (64K) with Floating Point Feature (#4427), a 1052 Printer-Keyboard console, a 2540 Card Read Punch, a 1403 Printer, two 2311 Disk Storage Drives (or one 2314 Direct Access Storage Facility), and a 2400 series tape unit.

Users of the 64K version of LPS must have 50K bytes of core available for program and data area; for the 32K version of LPS, users must have 26K bytes of core available (K=1024).

Basic Program Material:

Publications* -- Application Directory ... Program Description Manual (H20-0607) ... Operations Manual (H20-0611).

Machine Readable** -- The basic MRM for the 2311 is available on one 9-track DTR (800 or 1600 bpi), or one 7-track 2400' reel of tape at 800 cpi (Data Conversion feature required), or one 1316 disk pack.

The basic MRM for the 2314 is available on one 9-track 2400' reel of tape at 800 or 1600 bpi, or one 7-track 2400' reel of tape at 800 cpi (Data Conversion feature required).

† Supports S/370 configurations also.

When ordering on tape if the resident system is not specified, 2311 will be forwarded.

Optional Program Material:

Machine Readable** -- The source decks are available on one 9-track DTR (800 or 1600 bpi) or one 7-track 2400' reel of tape at 800 cpi (Data Conversion feature required).

Ordering Procedures:

* If only the Form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg - not PID.

** Magnetic tapes (2400') may be forwarded or ordered (the program order card should accompany the tape order form). The 1316 disk pack must be forwarded.

If the track and density requirements are not indicated on the program order card, 9-track at 800 bpi will be forwarded.

Additional Program Support Material: Application Description Manual (H20-0513-1),

Reference Material: Introduction to Linear Programming (E20-8171) ... Aluminum Alloy Blending (E20-0127) ... Electric Arc Furnace Steelmaking Manual (E20-0147) ... Feed Manufacturing (E20-0148) ... Ice Cream Blending (E20-0156) ... Blast Furnace Burdening (E20-0160) ... Cotton Blending (E20-0164) ... Gasoline Blending (E20-0168) ... LP-MOSS/1130 Program Reference Manual (H20-0345).

Wholesale IMPACT Program Library:† This IMPACT Program Library offers System/360 users the opportunity to use the IMPACT system of inventory management now in wide use among 1400-1311 systems users (1401/1440/1460). (360A-DW-05X)

Description: The IBM IMPACT (Inventory Management Program and Control Techniques) system of scientific inventory management provides the warehouse distributor (or any organization with the same inventory control characteristics) with the information of "when" and "how much" to buy for each inventory item controlled by the system. It does this through the means of probability science in conjunction with the many factors influencing the distributor's inventory control decisions. Factors considered include: lead time, lead time variability, forecast of demand, forecast error, service desired, inventory carrying costs, purchasing/receiving costs, discount structures, minimums, maximums, shelf lives and pack sizes. The "when" and "how much" answers find the most efficient balance between the cost of carrying inventory, cost of purchasing and receiving, discounts realized, and customer service requirements. The System/360 IMPACT includes the IBM System/360 IMPACT Program Library and a number of IBM and customer education classes and manuals.

The System/360 Wholesale IMPACT Program Library (with associated education classes and written material) enables the distributor who has an IBM System/360 Data Processing System (Model 22 or greater) to successfully implement an IMPACT inventory management system with minimum effort and expense. Programs and Macro Routines are included that perform in the following functional areas: editing, file initialization, estimating, forecasting, preparation of distribution by value reports, and the control of independent and joint replenishment ordering.

Features: The System/360 Program Library performs the same functions as the existing 1400-1311 Program Libraries. They are: edit all input for format ... screen historical demands for promotion ... determine the forecast model (horizontal, trend, horizontal-seasonal, or trend-seasonal) ... determine the ordering strategy to be used and calculate order quantity or order frequency as appropriate for the strategy selected ... calculate for each item the safety factor required for a prescribed level of customer service ... calculate initializing values required for forecast and order models selected ... estimate, in advance, results to be expected from applying the rules and values developed ... determine when to order items and item groups to meet service objectives after the system is operational ... calculate the product mix to be ordered within an item group that will meet both service objectives and limitations on total size of order.

In addition, the System/360 Program Library has included within it a set of macro routines which assist the user in the preparation of distribution-by-value reports and in the creation of his operating programs, particularly in the area of forecasting and order point calculation.

These macro routines are:

DBV 1	Distribution-By-Value, Pass 1
DBV 2	Distribution-By-Value, Pass 2
FCST	Forecast
LBTA	Lead Time Variability and Time to Beta Power
MAXA	Maximum Available
OPPP	Order Point and Peek Point
EOQ	Economic Order Quantity
SRB	Smooth and Rotate Base Index
INVLV	Inventory Level Evaluation
GOTO	Provides Standard Entry Into and Exit from other IMPACT Macros

In addition, the System/360 programs provide increased flexibility in the type of input/output devices used.

Both input and output of main data flow in all programs may be by disk or tape. An additional card-to-input file and output file-to-card option are available and can be specified at run time. Either a 1442 or 2540 Card Read Punch and a 1443 and 1403 Printer may be specified by the user.

For maximum compatibility with IMPACT Systems developed by present users, all input and output formats are identical to those of the 1400-1311 Program Libraries.

Use: The Program Library includes both initialization programs and operating programs and macro routines. Initializing programs are designed to be used once to set up a IMPACT System, then periodically (at least once a year) or, as required, to meet changing conditions. A complete set of programs is provided to perform necessary initializing functions. Operating programs are used in a day-to-day control of the IMPACT System (forecasting and ordering). Macro routines are provided to assist the user in the preparation of programs to perform those functions. Library programs are provided to control the ordering of both independent and joint vendors.

Customer Responsibilities: Because requirements vary widely, the user writes his own programs to perform record keeping, forecasting, reviewing (if he elects to use an order point or peek point approach), ordering follow-up (preparing purchase order, status listings, etc.), and linkage between his programs and IMPACT library programs. To assist the user in developing his own programs with minimum effort, the IMPACT package provides macro routines for use in the user's forecasting and reviewing programs

Programming Systems: Programs in the System/360 Wholesale IMPACT Library are written in Assembler language and the macro routines are written in Basic Macro definition language for use with Assembler language programs. Both operate under control of BOS, DOS or OS. The programs also operate in V=R mode under DOS/VS, OS/VS1 or OS/VS2.1. The programs are not supported under OS/VS2.2.

Minimum System Requirements:

For use with BOS or DOS --- A 16K System/360 or 24K with Decimal Arithmetic * 1442 or 2540 Card Read Punch, 1443 or 1403 Printer, and either two 2311 Disk Drives or one 2311 and two magnetic tape drives.

For use with OS -- The OS Wholesale IMPACT Program Library requires the Decimal Arithmetic option. With conservative blocking factors, the minimum main storage requirement does not exceed 18K bytes. In addition to the standard system residence, space is required in auxiliary storage for up to three input data sets ... two output data sets ... plus print output ... and one or two intermediate data sets ... requiring an additional DASD or two magnetic tape drives.

For use with OS/VS1 or OS/VS2.1: The minimum region (or partition) size is 20K bytes. System/360 I/O devices listed above or comparable System/370 equipment must be used.

*A minimum partition size of 16K bytes is required for execution of Wholesale Impact under DOS.

Basic Program Material:

Publications* -- Application Directory ... Application Description (GH20-0173-2) ... Program Description Manual (GH20-0255-2) ... Operator's Manual (GH20-0256-2) ... System Manual (GY20-0230).

Machine Readable** -- Source programs and sample problem decks are available on 9-track DTR (800 bpi) or one 9-track tape (1600 bpi) or one 7-track tape (800 cpi, Data Conversion feature required) or one 1316 Disk Pack.

Ordering Procedures:

* If only the form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg -- not PID.

** When ordering, if the distribution medium is not specified on the back of the program order card, 9-track tape at 800 bpi will be forwarded.

Magnetic tapes (2400') may be forwarded or ordered (the order card should accompany the tape order forms); disk packs must be forwarded to PID with the program order card.

Reference Material: Introduction to IBM Wholesale IMPACT (GE20-0278) ... Wholesale IMPACT-Based Principles Manual (GE20-8105) ... Wholesale IMPACT-Advanced Principles and Implementation Reference Manual (GE20-0174).

† Supports System/370 configurations also.

Numerical Control Processors:

AUTOSPOT (360A-CN-08X)

Description: AUTOSPOT operates as a task under control of DOS/360, accepts either BCDIC or EBCDIC input on any sequential system input device, and allows any number of input decks (part programs) to be processed in a single job step.

The AUTOSPOT processor accepts an English-like language defining geometric entities, patterns of points, desired motion sequences and machining information. This input, called a part program, is converted to a meta-language containing mathematical representations of the geometric surfaces and sequential instructions directing a cutting device with respect to defined surfaces and points.

The processor will then analytically calculate points on the cutting device axis at the tip (bottom center) of the device. The resultant motion will always be linear motions.

The AUTOSPOT processor also allows the optional interpretation of point-to-point machining verbs and eliminates the burdensome task previously required of a user-written post processor program.

These data are then available to a user-supplied post processor which must insure that they conform to the characteristics and dynamics of a particular N/C device.

The user is supplied with a printed listing of the part program and optionally a printed listing of the cutter center points and machining information. He must also specify which post processors are to be called to process the output of the AUTOSPOT processor.

Features: The processor includes extensive pattern definition and manipulative capabilities, scalar variables, nested definitions, FORTRAN-like arithmetic computational facilities, geometric definitions, sophisticated editing functions and the generation of cutter motions required to perform simple milling operations. The AUTOSPOT Processor establishes a precedent in that a wide range of machining verbs may optionally be interpreted. This capability substantially reduces the complexity of the user-supplied post processor required to produce the final input to a machine tool/controller.

Use: AUTOSPOT may be executed in a normal job step environment. It is designed to reside on a direct access device in executable form and need only be scheduled as a job operating under DOS/360.

Customer Responsibilities: A customer using AUTOSPOT must take the following steps to effect usable results and optimum performance:

1. Supply and merge into the AUTOSPOT processor any post processors required by his N/C controller/machine tool configurations.
2. Appropriately train system programmers to enable them to use the Disk Operating System facilities, to operate, maintain and update the AUTOSPOT processor.
3. Implement modification and version releases.
4. Insure that proper training is given to programmers responsible for developing part programs.

Programming Systems: The AUTOSPOT processor is written in its entirety in DOS Assembler Language. The input/output routines are written in physical IOCS. The minimum DOS configuration required to operate AUTOSPOT includes the DOS Assembly Language program and the DOS utilities. AUTOSPOT users must order the System/360 Disk Operating System separately.

Machine Requirements: A 2030 Processing Unit Model E with Floating Point Arithmetic (#4427), 1051 Attachment (#7915) ... 1051 Control Unit Model N1 with First Printer Attachment (#4409), First Punch Attachment (#4410), First Reader Attachment (#4411), and CPU Attachment (#3130) ... 1052 Keyboard Model 6 ... 2501 Reader Model B1 ... 1442 Punch Model N2 ... 1443 Printer Model N1 ... 2841 Storage Control ... 2311 Disk File Drive.

Basic Program Material:

Publications* -- Part Programming Manual (H20-0373-1) ... Operator's Manual (H20-0374-1) ... Application Directory.

Machine Readable** -- Relocatable object modules and sample problem contained on one 9-track DTR in either 9-track (800 or 1600 bpi) or 7-track 800 cpi (Data Conversion feature required), or a card deck.

Optional Program Material:

Machine Readable** -- Source programs and flow charts on one 9-track 2400' reel of magnetic tape (800 or 1600 bpi) or one 7-track 800 cpi (Data Conversion feature required) 2400' reel of magnetic tape.

Ordering Procedures:

- * If only the form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg - not PID.
 - ** If the track and density requirements are not specified on the back of the program order card, 9-track 800 bpi will be forwarded. Card decks for the Basic Machine Readable Material will be supplied only to users who do not have magnetic tapes available.
- DTRs for the basic program will be furnished by PID; no tape submittal is required.
- Magnetic tape (2400') for the Optional Program Material may be forwarded or ordered (the program order card should accompany the tape order form).

Additional Program Support: Application Description Manual (H20-0462) ... System Manual (Y20-0119).

AD-APT/AUTOSPOT (DOS/360) (360A-CN-09X)

Description: AD-APT/AUTOSPOT operates as a task under control of DOS/360, accepts either BCDIC or EBCDIC input on any sequential system input device, and allows any number of input decks (part programs) to be processed in a single job step.

The AD-APT/AUTOSPOT processor accepts an English-like language defining geometric entities, patterns of points, desired motion sequences and machining information. This input, called a part program, is converted to a meta-language containing mathematical representations of the geometric surfaces and sequential instructions directing a cutting device with respect to defined surfaces and points.

The processor will then analytically or iteratively calculate points on the cutting device axis at the tip (bottom center) of the device. The resultant motion will always be linear motions whose magnitudes are dictated by specified tolerance criteria.

These points are then available to a user-supplied postprocessor which must insure that they conform to the characteristics and dynamics of a particular N/C device.

The user is supplied with a printed listing of the part program and optionally a printed listing of the cutter center points and machining information. He must also specify which postprocessors are to be called to process the output of the AD-APT/AUTOSPOT processor.

Features: The AD-APT/AUTOSPOT Processor is the first sophisticated Numerical Control Processor which effectively addresses itself to the requirements of both point-to-point and contouring machine tool users, yet operates on a small computing system. It is designed to process the AUTOSPOT language and the AD-APT language, or any mixture of the two languages in any one part program, without sacrifice in processing speed. The processor is substantially faster than the 1620/1311 AD-APT Processor.

The AD-APT Numerical Control language provides contouring capabilities involving constant cutter contact with vertical surfaces of many shapes and nonvertical planes. In addition, very sophisticated macro and loop capabilities are provided for repeating with variations a set of predefined operations. The processor also encompasses a very extensive set of geometric definitions, FORTRAN-like computational facilities and comprehensive editing functions.

Use: The AD-APT/AUTOSPOT Processor may be executed in a normal job step environment. The processor is designed to reside on a direct access device in executable form and need only be scheduled as a job operating under DOS/360.

Customer Responsibilities: A customer using AD-APT/AUTOSPOT must take the following steps to effect usable results and optimum performance:

1. He must supply and merge into the AD-APT/AUTOSPOT processor any post-processors required by his N/C controller/machine tool configurations.
2. He must appropriately train system programmers to enable them to use the Disk Operating System facilities, to operate, maintain and update the AD-APT/AUTOSPOT Processor.
3. He must implement modification and version releases.
4. He should insure that proper training is given to those programmers responsible for developing part programs.

Programming Systems: The AD-APT/AUTOSPOT Processor is written in its entirety in DOS Assembler Language. The input/output routines are written in physical IOCS.

The minimum DOS configuration required to operate AD-APT/AUTOSPOT includes the DOS Assembly Language program and the DOS Utilities. AD-APT/AUTOSPOT users must order the System/360 Disk Operating System separately.

Machine Requirements: A 2030 Processing Unit Model F with Floating Point Arithmetic (#4427), 1051 Attachment (#7915) ... 1051 Control Unit Model N1 with First Printer Attachment (#4409), First Punch Attachment (#4410), First Reader Attachment (#4411), CPU Attachment (#3130) ... 1052 Keyboard Model 6 ... 2501 Reader Model B1 ... 1442 Punch Model N2 ... 1443 Printer Model N1 ... 2841 Storage Control ... 2311 Disk File Drive.

Basic Program Material:

Publications* -- Part Programming Manuals (H20-0375-1) and (H20-0373-1) ... Operator's Manual (H20-0374-1) ... Application Directory.

Machine Readable** -- Relocatable object modules and sample problem contained on one 9-track DTR in either 9-track (800 or 1600 bpi) or 7-track 800 cpi (Data Conversion feature required or a card deck).

Optional Program Material:

Machine Readable** -- Source programs and flowcharts on one 9-track 2400' reel of magnetic tape (800 bpi) or 9-track DTR (1600 bpi) or one 7-track 800 cpi (Data Conversion feature required) 2400' reel of magnetic tape.

Ordering Procedures:

- * If only the form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg -- not PID.
 - ** If the track and density requirements are not specified on the back of the program order card, 9-track at 800 bpi will be forwarded. Card decks for the Basic Machine Readable material will be supplied only to users who do not have magnetic tapes available.
- DTRs for the basic program will be furnished by PID; no tape submittal is required.
- Magnetic tape (2400') for the Optional Program Material may be forwarded or ordered (the program order card should accompany the tape order form).

Additional Program Support Material: Application Description Manuals (H20-0463) and (H20-0462) ... System Manuals (Y20-0118) and (Y20-0119).

APT (360A-CN-10X):†

Description: This processor operates as a task under control of OS/360. The APT processor accepts either BCD or EBCDIC input on any sequential system input device and allows any number of input decks (part programs) to be processed in a single job step.

The APT processor accepts an English-like language defining geometric shapes, desired motion sequences, and machining information. This input, called a part program, is converted to a meta-language containing mathematical representations of the geometric surfaces and sequential instructions directing the movement of a cutting device with respect to the defined surfaces.

The processor will then analytically or iteratively calculate points on the cutting device axis at the tip of the device (bottom center of the cutting device). The resultant motions will always be straight line motions whose length is determined by specified tolerance criteria. These points are then available to a user-supplied post processor which must insure that they conform to the characteristics and dynamics of a particular N/C device.

The APT processor is also capable of modifying the cutter axis to conform to part program specifications. When the processor is in a multi-axis (4 or 5 axis) environment, the output data will also contain the unit vector representing the cutter axis for each output point.

The user is supplied with a listing of the part program and optionally a listing of the cutter center points and machining information. He must also specify which post processors are to be called to process the output from the APT processor.

Features:

- Double precision calculations are used throughout the processor to improve reliability and extend the range of usable numbers.
- An analytical processing technique calculates start-up positions and non-iterative solutions for motion sequences involving vertical planes or cylinders for drive and check surfaces and non-vertical planes for part surfaces. This technique significantly reduces the processing time for these cases.
- The data handling technique for the POCKET feature has been designed to provide efficient usage of work files.
- An internal statement number is assigned by the processor and referenced by output listings and error messages.
- A debugging facility has been included in the processor to assist computer programmers in locating problem areas.
- The level of nesting allowed for MACRO's is five. The number of MACRO variables allowed is 50.
- The storage requirements for resident tables are predetermined and the space dynamically allocated to reduce the requirement for programmer manipulation.
- Reliability of the processor, particularly ARELEM is the primary design criterion.
- Dummy call structures are provided to assist with interfacing of special user programs.

- The redefinition of variable symbols as another surface of the same type without the inclusion of the CANON modifier in the surface definition is permitted via a modal CANON/ON - CANON/OFF command.
- The core storage requirements for each MACRO are printed.
- Post processors are created as separate load modules and may be added or modified without re-link editing other post processors or any other component of the APT system.
- A tool axis specification and algorithm have been implemented to provide predictable multi-axis results.
- A feature to allow selective printing of the output data.
- Pattern definition and manipulation capability to facilitate point-to-point programming.
- Capability for punching surfaces and scalar values into cards.
- System macro capability to allow commonly used macros to be defined once and subsequently be available to any input part program.
- Segment Read feature, which allows segments of part programs to be stored on direct access devices and subsequently read in and include in input part programs.
- Implicit subscribing for simplified part coding and improved processor performance.
- Improved Pocketing capability in that the part surface plane may optionally be used as the bottom of the pocket.
- Virtual elimination of arithmetic element loops by addition of code to detect and exit from loop conditions.

Use: The APT processor may be executed in a normal job step environment. The processor is designed to reside on a direct access device in executable form and need only be scheduled as a job operating under OS/360. PCP, MFT, or MVT options may be used to execute APT.

Customer Responsibilities: To achieve usable results and optimum performance, a customer must supply and merge into the APT processor any post processors required by his N/C controller/machine tool combinations ... he must make sure that appropriate training is given to system programmers to permit them to use the Operating System facilities to operate, maintain, and update the APT processor ... he must implement modification and version releases ... he must make sure that proper training is given to the part programmers responsible for developing the input.

Programming Systems: The APT processor routines are primarily written in FORTRAN H. The APT input/output routines are written in OS/360 Assembly Language and interface to the BSAM access method. The minimum OS configuration to operate APT includes the OS Assembly Language program, the FORTRAN H compiler, the 44K E-level linkage editor, and the OS utility programs.

APT users must order the S/360 Operating System separately.

System Configuration: Operating System/360 requirements ... Floating Point Arithmetic ... approximately 215K bytes of core storage. Executable load modules require 1.2 million bytes of direct access storage (310 2311 disk tracks). Additional storage is normally required for user-implemented post processor load modules.

Work space for intermediate storage must be available on one or more 2311, 2302, or 2314 disk storage device ... 2301 or 2303 drum storage drive ... 2400 tape unit.

The amount of intermediate storage required is a function of the part program executed. Intermediate storage requirements generally vary from a total of .3 million bytes to 2 million bytes.

At installations where APT is a significant application, to meet normal throughput requirements, consider: a model 2050H with Floating Point Arithmetic (#4427) ... one 2400 series tape drive ... four 2311 Disk Drives ... 2540 Card Read Punch ... 1012 Attachment Device (RPQ) ... 1012 Tape Punch.

Basic Program Material:

Publications -- Application Directory ... Part Programming Manual (H20-0309) ... Operator's Manual (H20-0331). If only the form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- Source programs, executable load modules, overlay structures, and sample part programs are contained on one reel of magnetic tape 2400' (800 bpi), 9-track DTR (1600 bpi) or 7-track (800 cpi, Data Conversion feature required) mode. The contents of the tape are written in the IEHMOVE unload format.

If track and density requirements are not indicated on the back of the program order card, a 9-track tape (800 bpi) will be forwarded.

Magnetic tapes (2400') may be forwarded or ordered (the order card should accompany the tape order form).

Ordering Procedures:

Additional Program Support Material: Application Description (H20-0181-3) ... System Manual (Y20-0080) ... System Manual Flowchart (Y20-0227).

AD-APT/AUTOSPOT (OS/360) (360A-CN-12X)†

AD-APT/AUTOSPOT is a bilingual processor which prepares numerical instructions for both point-to-point and contouring machine tools.

Description: The AD-APT/AUTOSPOT Processor addresses itself effectively to the requirements of both point-to-point and contouring machine users, yet operates on a medium scale computing system. It is designed to process the AUTOSPOT language and the AD-APT language, or any mixture of the two languages in any one part program, without sacrifice in processing speed.

The AD-APT/AUTOSPOT Processor provides contouring capabilities involving constant cutter contact with vertical surfaces of many shapes and non-vertical plane part surfaces. In addition, sophisticated macro and loop capabilities are provided for repeating with variation a set of predefined operations. The processor also encompasses an extensive set of geometric and pattern definition and manipulative capabilities, scalar variables, nested definitions, FORTRAN-like computational facilities, and sophisticated editing functions.

Features:

- Both the AUTOSPOT and AD-APT languages may be processed in the same part program.
- Long operand floating point calculations are used throughout the processor to improve reliability and extend the range of usable numbers.
- A processor assigned statement number is referenced in output listings and diagnostic messages.
- The number of MACRO variables allowed is 50. The level of MACRO nesting allowed is five.
- The number of vocabulary synonyms allowed is 50.
- Looping capabilities are implemented using the LOOPST/LOOPND feature of APT.
- The output file (CLFILE) may be edited by using TRACUT and/or COPY instructions.
- Debugging facilities are included to aid part programmers in locating problem areas.
- Extensive FORTRAN-like computational facilities are included.
- An extensive set of geometric and pattern definition and manipulative capability is included. The pattern capability is a significant subset of that contained in S/360 APT.
- A wide range of AUTOSPOT machining verbs may be interpreted by the processor.
- Any number of part programs may be processed in a single job step.
- Postprocessor input/output modules, completely compatible with those of S/360 APT, are provided for ease in implementation of FORTRAN-coded postprocessors.
- A system library concept permits accessing externally defined part program segments, such as a master TOOL or MACRO library.
- A significant subset of S/360 APT pattern definition and manipulative capability enhances the facility of point-to-point part programming.
- A thickness (THICK) statement may be applied to surfaces used in AD-APT contouring operations.
- The redefinition of variable symbols equivalenced to nonscalar entities is controlled via a modal CANON/ON-CANON/OFF statement.
- The capacity of the RESERV table accommodates 100 unique array names.
- New computational functions are included.
- The XYONLY mode of AUTOSPOT may be suppressed via the modal command XYONLY/OFF.
- AUTOSPOT constants, used in verb interpretation, may be modified via the modal command UNIT/u.

Use: The AD-APT/AUTOSPOT Processor accepts an English-like language defining geometric entities, patterns of points, desired motion sequences and machining information. This input, called a part program, is converted into a meta-language containing

mathematical representations of the geometric entities and sequential instructions directing a cutting device with respect to specified surfaces and points.

The processor then calculates either analytically or iteratively, points on the cutting device axis, such that the linear motions generated thereby are optimized with respect to the specified tolerance criteria.

Further, a wide range of AUTOSPOT machining verbs may optionally be interpreted by the processor, thus greatly reducing the tasks required of a postprocessor.

These data are then available for subsequent processing by a user-supplied postprocessor program, which must insure that they conform to the characteristics and the dynamics of a particular N/C device.

The user is supplied with a printed listing of the part program, and optionally a printed listing of the cutter center points and machining information. He must also specify which postprocessors are to be executed to process the output of AD-APT/AUTOSPOT.

Customer Responsibilities: A customer using AD-APT/AUTOSPOT must take the following steps to effect usable results and optimum performance.

1. He must supply and merge into the AD-APT/AUTOSPOT Processor any postprocessors required by his N/C Controller/machine tool configurations.
2. He must appropriately train system programmers to enable them to use the Operating System facilities, to operate, and update the AD-APT/AUTOSPOT Processor.
3. He must implement modification and version releases.
4. He must insure that proper training is given to programmers responsible for developing part programs.

Programming Systems: The AD-APT/AUTOSPOT Numerical Control Processor is written primarily in Assembler Language. It operates as a task under control of OS/360. It requires the F level assembler and E level linkage editor and uses the SYS1.MACLIB and SYS1.FORTLIB libraries.

The AD-APT/AUTOSPOT Processor may be executed in a normal job step environment. The processor is designed to reside on a direct access device in executable form, and need only be scheduled as a job operating under OS/360.

Minimum System Requirements: In addition to OS/360 requirements, this program requires the Floating Point Arithmetic feature and 100K of core. Distribution of the program will be by magnetic tape only. Systems without tape drives may be used to execute the program if other provisions are made to load the program to a disk storage device.

The program requires the equivalent of 15 cylinders of 2311 storage on a disk storage device. In addition, space must be available on a second disk storage device for intermediate storage. The amount of intermediate storage required is dependent on the input data.

An example of a configuration which could be used for this program is a 2040G ... 2540 Card Read Punch ... 1403 Printer ... two 2311 Disk Storage Drives ... one 2400 Magnetic Tape Drive.

Basic Program Material:

Publications -- Application Directory ... Part Programming Manual (H20-0549) ... Operations Manual (H20-0557). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable* -- Executable load modules, postprocessor overlay structure and sample part programs are contained on one DTR 9-track (800 or 1600 bpi) or one 7-track (800 cpi, Data Conversion feature required). The contents of the tape are written in the IEHMOVE unload format.

Optional Program Material:

Machine Readable* -- Flowcharts and source program modules contained on one 2400' reel of magnetic tape for 9-track (800 or 1600 bpi) users.

For 7-track (800 cpi, Data Conversion feature required) users, flowcharts, and listings will be available, each on an individual 2400' reel of magnetic tape. If only one of these 7-track tapes is desired, specify whether the flowcharts or the listings are required.

Ordering Procedures:

*If the track and density requirements are not specified on the back of the program order card, 9-track at 800 bpi will be forwarded.

DTRs are furnished by PID; no tape submittal is required.

Magnetic tapes (2400') may be forwarded or ordered (the program order card should accompany the tape order form).

Additional Program Support Material: Application Description Manual (H20-0523) ... System Manual (availability and form number will be announced in a PRL).

† Supports System/370 configurations also.

Requirements Planning:†

Offers a mechanized approach to detailed requirements planning for a large segment of manufacturing industries.

This system uses the Item Master and Product Structure files created by the System/360 Bill of Material Processor Program (360A-ME-06X) or DBOMP (5734-XX4). It performs time series planning to determine planned orders for finished products, assemblies, sub-assemblies, parts, and raw material based upon the input of forecasts and orders. (360A-MF-05X)

This system determines the net requirements for finished products and component parts, establishes planned orders based on the predetermined order policy, and offsets the planned orders with respect to lead times. Additional capabilities include projecting demand ... consideration of safety stock, allocated quantity, shrinkage factors ... plan order policies include discrete, fixed quantity, least unit cost, and part period balancing ... modifying plan order policies by considering number-days-supply, minimum-maximum-multiple quantities, and cutoff dates ... offsetting by a fixed or a calculated lead time. Processing variations include: complete generation of requirements, Requirements Alteration (revisions to gross requirements), and Conversational Planning (revisions to planned orders). A customizing procedure permits a user to tailor the system to meet his specific requirements. System/360 Requirements Planning utilizes many of the concepts of the requirements planning subsystem discussed in the IBM Production Information and Control System (E20-0280).

Description: System/360 Requirements Planning consists of two programs: The Requirements Generation Program and the Print Exception Program. The inputs to the system are from card, magnetic tape, or disk and contain the gross requirements by shop day, calendar date or time period. Card input is by date and quantity only. These requirements can be generated manually from a forecast, from customer orders, or from System/360 Inventory Control (Application Description Manual H20-0471). This input spans a user specified number of planning time periods into the future. The output of the Requirements Generation Program is in the form of planned orders for purchased and manufactured items. Orders for items manufactured are available for input to a capacity planning function, and orders to be purchased are available to a purchasing function. A considerable amount of flexibility is provided by System/360 Requirements Planning relative to the printing of pertinent information. This flexibility is provided to enable the extraction of as much or as little information as desired. Three types of reports are provided: detailed requirements, planned orders that have been adjusted through Conversational Planning, and an exception report. The Print Exception Program is used to print the exceptions generated from the Requirements Generation Program.

Features:

- Two programs are provided to assist the user in performing requirements planning: The Requirements Generation Program performs the actual time series requirements generation, and the Print Exception Program prints notices for the exceptions that were discovered during requirements generation.
- Functions performed include gross requirements determination, net requirements determination, plan orders, and offset requirements. Net requirements determination, plan orders, and offset requirements are optional functions.
- Many options are provided within the functions. These include: projection of demand ... safety stock quantity ... allocated quantity ... shrinkage factor ... discrete, fixed quantity, least unit cost, part period balancing, and user order policies ... minimum-maximum-multiple, number-days-of-supply, maximum quantity, and cutoff date modifiers to order policies ... fixed and calculated lead time ... product structure offset adjustment ... product structure scrap factor ... user's exits for engineering change effectiveness of product structure.
- Three types of processing variations are provided. These include: complete generation of requirements, Requirements Alteration (revisions to gross requirements), and Conversational Planning (revisions to planned orders).
- Three types of reports are provided. These include: detail report of requirements, planned orders that have been adjusted through Conversational Planning, and an exception report.
- Two optional methods are provided for printing of detail requirements. These include printing of item indicative information, gross requirements, open orders, net requirements, planned orders, and offset requirements in random sequence, as requirements are generated, or at the completion of generating requirements in the sequence that the Item Master file is organized.
- Provision is made to store gross requirements, open orders, and planned orders in either an Item Master file or a Subordinate Item Master file, both of which are created and maintained by the System/360 Bill of Material Processor or DBOMP. When the Subordinate Item Master file is used, any combination of the gross requirements, open orders, and planned orders will be stored as one separate record for each item. The linkage between the two files will be created by System/360 Requirements Planning.
- Input to the system is from card, magnetic tape, or disk and contain gross requirements by shop day, calendar date, or time period. Card input is by date and quantity only.
- A customizing procedure permitting the user to select the functions and options necessary to tailor the system to meet his specific requirements.

Special Sales Information: The philosophies and concepts incorporated in System/360 Requirements Planning are applicable to a large segment of the manufacturing industry. Modular design and programming techniques facilitate the user's selective expansion and modification of input-output formats, processing routines and the contents of the data base. Many of the aspects of this system are discussed in the Production Information and Control System (E20-0280).

Use: System/360 Requirements Planning is direct access file oriented utilizing data contained in the Item Master, Product Structure, and Subordinate Item Master (optional) files. The records within these files are created and maintained by the System/360 Bill of Material Processor Program (360A-ME-06X) or DBOMP (5736-XX4).

Frequency of use of System/360 Requirements Planning will depend on the user needs of his production planning function. Typically, each scheduled program run would be a complete generation of requirements with the input of gross requirements spanning from the current time period to the last time period in the planning horizon. The Conversational Planning (optional) method of processing enables the system to stop processing after each level of planned orders have been developed. This allows the planned orders to be reviewed and, if necessary, readjusted before the next level of requirements is determined. Thus, either complete requirements generation or Conversational Planning would normally be performed on a scheduled basis. Requirements Alteration processing (optional) provides for regeneration of requirements due to changes to the original gross requirements input. In this instance, only the altered gross requirements are input to the system. Requirements Alteration processing would normally be performed between scheduled complete requirements generation or Conversational Planning program runs.

Customer Responsibilities: A thorough knowledge and understanding of this program before installation ... customize S/360 Requirements Planning to meet user requirements ... a thorough knowledge and understanding of the S/360 Bill of Material Processor or DBOMP provide and maintain a shop calendar that resides on a direct access device ... define contents and format of the Item Master, Product Structure and Subordinate Item Master files ... maintain accurate up-to-date data ... provide open orders to the system ... provide file organization and maintenance of the Item Master, Subordinate Item Master, and Product Structure files through the use of the Bill of Material Processor Program and DBOMP.

Programming Systems: S/360 Requirements Planning programs are written in Assembler Language using the macro language facility and operate under DOS or DOS/VS. In addition, they also operate in a VM/370 environment under the control of DOS or DOS/VS. The DOS Disk Sort/Merge (360N-SM-450) (or S/370 equivalent) is required if the exception notice file is to be sorted. In addition, Bill of Material Processor or DBOMP is also required. The Bill of Material Processor is not supported under DOS/VS.

Minimum System Requirements:

Device or Feature	For S/360 Model 22	For S/360 Model 25	For S/360 Model 30
S/360 CPU, 32K bytes*	2022E standard	2025E standard	2030E 3237
Decimal Arithmetic Special Feature Control Unit for Printer-Keyboard	-----	-----	1051 N1
Integrated 1052 Attach. Feature S/360 Card Reader (see Note 1)	4690	-----	-----
Printer-Keyboard	Any	2540	Any
S/360 Printer	1052 Mdl 8	1052 Mdl 7	1052 Mdl 8
Storage Control	Any	1403 Mdl 2	Any (with at least 132 print positions)
Disk Storage Drives (as required to contain DOS or DOS/VS and the user's data files (minimum of 2))	2841 Mdl 1	-----	2841 Mdl 1
OR	-----	-----	-----
Direct Access Storage Facility (see Note 2)	-----	-----	2314

NOTES:

*A minimum partition of 24K bytes is required.

1. A System/360 card punch, while not used by the System/360 Requirements Planning programs, is required for system preparation.
2. In addition, a 2314-only system configuration also requires a 2400 series tape drive for system preparation.

Refer to the machines section of the sales manual for appropriate attachments required for connection of input/output units.

Basic Program Material:

Publications -- Application Directory ... Program Description Manual (H20-0584) ... Operations Manual (H20-0583). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- The source programs and sample problem may be obtained on one 9-track DTR (800 or 1600 bpi) or one 7-track 2400' reel of magnetic tape (800 cpi - Data Conversion feature required) or one 1316 Disk Pack.

If track and density requirements for magnetic tape are not indicated on the back of the program order card, 9-track at 800 bpi will be sent.

Magnetic tape (2400') may be forwarded to or ordered from PID. The program order card should accompany the tape order form.

Disk packs must be forwarded to PID with the program order Card.

Additional Program Support Material: Application Description Manual (GH20-0487-2) ... Systems Manual (Y20-0317).

Reference Material: Production Information and Control System (GE20-0280) ... Bill of Material Processor - Application Description Manual (GH20-0197) and Programmer's Manual (GH20-0246) ... Inventory Control - Application Description (GH20-0471) ... DBOMP - Application Description Manual (GH20-0771), Program Description Manual (SH20-0829).

†Supports S/370 configurations also.

Program for Optical System Design/II (POSD/II):

POSD/II consists of an inter-related set of programs providing a complete facility for the geo-

metric analysis of image forming optical systems, together with a means for automatically correcting such systems. The program has the capacity to analyze systems containing prisms, toric surfaces and diffraction gratings in addition to refracting or reflecting elements. The designer has access to outputs such as spot diagram information, radial energy distributions, and geometric frequency response tables. (360A-E0-15X)

Features:

- Maintenance of 30 surfaces in core.
- Thorough set of utility options.
- Ray tracing speeds in the order of .10 sec./ray surface.
- Enhanced energy distribution and frequency response data presentation.
- Vignetting control by ray aiming option.
- Energy distribution by 5% energy increments.
- Comprehensive plotting features (1130).
- Automatic Design -
 - Index and dispersion variables
 - Boundary Condition Controls
 - Maximum of 20 variables

Use: The program is under the control of the designer through user written commands. These commands provide data and bring into core the program modules necessary for the required problem solution. In automatic design, the program accepts as input target values and parameters. The program is iterative in this mode. If no solution can be found, the designer may set new targets.

Customer Responsibilities: The lens designer must be able to operate the S/360 console, and he must devise satisfactory batch problem solving procedures for S/360. He must be familiar with the operating rules and conventions for POSD/II. The customer must produce his own required lens library and glass tables. Utility programs assist him in this task.

Programming Systems: The program is written in basic FORTRAN IV and operates under the IBM Problem Language Analyzer (PLAN) (360A-CX-27X) for OS/360 which in turn operates under the Operating System/360.

Machine Configuration: System/360 models supported by OS/360. In addition to the System/360 main and auxiliary storage required by OS/360 and the DASD used by PLAN, POSD/II requires a 100K minimum partition or region and two million bytes of DASD.

Basic Program Material:

Publications -- Application Directory ... Program Description Manual (GH20-0577) ... Operations Manual (GH20-0578).

If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Object Decks, Sample Job Control cards, and the Sample Problem Decks are furnished on a 9-track DTR at 800 or 1600 bpi, or one 7-track DTR at 800 cpi (Data Conversion feature required).

Magnetic Tapes (2400') may be forwarded or ordered (the program order card should accompany the tape order form); disk packs must be forwarded to PID with the program order card.

If the track and density requirements are not indicated on the back of the program order card, 9-track at 800 bpi will be forwarded.

Optional Program Material:

Machine Readable -- Source Decks are available on one Distribution Tape Reel (DTR) 9-track 800 or 1600 bpi, or one DTR 7-track 800 cpi (Data Conversion feature required).

DTRs are provided by PID; no tape submittal is required. If the track and density requirements are not indicated on the back of the program order card, 9-track at 800 bpi will be forwarded.

Additional Program Support Material: Application Description Manual (GH20-0489) ... System Manuals.

Reference Material: PLAN Application Description Manual (GH20-0490) ... PLAN Program Description Manual (GH20-1066) ... PLAN Operations Manual (GH20-0596).

Remote Access Computing System (RAX): RAX provides sustained access to a System/360 from remote locations to enable programmers, engineers, scientists, and other users to obtain fast turnaround and reduced problem-solution time for their computational problems. (360A-CX-17X)

Description: RAX is a time shared, remote computing system. Users of RAX can submit Basic FORTRAN IV and Basic Assembler Language jobs for compilation and time-sliced execution from local and remote terminals, simultaneously with similar operations from other on-line equipment at the computer site. Programmers can compile, modify, and execute programs from their terminals while non-computer oriented users can be conversationally interacting with programs previously stored in the RAX library.

Terminal users of RAX can access up to 64 disk units to read or write permanent or temporary files. Multiple users are able to access these files simultaneously. The temporary files allow preparation of intermediate results storage for later recall in that program or subsequent programs.

RAX user flexibility is provided by a modular and compatible design. Three System/360 Models (30, 40, and 50) and three memory sizes (64K, 128K, and 256K bytes) are supported. Four terminals (the IBM 1050 Data Communications Terminal, the IBM 2741 Communications Terminal, the Nos. 33 and 35, ASR and KSR Teletypewriters, and the IBM 2260 Display Station) can be used depending on system memory size. Two 2311 Disk Storage Drives are necessary.

Features:

- Up to 63 terminals can be used with RAX, depending upon the amount of core memory available.
- Terminals may be 1050s, 2741s, or TTYs which provide keyboard input, typewriter output as well as 2260s, which provide keyboard input and CRT display of up to 12 lines of output. In addition, the 1050s provide card and paper tape input-output, and the TTYs provide paper tape input. All terminal device types may be combined on the same system provided that the configuration restrictions are observed. The 1050s, TTYs, and 2741s may be at a remote location from the computer. The 2260s must be local. The TTYs must be dial up.
- The terminal user may save source or object programs and data or program output in the RAX user library. Saved information may be shared with other terminal users. File security is provided by means of a lock code which prevents unauthorized deletion or modification of any file in the library.
- The terminal user may use permanent or temporary files for input or output. When using the File Input-Output capability of RAX the user is able to specify the file characteristics (logical record size, file name, volume name, disposition, etc.) from the terminal. Multiple users are able to access the permanent files simultaneously. File Input-Output requires a minimum of 128K bytes and one 2311 in addition to system residence and user library units.
- A restart capability is provided for resumption of jobs after recovery from system's error. Upon recovery, RAX will indicate to each user the last line of input accepted or repeat the last few lines of output.
- The 2260 Display Stations allow entry of up to twelve lines of input at a time. The Non-Destructive Cursor feature is used to provide for single character modification within a line when updating program or data files.
- Object program execution storage of 32K bytes is provided on the minimum memory configuration. 64K bytes are available on the 128K and 256K byte configurations.
- Users of RAX may enter programs and data one line at a time from their terminals or use a single terminal command to insert a previously stored data or program module into their job stream at compile time.
- The user may enter either USAS1 Basic FORTRAN IV or Basic Assembler jobs from his terminals. All input-output must be programmed in FORTRAN and the execution of privileged instructions in a user program is not allowed.
- A DISPLAY command is available for total or selective listing of a user's input or library files.
- RAX provides for the running of background batch processing through the 2540 Card Read Punch. The background batch jobs utilize the machine when it is not serving the terminals. Virtually any job prepared for terminal processing will run in batch mode. In addition, the batch can address file input-output on magnetic tape. Batch mode makes possible lengthy computer runs where turnaround time is not of prime importance and can be used to enter large programs and data files into the library.

Use: Sustained access to a System/360 from remote locations enable engineers, scientists, and other users to realize fast turnaround and reduced problem solution time. FORTRAN programmers can compile, modify, and execute programs from remote terminals, while non-programmers may use programs previously stored in the RAX library. Familiarity with the RAX terminal command language and the operation of the terminal device enables the user to exploit the computational power of System/360 in a convenient manner.

RAX provides a facility for conversational interaction between a user and an executing program. This is accomplished by the use of input/output statements in a problem program which addresses the user's terminal as an I/O device. Thus, programs can be written to take advantage of the "on-line" presence of the user by permitting him to selectively modify his input, observe intermediate results, and alter parameters - or perhaps the execution sequence of the program based on his interpretation of these results.

Customer Responsibilities: A customer using RAX must take the following steps before installation to insure satisfactory operations:

1. Order and install (satisfactorily) the communications equipment required.
2. Train operators to use the terminal command language, the programming languages, and terminal operations.
3. Familiarize a system programmer with the internal operations of the system.

Programming System: RAX is written in BPS Basic Assembler Language.

Minimum System Requirements: System/360 Model 30F with one Selector Channel, Interval Timer, Storage Protection, Decimal Arithmetic, Floating Point Arithmetic features ... 1052 Printer-Keyboard Model 8 as a system console ... 2821 Control Unit Model 1 ... 2540 Card Read Punch ... 1403 Printer Models 2, 3, 7 or N1 ... 2841 Storage Control ... two 2311 Disk Storage Drives; for attaching keyboard-typewriter terminals either a 2702 Transmission Control or a 2701 Data Adapter Unit. Up to ten keyboard-typewriter terminals may be attached to the minimum configuration. The 2260 Display Stations and terminal file capability are not supported on the 64K byte configuration. (For 2701 and 2702 features see Terminal Configuration Section.)

Memory Size Restrictions: The number of RAX terminals supported for the allowable memory configurations are:

64K - 1050 or 2741 or TTY up to 10 terminals

128K - 1050 or 2741 or TTY up to 36 terminals

- up to 32 of any two of the above

- up to 28 if all three are included

- if 2260's are to be included in the system, the number of terminals supported in addition to the 2260's may be calculated by using the following formula:
 $T = M - 3(n + 2)$

T = number of keyboard typewriter terminals RAX will support

M = maximum number of terminals due to installation configuration (i.e., 36, 32, 28 as explained above)

n = number of 2260's required (maximum of eight).

256K - up to 63 terminals in any combination (maximum of eight 2260s).

File Configuration: A minimum of two 2311 disk units are required by RAX but the system can use up to 64 disk units.

- One of the required disk units is for system residency and the other for the user library.
- Systems with 31 or more terminals require an additional 2311 for system residency.
- Up to six additional 2311s may be used for the user library storage.
- One additional 2311 is required for storage of permanent and temporary files when the terminal file input output capability is used.
- Additional 2311s may be used to store permanent and temporary files, but the total number of 2311s on a system may not exceed 64.
- Up to four 2400 tape drives (7- or 9-track in any combination) may be used in place of 2311s for file input-output for the background batch jobs.

Terminal Configuration:

IBM 1050 Data Communications Terminal: The IBM 1050 may be attached to the system through a 2701 or 2702. Specifications are:

IBM 2701 Data Adapter Unit

1. Terminal Adapter Type I (#4645 or 4646)

2. Appropriate line adapters (up to 4)

IBM 2702 Transmission Control

1. Terminal Control Type I (#4615)

2. Selective Speed feature (#9684)

3. Appropriate line adapters

The minimum IBM 1050 Data Communication Terminal consists of: one 1051 Control Unit Model 2 with the First Printer Attachment (#4408) and one 1052 Printer-Keyboard Model 2. The 1052 Printing Element used by RAX is Data 1 font (#9575 or #9576). The 1050 can utilize the 1054 Paper Tape Reader or 1056 Card Reader attached as Reader #1 on the 1051. For use with the 1056, cards can be prepared on either the 26 or 29 keypunch. The 1056 must have the Extended

Character Read Special Feature.

Below are indicated 1050 special features that can be used with RAX (A); features that can be attached but are not utilized by the system (B); and features that must not be attached to a RAX terminal (C). (AR) status means that, where the component is installed, the referenced feature must be available.

Component	Feature No.	Status
1051 Control Unit Model 1 & 2		AR
I/O Unit Attachments		
Card Punch Attachment	1635	B
1st Printer Attachment for Mdl 1 or 2	4408	AR for 1052
1st Punch Attachment	4410	AR for 1055,1057, 1058
1st Reader Attachment	4411	AR for 1054,1056
2nd Printer Attachment	6381	B
2nd Punch Attachment	6383	B
2nd Reader Attachment	6384	B
Auto Fill Char Gen	1287	B
Auto Ribbon Shift & Line Feed Select	1295	B
Audible Alarm	1307	B
Automatic EOB	1313	A
CPU Attachment	3130	C
Forms Stand Stacker	4450	B
1447 Attachment	4461	C
Home Comp Recgntn	4605	B
Home Correction	4607	B
Home Loop Input Component Interlock	4606	B
IBM Line Adapter	4647	A
Subchannel 1	4691	A
Subchannel 2	4692	A
Subchannel 3	4693	A
Subchannel 4	4694	A
IBM Line Adapter	4790	A
I/O Comp Table	4632	B
Keyboard Request	4770	A
Line Correction	4795	B
Line Cor Release	4796	B
Master Station	5050	B
Open Line Detection	5465	B
Reader Stop-Prefix J	6060	B
Switch Unit		
for Mdl 1	7660	C
for Mdl 2	7661	C
Tel Line Attachment	7873	C
Vertical Forms Control	8715	A
1052 Printer-Keyboard Mdl 1 or 2 only		
Accelerated Carrier Return	1006	B
Auto EOB	1313	A
Forms Feed Control	4452	A
Home Loop Input Component Interlock	4606	B
Open Line Detection	5465	B
1053 Printer Mdl 1		B
1054 Paper Tape Reader Mdl 1		A
Edge-Punch Read	3570	C
Reels, Center Roll Feed and Take-up	6120	B
Telegraph Speed	7910	C
1055 Paper Tape Punch Mdl 1		A
Edge-Punching	3571	C
Reel Take-up	6121	B
1056 Card Reader (Mdl 1 Recommended)		A
Card Reader Program	1640	B
Extd. Character Reading	3861	AR
Feed, 51 Col Card	4004	C
Feed, Short Card Pack	4006	C
High Speed Skip	4595	B
Telegraph Speed	7910	C
1057 Card Punch Mdl 1		A
Extd. Character Punching	3860	AR
Operator Panel	5478	C
1058 Printing Card Punch Mdl 1		C

2741 Terminal

The RAX system required the 2741 to have the Interrupt feature (#4708) on the terminal device and the 2741 BREAK feature (#8055) on the 2702 Transmission Control Unit. The RAX system does not support the 2741 on the 2701 Data Adapter Unit. Complete specifications are:

2702 Transmission Control

1. Terminal Control Type I (#4615)
2. 2741 Break Feature (#8055)
3. Selective Speed feature (#9684)
4. Data Set Line Adapter (#3233)

2741 Data Communications Terminal

1. Standard Correspondence IBM SELECTRIC® Keyboard
2. Interrupt Feature (#4708)
3. Manifold 72 type elements (#9806 or 9810)
4. 10 char/in character spacing (#9104)

5. Data set attachment: #9114 for use with dial-up data set ... #9115 for use with direct data set
6. If data set attachment #9114 is specified, Dial Up feature (#3255) is required.

No. 33 and No. 35 Teletypewriter

Teletypewriter terminals may be ordered through local Telephone Company representatives. RAX will support ASR and/or KSR Teletypewriter terminals. The teletypewriter keyboard should have a left arrow as upper case letter 'O'. At installation time, the answerback drum of the teletypewriter may be encoded with any sequence the user desires.

2701 Specifications: Telegraph Adapter Type II (#7885)

2702 Specifications: Telegraph Terminal Control Type II (#7912) ... Data Set Line Adapter (#3233) one per line.

2260 Terminal

For systems larger than 64K, support is provided for keyboard-typewriter terminals and 2260 Display Stations. The 2260 Display Station must have an Alphameric Keyboard feature (#4766) and be connected to the multiplexer channel through a directly attached 2848 Display Control Model 3 with the Non-Destructive Cursor feature (#5340 and #5341). One 2848 Model 3 with up to eight 2260 Display Stations is supported.

Maximum Support Configurations: System/360 Model 50H (256K byte memory) with three Selector Channels, Interval Timer, Storage Protection, Decimal Arithmetic, Floating Point Arithmetic, 1052 Printer-Keyboard Model 7, 2540 Card Read Punch, 1403 Printer Models 2, 3, 7, or N1, up to sixty-four 2311 Disk Storage Drives, up to sixty-three keyboard-type-writer terminals (connected via communications equipment to 2701 and/or 2702 control units), one 2848 Display Control Model 3 with Non-Destructive Cursor feature and up to eight 2260 Display Stations with the Alphameric Keyboard feature (with maximum of sixty-three terminals in all, four 2400 tape drives (with a maximum of 64 disk and tape drives).

Basic Program Material:

Publications -- Application Directory ... Program Description Manual (H20-0354 I), Operations Manual (H20-0355-1). If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- Object program load modules and sample problem decks are available on either one 9-track DTR (800 or 1600 bpi) or one 7-track DTR (800 cpi) - Data Conversion feature required.

Optional Program Material:

Machine Readable -- OPT1 and OPT2 are available -- either or both may be ordered.

OPT1 requires one 9-track DTR (800 bpi) or 7-track magnetic tape at 800 cpi (Data Conversion feature required) or 9-track 2400' MT at 1600 bpi. OPT2 requires one 2400' MT 9-track (800 or 1600 bpi) or one 2400' MT 7-track (800 cpi).

DTRs are provided by PID; no tape submittal is required. Magnetic Tapes (2400') may be forwarded or ordered (the order card should accompany the tape order form).

Note: Systems Generation -- Distribution of the RAX program will be on tape. RAX users must have access to tape configuration on which to punch the object and source program decks.

Additional Program Support Material: Application Description Manual (H20-0545-1) ... System Manual (Y20-0101-2).

Reference Material: IBM System/360 Basic FORTRAN IV Language (C28-6629)... BPS Basic Assembler Language (C28-6503) describes the languages implemented under RAX ... IBM System/360 BPS Specifications Direct Access Storage Device - Utility Programs (C24-3363) and IBM System/360 BPS Operating Guide - Utility Programs Direct Access Storage Device (C24-3392) describe utility programs which can be used to maintain backup copies of RAX user library disk packs.

Product Structure Retrieval: This program extracts selected information from files organized by the System/360 Bill of Material Processor Program (360A-ME-06X).

Six types of retrieval reports can be made with this module. They are Single Level Explosion ... Indented Explosion ... Summarized Explosion ... Single Level Implosion ... Indented Implosion ... Summarized Implosion. (360A-ME-07X)

The general structure of the retrieval program consists of a mainline phase and three retrieval phases ... (1) a single level retrieval phase ... (2) an indented retrieval phase ... (3) a summarized retrieval phase ... each phase incorporating both explosion and implosion logic ... a common area for constants and work area ... separate formatting routines are included.

Each of the three retrieval phases performs processing appropriate to it; linkage is then made to the required formatting routine to produce reports on a particular part number request. The program is written in a modular manner to provide for maximum flexibility in tailoring the reports to user needs. Maintaining and retrieving accurate, up-to-date product structure information at an economical cost suggests a central information system that can serve many functional areas in a manufacturing company.

Features: The mainline phase is the control section of this retrieval system. It performs system initialization; opening files; updating the run number ... reads the first request card (type of retrieval desired) ... fetches the appropriate retrieval program phase into core ... passes control to it.

The retrieval phases operate generally by: reading the part number request card ... retrieving the appropriate file records ... passing control to the appropriate report formatting routine ... reading the next part number request card (if any) ... continuing to link to and from the report formatting routine until a new retrieval request card is encountered ... returning control to the mainline.

When one of the retrieval phases encounters an end of job card, control is also returned to the mainline which performs end-of-job functions and ends the run. Use of the product data can be classified as explosion (assembly data) or implosion (where used data) by using the assembly-component addresses (chains) or where-used addresses (chains) contained in the master and product structure files. The user should refer to the Bill of Material Processor - A Maintenance and Retrieval System (E20-0114).

The following is a discussion of the features of each of the three retrieval phases which produce the following six report types:

Single Level Explosion. The most fundamental type of retrieval program using product structure data in assembly component sequence. The processing output is a bill of material. The assembly is exploded into its direct components and associated quantities per assembly. An example of a single level explosion application that uses product structure data as a framework for processing is the extended bill of material.

Indented Explosion. A processing technique for completely breaking a top-level or other major assembly into its multiple sub-assembly levels or tiers. The term "indented" refers to the format of the printed output frequently called an indented parts list. In addition, the order quantity of the starting assembly is multiplied by each of the quantity-per-assembly fields giving the total quantity for each component needed. This report shows a level by level relationship of all parts within an assembly.

Summarized Explosion. Provides gross requirements for end products and sub-assemblies. This is a processing technique for completely breaking a top-level or other major assembly into all its multiple sub-assembly levels and summarizing the quantities of each part (sub-assemblies and simple parts) found in the entire product structure. Low level codes are used to eliminate re-explosion of multiple-use assemblies. This type of retrieval provides the framework for performing a gross to net requirements application.

Single Level Implosion. The most basic type of retrieval program using the product structure data in where-used sequence. The output of the processing is a next assembly where-used listing.

Indented Implosion A processing technique for tracing the usages of a given part number in assemblies at various usage levels, and in turn, the use of the part number in higher level assemblies up to the top assembly level. The term "indented" refers to the format of the printed output which shows a level by level relationship through all products.

Summarized Implosion. A multi-level processing technique that totals the direct and indirect usages of a part number on all higher level assemblies. The printed output indicates all the assemblies that directly or indirectly contain the part number, including the total quantity of the part number in each assembly. This type of retrieval also reflects the effect of incremental cost increases or decreases of simple parts or sub-assemblies on top level products.

Use: The System/360 Product Structure Retrieval Program is a direct access file oriented concept that requires a master inventory file to be on line simultaneously with the product structure file. All files are created, added, deleted, and reorganized by the Bill of Material Processor Program (360A-ME-06X).

The package includes logic diagrams and programming support for the three retrieval phases of the module. The diagrams supplying the master logic describe the decisions required to determine which records to access ... accessing of the records ... controls ... the locations in the logic flow where the user may insert his own processing subroutines.

Customer Responsibilities: A thorough knowledge of the System/360 Bill of Material Processor Program ... creation of master inventory files ... creation of product structure files ... tailor sample file layouts to installation requirements.

Programming Systems: Assembler language with input/output macros under supervision of the Basic Operating System/360 or Disk Operating System/360.

Minimum System Requirements: System/360 Model 2030 D or DC (16K under BOS control or 24K under DOS control) ... Decimal Arithmetic (#3237) ... 1051 Control Unit Model N1 ... 1052 Printer-Keyboard Model 8 with appropriate attachments ... 2841 Storage Control Model 1 ... 2311 Disk Storage Drives as required to contain BOS/360 or DOS/360 and the user's data files (minimum of 2) or 2314 Direct Access Storage Facility (DOS only) ... any System/360 Card Reader and Card Punch or Card Read Punch ... any System/360 Printer.

System/360 Model 2025 D or DC (16K under BOS control or 24K under DOS control) ... 1052 Printer-Keyboard Model 7 ... 2311 Disk Storage Drives as required to contain BOS/360 or DOS/360 and the user's data files (minimum of 2) ... any System/360 Printer, Card Reader and Card Punch or Card Read Punch.

Basic Program Material:

Documentation -- Application Directory ... Programmers Manual (H20-0369) ... Operators Manual (H20-0370). If only the form numbered manuals are required, order from the IBM Distribution Center -- not from PID.

Machine Readable -- Source code.

Ordering Information: Program Number 360AME07X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	DTR 7DC/800	26	none
		DTR 9/800	28	none
		DTR 9/1600	29	none
		Cards	15	none

Additional Program Material*: Application Description (H20-0329) with TNL (N20-2015) and Systems Manual (Y20-0112).

Reference Material*: Bill of Material Processor - The Maintenance and Retrieval System (E20-0114) ... General Information Manual - Production Information Control System (E20-0280) ... Bill of Material Processor - Application Description Manual (H20-0197) ... System/360 Bill of Material Processor - Programmers Manual (H20-0246).

*Available only from Mechanicsburg.

Advanced Life Information System (ALIS):†

ALIS represents an insurance information system's approach to the maintenance, processing, and servicing of individual life insurance contracts. (360A-IL-09X)

Description: The system uses modular programming techniques to perform automatic processing of scheduled (internal) and nonscheduled (external) transactions ... and updating of policies with cash values, reserves, dividends, and other forms of participation, and renewable term premium rates just before the anniversary.

Most modules which perform these insurance logic functions are programmed in COBOL. This simplifies program maintenance and modifications. Executive routines link the insurance logic modules with the IBM Disk Operating System for System/360. These routines are modular and written in assembler language. This separation of processing and control functions provides the widest possible range of system configuration approaches to solve individual customer requirements.

Features: The system is designed in a modular concept to facilitate use and modification ... insurance logic modules are designed to work in a disk operating system's environment ... the mass direct access storage capacity of the IBM 2321 Data Cell Drive is used to house the policy master file ... insurance logic is designed to provide maximum flexibility for companies of all sizes to effectively utilize its features ... the system provides a base for Teleprocessing communications network ... the system supports one 1050 terminal and one 2260 terminal.

Customer Responsibilities: A thorough knowledge and understanding of the system before implementation ... design conversion procedures to generate policy master records in a form acceptable to the system ... generate dividend, renewable term premiums, cash value, net premiums, benefit and terminal reserve rate tables ... develop adequate procedures and programs to generate policy master records for all new business, exchange, conversion, and re-instatement contracts ... write programs to print premium notices and other forms of notification except where notification by automatic status is adequate ... prepare Commission statements and Agents Accounting from system generated output.

Use: ALIS represents a new information system's approach to the maintenance, processing, and servicing of life insurance contracts.

ALIS is an extremely comprehensive system, but it still must be modified or "tailored" to conform to the unique business practices of each user. Therefore, the first step in using ALIS is the determination of these modifications. The next step is to implement these modifications and to generate a policy master record file containing all of the information required by ALIS. The policy master record file and unscheduled transactions are then input and processed by the ALIS programs - scheduled transactions require no external input other than the information contained on the policy master record. Output from this processing is then analyzed by an output analysis program and routed to various programs for final printing. Intermediate files are also produced for use by the policy exhibit and valuation programs.

The Home Office Inquiry feature of ALIS may be used as soon as a policy master record file has been generated. This feature provides the facility to display on the 2260 or 1050 a partial image of the policy master record (plan, face value, mode premium, issue, paid-to and billed-to dates, etc.); the name and address of the insured, payer and other; and the results of the following quotation transactions: cash surrender, conversion to nonforfeiture option, withdrawn par values on deposit, withdrawn paid-up additions, maximum loan, loan payoff, and mode premium.

Programming Systems: ALIS operates under DOS/360 and uses the System Control and Basic TOCS, Consecutive Tape IOCS, Direct Access Method, Indexed Sequential File Management System, Group I, II, and III Utilities, Disk/Tape Sort/Merge or Tape Sort/Merge, Assembler language, COBOL, Compiler Input/Output Modules, and BTAM (Basic Telecommunications Access Method). Users must become familiar with these components of the Disk Operating System.

Minimum System Requirements: Daily Cycle and Valuation Programs - System/360 Model F30 with at least 56K bytes available for program, data, and access method storage and the decimal arithmetic, storage protection, interval timer, selector channel, and 1051 attachment features ... a 1051 Control Unit Model N1 with CPU attachment, systems console attachment, first punch, first reader, and first printer attachments controlling one 1052 Printer-Keyboard Model 8 ... 2841 Storage Control with 2321 attachment feature ... a 2321 Data Cell Drive Model 1 and a 2311 Disk Storage Drive Model 1 ... four 2401 Magnetic Tape Units Model 1 ... 2803 Tape Control Unit Model 1 ... 2821 Control Unit with a 1403 Printer Model 2 and one 2540 Card Read Punch Model 1.

Alternate input/output units supported by DOS/360 may be substituted to satisfy individual company requirements. Consideration must be given to volumes of input and output in light of required throughput speeds ... off-line system availability ... sorting capability in this or another system ... requirements of programming systems for other user applications.

Home Office Inquiry - System/360 Model F30 with 44K bytes available for program, data, and access method storage. In addition to the features required for the daily cycle and valuation programs, home office inquiry requires a 2848 Display Control Model 2 with display adapter, line addressing, non-destructive cursor, and non-destructive cursor adapter controlling a 2260 Display Station Model 2 ... 2701 Data Adapter Unit Model 1 with Line Adapter (#4636) and Terminal Adapter (#4645) ... a 1051 Control Unit Model 1 with line adapter, first printer attachment, and keyboard request features ... a 1052 Printer-Keyboard Model 1.

Basic Program Material:

Publications -- Application Directory ... Program Description Manual (H20-0518) ... Operations Manual (H20-0517) ... Home Office Inquiry Program Terminal Operations Manual (H20-0588). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable - The source programs and source tape ALIS maintenance program (STAMP) are available on two 2400' 9-track (800 or 1600 bpi) magnetic tape reels.

Magnetic Tapes (2400') may be forwarded or ordered (the program order card should accompany the tape order form).

If the density requirements are not indicated on the back of the program order card, 800 bpi will be forwarded.

Additional Program Support Material: Application Description Manual (H20-0126) ... Policy Master Record Code Book (H20-0483) ... Utility Program Description Manual (H20-0519) ... Batch Edit System Manual (Y20-0177) ... Input Edit System Manual (Y20-0178) ... Frequently Used Record Formats System Manual (Y20-0179) ... Miscellaneous Volume System Manual (Y20-0180) ... File Maintenance Run Executive System Manual (Y20-0181) ... Data Cell Reorganization Program, Policy Master Record Merge Program, Data Cell Reconstruction Program, and Data Cell Restore Program System Manual (Y20-0182) ... File Maintenance Include (R) Routines (Narratives) System Manual (Y20-0183) ... File Maintenance Include (R) Routines (Flowcharts) System Manual (Y20-0184) ... File Maintenance Call (S) Routines (Narratives) System Manual (Y20-0185) ... File Maintenance Call (S) Routines (Flowcharts) System Manual (Y20-0186) ... File Maintenance Issues, Additions, Complex Changes, and Terminations Transactions System Manual (Y20-0187) ... File Maintenance Simple Changes Transactions System Manual (Y20-0188) ... File Maintenance 36XX Financial Transactions - Payments System Manual (Y20-0189)

... File Maintenance Financial Transactions - Accounting Entries System Manual (Y20-0190) ... File Maintenance Status Transactions - Process and Quote Terminations System Manual (Y20-0191) ... File Maintenance Status Transactions - Process and Quote Miscellaneous, Loan Values, and Participation Values System Manual (Y20-0192) ... File Maintenance Billing Transactions System Manual (Y20-0193) ... File Maintenance Premium Due, Overdue, and Anniversary Processing Transactions System Manual (Y20-0194) ... File Maintenance Rate File Extract and Anniversary Extract Update Transactions System Manual (Y20-0195) ... File Maintenance Contractual Change and Notifications System Manual (Y20-0196) ... Output Analysis System Manual (Y20-0197) ... Transaction Register System Manual (Y20-0198) ... Status Print System Manual (Y20-0199) ... Policy Accounting Journal System Manual (Y20-0200) ... Accounting Control System Manual (Y20-0201) ... Error Register System Manual (Y20-0202) ... Rate File System Manual (Y20-0203) ... Home Office Inquiry Program System Manual (Y20-0321).

Reference Material: Promotional Brochure (520-1205).

† Supports System/370 configurations also.

Property and Liability Information System for System/360: † Consists of programs which maintain an Automobile and Other Lines policy master

file. It provides for direct access inquiry to these records.

Description: The system, consisting of three programs, will perform the following functions:

PALIS Basic Program (360A-IF-10X) - provides billing and premium collection for direct billed business ... a program to build and update user tables for automobile and homeowners rates ... a program to edit all transactions for format and range of values ... utility programs to aid the installation and modification of PALIS ... programs to load, reorganize, reconstruct and restart the policy file on the 2321 Data Cell ... status inquiry into policy file via Local 2260 or Remote 2260 and 1050 ... a run linkage program to interface between DOS/360 and PALIS insurance logic.

The Automobile Program (360A-IF-11X) - rate and write new business ... renewals ... endorsements, both premium and non-premium ... cancellations ... (reinstatements) ... claims arising ... claims payments and closing ... provides facility to recreate portions of the master record ... provides data for premium statistical reporting.

The Other Lines Program (360A-IF-13X) - maintain a complete insurance record for single and multi-location risks by processing the following new business ... renewals ... endorsements both premium and non-premium ... cancellations ... claims arising ... claims payments and closing ... provides facility to recreate portions of the master record ... provides data for statistical reporting.

Features: The system takes advantage of the powerful features of IBM System/360 ... the system functions in a Disk Operating System environment ... the flexibility of the system design allows for user defined configurations when processing loads exceed the capacity of the minimum configuration ... both the insurance logic and run linkage provide the flexibility required to make the system adaptable to most companies ... the policy master file is stored on the IBM 2321 Data Cell Drive.

Use: PALIS is designed to be the foundation of a P & L information system. As such, it creates and maintains a detailed policy enforce file. In addition, an Automobile Private Passenger policy rating and writing facility is provided. Premium, loss, and historical data are maintained by policy.

The customer must provide a program to interface user data capture and data coding procedures with the system edit. Output programs must be written to format and in some cases further process the contents of the generalized output records.

During implementation and conversion, interface programs between PALIS output and user accounting and statistical systems must be provided.

Customer Responsibilities: A thorough knowledge and understanding of the system before installation ... write conversion programs to create the master file ... write programming to format output for printing, punching and entry into other systems ... write all routines to satisfy special company policies such as underwriting criteria, loss reserving standards, accounting procedures, etc. ... write any programming required to effect user changes to record format; e. g., expand, contract routines, additional programming to handle new fields, etc., generate and expand tables for private passenger automobile according to the specifications provided; write programs and procedures to provide adequately edited input transactions to PALIS ... maintain the programs and documentation as changes to bureau requirements dictate changes in logic ... provide additional logic to format replies to inquiries beyond that supplied by PALIS.

Programming Systems: To facilitate understanding, the insurance logic program modules are written in Disk Operating System/360 COBOL. The use of System/360 COBOL allows for ease of modifications to the various programs and simplifies program maintenance. Run linkage routines have been written to form an interface between the insurance logic and Disk Operating System/360. Just as the insurance logic program modules are written in a modular fashion, the run linkage is also written in a modular fashion to allow for a wider range of system configurations. The run linkage is written in assembler language.

PALIS uses the following components of the Disk Operating System and the user must become familiar with them -- System Control and Basic IOCS ... Consecutive Tape IOCS ... Direct Access Method ... Group I, II and III Utilities ... Tape Sort/Merge ... Assembler Language ... COBOL ... DOS Supervisor (6K) ... RPG ... QTAM.

In addition, PALIS uses IBM System/360 FLOWCHART (360A-SE-22X) for printing of PALIS Flowcharts.

Minimum Machine Requirements: System/360 Model 40 G with Decimal Arithmetic (3237), Selector Channel (6980) and 1052 Attachment (7920) ... 1052 Printer Keyboard Model 7 ... 2841 Storage Control with 2321 Attachment (8079) ... 2321 Data Cell Model 1 ... 2311 Disk Storage Drive Model 1* ... Four 2400 series Magnetic Tape Units (at least three of the magnetic tape units must be 9-track) ... 2821 Control Unit with 1403 Printer Model 2 and 2540 Card Read/Punch Model 1.

The Automobile application requires 89K of core and Other Lines application requires 120K core for program, data and access method storage.

*One or two additional 2311's will be required if the user rates Homeowners in all states.

Additional System Requirements for Inquiry:** Storage Protection (7520). For 2260 Local: 2848 Display Control Model 2, Display Adapter (3356), Line Addressing (4787), 2260 Display Station Model 2, Alpha Numeric Keyboard (4765). For 2260 Remote: 2848 Display Control Model 2, Display Adapter (3356), Line Addressing (4787), 2260 Display Station Model 2, Alpha Numeric Keyboard (4765), 2701 Data Adapter Unit, IBM Terminal Adapter Type III (4656). For 1050 Remote: 1051 Control Unit Model 2, First printer Attachment (4408), IBM Line Adapter (Dependent on line-type), Keyboard Request (4770), 1052 Printer Keyboard Model 2, 2701 Data Adapter Unit, IBM Terminal Adapter Type I (4640).

For Inquiry application 26K of core is required in Foreground I for QTAM and 65K of core is required for program, data and access method storage.

** In minimum configuration, Inquiry will operate only independent of other PALIS runs.

Basic Program Material for PALIS Basic Program (360A-IF-10X):

Documentation - Application Directory ... Basic Program Description and Systems Manual (H20-0497-1) ... Basic Operations Manual (H20-0498-1) ... Overview Program Description Manual (H20-0501).

Machine Readable - Contains source code, flowcharts, formats and sample problems.

Basic Program Material for PALIS Automobile (360A-IF-11X):

Documentation - Application Directory ... PALIS Automobile Premium Processing Program Description Systems Manual (H20-0499-1) ... PALIS Automobile Claims Processing Program Description and Systems Manual (H20-0500-1).

Machine Readable - Contains source code, flowcharts and formats.

Basic Program Material for PALIS Other Lines (360A-IF-13X):

Documentation - Application Directory ... PALIS Other Lines Premium Processing Program Description and Systems Manual (H20-0503-1) ... PALIS Other Lines Claims Processing Program Description and Systems Manual (H20-0504-1).

Machine Readable - Contains source code, flowcharts and formats.

Note: If only the form numbered manuals are required, order from Mechanicsburg - not from PID.

Ordering Information - Numbers 360AIF10X, 11X, 13X.

	Program Number		Distribution Medium		User Volume Requirements
	Extension	Type	Track/Density	Code	
Basic	None	MT	7 DC/800	26	01
		MT	9/800	28	01
		DTR	9/1600 (10X)	29	None
		MT	9/1600 (11X)	29	01
Optional	None	DTR	9/1600 (13X)	29	01
		None			None

Additional Program Support Material (available from Mechanicsburg): Application Description Manual (H20-0283-2).

† Supports System/370 configurations also.

Administrative Terminal System Under OS/360:† ATS/360 is a new dimension in data entry and text processing. ATS/360 is a user-oriented remote typewriter terminal system which operates in the multiprogrammed environment of either OS/360 MFT (Version 2) or MVT, typically in the high priority partition/region. Multiprogramming means the customer does not need to dedicate an entire system to ATS/360 operations. Other programs may run concurrently with and independently of normal OS/360 terminal operation, thereby extending the productivity of System/360 for users of ATS/360. (360A-CX-19X)

The three major applications of ATS/360 are:

1. Data Entry typically by placing typewriter terminals in the source department.
2. Text Processing including Terminal input, Terminal editing, and Terminal or 1403 N1 Printer formatted output.
3. Foundation for specialized typewriter terminal applications by the modification of ATS programs or the addition of new programs to ATS.

Features: The features of ATS/360 are used in three basic areas: those which have general applications for all the uses of the system, those which are oriented to text and documentation processing, and those which are oriented to data entry:

General --

- Low entry and start up costs.
- In some applications the capture of text or data can take place as it is originated.
- Is multiprogrammed, which allows for efficient use of the computer.
- Rapid direct access to stored documents.
- Input and corrections are easy and fast.
- Productive without customer program change or modification.
- Commands are short mnemonics, easy to learn and quick to use.

Text --

- Upper and lower case printing.
- Corrections do not require extensive retyping.
- Hyphenless justification of right margin.
- Free form input for "formatted" (narrative) text, fixed form for tabular material.
- Computer printing (1403 N1 with TN train) of upper and lower case, about 5,000 words per minute.
- Correction facilities include change/addition/deletion of a phrase or word; addition or deletion of paragraphs; rearrangement of sentences or paragraphs.
- Flexible headings, footings, and page numbering.
- Line width and page depth controlled by terminal operator.
- Vertical spacing commands for the later insertion of art work.
- Tabs used like regular typewriter.

Data Entry --

- Quickly changing data can be easily maintained.
- Automatic sequence numbering, including resetting the number at any point.
- Field duplication.
- Variable length record sizes up to 132 characters.
- Output as OS data set to disk or tape; OS writers used to write to punch or printer.
- Easy to use the terminal typewriter in the source department.
- Upper only or upper and lower case.

Special Sales Information: Types of customers and prospects interested in ATS/360 are aerospace, manufacturing, financial, publishing operations, engineering groups, large computer programming groups (particularly those remote from the computers), transportation, insurance, legislative bodies, legal firms, process, public utilities, distribution, state & local governments, education, medical, scientific, etc.

Customer Responsibilities: The system is designed to run primarily unattended. However, when console operator intervention is required, a knowledgeable individual thoroughly trained in the equipment and programs, including OS/360, must be available to make quick accurate decisions. Education of the terminal and console operators is the prime installation requirement for this system. It is the customer's responsibility to order and install the communications facilities required. Terminal texts, which are provided should be included in the disk system at generation time.

Programming System: The ATS/360 program is written in OS/360 Assembler Language and operates under control of OS/360, either with MFT (Version 2) or MVT. ATS/360 writes its peripheral (card, printer) output on disk or tape as an OS data set. Input to ATS/360 can be an OS data set. A writer in another partition/region is required to perform the actual output to the peripheral device.

Minimum System Requirements: The basic machine components used for ATS/360 consist of a System/360 Processing Unit with at least 22,528 bytes of dynamic main storage (see note below), Multiplexer Channel, Selector Channel ... 1052 Printer-Keyboard (or other system console device) ... 2841 Storage Control Unit ... 2311 Disk Storage Drives (2 minimum) or, 2314 Direct Access Storage Facility ... 2701 Data Adapter Unit ... 2702 or 2703 Transmission Control ... 2741 Communication Terminal, with only Feature #9812, Courier 72 standard IBM SELECTRIC® printing element (part 1167043), and an appropriate line adapter.

Note: In addition to the 22,528 bytes of dynamic main storage specified above, provision must be made for the OS/360 Queued Sequential Access Method (QSAM) routines. Additional dynamic main storage will be required to support additional terminals and devices and optional ATS functions. See the Application Description Manual for further information.

The above configuration is in addition to OS/360 requirements. This configuration will preclude some ATS/360 document transmission capabilities depending on the selection of I/O devices and the availability of additional dynamic main storage. A typical ATS system supporting ten terminals and a peripheral printing capability will require 45,056 bytes of dynamic main storage in addition to that required by the QSAM routines. A typical 100 terminal system would require 115 - 140K bytes of dynamic main storage in addition to that required by the QSAM routines. In any case, a separate partition region is also required to write the print/punch data set on the printer and punch.

One 2400 Magnetic Tape Unit must be available for system generation and maintenance of ATS/360. One 2400 Magnetic Tape Unit is desirable for ATS/360 peripheral operations. It is also desirable that at least one 2741 Communications Terminal be located near the system console.

Optional Machine Units: Additional Processor Storage (see the Application Description Manual) ... Additional Selector Channel(s) ... Additional 2741 Communications Terminals (see the Application Description Manual) ... 2311 Disk Storage Drives ... 2314 Direct Access Storage Facility (one or more) ... 2400 Magnetic Tape Units with Control Unit (one or more) ... Card Read Punch Unit ... Printer (producing at least 132 character print line).

If upper and lower case high-speed printing is desired, a 1403 Printer Model 2, 3, or N1 equipped with the universal character set feature and the TN printing arrangement may be used. It should be noted that the TN characters are appreciably thinner than the Courier characters used at the terminal. The print quality of the 1403 can be improved and made to approximate that of the 2741 by the use of the special "Courier" characters. The quality may be further improved by special "wide hammers" on the printer. Both the special slugs and the wide hammers are RPQ items. See the Application Description Manual for further information.

Basic Program Material:

Publications* -- Application Directory -- Terminal Operations Manual (H20-0589) Operations Manual (H20-0590), Program Description Manual (H20-0582).

Machine Readable** -- The basic machine readable material is contained on one 9-track DTR (800 or 1600 bpi) on one magnetic tape (2400') 7-track 800 cpi (Data Conversion feature required). This reel contains the material required to install ATS/360 plus two archive documents (terminal texts) which are necessary for terminal maintenance.

Optional Program Material:

Machine Readable** -- The optional machine readable material is contained on 9-track DTR (800 or 1600 bpi) or on one magnetic tape (2400') 7-track 800 cpi (Data Conversion feature required). This tape contains the print images of the ATS/360 flowcharts.

Ordering Procedure:

*If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

**Magnetic tapes may be forwarded or ordered (the program order card should accompany the tape order form). If the track and density requirements are not specified, 9-track 800 bpi will be forwarded.

Additional Program Support Material: Application Description Manual (H20-0297-02) ... Systems Manual (Y20-0320).

† Supports System/370 configurations also.

1400 Autocoder to COBOL Conversion Aid Program (ACCAP): ACCAP is intended to assist in converting 1400 series Autocoder or Symbolic Programming Systems (SPS) programs to System/360 COBOL. (360A-SE-19X)

Description: ACCAP is a System/360 Application Program which accepts as input source statements written in Autocoder or SPS for the 1401, 1410, 1440, 1460 and 7010 systems. It produces System/360 COBOL statements when possible and diagnostic messages in the case where the program is unable to complete the translation.

The purpose of ACCAP is to reduce the costs and manpower requirements for converting 1400 series programs to System/360 by (1) recoding to COBOL as many Autocoder statements as possible and identifying those statements that cannot be translated ... (2) generating syntactically correct COBOL which reduces coding and clerical errors ... (3) automatically producing a deck of the generated COBOL statements thus reducing keypunching requirements ... (4) providing a facility to convert to a problem oriented language that can be easily used as a new base for future additions, changes and development ... (5) retaining the original program logic and symbols to facilitate the conversion to COBOL and the testing of the new program ... (6) providing documentation and diagnostics for the new COBOL program in terms of the original Autocoder program.

ACCAP performs the conversion on a statement-for-statement basis; therefore, the generated code may not be as optimum as COBOL coding written expressly for System/360. Where the program is unable to translate the Autocoder (SPS) source statement, it will provide a diagnostic message. Thus a manual coding effort is required to complete the new COBOL source program prior to its compilation and testing.

Features: Machine assisted conversion of your customer's Autocoder (SPS) program to a problem oriented language ... generates COBOL statements using the same symbolic labels of the Autocoder program, supplemented with information indicating their original use ... all Autocoder comments are included on the COBOL listing and comment cards become COBOL NOTES in the new source deck ... includes an option for recognizing and generating the record mark position when specified as part of the DA statement ... the output listing allows a programmer to relate the original Autocoder statements to the generated COBOL statements ... diagnostics, provided on the output listing, highlight the specific statements which require user attention ... retention of the original program logic allows the user to relate this logic to the new COBOL program ... no user modifications to the Autocoder source programs are required ... testing of the new COBOL program is facilitated by the use of the generated cross-reference listing ... produces properly structured COBOL divisions in sequence and creates a syntactically correct COBOL source deck ... improves the effectiveness of your customers' programming staff by relieving them of much of the clerical effort associated with program conversion.

Customer Responsibility: The potential user must become thoroughly familiar with the capabilities and limitations of ACCAP to determine the effectiveness of the program for his installation. The economies of using ACCAP in terms of manpower, machine time, and performance of the resulting program must be evaluated. Further, he should make trial conversions of representative production programs before deciding on general use of ACCAP.

The Application Description Manual (H20-0352) was specifically designed to aid your customer in making this decision.

The customer should determine the suitability of the Autocoder program for Conversion to COBOL. In addition, he should insure that the Autocoder (SPS) source programs used correctly reflect the current production run.

Use: The conversion process proceeds as follows: add the necessary control cards (approximately 6) to the selected Autocoder or SPS source deck ... execute ACCAP ... examine ACCAP output and manually complete the conversion by resolving the diagnostics as indicated on the COBOL output listing; the extent of this manual effort is a function of the programming techniques and statements used in the Autocoder (SPS) program which cannot be converted by ACCAP; programs should be selected for ACCAP conversion based on the knowledge of ACCAP's capabilities.

Programming Systems: ACCAP contains its own control program which was adapted from OS/360. This control program is independent of the user's System/360 Operating System and allows Autocoder or SPS programs or both to be stacked for input.

If the user desires to modify the ACCAP program, he must provide his own Operating System/360 which must contain both the COBOL E and COBOL F compilers.

Minimum System Requirements: A System/360 Model G40 (131K) with Decimal Arithmetic ... 1052 Printer-KeyBoard Model 7 ... 2540 Card Read Punch Model 1 (or a 1442 or 2501) ... 1403 or 1443 Printer ... two 2311 Disk Storage Drives. A 2400 series tape unit can be substituted for the card reader, card punch, and/or printer.

This configuration accepts Autocoder or SPS source decks of up to approximately 10,000 cards. The same EC levels required for OS/360, Release 13, are required for execution of ACCAP.

Basic Program Material:

Publications* -- Application Directory ... Program Description Manual (Y20-0105-1) ... Operators Manual (Y20-0106-1).

Machine Readable** -- The dump/restore image of ACCAP system pack is available on one 9-track DTR (800 or 1600 bpi) or one 7-track magnetic tape at 800 cpi (Data Conversion feature required), or one 1316 Disk Pack.

Optional Program Material:

Machine Readable*** -- The ACCAP source decks are available on one 9-track DTR recorded at 800 bpi or 1600 bpi. It is also available on a 7-track DTR recorded at 800 cpi (Data Conversion Feature required).

This program is highly complex and can lead to underestimating the modification effort.

Ordering Procedures:

*If only the form numbered manuals are required, order from Mechanicsburg -- not from PID. Customer orders for the manuals from Mechanicsburg require Branch Manager's approval.

**Magnetic Tapes (2400') may be forwarded or ordered (the order card should accompany the tape order form); disk packs must be forwarded to PID with the program order card.

If the distribution medium is not indicated on back of the program order card, 9-track at 800 bpi will be forwarded.

***DTRs are provided by PID; no tape submittal is required.

Additional Program Support Material: Application Description Manual (H20-0352-2) ... System Manual (Y20-0124-1).

Text Processor - COMPOSITION: This program, in conjunction with a user-supplied program, forms the basis of a comprehensive text-composition system that operates under DOS/360.

(360A-DP-08X)

Description: The program consists of control and functional routines that accept input from a user-prepared disk-resident file. The disk-resident file must contain the copy to appear in print and instructions describing the desired printing format. The program produces generalized output records and stores them in a specified disk area. These output records contain (1) the original copy in the form of justified lines arranged according to the graphic and stylistic requirements described by the user with the input format instructions and (2) the functional format control information necessary to completely define the printed appearance of the lines. The user must retrieve this generalized information from the disk area, convert it into coding acceptable to the specific composition device on which final printing will occur, and write it to the appropriate systems output device. The input/output processing described must be provided by the user in the form of an input/output generation program. If word division capabilities are required, COMPOSITION/360 is designed to use the HYPHENATION/360 (360A-DP-07X) component program of System/360 Text Processor.

Although COMPOSITION/360 is programmed to run in one partition under DOS/360, it is designed with the intent that the user-supplied input/output generation program occupies the Foreground I partition with COMPOSITION/360 occupying either the Foreground II (if independent user background programs are desired) or Background partition (if in a dedicated text-processing environment). Implementation of an operational System/360 Text Processor, which consists of COMPOSITION/360, HYPHENATION/360 (if required), and a user-supplied input/output generation pro-

gram, requires two partitions of DOS/360, with the user-supplied program occupying Foreground I. The two partition operational concept for System/360 Text Processor is designed to gain maximum utilization of the multiprogramming features of DOS/360 in effecting maximum program overlap and thruput, while allowing non-related programs in the Background partition to run concurrently with and independently of normal text processing operation.

Features: Two format control languages are supported to allow user flexibility in utilizing maximum capabilities of different composition output devices and to permit the transition of existing 1130 or 1620 Type Composition installations to System/360 with minimum operator training ... COMPOSITION/360 is intended to provide functional capabilities which are common to most text composition applications, thus forming the base from which the user can integrate the facilities of System/360 and System/360 Disk Operating System with his specific installation requirements ... the composition device-independent output records produced by the program are designed to permit user utilization of the capabilities of a broad range of composition output devices without requiring a separate COMPOSITION/360 program run for each device. This could be advantageous, for example, with a system in which proofing operations are desired on an output device different from the final composition device ... COMPOSITION/360 can be used to process text input originating from different system input devices since it is designed to operate independently of I/O facilities; this input media transparency is effected by user code conversion of the input data stream prior to writing it onto the disk file for input to COMPOSITION/360.

Special Sales Information: Any organization which transcribes textual information into the form required for final printing on composition devices that can be attached directly to System/360, or controlled indirectly (e.g., via magnetic tape or paper tape) from System/360 is a potential user. Other users are newspapers, book publishers, technical manual publishers, and in-house publishers which can significantly reduce the time and programming effort required to implement computerized text composition.

Use: This component program of System/360 Text Processor consists of control and functional routines that accept input text from a user-prepared disk file, process the text into justified lines according to graphic and stylistic requirements described by the user, and produce generalized output records on disk. The user must write the routines to place input on the file and relieve the generalized output records from the file. This enables the user to tailor the system to his own requirements and provides the necessary flexibility for change and growth.

Customer Responsibilities: For a minimum operational system, user responsibility encompasses the following two areas:

1. Write an input/output generation program which tailors COMPOSITION/360 to the user's own input/output requirements. This program includes:
 - Routines (1) which select, initiate, and handle reading of textual and format control information from the specific systems input device(s) selected by the user for that function and (2) which place the textual and format control information in the designated disk file area in the proper format where it then becomes input to COMPOSITION/360.
 - Routines (1) which relieve the generalized output record from the designated file output area after COMPOSITION/360 processing, (2) tailor the output records to the specific composition device on which the copy is to be printed or displayed, and (3) which select, initiate, and handle the output of tailored device-dependent records to the specific systems output device(s) selected by the user for that purpose.
2. Gather data which controls the graphic and stylistic appearance of the text and which defines the fonts used to justify the text. This data must then be loaded on a disk in a format acceptable to COMPOSITION/360 via utility programs supplied with this package.

Programming Systems: COMPOSITION/360 is written in Assembler Language and operates under control of DOS/360 in a multiprogramming environment. In addition to a Supervisor and System Control and Basic IOCS, the following components are required:

Direct Access Method	360N-10-454
Disk Sort/Merge	360N-SM-450
Assembler	360N-AS-465

Minimum Machine Configuration: System/360 Model F Processing Unit (64K bytes) with Decimal Arithmetic, Interval Timer, Storage Protection, and one Selector Channel, 1052 Printer-KeyBoard with CPU attachments, 2841 Control Unit, and one 2311 Disk Storage Drive. These components are in addition to DOS/360 requirements of one 2311 Disk Storage Drive, one card reader*, one card punch*, and one printer*. Note that this minimum machine configuration does not include the text input/output system devices necessary to implement an operational text processing system (e.g., magnetic tape, paper tape, data entry terminals, display components etc.). It is the responsibility of the user to select these components and provide the necessary support programming based on his composition system requirements.

The core residence requirement for COMPOSITION/360 is 30K bytes. The inclusion of HYPHENATION/360 with COMPOSITION/360 does not increase this requirement since HYPHENATION/360 functions as an overlay phase in COMPOSITION/360. The remaining 34K in a minimum system can be used for the DOS Supervisor, the user's input/output generation program, and a user background program. Implementation of a three partition system (user's input/output generation program in Foreground I, COMPOSITION/360 in Foreground II, and user program in Background) in a minimum system is dependent upon the size of user's input/output generation program and the DOS Supervisor needed.

*See System/360 Disk Operating Guide (C24-5022) for acceptable units and possible substitutions.

Basic Program Material:

Publications: Application Directory ... Program Description Manual (H20-0585) ... Operations Manual (H20-0579). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable: Machine readable material may be obtained on one 9-track DTR (800 bpi) or 9-track 2400' magnetic tape (1600 bpi) or one 7-track 2400' magnetic tape (800 cpi, Data Conversion feature required) or on one 1316 Disk Pack.

Magnetic tapes (2400') may be forwarded or ordered (the program order card should accompany the tape order form); disk packs must be forwarded to PID with the program order card.

If track and density requirements are not indicated on back of the program order card, 9-track at 800 bpi will be forwarded.

Additional Program Support Material: Application Description (E20-0256) ... Systems Manual Flowchart Narratives Vol. 1 (Y20-0318) ... Systems Manual Flowcharts Vol. 2 (Y20-0319).

The Subscription Service (SRL/SS) should be used to ensure that revisions to the Systems Manuals are received.

Text Processor - HYPHENATION:

Consists of control and functional routines that provide for division of words in text-processing applications. This permits the addition of word syllables to meet justification requirements rather than forcing the line to end with the complete word. This hyphenation capability is provided in the form of a module which can be linked with a text-processing program. (360A-DP-07X)

Through program linkage, HYPHENATION/360 accepts a word up to 63 characters in length from the user's program and determines the division points. The word, with the division point or points indicated (based on user option), is returned to the user program where the portion to be retained on a line can be selected as determined by user's graphic requirements.

The program assumes the burden of all hyphenation decisions, regardless of whether the word to be divided contains alphabetic characters only, or combination of alphabetic characters, numbers, and/or punctuation.

A word presented to the program normally consists entirely of alphabetic characters. However, lengthy compound words or phrases, alphanumeric words, and words containing punctuation can be divided by HYPHENATION/360.

Features: Modular design concept permits inclusion of HYPHENATION/360 in any user text processing program ... broad statistical data base used to generate probabilities implies higher accuracy through a wide range of words ... exception word dictionary concept with IBM-supplied utility programs provides ability to tailor HYPHENATION/360 to highly specialized word lists (e.g., legal, medical, scientific) ... file and program layout based on statistical analysis that insures faster hyphenation of commonly used words ... dual operating mode (i.e., last-to-fit or all-points hyphenation) provides fast throughput coupled with flexibility to accommodate a wide variety of user-required graphic considerations ... hyphenation of all words, including those containing numerals, punctuation, special characters, text hypens, etc. ... system utility programs provide user maintenance and display capability utilizing the logic of this package.

Use: HYPHENATION/360 can be used in conjunction with a text composition program to produce justified and hyphenated lines of text. HYPHENATION/360 accepts a word from the composition program and returns to the composition program the hyphen points for that word. The number of hyphen points picked depends on the mode of operation desired.

If All Points mode is selected by the composition program then all valid hyphen points in the word are indicated. However, if Last-to-Fit mode is chosen only one hyphen point closest to the last character in the word to fit is chosen.

Two utility programs are also supplied which allow the user to test words for hyphen points and maintain the exception word dictionary.

The testing program processes words entered on cards with desired hyphen points indicated. These words are processed through the hyphenation logic and if the computed points are different than those desired, the word is indicated as an exception.

These exception cards can then be used as input to the maintenance program which loads them on the exception word dictionary.

Using the facilities of these programs the user can insure a high degree of hyphenation accuracy.

Customer Responsibilities: The user of HYPHENATION/360 must assemble and generate an operational program and link edit it with a text-processing program. That program must contain the routines necessary to initialize the linkages to and from HYPHENATION/360.

To build the user's exception word dictionary so that it contains the appropriate words, the user should test words that he feels might be exceptions to the hyphenation logic. Exceptions to the hyphenation rules as indicated by the testing program, together with the exception words distributed with the program, are loaded on the exception word dictionary by the maintenance program.

As additional words which do not follow the hyphenation logic are encountered, they can be added to the exception word dictionary by using the maintenance program.

Programming Systems: This program is coded in Assembler Language and operates under DOS. The program also operates in a V=R mode under control of DOS/VS. In addition, the program operates in a VM/370 environment while in V=R mode under control of DOS and DOS/VS.

The program operates with the batch or multiprogramming supervisors of DOS or DOS/VS in any of the three partitions.

The user's text processing environment will determine the Supervisor options and system components required.

To assemble and catalog the HYPHENATION/360 and utility program source books, a DOS system including the following components is required:

- . System Control and Basic IOCS (360N-CL-453)
- . Assembler (360N- AS-465)
- . Direct Access Method (360N-IO-454)
- . Consecutive Disk IOCS (360N-IO-455)

The following DOS utility programs are required for retrieving machine readable material:

- . Disk to Card (360N-UT-461)
- . Disk to Printer (360N-UT-461)

Minimum Machine Configuration: The minimum machine configuration required for execution of HYPHENATION/360 and its two associated utility programs includes:

- . one System/360 Processing Unit (32K)
- . one Card Reader (1442, 2501, 2520, 2540)
- . one Card Puncher (1442, 2520, 2540)
- . one Printer (1403, 1443)
- . one 2311 Disk Storage Drive (includes SYSRES)
- . one 1052 Printer-KeyBoard

The core residence requirement for HYPHENATION/360 is 11,280 bytes. The minimum processor storage capacity of 32K is dictated by the core requirements of one of the utility programs.

Retrieval of machine readable material can be obtained on the minimum configuration with the restriction that the System Printer must be a 1403 Printer with 132 print positions. This Printer configuration is required for listing flowcharts. It is desirable, but not required, that the printer have a PN or QN chain arrangement (PL/I).

If this arrangement is not available, the following four delimiter characters may either not print, or else print as different characters: percent sign, colon, semi colon, and number sign.

If a 2400 series Magnetic Tape Unit is available in addition to the above configuration, the user can order the machine readable material on magnetic tape. A tape to disk operation is then required prior to retrieving the data from disk.

All components of HYPHENATION/360 can be assembled and link edited on the same minimum configuration with the CPU core requirement of only 24K instead of 32K.

Basic Program Material:

Publications* -- Application Directory ... Program Description Manual (H20-0525) ... Operations Manual (H20-0626) ... System Manual (Y20-0208).

Machine Readable** -- Source statements of the 3 component programs in card image format, basic file of exception words, and system flowcharts along with reference listings are available on one 9-track DTR (800 bpi) or 9-track (1600 bpi) 2400' MT or one 7-track 800 cpi 2400' magnetic tape reel (Data Conversion feature required) or one 1316 Disk Pack.

Ordering Procedures:

*If only the form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg -- not from PID.

**If track and density requirements are not indicated on the back of the program order card, a nine-track (800 bpi) tape will be forwarded.

Magnetic tapes (2400') may be forwarded or ordered (the order card should accompany the tape order form); disk packs must be forwarded to PID with the program order card.

Additional Program Support Material: Application Description Manual (E20-0257).

Reference Material: IBM System/360 Disk and Tape Operating Systems Assembler Specifications (C24-3414) ... IBM System/360 Disk Operating System, System Control and Service Programs (C24-5036) ... IBM System/360 Disk and Tape Operating Systems Utility Programs Specifications (C24-3465) ... IBM System/360 Disk Operating System Operating Guide (C24-5022) ... IBM System/360 Principles of Operation (A22-6821).

Administrative Terminal System under DOS/360:† ATS/360 under DOS is intended for System/360 Model 30, 40, and 50, and uses the multi-programming features of DOS/360 (360A-CX-18X).

Description: ATS/360 is a new dimension in text and data processing. ATS/360 is a user-oriented remote terminal system designed for large text and data files. The terminal user has complete control over the management and processing of his own information files. ATS/360 operates under DOS/360 which means the customer does not have to dedicate an entire system to ATS/360 operations.

ATS/360 is programmed to run in one partition under DOS/360 using the multiprogramming supervisor. Other programs may run concurrently with and independently of normal ATS/360 terminal operation, thereby extending the productivity of System/360 for users of ATS/360.

ATS/360 uses include source data recording, data modification and correction, data manipulation, retrieval of information from large disk and magnetic tape files; outputting of information on the same terminal or another terminal, magnetic tape, punched cards, and high speed upper and lower case printed output. Information may be entered and stored in either a free or fixed form. Stored information may be recalled for further processing.

Features: Remote entry and processing of large text and data files ... direct access by an alphanumeric name to large data banks by remote terminals ... ATS/360 activities are time shared with other data processing activities on the same computer ... reduced cost of capturing information at its point of origination ... ATS/360 information is processed in real-time ... low entry and start-up cost ... little skill and training needed to use the system ... data correction, modification and rearrangement by back-spacing and retyping during original entry; retyping beginning with a particular phrase; replacing a word or phrase; inserting, erasing, copying, or moving lines of information; gathering stored information in any sequence ... storage and retrieval of data from disk files or magnetic tape ... remote or centralized, upper case, or upper and lower case printed output, magnetic tape or punched card; output format controlled from the terminal at the time of output by -- limiting free-form text line length, hyphenless justification of right-hand margin, intermix of free-form and fixed format information, controlled vertical spacing, very flexible heading, footing, and page numbering capabilities, halting to allow insertion of information or changing of print elements, etc.

Special Sales Information: Principal application areas are source data recording, key-punch replacement, technical manual preparation, data file conversions, proposal writing, computer and numerical control programmers, library abstracts, purchase order preparation, property - sales - engineering - personnel - tooling - manufacturing - financial and quality data file management, etc.

Type of customers and prospects interested in ATS/360 include aerospace, airlines, consultants, distribution, education, federal government, finance, insurance, legal, manufacturing, medical, printing and publishing, process, public utilities, service bureaus, scientific, state and local government, and transportation.

Customer Responsibilities: The system is designed to run primarily unattended. However, when console operator intervention is required, a knowledgeable individual thoroughly trained in the equipment and program, including DOS/360, must be available to make quick accurate decisions. Education of the terminal and console operators are the prime installation requirements for this system.

Programming System: The ATS/360 program is written in DOS/360 Assembler language and operates under control of DOS/360 with the multiprogramming feature.

The DOS/360 version uses the console interrupt key to call for the cessation of ATS/360 peripheral functions. Therefore, background programs that use this key for console operator initiated messages may not run while ATS/360 is running.

Minimum System Requirements: Model F Processing Unit (64K bytes), one Selector Channel, 1052 Printer-Keybaord with appropriate attachment ... 2841 Control Unit, two 2311 Disk Storage Drives or one 2314 Direct Access Storage Facility ... one 2701 Data Adapter Unit or 2702/2703 Transmission Control, 2741 Communication Terminals equipped only with Standard Courier 72 SELECTRIC® printing element (Part 1167043) with Feature #9812, and with the appropriate line adapters. ATS/360 supports only the Correspondence Code 2741 Terminals without the interrupt feature. These components are in addition to DOS/360 requirements of one 2311 Disk Storage Drive, one card reader†, one card punch†, and one printer†. This minimum configuration could preclude some ATS/360 document transmission functions depending upon selection of I/O devices. One 2400 magnetic tape drive is required for system generation.

In practice it is recommended that a user include sufficient components to obtain maximum benefits and performance from ATS/360. Additional components supported include up to eight 2311 Disk Storage Drives ... one or more 2400 Magnetic Tape Drives with tape control unit†, card reader†, card punch†, and printer† producing at least 132 character print lines.

If the multiprogramming feature of DOS/360 is used, the Storage Protect feature is required on the processing unit. If uppercase and lowercase printing (similar to the Courier 72 printing element on the terminals) is desired, a 1403 Printer Model 2, 3, or N1 equipped with the Universal Character Set feature and TN printing arrangement must be used.

† Supports System/370 configurations also.

ATS/360 does not in general require exclusive use of any particular channel. ATS/360 I/O devices are channel independent to the extent of physical attachment. Several 2311s, for example, may be assigned to separate control units on each of two selector channels if desired; furthermore, programs in other partitions may share channels with ATS/360 operations. However, if programs in other partitions require a selector channel, for best ATS/360 performance it is recommended that a second selector channel be added, one dedicated to ATS/360 functions, and the other to background programs. Further, it is recommended that burst mode devices not be attached to the multiplexer channel to avoid interference problems which might occur in some configurations.

†See IBM/360 Disk Operating Guide (C24-5022) for acceptable units and possible substitution.

Basic Program Material:

Publications* -- Application Directory ... Terminal Operator's Manual (H20-0509) ... Computer Center Operator's Manual (H20-0511) ... Program Description Manual (H20-0508).

Machine Readable** -- ATS/360 macros for ATS assembly and object program are available on one Distribution Tape Reel (DTR) 9-track 800 or 1600 bpi or 7-track 800 cpi (Data Conversion feature required).

Optional Program Material:

Machine Readable** -- Source statements and flowchart print lines available on one 9-track 2400' reel of magnetic tape (800 or 1600 bpi) or one 7-track 2400' reel of magnetic tape (800 cpi - Data Conversion feature required).

Ordering Procedure:

*If only the form numbered publication or if additional copies of the form numbered publications are required, order from the IBM Distribution Center, Mechanicsburg -- not PID.

**If the track and density requirements are not specified on the back of the program order card, 9-track at 800 bpi will be forwarded.

DTRs will be provided by PID; no tape submittal is required.

Magnetic Tapes (2400') may be forwarded or ordered (the order card should accompany the tape order form).

Additional Program Support Material: Application Description Manual (H20-0510) ... System Manual (Y20-0174).

Reference Material: IBM 2741 Communication Terminal (A24-3415) ... IBM 2702 Transmission Control Unit (A22-6846) ... IBM System/360 Principles of Operation (A22-6821) ... Disk Operating System/360 Supervisor and Input/Output Macros (C24-5037) ... Disk Operating System/360 System Control and System Service Programs (C24-5036) ... Disk and Tape Operating System/360 Assembler Specifications (C24-3414) ... Disk and Tape Operating System/360 Utility Programs Specifications (C24-3465) ... Disk Operating System/360 System Generation and Maintenance (C24-5033) ... Disk Operating System/360 Operating Guide (C24-5022).

Vehicle Scheduling Program (VSP):

VSP provides a comprehensive tool in the planning and operating of a distribution and delivery system. It computes near-optimal

routes for delivery of products or services by a fleet of vehicles. Because of the wide range of program options, it can be applied to most fleet routing and delivery situations. The advantages over manual methods are increased efficiency and speed of scheduling, improved routing, and cost reductions (through better fleet utilization). (360A-ST-06X).

Description: VSP determines the routes a group of vehicles must travel to meet certain commitments in the delivery of service or products to customers at given locations. The program tends to optimize basic factors such as travel time and number of vehicles. VSP consists of two main sections, the Network Analysis Program and the Schedule Production Program. The first program analyzes a network representing the potential calling points by computing either actual or approximate distances between all points. The second program can repetitively produce schedules which meet various restrictions such as route-time, speed, vehicle capacity, and customer requirements.

The program can be used to solve many types of delivery problems. In addition to fulfilling the daily routing function, VSP can also be applied to realign fixed routes, aid in determining feasible locations of warehouses and depots to service potential customers, plan for a new fleet, and provide statistical and cost data relative to the efficiency of a fleet.

Input to the Network Analysis Program can be either of two types: True Distance or Coordinates. Both methods are concerned with zones, not actual customers. A zone is defined as a delivery area (e.g., a shopping center, a postal zone, or a section of a city), which can contain from 1 to 255 customers. The True Distance Method considers distances over actual roads between all points, intersections, and zones. Individual speed can be specified for each road in the network, if desired. This method, while more time consuming to prepare, gives a higher degree of accuracy as the output file will represent the combined knowledge of a firm's manual routing and dispatching departments. True Distances are best suited for networks in which customer location can be determined in advance with relatively few changes so that it needs to be run infrequently. Both methods produce a file representing all practical combinations of potential delivery zones.

The Schedule Production Program uses the output of the Network Analysis Program, together with the list of calls to be made. It then prepares feasible routes approaching optimum loads and minimum travel time, within the restrictions imposed by the user; the most valuable result is that fewer vehicles may be required. The output of the program consists of a printed list of the recommended routes. A summary of the fleet utilization is also produced. All output is stored on disk and can be modified by the user to prepare a variety of specialized reports, including: warehouse picking and loading lists, invoices in route sequence, special driver instructions; plus various analytical reports. The output can, of course, also be used as the entry back into the customer's existing data processing flow. VSP can, therefore, be a link to a more fully integrated distribution system.

Features: The features of the Schedule Production Program listed below are of particular interest as they allow the schedules to be tailored to meet specific demands of customer service and fleet utilization. These features are designed as options which are used only when requested by the user and can then be combined in almost any manner.

- . Limited calling times by stop
- . Average time at all stops in addition to loading/unloading
- . Special additional time for an individual stop
- . Vehicle limits by calling point
- . Up to 255 different vehicle types and capacities
- . Modification of average vehicle speed
- . Earliest possible starting and latest possible finishing time for the fleet
- . Maximum route time by vehicle type
- . Maximum number of calls per route
- . Multi-compartment vehicles
- . Variable assignment of trailers to vehicles
- . Average unloading time per unit
- . Dual specification of load e.g. weight and volume
- . Multiple day journeys
- . Low priority orders
- . Traveling time between calls within a zone.

Use: VSP consists of two basic parts, which can be thought of as separate programs and run independently if desired. These are the Network Analysis and Schedule Production Programs.

After determining whether to use the True Distance or the Coordinate Method of input, the user must prepare the appropriate Network description cards for the Network Analysis Program. The output file from this first phase is then used as partial input for the Schedule Production Program. In addition, for this second phase, the user must specify the various delivery requests and restrictions, fleet descriptions, and limits to be imposed.

Output from the program consists of a suggested schedule for each route, a summary of fleet utilization, and disk storage of all output. Although the user is not required to write any additional programs, he may do so to create input for either phase or to expand the output from the Schedule Production Program.

Customer Responsibilities:

1. The user must be familiar with the options and features of both the Network Analysis and the Schedule Production Programs.
2. Capable user personnel must be assigned to choose between the True Distance and the Coordinate methods and gather the appropriate data. Sufficient time should be given to data gathering prior to implementation of VSP.
3. Overall work standards and special requirements for each delivery must be documented prior to producing the first workable schedule.
4. Some user programming may be required to tailor the input and output of the Schedule Production Program, as mentioned above.
5. A period of parallel operation should be planned when both VSP and the manual system are used. This will allow time to try various combinations of the program features to produce the desired routings.

Programming Systems: VSP is written in Basic Assembler Language and operates under the IBM System/360 Disk Operating System (DOS). Use is also made of the DOS Sort/Merge.

Minimum System Configuration: System/360 Model E25 (32K) ... 1052 Model 7 and two 2311 Disk Storage Drives (which include provision for DOS/360 disk residence) with attached features ... 1442 Card Read Punch Model N1 and Multi-plexer Channel.

Features:

- Data base creation using either full text, abstracts or index terms.
- Word and document frequency counts to improve search word effectiveness.
- Words occurring in the input can be eliminated from further processing by a variety of system options.
- Search expansion employing terms selected by user.
- Search precision by preserving context.
- Specialized search operators against bibliographic (formatted) fields: such as, between, mask, scan, and numeric operators.
- Search language easily learned.
- Printed index--search word and document frequencies, document cross references, and reference field and text listing by selected keyword.
- Search and output language allowing keyword (dictionary) parameters; sentence, paragraph, or positional separation restrictors; synonym, equivalents, or truncation expanders; reference field parameters; or logical combinations of parameters.

Use: As input, the program accepts user-defined documents composed of a sequential document number, bibliographic data, and narrative data. The program converts narrative data from all documents into alphabetically ordered search terms, creates a file accessing dictionary composed of the unique words of the set of documents, and stores a searchable representation of each document's original terminology and context. Moreover, the program stores reference data (bibliography and control number) as formatted fields within pertinent records containing document text representation. If full-text retrieval is elected as an installation option, the program also stores a verbatim copy of input documents. A user-generated exclusion table causes the system to purge common words; a user word edit further limits dictionary size and contents.

A user's search request accesses the dictionary with a Boolean combination of search terms possibly constrained by relative position indicators: word distance, sentence, paragraph. The request may also cite reference data as search criteria. The program then amasses and merges strings of document control numbers, reduces the candidate documents through a check of formatted reference fields, satisfies search-term-position criteria, and prints a bibliography of qualifying documents. A full-text printout is an installation option.

A search procedure can also employ synonymous/equivalent terms from two user-generated search-word-substitution lists. A special kind of search procedure - index list - produces various forms of topical listings based on the words contained in the dictionary.

Customer Responsibilities: All persons installing, operating, or maintaining the application program must have a working knowledge of Operating System/360.

A system user must convert his document source data into machine-readable records acceptable by the Document Processing System, for an I/O device supported by OS/360. Specifications for such input conditioning should be made as nearly universal as possible so that they apply to document holdings in many forms. The user's conversion specifications should particularly address word, sentence, and paragraph termination as employed in his current information holdings and as conventions to be adopted within the Document Processing System. Input conditioning must also format document reference data into field structures allowable within the system. The data format produced under input conditioning specifications must be described to the system one time via data base description procedures.

The system user should exercise the application program against a quantity of documentary data to familiarize himself with the system's operation and capabilities. Machine time will be minimized and procedural errors more quickly noted if the user prepares a relatively small set of documents as a test vehicle.

To ensure proper operation of the program with the intended set of documents, the user is responsible for providing adequate equipment and programming support as outlined below.

Programming Systems: The application program is written in the OS/360 Assembler Language. Operation of the Document Processing System hinges on the following OS/360 options and components:

Primary Control Program	360S-CI-505
Input/Output Support for BDAM	360S-DM-509
Utilities	360S-UT-506
Sort/Merge	360S-SM-023
Linkage Editor E	360S-ED-510

Minimum Machine Configuration: The Document Processing System requires OS/360 facilities for planned configurations. As a guideline, this application programming system requires a System/360 Model 2040G. The requirement for dynamic main storage is 44K bytes. In addition to OS/360 secondary storage requirements, a minimum of three IBM 2311's (or equivalent) is recommended. Peripheral devices needed include a card reader (for system generation), a tape station or printer (for output), and provision to sort the user's data sets. The allowance of 44K bytes for the Document Processing System satisfies the OS/360 SAM and BDAM requirements.

Basic Program Material:

Publications* -- Application Directory ... a combined Program Description and Operations Manual (H20-0477).

Machine Readable** -- The generation job stream object programs and sample program are available on one 9-track DTR (800 or 1600 bpi) or one 7-track DTR (800 cpi - Data Conversion feature required).

Basic Program Material:

Publications -- Application Directory...Program Description Operations Manual (H20-0506)... If only the form numbered manual is required, order from the IBM Distribution Center, Mechanicsburg -- not PID.

Machine Readable* -- The relocatable programs and sample problem deck are available on one 9-track DTR (800 or 1600 bpi) or one 7-track DTR (800 cpi) Data Conversion Feature required or one 1316 Disk Pack. (Disk Pack must be forwarded to PID with the program order card).

Optional Program Material:

Machine Readable* -- The source programs and flow charts for the Schedule Production phase of VSP are available on one 9-track DTR (800 or 1600 bpi) or one 7-track DTR (800 cpi) Data Conversion Feature required.

Ordering Procedures:

* If the track and density requirements are not specified on the back of the program order card, a 9-track (800 bpi) DTR will be forwarded. DTRs will be supplied by PID; no tape submittal is required.

Additional Program Support Material: System Manual (Y20-0168) ... availability and form number for the Assembly Listings for the Schedule Production and Distance Listings on microfiche will be announced in a PRL...Application Description Manual (20-0464).

Reference Material: Promotional Brochure "VSP/360: Direct Route to Improved Vehicle Scheduling" (520-1914)...VSP/360 Promotional Kit (slides and narrative) (V20-0156).

Document Processing System: Provides for the creation of document files by storing in machine-readable form either full text, abstracts, or keywords. The program generates a series of inter-related files which furnish direct access to each textword or keyword and the documents which contain them. A dictionary file provides control over the words available for searching. Contextual relationship is preserved by storing in the master file every word (in coded form) in the sequence in which it occurred in the input. This capability ensures high precision in answering queries. To assure a high level of retrieval of relevant documents, the Document Processing System optionally provides for the maintenance of a Synonym/Equivalents file which is designed to expand terms used by the search. (360A-CX-12X)

Where full text of a document or at least an abstract is available in machine-readable form, it may optionally be stored in a file and presented in answer to a query.

Description: This application program converts input source records into three searchable files. The input record format must contain a unique and ever-increasing identification number (assigned by the user) and at least one alphameric text word.

Optional fixed or variable length bibliographic (formatted) fields may be included in the input source record. The system compares, on a word basis, the contents of the narrative portion of the input record against a dictionary file containing acceptable terms obtained from previous processing. If the word already exists in this file, the unique identification number of the input record containing this alphameric word is placed in a Vocabulary File, as well as all successive input record numbers containing this specific word. Hence, if a given word occurred ten times in document #123 and 100 times in document #456, the Dictionary File would contain a single entry (for the given word) and an associated record in the Vocabulary file with document numbers #123 and #456. A third, or Master, file contains for each input record the contents of the bibliographic (formatted) fields as well as a coded representation of the narrative data so as to indicate to the program the relative location of each word within the narrative portion of the input record.

Two optional files can also be created: (1) an Auxiliary Text file, which stores, verbatim, the narrative, and (2) a Synonym/Equivalent file, which the user creates from the words or terms he frequently associates with those in the dictionary. With this facility, for example, a multi-language data base might be searched from an inquiry containing words from only one language.

Optional Program Material:

Machine Readable** -- Source statements and flowchart print lines available on one 9-track 2400' reel of magnetic tape (1600 bpi) or 9-track DTR (800 bpi) or one 7-track 2400' reel of magnetic tape (800 cpi - Data Conversion feature required).

Ordering Procedure:

**If only the form numbered publication or if additional copies of the form numbered publications are required, order from the IBM Distribution Center, Mechanicsburg -- not PID.

**If the track and density requirements are not specified on the back of the program order card, 9-track at 800 bpi will be forwarded.

DTRs will be provided by PID; no tape submittal is required.

Magnetic Tapes (2400') may be forwarded or ordered (the order card should accompany the tape order form).

Additional Program Support Material: Application Description Manual (H20-0315) ... Systems Manual.

Reference Material: System/360 Operating System -- Utilities (C28-6586) ... System Programmer's Guide (C28-6550) ... Sort/Merge (C28-6543) ... Job Control Language Charts (C28-6632) ... Storage Estimates (C28-6551).

Shared Hospital Accounting System (SHAS):† SHAS provides hospital accounting for the multiple hospital environment. The member hospitals are tied to the central computer facility by Teleprocessing terminals. The accounting applications are Patient Billing, Accounts Receivable, and General Ledger. Accounting for both inpatients and outpatients is provided. In addition to Medicare cost allocation, SHAS determines Medicare insurance proration facilitating the preparation of the Medicare inpatient and outpatient billing forms. The design of SHAS facilitates the addition of clinical or administrative user written programs. SHAS programs are designed to provide better administrative and operational control and reduce the ever increasing clerical load associated with hospital administration. (360A-UH-11X)

Description: The SHAS programs and the System/360 using remote terminals encompass the application areas of Patient Billing, Accounts Receivable, and General Ledger for multiple hospitals.

The SHAS applications operate in two modes: on-line entry of data and receipt of reports by means of Teleprocessing terminals and off-line data entry and reporting at the central data processing location. The SHAS programs provide the on-line facility for applications where immediacy of the information is significant (entry of charges, cash payments, request for demand bills, etc.). For other applications, receivable statement writing, etc., the central facility (with its high speed printer) is used directly.

Features:

General

- . Input Edit Tables and Report Format Control provide flexibility at the user's option to tailor the input and output for each application.
- . Hospital Profile provides for individual hospital processing decisions and parameters tailoring SHAS program processing to each hospital on the system.
- . The SHAS Executive provides the capability for processing foreground and background programs. Several terminals can transmit and receive data concurrently through foreground programs while batch applications are processed by background programs.
- . Job Accounting statistics including terminal and CPU utilization are logged internally and are available in report form.
- . Security is attained through input and data set identifications to limit access of data. Each hospital is permitted to inquire into or modify its data only.

Executive

Manage communications lines ... handle the timer ... handle interrupts (e.g., demand bill request and inquiries) ... queue messages ... manage input/output.

Patient Billing

Setting up patient's files upon admission to hospital ... central pricing of hospital services ... charge posting ... census ... insurance proration (including Medicare) ... record cash payments ... Daily Balance Forward printed at the hospital ... inquiry on the status of patient accounts (detail and summary patient bills) ... automatic preparation of patient bills ... automatic printing of insurance statements ... automatic transfer to accounts receivable ... accumulation of revenue and usage data for Medicare requirements.

Accounts Receivable

Preparation of statements ... recording cash payments ... receivable accounts stored either off-line or on-line ... inquiry on the status of receivables ... on-line account validity check for off-line receivables ... listing of accounts which require a final diagnosis ... listing of receivables by financial class ... aged trial balance ... listing of accounts which have insurance receivables ... listing of accounts which fail to meet installment payments ... consolidated statement for family billing ... bad debt reports.

General Ledger

Ledger posting ... Trial Balance ... Comparative Income and Expense Report ... Balance Sheet ... Operating Statement ... cost allocation methods suitable for Medicare - stepdown and double apportionment.

Use: The SHAS system processes input data against patient and account master files. These files are established through procedures supported by the SHAS programs. Patient admissions and dismissals, charges, payments, and accounting transactions are processed for multiple or single hospitals. Teleprocessing provides an alternate input method and an alternate output for certain operational reports and inquiries. Volume output reports are printed centrally in a Teleprocessing system. File update and report jobs are controlled by the central operator through a higher level function language (series of cataloged job steps).

Balance and edit, maintenance, and error reporting programs process data for all applications. Update programs in each application maintain and back-up tape and Indexed Sequential disk master files. Report programs can select data for individual hospitals from billing and receivables tape and disk files. The Background Monitor supports function initiation and uniform restart capabilities for operator control. The Teleprocessing Foreground Monitor is assembled from user Teleprocessing network specifications.

Customer Responsibilities: A thorough understanding of the system (by personnel in the central facility) before installation ... a thorough understanding of DOS and COBOL, including operating experience with DOS ... a thorough understanding of QTAM for installations with Teleprocessing ... selection of terminal site ... creation of master files ... terminal operation manuals for clerical personnel affected ... preprinted forms for certain reports ... customize formats specified by the user by means of SHAS Input Edit Tables and Report Format Control modules ... create hospital profile parameter records ... make necessary arrangements for communication lines and equipment.

Programming Systems: The Shared Hospital Accounting System (SHAS) operates under the IBM System/360 Disk Operating System (DOS/360). The application programs are written in COBOL and Assembler Language. Also used are Sort/Merge and Utility Programs. Teleprocessing programs utilize Queued Teleprocessing Access Method (QTAM).

Minimum Teleprocessing System Requirements: 2030F Processing Unit (64K), Decimal Arithmetic (#3237), Floating Point Arithmetic (#4427), Interval Timer (#4760), Selector Channel - first (#6960), Selector Channel - second (#6961), Storage Protection (#7520) ... 1052 Printer-KeyBoard with appropriate attachments ... 2821 Control Unit Model 1 with 1,100 lines per minute Printer Adapter (#3615) ... 1403 Printer Model N1 ... 1416 Interchangeable Train Cartridge ... 2540 Card Read Punch Model 1 ... 2841 Storage Control Model 1 ... three 2311 Disk Storage Drives Model 1 ... 2415 Magnetic Tape Unit and Control Model 1 ... 2701 Data Adapter Unit Model 1, Terminal Adapter - Type 1 (#4645) or 2702 Transmission Control Model 1, Terminal Control - Type 1 (#4615), Selective Speed (#9684), and IBM

Line Adapters as required. System control terminal at the Central computer site includes 1051 Control Unit Model 2, First Printer Attachment (#4408) ... 1052 Printer-Keyboard Model 2.

Terminal configuration at each hospital uses 1050 series equipment. Recommended are 1051 Control Unit Model 2, First Printer Attachment (#4408), First Reader Attachment (#4411), IBM Line Adapter (#469X), Line Correction (#4795), Line Correction Release (#4796) ... 1052 Printer-Keyboard Model 2 ... 1056 Card Reader Model 1 ... 29 Card Punch Model A22* ... 59 Card Verifier Model 2.

* Self-Checking Number Feature (#7062) may be additionally specified for card punch as desired by the user.

Minimum Non-Teleprocessing Machine Configurations (formerly announced as the CARE Accounting System): A 2030 Processing Unit Model E (32K) with Decimal Arithmetic (#3237), Floating Point Arithmetic (#4427), Interval Timer (#4760), Selector Channel - first (#6960), Storage Protection (#7520) ... 1052 Printer-Keyboard with appropriate attachments ... 2821 Control Unit Model 1 ... 1403 Printer Model 2 ... 2540 Card Read Punch Model 1 ... 2841 Storage Control Model 1 ... three 2311 Disk Storage Drives Model 1 ... one 2415 Magnetic Tape Unit and Control Model 1.

A 2025 Processing Unit Model E (32K) with Floating Point Arithmetic (#4427), Interval Timer (#4760), Selector Channel (#6960), Storage Protection (#7520) ... 1052 Printer Keyboard with appropriate attachments ... Integrated 1403 Attachment (#4590) ... 1403 Printer Model 2 ... Integrated 2540 Attachment (#4595) ... 2540 Card Read Punch Model 1 ... Integrated 2311 Attachment (#4598) ... three 2311 Disk Storage Drives Model 1 ... one 2415 Magnetic Tape Unit and Control Model 1.

Basic Program Material:

Publications -- Application Directory ... Program Description Manual (H20-0533-1) ... Operations Manual (H20-0534-1) ... Teleprocessing Operations Manual (H20-0550).

If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not PID.

Machine Readable -- One 9-track DTR (800 or 1600 bpi) or one 7-track 2400' reel of magnetic tape (800 cpi) Data Conversion feature required. The machine readable material contains the source program modules and catalog control cards, model job control statements, and data set file descriptions for compiling and cataloging into the core image and source library for program operation. Also included is a sample problem with control cards for execution.

If the distribution medium required is not indicated on the back of the program order card, 9-track at 800 bpi will be forwarded.

Magnetic tape (2400') may be forwarded or ordered. (The program order card should accompany the tape order form.)

Additional Program Support Material: Teleprocessing Systems Manual (Y20-0251) ... Systems Manual (Y20-0215-1) ... Application Description Manual (H20-0302-2).

† Supports System/370 configurations also.

Problem Language ANalyzer (PLAN):† This program (DOS/360, 360A-CX-26X or OS/360, 360A-CX-27X) is a sub-monitor and application development support system, implemented in an externally uniform way under the S/360 Disk Operating and Operating Systems. It is especially designed to support problem solving and other highly variable applications.

Description: PLAN furnishes five closely related program sets that are mutually dependent. These provide the basic PLAN functions: the submonitor ... the PLAN input language interpreter ... the PLAN input language definer ... the PLAN subroutine package for FORTRAN application programmers ... the Diagnostic Supervisor.

The PLAN programs for each operating system are written to support a single application development interface. (Each set also allows some desirable, but non-standard operations.) As a result, applications may be moved from one environment to another without change, provided the common interface is adhered to. High level languages offer this kind of support for many purposes. PLAN adds uniform methods of user interaction, data definition, and program structure, in the FORTRAN environment.

Because PLAN was designed to support highly variable applications, it offers a new type of modularity. Program linkage definition and intermediate DASD specifications are deferred until execution time, when they can be varied by input data. As a result, much program recoding and re-organization can be avoided.

In further support of this idea, input languages used for application control under PLAN are also defined at the statement level. Both new statement definitions and new program modules can be added to a PLAN application without forcing changes in existing programs and statement definitions.

+ Supports System/370 configurations also.

Features: Free form input ... four levels of input statement hierarchy ... user controlled error recovery and diagnostic features ... powerful input data options, such as default value, override, algebraic and logical expressions for data values, automatic mode conversion and scaling ... dynamic program loading ... extensive subroutine support for FORTRAN application programmers.

Use: The problem solver (application user) communicates with PLAN through PLAN statements designed by the user to suit his needs. Each PLAN statement contains a maximum of 450 characters; terminated by a semicolon. A new statement may immediately follow the semicolon. Each statement usually contains both a command and data. Processing a PLAN statement causes execution of one or more program modules, using accumulated data and the partial results available at that time.

Programmers communicate with the PLAN system to obtain program linkage, error handling, data management and utility functions by entering PLAN subroutines through CALL linkages (normally from FORTRAN).

Customer Responsibilities:

Program Requirements -- Functional program modules must be written for new applications, following FORTRAN conventions. These modules are named and stored in the system library.

Certain FORTRAN operations may terminate the execution of PLAN. In general these are the functions that return control to the operating system. Substitute functions are provided for these under PLAN and should be used.

For each PLAN application, the customer must also design and define the input language that he wants to use.

Staffing -- Capable user personnel are necessary for good results. Creating a PLAN application involves three groups of people. They are (a) users who are to be served by the application (b) programmers who implement functional logic modules, and (c) system designers who actually design the application input language in detail and specify the data and program modules to be used for each kind of input statement.

Education -- Initial education for system designers and key programmers can be accomplished in a four-day workshop school. No more than a few hours of PLAN training will be needed for those who are simply using a PLAN based application. Customers should expect to prepare simplified user's manuals for application users. Their direct use of PLAN program documents is not intended.

Evaluation -- PLAN is designed to support change. An important factor in the long-term success of PLAN applications is user feedback to and continued attention from the application designer.

Programming Systems:

DOS/360 PLAN -- PLAN runs under S/360 Disk Operating System (DOS/360). It is programmed in the S/360 Assembly language and Basic FORTRAN IV. EXCC is used by PLAN for processing of files.

OS/360 PLAN -- PLAN runs under OS/360 PCP, MFT, or MVT. It is programmed in the S/360 Assembly language and Basic FORTRAN IV. BDAM, BPAM and BSAM are used by PLAN for processing of logical files.

Minimum Systems Configuration: The minimum core requirement for PLAN is 24K for DOS, 32K for OS/360 PCP or MFT, and 44K for MVT. Only part of this space is permanently used by PLAN. About 17K is transient, and this part can also be used by PLAN applications. Under OS/360, an additional 6K is re-enterable, and may be assigned to the RAM or Link Pack areas. The remainder contains buffers, pointers, and control blocks that are permanently resident.

DOS/360 PLAN -- Models 22, 25, 30, 40, 50, 65 or 75 (background partition of 24K bytes or larger) ... all features required for DOS/360 FORTRAN ... Floating-point Arithmetic (#4427) ... one 2311 Disk Storage Drive with 2841 Storage Control in addition to DOS/360 requirements (total of two disk storage drives).

OS/360 PLAN -- Model 30, 40, 50, 65, 75, 85, 195 or 67 in 65 mode. In addition to OS/360 main and auxiliary storage requirements, PLAN requires 32K or larger partition size for PCP-MFT and 44K or larger for MVT ... Floating-point Arithmetic (#4427) ... direct access storage space equivalent to the capacity of one 2311 Disk Storage Drive (any DASD supported for system residence may be used) in addition to OS/360 requirements.

Basic Program Package:

Documentation* -- (OS/360 PLAN) Application Directory ... Program Description Manual (H20-0594-1) ... Operations Manual (H20-0596-1).

(DOS/360 PLAN) Application Directory ... Program Description Manual (H20-0594-1) ... Operations Manual (H20-0597).

Machine Readable -- (OS/360 PLAN) Object code, PLAN commands, sample problem.

(DOS/360 PLAN) Object code, PLAN commands, sample problem.

Optional Program Package (no documentation):

Machine Readable -- (OS/360 PLAN) Source code. Code is contained as an unloaded PDS created by the OS Utility IEHMOVE

(DOS/360 PLAN) Source code. Code & Listing are generated by executing the self-loading program contained on the: Tape on a System/360 Mdl 22DC or Mdl 30D or larger.

Ordering Information: Program Number 360ACX27X OS/360 PLAN

	Program Number Extension	Distribution Medium			User Volume Requirement
		Type	Track/Density	Code	
Basic	none	DTR	7/800 DC cpi	26	none
		DTR	9/800 bpi	28	none
		DTR	9/1600 bpi	29	none
Optional	none	Tape	7/800 DC cpi	26	01
		DTR	9/800 bpi	28	None
		DTR	9/1600 bpi	29	None

Ordering Information: Program Number 360ACX26X DOS/360 PLAN

	Program Number Extension	Distribution Medium			User Volume Requirement
		Type	Track/Density	Code	
Basic	none	Tape	7/800 DC cpi	26	01
		DTR	9/800 bpi	28	None
		DTR	9/1600 bpi	29	None
		1316		52	01
Optional	none	Tape	7/800 DC cpi	26	01
		Tape	9/800 bpi	28	01
		DTR	9/1600 bpi	29	01

Additional Program Support Material:**

OS/360 -- Application Description Manual (H20-0490) ... System Manual -- Volume 1, Narratives (Y20-0345), Volume 2, Flowcharts (Y20-0346), and Volume 3, Assembly Listings (Y20-0351) ... User's Introduction Manual (H20-0626).

DOS/360 -- Application Description Manual (H20-0490) ... System Manual -- Volume 1, Narratives (Y20-0345), Volume 2, Flowcharts (Y20-0346), and Volume 4, Assembly Listings (Y20-0350) ... User's Introduction Manual (H20-0626).

*If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

**Available from Mechanicsburg.

PLAN Graphics Support: PLAN Graphics Support (360A-CX-34X) reduces the time and effort required to implement an interface between the IBM 2250 Display Unit and application programs.

In most instances, an application programmer may use this system to avoid coding the graphics portion of an application at a FORTRAN or Assembly Language level. The user may rapidly integrate graphic capability into existing and new applications. This system is an excellent tool to minimize learning and programming time when extending existing applications to include graphic capability. PLAN OS/360 (Problem Language Analyzer) a Type II program (360A-CX-27X) must be used by PLAN Graphics Support. The user has access to all the functional capability in PLAN.

Description: A user-oriented statement language has been implemented into PLAN Graphics Support via the facilities provided by PLAN for language definition. By means of the free format language statements and the more conventional fixed format specification cards, the application programmer can specify the graphic displays and interrupt (Light Pen and Keyboards) controls desired by the application user. During the execution of the application, the display console operator may dynamically control his application utilizing the interactive graphic capability of the IBM 2250.

The facilities available to the application user (display console operator via PLAN Graphics Support include:

- **Graphic Output**
Data lists from the application program may be displayed in any desired format using points, characters, lines, arcs, circles, etc. -- the format and control options being previously defined via language statements and/or specification cards.
- **Graphic Input**
Data may be created or modified at the console and passed to an application program via the Alphameric Keyboard and/or the Light Pen.
- **Monitoring and Controlling the Application**
The console user dynamically controls subsequent displays and application functions to be executed via the Light Pen, Programmed Function Keyboard, and the Alphameric Keyboard.

PLAN Graphics Support can be used for nearly any application which can utilize the capability of the IBM 2250. In particular, this includes Engineering Analysis, Petroleum Exploration and Production, Management Information Systems, and Data Reduction.

Features:

- Easy-to-use statements for specification of graphic displays and interrupt control.
- Includes routines for lines, arcs, circles, and conic sections.
- Special "high speed displays" may be defined giving rapid response to operator interrupts.
- Built-in default options simplify programming.
- Since PLAN Graphics Support and PLAN coexist, all the PLAN functions and facilities are available to the user.
- Open-ended system allows user to build additional capability into PLAN Graphics Support.
- Special routines facilitate maintenance of graphic data.

Use: The application programmer describes the graphic displays and interrupt controls by means of statements and specification cards. These cards are normally used as input to an off-line operation during application development to create and store the files necessary to generate the graphic displays. During the running of the application, the previously stored files are used to generate the displays on the IBM 2250, allowing the console user to communicate with his application. Information flowing between PLAN Graphics Support and the application program pass through FORTRAN COMMON managed by PLAN.

Customer Responsibilities: PLAN Graphics Support minimizes the requirement for detailed knowledge of graphics. A knowledge of PLAN is useful but is not a prerequisite when working at the PLAN Graphics Support level. The application programmer must be familiar with FORTRAN conventions and the use of COMMON.

Note: The application user (the console operator) does not have to understand PLAN Graphics Support. Only a familiarity with the use of Light Pen, Programmed Function Keyboard, and Alphameric Keyboard is required.

Programming Systems: PLAN Graphics Support is programmed primarily in FORTRAN IV with some Assembler code and requires the following system environments: IBM System/360 Operating System ... IBM System/360 Operating System - Graphic Program Services for FORTRAN IV, Type I (360S-LM-537) ... S/360 PLAN (Problem Language Analyzer) Type II (360A-CX-27X).

Minimum System/360 Configuration: S/360 Central Processing Unit Model 40 with a minimum of 128K memory (90K application partition required) ... One 2250 Model 1 with Absolute Vectors and Control (#1002), Alphameric Keyboard (#1245), Buffer (#1498 or 1499), Character Generator (#1880), Light Pen (#4785), Programmed Function Keyboard (#5855) ... OR ... One 2250 Model 3 with Alphameric Keyboard (#1245), Programmed Function Keyboard (#5855) and 2840 Display Control Model 2. In addition to the I/O units and intermediate storage for OS/360, PLAN, and Graphic Program Services for FORTRAN IV, storage on a DASD is required for:

- (a) PLAN Graphics Support Load Modules -- approximately 350K bytes.
- (b) Panels -- approximately 2K bytes per panel (based on an average of 25 specifications per panel).

Access to a tape drive will be necessary for system generation and maintenance.

Refer to the Program Description Manual (H20-0614) for tailoring the system to run an application in a minimum size partition of 90K.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H20-0614) ... Operations Manual (H20-0615). If only the form numbered manuals are required order from Mechanicsburg -- not from PID.

Machine Readable -- Object Decks, Sample Job Control Cards, and the Sample Problem Decks.

Optional Program Package:

Machine Readable --

Option 1 - Source statements are specified by using Program Number Extension - OPT1.

Option 2 - Program Listings are specified by using Program Number Extension - OPT2.

Ordering Information: Program Number 360ACX34X

	Program Number Extension	Distribution Medium		User Volume Requirements	
		Type	Code		
Basic	none	DTR	7DC/800	26	none
		DTR	9/800	28	none
		DTR	9/1600	29	none
Optional	OPT1	DTR	7DC/800	26	none
		DTR	9/800	28	none
		DTR	9/1600	29	none
	OPT2	MT	9/800	28	01
		MT	9/1600	29	01

Additional Program Support and Reference Material: Application Description Manual (GH20-0535) ... Systems Manual (LY20-0394) ... PLAN Application Description Manual (GH20-0490) ... PLAN Program Description Manual (GH20-1066) ... PLAN Operations Manual (GH20-0596) ... Graphic Programming Services for FORTRAN IV (GC27-6932).

Coursewriter III:† Coursewriter III is a program that can be used with System/360 Models 30, 40, 50, 65 or 75 to develop and present course materials for Computer Assisted Instruction (CAI)(360A-UX-01X).

Description: Coursewriter III can be used for educational research, curriculum development, and operational uses of Computer Assisted Instruction. Course materials may be designed for basic or supplemental instruction and can include pretests to assess student capabilities, drill and practice problems and laboratory simulations.

The System/360, through IBM 1050 or 2740 terminals, interfaces directly with students, authors of curriculum materials, monitors who assist students, and supervisors of the CAI installation.

Coursewriter III applications exist primarily in the following areas:

- Teaching and learning research
- School and university instruction
- Industrial and military training

The Coursewriter III programming system is made up of four elements:

- Coursewriter III Author Language
- Coursewriter III Processor Program
- Coursewriter III Input/Output Control Program
- Coursewriter III Student Response Processor

These elements, under control of the Disk Operating System/360, store, present, and administer the author-prepared course materials.

Disk Operating System/360 is a disk-resident system composed of control programs and processing programs configured in the system generation of each individual installation. Multiprogramming is included as a facility which enables System/360 to process a background job and foreground jobs simultaneously. The Coursewriter III program will normally be run in the highest priority foreground partition. The Teleprocessing operations of DOS/360 manage the line communications with the IBM 1050 or 2740 terminal stations.

The Coursewriter III Author Language provides capability for the development and presentation of educational course materials through the terminals.

This special language enables authors to control computer presentation of course material and processing of student responses. The contents and techniques of instruction can vary widely depending on the type of student, the learning environment and the performance objectives of the course.

The Coursewriter III Processor Program operates interpretively and contains the control routines, author routines, student and monitor routines, and supervisor routines. Together, these routines direct System/360 to perform the specific tasks initiated by its users.

The Coursewriter III Input/Output Control Program maintains the current status of communication lines and their associated terminal stations.

A Coursewriter III Student Response Processor Utility Program is also included which extracts and prints from selected records from the Coursewriter III recording tape.

Features: Coursewriter III provides essential language, processor, and control program capabilities that enable:

- Authors to write and correct course material.
- Data to be collected on student responses for later analysis.
- Authors or programmers to add new functional capabilities to the Coursewriter III language for unique requirements.
- A macro capability to be used for easier development of repetitive course routines.
- As many as 161 independent 1050 or 2740 terminals to be serviced when a System/360 Model 50, 65 or 75 is used.

Removable 1316 or 2316 Disk Packs store the course materials along with individual performance records and other administrative materials.

IBM 1050 and 2740 terminals are used by students to receive instruction and by course authors to input and modify instructional materials.

Customer Responsibilities: Customers are responsible for providing their own course materials. Currently, only limited amounts of course materials are available from publishers or other users. Therefore, customers should have an experienced staff to develop and/or evaluate curriculum materials. The customer must make the necessary arrangements for communication lines and equipment. Knowledgeable individuals thoroughly trained in DOS/360 and Teleprocessing techniques are essential.

Programming Systems: Coursewriter III is written in DOS/360 Assembler language. It operates under the control of DOS/360 with the multiprogramming feature. The interval timer is required. The Direct Access Method is used for disk, Sequential Access Method for tape and BTAM for teleprocessing.

Minimum Machine Configuration: A 2030 Model F Processing Unit with Decimal Arithmetic (#3237), First Selector Channel (#6960), Storage Protection (#7520), 1051 Attachment (#7915), and Interval Timer (#4760) ... 1051 Control Unit Model N1 with CPU attachment (#3130) ... 1052 Printer-Keyboard Model 8 ... 1442 Card Read Punch Model N1 ... 1443 Printer Model N1 with Selective Character Set (#6402) ... 2841 Disk Storage Control Model 1 ... two 2311 Disk Storage Drives Model 1 ... 2803 Tape Control Model 1 ... 2401 Magnetic Tape Unit Model 1 ... 2701 Data Adapter Unit Model 1 with Terminal Adapter (#4645) ... 2740 Communication Terminal with Record Checking (#6114).

As many as 161 IBM 1050 or 2740 terminals may be connected to a System/360 Model 50, 65, or 75 through remote dial-up or dedicated voice grade lines. A user selects one of three transmission control units according to the number of terminals to be serviced by the system. The 2701 Data Adapter Unit handles up to four lines while the 2702 Transmission Control Unit, with a speed extension feature (7387) can handle up to 31 half-duplex communication lines. One 2703 Transmission Control Unit can service up to 176 half-duplex lines simultaneously operating at speeds up to 180 bits per second.

The 2701 Data Adapter Unit requires special feature 6445; the 2702 requires special features 3233, 4615, and 7955; the 2703 requires special features 7505, 4878, 4619, 4696, and a 3205 (for every eight lines). Each 1051 Model 2 terminal must be equipped with feature 4408, each 1052 Model 2 with feature 1006, each 2740 Model 1 with feature 6114.

Either the tape or the printer is required as a system log device in the minimum configuration. To record student responses, and at the same time perform functions such as print course, course off/on, one tape must be added for each such function performed.

Coursewriter III will accommodate the following sample configurations along with a background job under control of DOS/360:

Model	Core Size	Coursewriter III Partition Size	Number of Terminals
30	64K	44K	15
40	128K	108K	62
40	256K	170K	124
50	256K	220K	161

The number of terminals a system can actually handle will depend upon the amount of core storage available and the response time required. The response time to the student will be dependent upon many factors, including:

- System configuration.
- The complexity of the courses being used.
- The number of terminals in use.
- The type of background job being run.
- The number and type of buffer areas allocated at Coursewriter III system generation time.

Basic Program Package:

Documentation -- Application Directory ... Author's Guide (H20-0609) ... Supervisor's Guide (H20-0610) ... Student Monitor User's Guide (H20-0608). If only the form numbered manuals are required, order them from Mechanicsburg -- not from PID.

Machine Readable -- Program object deck and sample problem.

Optional Program Package:

Machine Readable -- Source program decks, assembly listing, and flowchart listings.

Ordering Information: Program Number 360AUX01X.

	Program Number Extension	Dist. Type	Med. Code	User Volume Requirement
Basic	None	DTR 9/800	28	None
		DTR 9/1600	29	None
Optional	None	MT 9/800	28	01
		MT 9/1600	28	01

Additional Program Support Material: Application Description Manual (H20-0587)* Obsoletes Z20-1872 ... Student/Monitor User's Reference Card (X20-1780)* ... Author's Reference Card (X20-1781)* ... Supervisor's Reference Card (X20-1782)* ... Instruction Sheet Padded Form (X20-1750)* ... System Programers Guide (Y20-0372)* ... Student Text for Authors (C20-1706)*.

Use: IBM System/360 Models 30, 40, 50, 65 or 75 serve as central processing units for Coursewriter III instructional systems. The CPU can access course material from 2311 or 2314 Disk Storage Drives, interpret course statements, analyze student responses and control data flow between the CUP and system terminal stations.

† Supports System/370 configurations also.

Reference Material: Computer Assisted Instruction at The Florida State University (K20-0208)... Learning and the Computer (520-1967).

*Available from Mechanicsburg Distribution Center.

Inventory Control:† This group of integrated programs has been especially designed for the implementation of order point inventory control where it applies in manufacturing organizations (360A-MF-04X).

Programs are provided for (1) classification of inventory items for determining the type of control, (2) calculation of economic order quantities based upon usage information or future requirements, (3) computation of safety stock and order point, (4) projection of demand based upon historic data, and (5) basic programs for transaction processing and report preparation.

Description: This application programming package consists of source programs and supporting documentation for the installation of an effective order point inventory control system. There are three major aspects - planning, projection, and execution.

For planning purposes three programs are provided: (1) Inventory Analysis, (2) Order Point, and (3) Order quantity.

The projection phase includes four programs: (1) Edit, (2) Model Select, (3) Initial Update, and (4) Update and Project.

The execution phase is made up of two basic programs: (1) Transaction Processing, and (2) Status Reporting.

Inventory Analysis: A program that provides detailed analysis of inventory items based upon usage and cost. The output is useful in determining how the items are to be controlled.

Order Point: A program that calculates order point and safety stock for items in the inventory master file. Seven different options for computing safety stock are provided. Four of these use Mean Absolute Deviation (MAD) and user supplied level of service.

Order Quantity: Inventory carrying rate and order costs are used by this program to determine economic order quantities. The program calculates order quantities based on average usage or future requirements. Four techniques for order quantity calculation are included in the module. It is highlighted by an analysis for implementation feature which permits the user to analyze the effect of changing order quantities prior to implementing.

Edit: A program that provides an interface to user demand data. The program converts the user's demand history file (card, disk or tape) to format required for the model select program. It also edits data for unusual demand variations.

Model Select: The historic demand information is analyzed by this program to determine if patterns exist. Items are classified into one of four types that are used to select the technique for projecting future demand. Initial values (averages, MAD, etc.) are also computed.

Initial Update: This program uses the output of model select and places these codes and values on the item master file.

Update and Project: An operational program that uses the latest demand for each time period and keeps the item master up to date. It has provision for projecting future demand based upon the most recent information in the item master file.

Transaction Processing: This program accepts input transaction, for example, receipts, issues, etc., and updates the item master record. Transaction listings with exception highlighting and order recommendation cards for order point items are the output of this program.

Status Reporting: Information regarding the status of items in the file is made available by this program. Output is a stock status report for all or a selected portion of the items in the file.

Features:

- Nine programs are provided to assist the customer in developing an order point inventory control system.
- Four of the inventory programs are for analysis of inventory usage to provide information for operational programs.
- Operational programs that update inventory master record for current status and the most recent usage information.
- Provision for order action notice for order point items when order point is calculated and when transactions are processed.
- Five options for computing safety stock including two statistical methods using Mean Absolute Deviation (MAD) and user specified level of service.
- First and second order exponential smoothing with automatic updating of MAD.
- Highlighting of items when new order point varies from old order point by a specified percentage.
- Evaluation of old and new safety stock each time order point is calculated.

- Analysis can be performed on all items or on a portion of the file, with or without updating.
- Order quantity calculations based on averages or future requirements.
- Four methods for calculation of order quantity with exits for insertion of user routines.
- Analysis for implementation is part of order quantity program it provides for contrasting the newly computed order quantity to existing order quantity.
- Analysis for implementation feature of order quantity program provides for contrasting the newly computed order quantity to existing order quantity with respect to inventory level and set up costs.
- Order quantity category code allows for many combinations of order costs and carrying rates. Only the code is stored on the inventory record.
- Provision for processing specific transactions that update the master inventory file.
- Special emphasis is placed on ease of implementation.
- Programs are modular in design to permit the customer to use only the options he desires.

Use: The S/360 Inventory Control Programs are direct access file oriented and work in conjunction with an item master inventory file. The records within this file are created, added, deleted, and reorganized using the S/360 Bill of Material Processor Program or DBOMP or DOS Indexed Sequential File Management System.

The inventory control package includes initializing and operational programs. Inventory Analysis, Edit, Model Select, and Initial Update are designed to be used once to set up the system, then periodically (perhaps yearly) or as required to meet changing conditions. Order Point and Update and Project are run on a regular basis (for example, every month or every two weeks). The frequency of using the Order Quantity program depends upon the user's requirements. Normally the items considered as having a fixed order quantity would be processed once or twice a year. This is true if present order quantities are consistent with management's ordering policy. If the order quantities are not considered economical, this program, with its analysis for implementation feature, will be used frequently.

The execution phase consists of two basic programs for recording and obtaining information from the file. The two basic programs of execution (or modifications to these of the user's own programs) will be used in the day-to-day operation. The amount of use depends upon transaction volume and the number of reports the user prepares.

Customer Responsibilities:

- Tailor the source programs to meet user requirements.
- Organization and construction of item master file, including specifying all data fields to be included.
- Creating, adding, deleting of records in the master file.
- An understanding of the inventory control concepts embodied in the programs so that the customer can make the selection and specification of parameters for planning and projection programs.
- Provide historic data for inventory analysis programs.
- Identification coding and processing definition for transactions.
- Writing routines to perform tasks not covered by these programs.

Programming Systems: Inventory Control Programs will operate under the IBM System/360 Disk Operating System or Disk Operating System/VS. In addition, this program product also operates in a VM/370 environment under the control of DOS or DOS/VS. The planning and projection programs are written in Assembler Language. The execution programs are written using Report Program Generator II. The schedule of availability under DOS/VS is as announced in P-letter P72-94.

Minimum System Requirements: System/360 Model 2030 E* ... Decimal Arithmetic (3237 ... 1051 Control Unit Model N1 ... 1052 Printer-KeyBoard Model 8 with appropriate attachments ... 2841 Storage Control Model 1 ... 2311 Disk Storage Drives as required to contain Disk Operating System/360 and user's data files (minimum of 2) or 2314 Direct Access Storage Facility (configurations with 2314 only require a 2400 series tape drive for system preparation) ... System/360 Card Reader and Card Punch or Card Read Punch capable of reading one file and punching a second file simultaneously ... System/360 Printer with at least 120 print positions.

System/360 Model 2025E ... 1052 Printer-KeyBoard Model 7 ... 2311 Disk Storage Drives as required to contain Disk Operating System/360 and user's data files (minimum of 2). System/360 Printer, Card Reader and Card Punch as described for Model 2030 E.

* A minimum partition of 24K bytes is required for execution of DOS Inventory Control

† Supports System/370 configurations also.

Basic Program Material:

Documentation -- Application Directory ... Program Description Manual (H20-0555) with TNL (N20-2014) ... Operation Manual (H20-0556). If only the form numbered manuals are required, order from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- Source code and sample problem.

Ordering Information: Program Number 360AMF04X

	Program Number Extension	Distribution Type	Medium Code	User Volume Requirement
Basic	none	MT 7DC/800	26	01
		DTR 9/800	28	None
		DTR 9/1600	29	None
		1316	52	01
Optional	none	none		None

Additional Program Material*: Application Description Manual (H20-0471) with TNL (N20-2013) ... System Manual (Y20-0256).

Reference Material*: Production Information and Control System, E20-0280 ... Bill of Material Processor - Application Description Manual (H20-0197) ... Bill of Material Processor - Programmer's Manual (H20-0246) ... DBOMP - Application Description Manual (GH20-0771) ... DBOMP - Program Description Manual (SH20-0529) ... Wholesale IMPACT (E20-3105) ... Wholesale IMPACT Advanced Principles and Implementation Reference Manual (E20-0174).

*Available only from Mechanicsburg.

Decision Logic Translator: This program provides an advanced tool needed to translate decision tables into FORTRAN language. (360A-CX-32X)

Description: Decision tables are a technique for documenting the logic of a problem and its solution. The concise format of decision tables allows them to present information so that it is easily read and understood, and to present logic simply so that its concepts are readily grasped. The tabular approach is used to express complex decision logic in a manner that encourages the analyst to reduce a problem to its simplest form by arranging and presenting logical alternative courses of action under various combinations of conditions.

The Decision Logic Translator incorporates many logical capabilities and FORTRAN features into the decision table language.

Features:

- The number of tables to translate is not limited, the limit is due to the size of the FORTRAN program which is obtained.
- Tables may contain a mixture of limited and extended entry rows.
- The logical connective between conditions in a rule may be either "AND" or "OR". Both connectives may appear in the same table and rule.
- A variable value may be compared with the values of a singly subscripted array in the condition area of a decision table.
- Arrays with up to three subscripts (FORTRAN limit) may be used.
- Blocks of FORTRAN arithmetic statements may be defined in addition to the formula statements.
- FORTRAN Features ... the use of the specification statements -- DIMENSION, COMMON, EQUIVALENCE and FORMAT ... the use of FUNCTION and SUBROUTINE statements ... the use of direct access input/output statements -- DEFINE FILE, FIND, READ, WRITE.
- Tape or disk may be used to store the output FORTRAN source statements which will be acceptable input to the FORTRAN compiler for translation into machine language and execution without further manipulation.
- Table with up to 64 columns and 99 condition and action rows can be translated.
- Each main program or subroutine may have up to 20 closed tables.
- There may be up to 99 references to a single closed table.
- The table columns may be 2, 8, or 16 spaces wide depending on the needs of this table.

Sales Information: All current users of the 1401 Decision Logic Translator program and all analysts and programmers are potential users of the S/360 Decision Logic Translator program.

Areas of application of decision tables and the S/360 Decision Logic Translator apply across industry lines.

Sample Application Areas:
In the Manufacturing and Scientific Industries

The main applications are for Automated Design Engineering (ADE) and Automated Manufacturing Planning (AMP). These applications represent a precise method and set of tools for studying engineering problems and establishing working computer oriented systems. They both accept customer requirements as input and, through the medium of explicit design logic stored in the computer by means of decision table technique, produce the completed design information for manufacturing. Error-checking, bid and order costing can be incorporated into such systems.

In the Distribution Industries

Decision tables are very useful for credit checking, price computation, and inventory control.

In the Transportation Industries

Decision tables are used to establish automated reservation systems and set prices.

In the Service Industries

Decision table techniques are used in insurance areas to establish the policy type and the tariffing from a customer request.

Decision tables can be used effectively for systems analysis, procedure design, program debugging, and many varied applications.

Decision tables may also be employed to describe an entire data processing system as well as a portion of the system.

Use: This program is designed primarily for areas concerned with problems having a complex decision logic.

Decision tables are a means of bringing together and presenting the related information to express complex decision logic in a way that is easy to visualize and follow. They can be used independently of, or to complement, flow charts and block diagrams in recordkeeping, decision-making and problem-solving operations in business, mathematical and the science fields. Decision tables can be used effectively for system analysis, procedure design and documentation. Their use expedites and simplifies the time-consuming functions of problem definition, system analysis and programming.

Once the system is established, it is easy to maintain, and the documentation and program are easy to change.

Customer Responsibility: The S/360 Decision Logic Translator provides output in the form of FORTRAN source programs. To augment the many capabilities of the program it is recommended that the customer have an individual who is knowledgeable in FORTRAN and familiar with the applications.

The customer must be prepared to compile test and implement the FORTRAN programs obtained from the Decision Logic Translator processor.

Programming System: The program is written in System/360 Assembler Language and operates under the Disk Operating System (DOS). The Standard Instruction Set and Decimal Arithmetic (#3237) are required to assemble the original programs and the Floating Point (#4427) is required to compile the Basic FORTRAN IV source program produced.

Minimum Machine Configuration: System/360 Model E supported by DOS/360 ... two 2311 Disk Storage Drives ... Printer, Card Reader, and Card Punch (selected from the set supported by DOS/360) ... 1052 Printer-Keyboard.

Basic Program Material:

Publications* -- Application Directory ... Program Description Manual (H20-0572) ... Operations Manual (H20-0573).

Machine Readable** -- The program object decks and sample problem deck are available on one 9-track DTR (800 or 1600 bpi), one 7-track DTR (800 cpi) or one card deck. The Data Conversion feature is required with 7-track tape.

Optional Program Material:

Machine Readable** -- The source decks, assembly listings and flowcharts are available on one 9-track DTR (800 or 1600 bpi) or one 7-track (800 cpi) magnetic tape (2400'). Data Conversion feature is required with 7-track tape.

Ordering Procedure:

*If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not PID.

**If the density requirements are not specified on the back of the program order card, 9-track magnetic tape at 800 bpi will be forwarded.

DTRs are supplied by PID; no tape submittal is required.

Magnetic tape (2400') may be forwarded or ordered. The program order card should accompany the tape order form.

Program Support Material: Application Description Manual (H20-0492-1) ... Systems Manual (Y20-0263).

Reference Material: Automated Design Engineering (E20-8151) ... Automated Manufacturing Planning (E20-0146).

Bill of Material Processor: Provides the support to organize, maintain, and reorganize the four basic manufacturing data files -- Part Number Master File, Product Structure File, Standard Routing File, and Work Center Master File -- described below. (360A-ME-06X)

Description: This application program represents a continued support by IBM in the area of manufacturing application definition and implementation. The package provides manufacturing organizations with easy-to-modify programs that establish and maintain basic information files describing the structure of products and their manufacturing procedures, and logic diagrams explaining the retrieval of this information in fundamental applications.

The System/360 Bill of Material is a direct access file-oriented concept that requires the part number master (inventory-type) file to be on-line simultaneously with the product structure file and/or the standard routing file. All three could be used on line to produce alternate manufacturing work orders and components lists. The work center master file can be integrated by the user with the routing file for a machine loading application. All files are created, added, deleted and reorganized by the Bill of Material Processor employing Assembler Language with Input/Output Macros.

The package includes logic diagrams for eight fundamental classifications of retrieval programs that the user may desire to prepare. They are: (1) one-level bill of material or parts list, (2) next assembly where-used listing, (3) indented parts list, (4) indented where-used list, (5) summarized explosion, (6) summarized implosion, (7) manufacturing routings, and (8) work center where-used. The package is designed so that the logic diagrams can be used by any customer as a guide in the preparation of his own set of programs.

The logic diagrams for classifications 5 and 6 are particularly significant since they are the framework for two major application areas that are vital to the planning and execution of the manufacturing operation. The summarized explosion logic provides the framework for performing a gross to net requirements generation application. The summarized implosion logic can be expanded to show the effect of incremental cost increases or decreases of parts and sub-assemblies on top level products.

Features: Product structure records are linked with part number master inventory type records on disk files ... disk file chaining is used to organize product structure data in two inherent sequences: (1) assembly or bill of material sequence (i.e., linking the components of an assembly); the user determines the maintained sequence of components within the assembly; typical sequences might be component part number or engineering drawing item number; and (2) where-used sequence (i.e., linking the usages of a part number on higher level assemblies); this cross-referenced sequence eliminates the need to (a) maintain a duplicate file in where-used sequence, or (b) periodically sort an assembly deck file to where-used sequence for listing purposes ... raw material can be included in the product structure file, providing complete where-used cross reference of each raw material number ... user designs his own record layouts by incorporating his own information plus certain required data into part number master inventory and product structure records ... low-level coding is automatically maintained ... assembly to sub-assembly continuity is verified; this feature guarantees that the product structure records can be "exploded" ... user builds his own engineering change procedure into the file organization and maintenance programs.

Modular in design, the system permits the customer to use only features that suit his needs ... the ability of the user to combine program modules so that combinations of maintenance functions can be performed against multiple files during the same program run ... bi-directional file chains to speed the maintenance of part number where-used data; (where record A points to record B, record B also points to record A) ... Work Center Master File organization and maintenance containing one record per unique work center and including bi-directional work center where-used chains ... standard Routing File organization and maintenance including: (A) bi-directional file chains to specify the logical sequence between fabrication or assembly operations; specify the reverse sequence to aid in the calculation of scheduled start and finish times; speed the maintenance of the file; (B) links to the Work Center Master File to facilitate the accumulation of work loads; (C) links to and from the corresponding part number master records ... a run activity control technique to aid in restart and reconstruction and to facilitate additional retrieval features ... record count for audit and control of direct access chains; the count is maintained in the part number master and Work Center Master files where the chains are anchored ... tailoring of the generalized source programs to the specific needs of each user's installation through a special customizing program supplied with the package; the customer has only to prepare a set of parameter cards to specify his needs; the choice of BOS/360 or DOS/360 is made in one of these parameter cards ... Macros for sequential processing of both master files; this capability is available for retrieval programs written in Assembler Language or under DOS/360, PL/I, or COBOL ... a macro furnishing the capability to retrieve a set of disk file records which comprise a single-level bill of material or a single-level parts where-used list; a macro also provides the capability to retrieve a manufacturing routing or a work center where-used list in addition to being available for use with Assembler Language, the capability is also furnished for either PL/I or COBOL under DOS/360.

- Supports System/370 configurations also.

Customer Requirements: A thorough knowledge of Bills of Material by the system designer is necessary. To implement this system determine the format and content requirements of the disk file ... write retrieval programs to acquire information from the files; the System/360 Product Structure Retrieval program (see 360A-ME-07X) will provide the basic retrieval functions ... design input card format ... design audit list print formats and write print routines to implement them.

Programming Systems: The Bill of Material Processor operates under either BOS or DOS. The BOS modules required in support are Control Program, 360B-CL-302; Direct Access Method, 360B-IO-305; Assembler, 360B-AS-309; and Utilities, Group 1, 360B-UT-300. The DOS modules required in support are Assembler Basic Modules, 360N-AS-465; System Control and Basic Input/Output Control Systems, 360N-CL-453; Direct Access Method Macros, 360N-IO-454; Unit Record and Disk Utilities, Group 1, 360N-UT-461. The user may, at his own option, employ the following additional DOS modules: COBOL, 360N-CB-452; PL/I, 360N-PL-464; Consecutive Tape Input/Output Control System Macros, 360N-IO-456. User data files created under BOS may later be maintained and processed under DOS.

Minimum System Requirements: System/360 Model 25 (16K bytes for operation under BOS and 24K bytes for operation under DOS) with Decimal Arithmetic (#3237) ... 1052 Printer-KeyBoard Model 8 with appropriate attachments ... Card Read Punch (any S/360 model) ... Printer (any S/360 model) ... 2841 Storage Control ... 2311 Disk Storage Drives as required to contain BOS or DOS and the user's data files (minimum of 2). Chain file reorganization program modules (product structure and routing) require enough drives to contain both the old and the new chain files as well as the master files that must be on-line for reorganization. 2314 Disk Storage Drives as required to contain DOS and the user's data files. These drives may be either in addition to, or instead of, the 2311 Disk Drives. Chain file reorganization program modules require enough disk space as described above.

System/360 Model 22DC (24K bytes for operation under DOS) ... 1052 Printer-KeyBoard Model 8 ... any card read punch and printer ... 2841 Storage Control ... 2311 Disk Storage Drives as required to contain DOS and user's data files (2 minimum). Chain file reorganization program modules (product structure and routing) require enough drives to contain both the old and the new chain files as well as the master files that must be on-line for reorganization.

Special Note: The sample problem distributed with the program is customized to run in 32K. The 24K operation requires regrouping of functions into more and smaller core loads as is done to operate in 16K under BOS. Examples of this regrouping are shown in the Programmer's Manual (H20-0246).

Special Use Information:

1. For simplification of documentation and distribution procedures, the BMP system (generalized source programs, etc.) is resident on 2314 in 2311 mode. The BMP utility programs (Customizer, etc.) operate only against 2311-mode files. The 2311-mode disk pack need be on line only during BMP-SYSGEN procedures.
2. Object program modules resulting from BMP-SYSGEN procedures are cataloged in DOS libraries, which may be in native-mode residence.
3. Customer data files are maintained in native mode. This point, together with point 2 above, provide for the 2314 customer day-to-day operations in native mode.
4. 2311 to 2314 reorganization of user data files is a standard feature of the program.
5. When a user converts from 2311 to 2314, no change to or reassembly of user application programs which reference Bill of Material Processor files is dictated by differences in BMP operation. The user may, however, be required to modify and/or reassemble for the following reasons:
 - a. device-type dependencies in his own code.
 - b. changes he desires to implement at conversion time.

Most of the IBM-supplied BMP program modules will require customizing and assembly for conversion to 2314. (The exceptions are those known as MAINLINE modules.) This preparatory work may be accomplished with 2311's prior to 2314 delivery.

Basic Program Material:

Publications -- Application Directory ... Programmer's Manual (H20-0246) ... Operator's Manual (H20-0254) ... Basic Tape System, System Generation and Maintenance (C24-5061). If only the form numbered manuals are required, order them from Mechanicsburg -- not from PID.

Machine Readable -- The macros, generalized source programs, specialized utility programs, and sample problem input may be obtained on one 9-track DTR (800 or 1600 bpi) or one 7-track tape (800 cpi, Data Conversion feature required) or one 1316 Disk Pack. The requester may forward or order magnetic tape or forward the 1316 Disk Pack.

This program will not be distributed on 2316 Disk Pack.

When ordering this program on magnetic tape, the requester must indicate whether 9-track tape (800 or 1600 bpi or 7-track 800 cpi) is required. If not specified, 9-track tape (800 or 1600 bpi) will be forwarded. The Data Conversion feature is required if the program is received on 7-track tape.

Reference Material: Bill of Material Processor - Maintenance and Retrieval System (E20-0114) ... Application Description Manual (H20-0197-2 TNLs N20-1020 and N20-1864) ... System Manual (Y20-0099 TNL Y20-0210) ... The Production Information and Control System (E20-0280).

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Ordering Information

Program Number: 360VDW06X

	<u>Program Number Extension</u>	<u>Distribution Type</u>	<u>Medium Code</u>	<u>User Volume Requirement</u>
Basic	none	DTR 9/1600	29	none
		DTR 9/800	28	none
		DTR 7DC/800	26	none

Program Numbers: 360VME08X, 360VUH09X, and 360VUH16X

	<u>Program Number Extension</u>	<u>Distribution Type</u>	<u>Medium Code</u>	<u>User Volume Requirement</u>
Basic	none	1316	52	01
		DTR 9/1600	29	none
		DTR 9/800	28	none
		DTR 7DC/800	26	none

Program Number: 360VSU11X

	<u>Program Number Extension</u>	<u>Distribution Type</u>	<u>Medium Code</u>	<u>User Volume Requirement</u>
Basic	none	DTR	00	none

Program Number: 360VMF10X

	<u>Program Number Extension</u>	<u>Distribution Type</u>	<u>Medium Code</u>	<u>User Volume Requirement</u>
Basic	none	DTR 9/800	28	none
		DTR 9/1600	29	none
		1316	52	01
Optional	none	DTR 9/800	28	none
		DTR 9/1600	29	none
		1316	52	01

Wholesale IMPACT: This program offers Model 20 users the opportunity to use the IMPACT system of inventory management now in wide use among S/360 and 1400 systems users. The Model 20 IMPACT library contains only the operating programs (SVA and AP) and MACRO routines. Initialization is accomplished on a Model 25 using the Wholesale IMPACT Program Library (360A-DW-05X). The program order number is 360V-DW-06X.

Description: The IBM IMPACT (Inventory Management Program and Control Techniques) system of scientific inventory management provides the warehouse distributor (or any organization having identical inventory control characteristics) with the information of "when" and "how much" to buy for each inventory item controlled by the system. It does this through the means of probability science in conjunction with the many factors influencing the distributor's inventory control decisions. Factors considered include lead time, lead time variability, forecast of demand, forecast error, service desired, inventory carrying costs, purchasing/receiving costs, discount structures, minimums, maximums, shelf lives and pack sizes. The "when" and "how much" answers find the most efficient balance between the cost of carrying inventory, cost of purchasing and receiving, discounts realized, and customer service requirements.

The System/360 Model 20 Wholesale IMPACT Program Library (with its associated education classes and documentation) enables the distributor who has an IBM System/360 Model 20 Data Processing System to successfully operate an IMPACT inventory management system with minimum effort and expense. Programs and/or macro routines are included that perform in the functional areas of forecasting, reviewing, and the control of both independent and joint replenishment ordering.

Features: This application programming system includes two complete programs, plus a group of macro routines. The two Model 20 programs (SVA, AP) are the same as those in the previously developed System/360 Wholesale IMPACT Program Library in terms of scope, names of programs, and input/output format and content.

The System/360 Model 20 Program Library performs the same functions as the comparable components of the System/360 Wholesale IMPACT Program Library, which are forecast demand and measure forecast error, including demand filter and tracking signal tests ... calculate the adjustment factor for lead time variability, and time to the Beta power ... calculate maximum available stock level for a specified shelf life limit ... calculate order points or peek points ... calculate economic order quantities (with an option to include safety stock in the calculation) ... rotate base index values to sequence and format required by the ordering program ... determine when to order items and item groups to meet service objectives ... calculate the product mix to be ordered within an item group that will meet both service objectives and limitations on total order size ... macro routines which assist the user in the preparation of distribution-by-value reports and in the creation of his operating programs.

The following programs and macro routines are provided in the S/360 - Model 20 version of Wholesale IMPACT:

Macros

DBV1	Distribution-by-Value, Pass 1
DBV2	Distribution-by-Value, Pass 2
FCST	Forecast
LBT A	Lead Time Variability and Time to Beta Power
MAXA	Maximum Available
OPPP	Order Point and Peek Point
EQQ	Economic Order Quantity
SRB1	Smooth and Rotate Base Index
INVLV	Inventory Level Evaluation
GOTO	Provides Standard Entry Into and Exit from other IMPACT Macros

Programs

SVA	Service Point and Variable Interval Allocation
AP	Allocation Print

Flexibility in the choice of input and output is provided. Input and output of main data flow in programs may be disk or tape, as specified by the user at assembly time. At run time the user may specify card input in lieu of tape or disk and/or may specify card output in addition to tape or disk. The macro routines are device independent.

Use: The program library includes operating programs and macro routines. Initialization programs which are designed to be used once to set up an IMPACT System, then as required to meet changing conditions, are not part of the Model 20 library. The user must provide time on an S/360 Model 25 or larger to initialize the system using the initialization programs in the System/360 Wholesale IMPACT Program Library (360A-DW-05X). The output from these initialization programs is completely compatible with the Model 20 operating programs and macro routines.

Customer Responsibilities: Because the Model 20 IMPACT library contains operating programs and Macro routines only, the user must make use of the existing System/360 Wholesale IMPACT Program Library's initialization programs. These programs which are used initially and as required thereafter require a 16K System/360 Model D25 using BOS or DOS or a 64K System/360 Model F30 using OS. Detailed machine requirements are provided with the program documentation. The user is responsible for providing his own record-keeping system. In addition, some user programming is required to use the macro routines and to provide linkage between his programs and IMPACT library programs.

Programming Systems: Model 20 IMPACT may be run under either the Disk-Resident Monitor or the Card-Resident Monitor of the System/360 Model 20 Disk Programming System. Programs are written in Assembler Language. Macro routines are written in Basic Macro Definition Language. Macro routines are written in Basic Macro Definition Language for use with Assembler Language programs.

Minimum System Requirements: A 2020 Processing Unit Model D4 with Disk Storage Control (#7495), the appropriate printer attachment, the appropriate card reader attachment, the appropriate card punch attachment ... 1403 or 2203 Printer (48 character set minimum) ... 2501, 2560, or 2520 Model A1 Card Reader ... 2560, 1442, or 2520 Card Punch ... two 2311 Disk Storage Drives (Model 11 or 12) or one 2311 (Model 11 or 12) and one 2415 Magnetic Tape Unit.

Note: The 2560 or 2520 Model A1 can be used as both the card reader and card punch.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H20-0255-2) ... Operations Manual (H20-0256-2). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Source program and sample problem.

Ordering Information: Program Number 360VDW06X.

Additional Program Support Material: System Manual (Y20-0230) ... Application Description Manual (H20-0461-1).

Reference Material: Introduction to IBM Wholesale IMPACT (E20-0278) ... Wholesale IMPACT - Advanced Principles and Implementation Reference Manual (E20-0174).

Bill of Material Processor: This program has the capability to load, maintain, retrieve, and reorganize part number master and product structure records. (360V-ME-08X)

Description: The program represents an extension of the support by IBM in the area of manufacturing application definition and implementation to the System/360 Model 20. The package contains generalized source programs to load and maintain product structure and part number master records on IBM 2311 disk files ... generalized source programs

IBM System/360 Model 20 Application Programs

to reorganize the product structure and part number master files ... a generalized source program to perform six basic product structure retrievals (single level, indented and summarized parts lists and single level, indented and summarized where-used parts lists).

The program uses a direct access file-oriented concept that requires the part number master (inventory-type) file to be on-line simultaneously with the product structure file.

Features:

- Product Structure records are linked to the Part Number Master (inventory-type) records.
 - Disk file chaining is used to organize product structure data in two inherent sequences:
 1. Assembly or bill of material sequence (i.e., linking the components of an assembly).
 2. Where-used sequence (i.e., linking the usages of a part number on higher assemblies).
 - Raw material can be included in the product structure file, providing for complete where-used cross reference of each raw material.
 - User designs his own record layouts by incorporating his own information plus certain required data into Part Number Master and Product Structure records.
 - Low level coding is automatically maintained when adding records to the Product Structure file.
 - Assembly to sub-assembly continuity is verified. This feature guarantees that the product structure records can be "exploded."
- Plus
- Bi-directional file chains to speed the maintenance of part number where-used data.
 - A run activity control technique to aid in restart and reconstruction and to facilitate additional retrieval features.

Use:

File Load and Maintenance: The user prepares his bills of material and transactions in his predefined card formats. The programs load and maintain this information on disk in a logical structure consistent with the relationship of the data.

Retrieval: The user prepares a simple inquiry transaction card to request one of his six basic product structure retrieval reports. The program retrieves the information from the disk files and prints the required document in user-defined format.

Reorganization: At the user's discretion, he can reorganize one or both files with programs supplied.

Customer Responsibilities: A thorough knowledge of Bill of Material Processor concepts (explained in the Application Description Manual) by the system designer is necessary. To implement this system, the following steps must be taken -- determine the format and content requirements of the records ... design additional input edit routines (if desired) ... establish control sequence (up to three levels available) ... design print formats and write routines to implement them ... tailor the Assembler Language Source Programs to fit his requirements.

Programming Systems: The following modules of the System/360 Model 20 Disk Programming System are required for the assembly and execution of the System/360 Model 20 Bill of Material Processor:

Program Name	Program Number
Disk-Resident Control Programs	360W-CL-171
Macro Maintenance Program	360W-SL-176
Library Service Programs	360W-SL-177
Core Image Maintenance Program	360W-SL-175
Assembler Program	360W-AS-181
Initialize-Disk Utility Program	360W-UT-183
Disk-to-Card Utility Program	360W-UT-189
Input/Output and Basic Monitor Macro Definitions	360W-IO-192
Punched Card Utility Programs	360-UT-100

The above modules of the System/360 Model 20 Disk Programming System are required; however, if any others are present, they will not affect the System/360 Model 20 Bill of Material Processor programs. Also, it should be noted that the System/360 Model 20 Bill of Material Processor programs will execute under either the Disk-Resident Control Programs (360W-CL-171) or the S/360 Model 20 DPS Monitor Generation Macro Definition (360W-IO-200). The Punched Card Utility (360T-UT-100) is used in the selective reproduce procedure of the modification process.

Note: If the user has a 2560 attached to his system, he may find it useful to have a Punched Card Utility Program (360T-UT-101). Although it is not a required program, it will simplify generation of the sample problem.

Minimum System Requirements: A 2020 Processing Unit Model D4 with Disk Storage Control, the appropriate printer attachment, the appropriate card reader attachment, the appropriate card punch attachment ... 1403 or 2203 Printer (48 character set minimum) ... 2501, 2560, or 2520 Model A1 Card Reader ... 2560, 1442, or 2520 Card Punch ... two 2311s (Model 11 or 12).

Note: The 2560 or 2520 Model A1 can be used as both the card reader and card punch for the System/360 Model 20 Bill of Material Processor.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H20-0553) ... Operations Manual (H20-0554). If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- Generalized source programs, macros, and sample problem.

Ordering Information: Program Number 360VME08X.

Additional Program Support Material: Application Description Manual (H20-0478) ... Systems Manual (Y20-0255).

Reference Material: Bill of Material Processor -- A Maintenance and Retrieval System (E20-0114) ... The Production Information and Control System (E20-0280).

Hospital Patient Billing: This program provides smaller hospitals with the capability of installing a patient billing system with a minimum of programming effort. (360V-UH-16X)

Description: The programs accept patient charges, provide for insurance company billing, Medicare Part A (SSA-1453C) and Part B (SSA-1554), and detailed billing of patients. The package covers admissions ... charge posting ... census reporting ... insurance proration ... preparation of detailed bills ... preparation of summary bills ... daily balance forward ... updating room transfers and discharges.

Features:

- Stored Programs - each of the application programs, stored on disk, is called into core as needed, using System Control and Service Program (Disk) and Job Control cards.
- Insurance Proration - charges are automatically prorated among the patient and insurance companies at the time a bill is printed. Provision is made to handle up to three insurance plans (including Medicare).
- Internal Pricing - standard charges are priced automatically.
- Preparation of data for entry to Accounts Receivable - patient data are punched at the time a final bill is prepared. The data are punched in the format required for direct entry to System/360 Model 20 Hospital Accounts Receivable program (360V-UH-09X).
- Revenue Distribution Data - punched into charge requisition cards as charges are posted. The user may then distribute revenue according to his particular needs.
- Controls - system control totals, in conjunction with manually posting to the Patient Billing Audit form, provide for an effective audit trail. The Patient Billing Audit form is used to record the dollar value of patient transactions in the billing system.

Use: When a patient is admitted, his record is entered into the Patient Master Data Set and the Census Master Data Set. As services are provided, all charges, credits, and payments are entered into the patient record. When insurance verification is received, the provisions of up to three plans are recorded in the patient insurance master data set.

Interim reports such as Census, Daily Balance Forward, Interim bills are printed. Final patient bills are prepared after discharge. Insurance bills are printed after interim and final bills. When final bills are printed the patient data are punched for entry to Accounts Receivable (refer to System/360 Model 20 Hospital Accounts Receivable, 360V-UH-09X).

The largest module of the patient billing system (DEWBFF) requires 16,339 bytes of core storage including input/output areas and system overhead.

IBM System/360 Model 20 Application Programs

Customer Responsibilities: A thorough understanding of the system before installation ... conversion to card format of data on present patients ... establishment of master data sets for charge description, department description, physician description ... a census master data set must also be established in card format ... design and printing of forms for bills and control of documents within the hospital.

Programming Systems: Programs are written using Report Program Generator (RPG) and Assembler Language. Hospital Patient Billing operates under Model 20 Disk Programming system (DPS). Also used are Sort/Merge, Disk Utility Programs, and Input/Output Control System (Disk).

Minimum Machine Configuration: A 2020 Model D2 (16,384 bytes) with 2203 Attachment (#8082), 2560 Attachment (#8099), 2311 Attachment (#7495) ... one 2560 Multi-Function Card Machine Model A1 ... one 2203 Printer Model A1 with 52-Character Set (#9088) ... two 2311 Disk Drives Model 12 ... OR a 2020 Model D4 (16,384 bytes) with 2203 Attachment (#8084), 2560 Attachment (#8100), 2311 Attachment (#7496) ... one 2560 Multi-Function Card Machine Model A2 ... one 2203 Printer Model A2 with 52-Character Set (#9088) ... two 2311 Disk Drives Model 12 ... OR a 2020 Model D5 (16,384 bytes) with 2203 Attachment (#8082), 2560 Attachment (#8099), 2311 Attachment (#7497) ... one 2560 Multi-Function Card Machine Model A1 ... one 2203 Printer Model A1 with 52-Character Set (#9088) ... two 2311 Disk Drives Model 12.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H20-0570) ... Operations Manual (H20-0571). If only the form numbered manuals are required order them from the IBM Distribution Center, Mechanicsburg -- not PID.

Machine Readable -- Source modules and job control statements for compiling. Sample problem with control cards for execution is also provided. (A bootstrap card will be provided with each DTR).

Ordering Information: Program number 360VUH16X.

Additional Program Support Material: Application Description Manual (H20-0548) ... System Manual (Y20-0297).

Transactions are valued using standard unit cost.

Open-order records are created only for placed purchase or production orders. A suggestion to order does not create an order.

Unit of packing is included in the item master record. Therefore, orders can be rounded to commercial or shop quantities.

The order file is created and maintained by the system. Updating the open-order file may occur through a separate Order File Maintenance run or as part of the Status Updating run. These two runs may be made at any desired frequency. The Requirements Planning and Order Policy programs are run at the end of each requirement period.

Stock value adjustment is performed. Work-in process and allocated inventories are updated.

Forecasting of unscheduled requirements and scrap rates is done by means of first-order exponential smoothing. Lot sizes are computed by means of the Floating Economic Order Quantity formula.

The operations of the Requirements Planning and Inventory Control System can be combined with the operations of an automated accounting system.

The modular concept allows the user to tailor the system to his particular requirements.

The user has the option of using the standard record formats as provided, or to create his own.

User-written sub-routines may be added throughout the system.

Variable control data may be changed for each system run.

The part number master file is organized indexed-sequentially. The product-structure and open-order files are direct-access files chained to the part number master file.

The part number master file may be accessed and processed by RPG programs.

Requirements Planning and Inventory Control System:

This group of integrated programs has been designed to assist manufacturing companies to better achieve economic management of their manufacturing inventories.

Programs are provided to (1) create and update the order file, (2) update inventory status with all transactions, (3) plan future requirements by explosion and forecasting, and (4) assure an economic coverage of requirements by means of an order policy based on stock-out point and order quantity rules. (360V-MF-10X)

Description: The system consists of two subsystems, each processed by job control: an Order File Organization subsystem, and a planning and updating subsystem comprised of Status Updating, Requirements Planning, and Order Policy.

Mainline -- The control mainline routines reside in core storage throughout the system runs. On the basis of RICS system control cards, they select the next phase, load it, and control execution of the program.

Order File Organization -- This contains the routines required to create and maintain the open-order file. It includes the functions load, unload, add, update, and delete. The output of this program is an order audit list. Updated inventory account totals are printed at the end of the run.

Status Updating -- All transactions (issues, receipts, orders, etc.) are processed and the item master and open-order records are updated. Status Updating Report may be printed for each updated item, or for every item in the file depending upon the user specification. Updated inventory account totals are printed at the end of the run.

Requirements Planning -- The requirement fields in the item master records are updated by means of input cards and explosion of the input through the product-structure chains. Gross requirements are netted against available inventory. The orders needed to cover net requirements are determined for finished products and components by means of lot-sizing and offsetting routines. Forecasts for unscheduled requirements and scrap rates are made using exponential smoothing.

Order Policy -- All items are periodically checked to determine whether all the requirements for a user-specified time period are filled by stock on hand or open orders. If the requirements are not covered, one of the following actions will be suggested to assist achieving a balance between the requirements and the available inventory: order, reschedule order, follow-up, or cancel order. A suggestion to remove an item from stock is made if the item has been inactive for a specified length of time. Order Policy Reports showing the planning status may be printed for every item in the file or only for those items that have uncovered requirements within the specified scheduling period.

Features:

Seven system runs are provided to assist the user in developing an integrated, economic, material management system.

The IBM System/360 Model 20 Bill of Material Processor is required to create, maintain, and reorganize the part number and product-structure files.

It is possible to implement the three application programs (Status Updating, Requirements Planning, and Order Policy) as an integrated system or independently.

Use: Seven different system runs are possible.

- Create the open-order file.
- Maintain the open-order file.
- Unload the open-order file.
- Update status by orders and transactions.
- Determine order policy for special items.
- Forecast, period shifting of requirements and order policy.
- Enter and plan requirements and order policy.

The last disk runs may be processed as one job using RICS system control cards to separate the execution of each system run.

Customer Responsibilities:

Record lengths must be determined with a view towards the number of item master, product-structure and open-order records to be processed and the capacity of the disk storage available, if the standard system is not used.

Organization, construction, and maintenance of the part number master and product-structure files.

Obtain an understanding of the concepts utilized in order to select the most meaningful values as parameters, IBM Production and Information Control System (PICS) manual discusses many of these concepts.

Designing of record formats and the assignment of transaction codes if the standard system is not used.

Customizing by selecting the required routines and, if necessary, changing the phase constructions, if the standard system is not used.

Programming Systems: This system is written in the IBM System/360 Model 20 DPS/TPS Assembler language, using the DPS IOCS. Initial distribution is supported by DPS release 6.

The following modules of the IBM System/360 Model 20 Disk Programming System are required for the assembly and execution of the Requirements Planning and Inventory Control System.

Program Name	Program Number
Disk Resident Control Programs	360W-CL-171
Macro Maintenance Program	360W-SL-176
Library Service Programs	360W-SL-177
Core Image Maintenance Programs	360W-SL-175
Assembler Program	360W-AS-181
Initialize-Disk Utility Program	360W-UT-183
Disk-To-Card Utility Program	360W-UT-189
Input/Output and Basic Monitor Macro-Definitions	360W-IO-192
Punched Card Utility Programs	360T-UT-100

IBM System/360 Model 20 Application Programs

The above modules of the IBM System/360 Model 20 Disk Programming System are required; however, if any others are present, they will not affect the Requirements Planning and Inventory Control System programs. Also it should be noted that the IBM System/360 Model 20 Requirements Planning and Inventory Control System programs will be executed only under the Disk-Resident Control Programs (360W-CL-171). The punched Card Utility (360T-UT-100) is used in the selective reproduce procedure of the customizing process.

Note: If the user has an IBM 2560 attached to his system, he may find it useful to have the Punched Card Utility Program (360T-UT-101). Although it is not a required program, it will simplify generation of the customized user system.

Minimum System Requirements:

IBM System/360 Model 20 Central Processing Unit Model D2, D4 or D5 with decimal arithmetic and 16K core storage.

The appropriate card reader attachment
The appropriate card punch attachment
The appropriate printer attachment
One card reading device IBM 2501, 2560, or 2520 Model A1
One card punching device IBM 2560, 1442, or 2520
One printer IBM 1403 or 2203 (48 character set minimum)
Storage Control IBM 7495
Two Disk Storage Drives IBM 2311

Note: The 2560 or 2520 Model A1 can be used as both the card reader and card punch for the IBM System/360 Model 20 Requirements Planning and Inventory Control System.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H19-0023) ... Operations Manual (H10-0022). If only the form numbered manuals are required, order from Mechanicsburg -- not from PJD.

Machine Readable -- Standard source programs, macro, and sample problem.

Optional Program Package:

Machine Readable -- A sample minimum DPS system containing the RICS object programs and the sample BOMP 20 object programs, sample BOMP 20 source programs, macros, and sample problem.

Ordering Information: Program Number 360VMF10X.

Additional Program Support Material: Application Description Manual (H19-0007) ... System Manual (Y19-0002).

Reference Material: PICS - Production Information and Control System (E20-0280) ... IMPACT - Inventory Management and Control Techniques (E20-8105) ... Bill of Material Processor - a Maintenance and Retrieval System (E20-0114) ... Model 20 Bill of Material Processor (H20-0478).

Hospital Accounts Receivable: This program provides smaller hospitals having a disk-oriented data processing system the capability to perform the major processing runs in the hospital accounts receivable area including accurate and timely information to management for better accounting control (360V-UH-09X).

Description: Design of the program allows the user to enter accounts receivable data cards directly from billing output (e.g., Patient Billing Program to be available 12/15/68). The programs provide entry to accounts receivable ... Cash Receipts and Adjustments Report ... Aged Accounts Analysis ... statement writing with selective account printout ... Accounts Receivable Status, listing all balances and detail transactions for each account ... Insurance Accounts Receivable by insurance company and plan of coverage ... Delete Accounts Receivable for accounts at zero balance or below user-determined write-off amount.

Features: Stored Programs - each of the application programs stored on disk is called into core as needed, using System Control and Service Program (Disk) and Job Cards. Entered Accounts - final billing totals including prorated insurance amounts are accepted by the programs to set up an account for the discharged patient. Transaction posting - cash receipts, late charges, and adjustments are posted and control totals are established. Aged Accounts - the accounts receivable file is automatically aged and a report produced showing the age of the account in months. A summary is also produced showing total dollars in age categories. Status Reporting - a full detail listing is provided showing the complete history of the account. Statement writing - statements are prepared either for the entire file or selectively by financial class as determined by the user. Insurance Accounts Receivable - a report of amounts due from each insurance company showing patients covered by each company. Deleted Accounts - as an account is closed the record is automatically deleted and a report is prepared showing which accounts were removed from the file. Card Inquiry - inquiry is available through card input.

Use: When a patient is final billed (after discharge), the final amounts are punched and entered into the Accounts Receivable Master Data Set. As financial transactions occur, they are entered into the system for posting to the account. Daily and periodic reports are printed from the data provided.

Customer Responsibilities: A thorough understanding of the system before installation ... design of statement forms for use by the Statement Writing Program ... creation of table of insurance companies and plans of coverage for use by the Insurance Accounts Receivable program ... establishment of Accounts Receivable Master Data Sets ... installation requires the conversion to card format of data on present accounts receivable.

Programming Systems: This program operates under the IBM Disk Programming System for IBM System/360 Model 20. The application programs are written in Report Program Generator (RPG). Sort/merge and Disk Utility Programs are also utilized.

Minimum System Requirements: 2020 BC2 Central Processing Unit (12K bytes), 2560 Attachment (#8099), 2203 Attachment (#8082), 2311 Attachment (#7495) ... 2560 Multi-function Card Machine Model A1 ... 2203 Printer Model A1, 52 Character-Set (#9088) ... two 2311 Disk Storage Drives Model 12s. Core requirement for largest module of the system is 11,171 bytes including system overhead.

OR

2020 BC4 CPU (12K bytes), 2203 Attachment (#8084), 2560 Attachment (#8100), 2311 Attachment (#7496) ... 2560 MFCM Model A2 ... 2203 Printer Model A2, 52 Character-Set (#9088) ... two 2311 Disk Storage Drives Model 12s.

OR

2020 BC5 CPU (12K bytes), 2203 Attachment (#8082), 2560 Attachment (#8099), 2311 Attachment (#7497) ... 2560 MFCM Model A1 ... 2203 Printer Model A1, 52 Character-Set (#9088) ... two 2311 Disk Storage Drives Model 12s.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H20-0567) ... Operation Manual (H20-0568). If only the form numbered publications are required, order from Mechanicsburg -- not PID.

Machine Readable -- RPG source programs and sample problem (a bootstrap card will be provided with each DTR).

Ordering Information: Program Number 360VUH09X.

Additional Program Support Material: Application Description Manual (H20-0547) ... System Manual (Y20-0295).

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Rigid Frame Selection Program: RFSP assists customers who must design two or three hinged rigid frames and other simpler, structural elements. (1130-EC-09X)

It contains design logic for steel, laminated wood, and reinforced concrete structural elements. RFSP is of direct interest to manufacturers of prefabricated buildings and to consulting engineers and architects.

The principal value of the program is its ability to produce a least weight design, within the range of material sizes available to a particular user. Designs produced by RFSP will satisfy one user-specified set of loading and stress specifications, for generalized, non-symmetric frames. In the more typical case, symmetric frames can be designed for three standardized load cases at one time.

RFSP uses building profile dimensions, applied loads, and the user's choice of material dimensions to produce a design.

Features:

- Has direct design of least-weight two- and three-hinged rigid frames by automatic, successive approximation, using outside building dimensions and applied loads.
- Allows several inventory policies to be evaluated for a product line, by creating section economy tables from various inventory specifications.
- Provides a convenient language for users to specify design and inventory variables.
- Calculates dimensions and weights of frames and their components.
- Allows for the design of members of other structures, given the results of a structural analysis.
- Supports interactive operation via the 1130 keyboard.

Use: Inventory calculations are made once for each different choice of material types and sizes. Design calculations are made for each different structure, for each different combination of dead, live, and wind load.

Users describe inventory choices, external structure dimensions, and applied loads in a convenient free form language, implemented under the Problem Language Analyzer (PLAN). These statements determine which inventory, analysis, input and output programs are executed. Results are printed for inspection and may be stored on disk for modification and recalculation.

Customer Responsibilities: Users should be familiar with the theory and practice of rigid frame design. At least one person in the installation should be familiar with the use of 1130 PLAN (1130-CX-25X) and the 1130 Disk Monitor System. No programming or classroom training is required unless the customer decides to alter or extend the system. In this case, he must be familiar with FORTRAN, PLAN, and structural engineering.

Programming System: The RFSP/1130 is written in FORTRAN and operates under the 1130 Problem Language Analyzer (PLAN) which, in turn, operates under the 1130 Disk Monitor Version 2.

Minimum 1130 System Configuration: 8K disk 1131 Central Processing Unit ... 1442 Card Read Punch Model 6 ... one 2315 Disk Cartridge

Expanded 1130 Systems: RFSP throughput and usefulness are increased by the addition of a line printer, larger main storage, a 2311-12 or 11, a 2310 Model B1 or B2, and faster main storage, in that order of importance. 1131 Models 2C, 2D, 3B, 3C, and 3D may be used. All combinations of 1130 line printers, card readers, and card punches supported by FORTRAN can be used for RFSP.

Basic Program Package:

Documentation -- Application Directory ... Program Description and Operations Manual (H20-0580). If only the form numbered manual is required, order from Mechanicsburg -- not from PID.

Machine Readable -- Object decks and sample problem.

Optional Program Package:

Machine Readable -- Source statements.

Ordering Information: Program number 1130EC09X.

	PROGRAM NUMBER EXTENSION	DISTRIBUTION MEDIUM TYPE	CODE	USER VOLUME REQUIREMENT
BASIC	none	2315	58	01
OPTIONAL	none	DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Support Material: Application Description Manual (H20-0598) ... Systems Manual Flowcharts and Narratives (Y20-0316) ... Compiled Listings (Y20-0366).

Reference Material: PLAN Application Description Manual (H20-0490-1) ... PLAN Program Description Manual (H20-0594) ... 1130 PLAN Operations Manual (H20-0595).

Automated Chemistry Program (ACP): ACP supports the IBM 1080 Data Acquisition System in the clinical laboratory. (1130-UH-13X)

Description: This program processes the punched card output of the IBM 1080 Data Acquisition System.

Processing of 1080 Punched Card Output -- establishes the calibration function from control standard ... checks the quality of the control standards used ... computes the test result ... adjusts the test result for interaction between specimens (high concentration followed by low concentration) ... compares test result with mean and standard deviation of cumulative data for all results for that test ... associates each test result with the proper specimen identification number.

Setting Up a Test Result File -- sets up a file by specimen number and tests results for each test ordered ... the data from this file can be transferred to and integrated with a Patient Master Record by user-written routines.

Print Out of Quality Control Report -- Prepares a quality control report for review by the laboratory prior to release of test data for distribution to the ward or clinic ... the quality control report lists for each specimen processed: test result, dilution factor (if any), abnormal indication for 1 or 2 standard deviations, and specimen number.

Features: This program encompasses the following unique features that produce more reliable test result -- it checks reliability of control standards ... adjusts for analyzer drift ... reports quality control information ... flags abnormal test results for retesting of these specimens.

Special Sales Information: The output from this program can be combined with the user-provided basic patient data and printed by simple user-written routines to serve as a Patient Summary Sheet for tests processed by 1130 ACP.

Use: The program is loaded into the library and called via job control cards. Environmental data are loaded and retained on disk via a maintenance program included with this program, this is a one-time operation for a given operating environment ... 1080 card output can then be processed.

Customer Responsibilities: The user is responsible for -- providing basic patient data, associating patient number and specimen number ... setting up the 1080 by providing a description of which analyzer strip chart recorders are associated with which 1084, a description of the tests run on each 1084, test number and name, concentration of each calibration-standard, control standards used, and chemistry procedure used.

Programming Systems: ACP is written in 1130 Basic FORTRAN IV and Assembler language and operates under the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk 1131 Central Processing Unit or larger, with 2315 Disk Cartridge, 1442 Card Read Punch Model 6 ... 1132 Printer Model 1.

Additional Device Support: A 2501 card reader and a 1403 printer are supported under Version 2.

Basic Program Package:

Documentation -- Application Directory ... Program Description Manual (H20-0542-1) ... Operations Manual (H20-0543-1)

Machine Readable -- control cards, object modules necessary to store the programs in the user area of the 1130 Monitor Disk, and a sample problem (with control cards).

Optional Program Package:

Documentation -- None
Machine Readable -- Source code.

Ordering Information: Program number 1130UH13X

	Program Number Extensions	Distribution Medium Type	Code	User Volume Requirement
Basic	none	Cards	15	none
Optional	none	DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Material: Application Description Manual (H20-0482) with TNL (N20-1998) System Manual (Y20-0216) with (Y20-0402).

Reference Material: System Summary (A26-5574) ... Installation Manual-Physical Planning (A26-3684) ... Functional Characteristics (A26-3661) ... Disk Monitor System Reference Manual (C26-3750) ... Basic FORTRAN IV Language (C26-5933) ... Assembler Language (C26-5927) ... Subroutine Library (C26-5929) ... Functional Characteristics (A26-5881) ... Data Presentation System--User's Manual (H20-0338) ... Problem Language Analyzer (PLAN) Program Description Manual (H20-0594) ... 1130 Operations Manual (H20-0595)

IBM 1130 Application Programs

Structural Engineering System Solver (STRESS): A powerful tool for solving structural engineering problems. It is a problem-oriented language which enables the engineer to communicate with the computer even though he has had no previous programming experience. (1130-EC-03X)

This program covers many application areas in the field of structural analysis. Most buildings and bridges are designed by consulting engineers or government agencies, but many other types of structures in other industries can also be designed using 1130 STRESS. Some of the other industries and typical applications for each are Aerospace (Wing Members) ... Manufacturing (Conveyer Framing, Plant Design) ... Process (Supporting Towers) ... Utilities (Transmission Towers, Culvert Sections) ... Federal (Dam Design, Ship Design).

Features: STRESS incorporates many features that will make it extremely valuable to the engineer. Included are a user-oriented language for describing the geometry of the structure which is essentially the same as the language used generally in engineering ... facility to solve space frames, trusses, rigid frames, box culverts, tunnel sections, plane grids and plane frames ... problem sizes up to 125 joints and 250 members ... access to the stiffness matrix.

Use: To use 1130 STRESS the engineer simply describes the shape of the structure, the properties of the members, the loadings placed on the structure and the output he requires, using the 1130 STRESS language. Each statement is punched into a card in free form. This deck of statement cards is then read into the computer, and the 1130 STRESS system provides the specific output that the engineer has requested.

Customer Responsibilities: The customer is required to be familiar with the 1130 STRESS language. The STRESS program is ready to run as distributed. The customer need only load the cards onto a disk.

Programming Systems: FORTRAN is used as the primary source language, with a few subroutines written in 1130 Assembler language. Knowledge of these programming languages is needed only if the user expects to augment or modify the system. The program operates entirely under the control of Version 2 of the 1130 Disk Monitor System (1130-0S-005).

Minimum System Requirements: An 8K 1130 with disk and a 1442 Card Read Punch. The addition of an 1132 Printer, while not required, will appreciably improve the speed of performance. If a printer is not included, the output will consist of punched cards or will appear on the console typewriter at the user's option.

Basic Program Material:

Publications* -- Application Directory ... User's Manual (H20-0340-2) ... TNLN20-1063.

Machine Readable -- Object card decks and sample program deck available in card form.

Optional Program Material:

Machine Readable** -- Source Cards are available on one 9-track Distribution Tape Reel (DTR) (800 bpi or 1600 bpi.)

Ordering Procedures:

*If only the form numbered manual is required, order from the IBM Distribution center, Mechanicsburg -- not from PID.

**No tape submittal is required; the DTR will be supplied by PID. If the density is not specified on the program order card, 800 bpi will be supplied.

Additional Program Support Material: Application Description Manual (H20-0237-3) ... Systems Manual (Y20-0081-1).

Numerical Surface Techniques and Contour Map Plotting: Supports a wide range of applications requiring the analysis of numerical surfaces and the display of contour maps that describe these surfaces. This program can be applied in the medical, oceanography, mining, meteorology, manufacturing, and petroleum exploration and production areas. (1130-CX-11X)

Description: In many sciences and fields of industry there is a need to express surfaces analytically by equations or numerically by a set of data points. This program provides the user with a number of techniques which may be carried out singly or in various combinations without the requirement of intermediate output. Final output either numerical data in cards or on typewriter or maps drawn by the IBM 1627 F

The programs included in the set are:

- Utility Programs -- load user data of intermediate results to disk storage ... dump intermediate or final results from disk to cards ... initialize disk storage ... modify data sets in disk storage.
- Numerical Approximation over a Uniform Grid -- takes irregularly spaced data points that define a surface and produces values at the mesh points of a square grid system superposed on the surface.
- Interpolation to a Finer Grid -- takes the values that define a surface at the mesh points of a square grid and, by nonlinear interpolation, defines the surface on a grid with one-half the spacing.
- Smoothing -- applies a controllable degree of smoothing to the values that define a surface, thereby eliminating unwanted minor irregularities in the surface.
- Surface Fitting with Orthogonal Polynomials -- fits orthogonal polynomials to either regularly or irregularly distributed data.
- Equation Evaluation over a Uniform Grid -- produces representative values for a surface by evaluating a defining equation at the mesh points of a square grid.
- Grid-to-Grid Operations -- adds, subtracts, multiplies, or divides the values at the common points on two grid networks ... an option provides the capability to modify the boundaries of a grid network to conform to the common area of two overlapping grids ... another option provides the capability of output the greater of lesser of the two values at each grid point.
- Numerical Integration -- takes a surface defined at the mesh points of a square grid and computes surface areas, projected areas, or volumes by techniques of numerical integration.
- Contouring -- takes a surface defined by values on a square grid and produces a contour map using the IBM 1627 Plotter.
- Map Annotation -- draws letters, numbers, special symbols of various sizes, map boundaries, and titles of maps.

Features: The program uses a data set concept for disk storage of intermediate results ... this offers the user a great deal of convenience in establishing solutions for a variety of problems ... output data sets are named so that they may be called as input to subsequent subprograms.

A nonlinear contouring technique produces maps which closely resemble those produced by hand ... an option provides for rapid linear contouring of intermediate maps ... another option provides for contouring of a series of maps without operator intervention.

Use: Data input consists of a series of control points at which two independent variables (X and Y) and up to thirteen dependent variables (Z values) are recorded. To use the program the customer describes the format in which these data are recorded, names intermediate data sets, prepares program parameter cards according to specified formats, establishes the sequence of subprograms required for solution of a particular problem, and prepares monitor control cards for execution of the program sequence.

Customer Responsibility: The customer is responsible for placing his data in machine readable form and for providing a disk containing the 1130 Disk Monitor System.

Programming Systems: The program is written in 1130 Assembler Language and 1130 FORTRAN. It is designed to run under control of the 1130 Disk Monitor System, Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter.

Basic Program Package:

Documentation -- Application Directory ... Programmers' Manual (H20-0357 with TNL N20-1992) ... Operators Manual (H20-0356-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Object code and Sample Problem.

Optional Program Package:

Machine Readable -- Source Statements (order using program number 1130CX11X).

Ordering Information: Program Number 1130CX11X:

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	none	Cards	15	none
Optional	none	MT 9/800	28	01
		DTR 9/1600	29	01



Additional Support Material: Application Description Manual (H20-0140 with TNL N20-1991)* ... System Manual (Y20-0103-1)*

Reference Material: 1130 FORTRAN Language (C26-5933)* ... 1130 Disk Monitor System, Version 2 (C26-3717)* ... 1130 Input/Output Units (A26-5890)* ... 1130 Assembler Manual (C26-5927)* ... IBM 1130 Subroutine Library C26-5929)* ... IBM 1130/1800 Plotter Subroutines (C26-3755)*

*Available from Mechanicsburg Distribution Center.

Mechanism Design System Gears and Springs: This program provides design and analysis for five distinct mechanical components used in a wide variety of machines. Spur and Helical Gears, Compression, Extension and Torsion Springs are the components covered by this application. (1130-EM-01X)

Description: The 1130 Mechanism Design System Gears and Springs provides the mechanical engineer and mechanism designer with a flexible, easy-to-use program set which will design new parts or analyze existing parts. Gears and Springs may exist in dozens of types, but those covered here represent a high proportion of the total design effort expended in this area.

The engineer is expected to furnish the problem description in terms of design restrictions and material parameters. This description is in a flexible problem language format processed by the Problem Language Analyzer (PLAN). It greatly simplifies man-machine communication. Operation can be either by a batch, card input mode or in interactive typewriter input mode. In the latter case, an engineer can readily evaluate parametric changes and use the computer as a design tool.

The Spur and Helical Gear Programs enable the engineer to design a new gear train containing two gears or to analyze an existing gear train. The programs for gear design compute the parameters of gears with the smallest dimensions that will give stresses below the allowable limits for the materials specified. When designing gears, the engineer may furnish the data about one gear or the shaft center distance of the two gears. In both cases, the computer will generate the information necessary for producing the gears and evaluating the design.

The Compression and Extension Spring programs provide for both the design and analysis of round wire helical springs. The Torsion Spring program provides for the design and analysis of round and rectangular wire helical springs.

When designing springs, the user can specify an allowable design stress or allow the program to compute the design and limit stresses based on wire diameter. Commonly used materials and wire sizes are furnished with the Spring programs in the form of tables. The user has the option of using these standard values or providing a minimum and maximum wire size and an incremental value to be used in selecting a workable wire size. The acceptability of each wire size for a given spring design is based primarily on the spring operating at a safe stress level consistent with service requirement. However, once a real spring is calculated, several other checks can be performed. Two such checks are for the spring index and the spring diameter to be within specified limits.

Features: A modifiable command structure is provided which the user can tailor to meet individual requirements ... input can be in batch or interactive mode ... while operating in the latter mode (typewriter input), the engineer can readily modify the problem parameters to achieve a satisfactory design ... programs are highly modular and coded in FORTRAN for ease of modification; calculations not performed in this application can be added to existing program modules or new program modules written; standard data can be called by name through use of the command structure provided; new commands can be added to those provided with the system for tables of standard size data, material physical parameters, etc. ... American Gear Manufacturing Association (AGMA) and Spring Manufacturer's Institute (SMI) tolerance and quality data are available in the command list; thus, the user can utilize that quality data furnished with the program or by adding new commands he can use local practices ... new components can be designed or existing components analyzed ... design documentation includes data required for a part drawing and additional calculated data required for design evaluation ... a framework is provided for expanding the existing command structure to include functions not covered in these applications as well as for creating new applications for additional component types. (Examples for the former are type and size synthesis; for the latter, cams, different gear type and linkages.)

Customer Responsibilities: A basic knowledge of gear and spring design terminology, materials, manufacturing tolerances and inspection techniques is essential. The customer must, in addition, study and understand what design criteria are implemented in this application. In any given machine generated design, the results may not agree with a preconceived idea or an existing design. It is envisioned that in situations like this, the engineer will be able to direct the machine to a satisfactory solution by means of a feature provided. If he cannot, however, program modification will be necessary. The programs were constructed with this in mind and are modularly coded in FORTRAN, and thoroughly documented. This program is not a substitute for an engineer's experience and judgment. Rather, it is a tool to be used which enables him to think more about design and less about detail calculations.

Use: The Mechanism Design System is controlled by user written commands which describe the problem to be processed. The commands are processed by the Problem Language Analyzer (PLAN).

Programming Systems: Version 2 of the IBM 1130 Monitor (1130-OS-005) Modification Level 5 or higher and 1130 Problem Language Analyzer (PLAN) (1130-CX-25X). The application programs are written in 1130 FORTRAN.

Minimum System Requirements: 8K disk 1130 Computing System ... 1442 Model 6 or 7 Card Read Punch ... 2315 Disk. Larger 1130 models, alternate card input/output devices and printers supported by 1130 Disk Monitor are also supported by Mechanism Design.

Optional System Requirement: 1132 Printer for more efficient production ... Expansion Adapter (#3616) ... 1132 Attachment (#3854).

Basic Program Package:

Documentation* -- Application Directory ... Program Description Manual (H20-0365-1) ... Operations Manual (H20-0366-1).

Machine Readable -- Object code decks, language definition card decks, and sample problem.

Optional Program Package:

Machine Readable -- Program source code. Decks and listings are generated by the self-loading program on the tape using a System/360 Model 2030 D or larger.

Ordering Information: Program Number 1130EM01X

	Program Number	Distribution Medium		User Volume Requirements
		Extension	Type Code	
Basic	none	CARDS	15	none
Optional	none	DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Material:** Application Description Manual (H20-0268-1) with TNL (N20-2020) ... System Manuals -- Flowchart and Narratives (Y20-0109-1) ... Listings (Y20-0434).

Reference Material:** PLAN Application Description Manual (H20-0490) ... PLAN Program Description Manual (H20-0594) ... 1130 PLAN Operations Manual (H20-0595).

*If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

**Available from the Mechanicsburg Distribution Center.

Decline Curve Analysis Program: Computes the coefficients in the equation best fitting past production data and the reserves associated with these data. Using a method of least squares for non-linear systems, the coefficients of the equation best fitting past production data are determined. By means of the equation, future production rates and future cumulative production are computed. These figures are used to better evaluate a producing property. Output may be on the typewriter, 1132 Printer, or 1627 Plotter. (1130-MP-03X)

Description: Past oil production data for a number of time periods (the length of which the user may select) serves as input to the Decline Curve Analysis. (A maximum of 50 past production periods may be used).

Two types of equations are available for fitting past production data and for projection into the future. The user may select either the exponential equation or the hyperbolic equation to be used, or he may allow the program to select the equation which gives the best fit to past data. In either case, the coefficients for the equation selected are determined by the method of least squares. Output from this first program includes past production rate, computed production rate, and cumulative production for the period of past performance. The computed production rate and cumulative production are then calculated for the future. The above output is utilized by a second routine which prepares two different types of output under the control of the user. First, a typed report of the production data may be prepared. Second, a decline curve showing both past and predicted production may be plotted on the 1627 Plotter.

Features: Up to 50 past production periods may be used ... the user may select either a hyperbolic decline or an exponential decline ... results of the calculations may be tabulated or plotted ... the output is directly available for input to the Economic Evaluation Program (1130-MP-01X)

Use: The program accepts as input the past production history from a well or a series of wells. A least squares fit is then made through this data and the curve is extrapolated into the future. Ultimate recovery and production rates at selected points in the future can then be estimated from the decline curve generated by the program.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output description section of the Programmer's Manual. The customer assumes the responsibility for program modification if plotting of a decline curve showing both past and predicted production is not desired. The results of calculations then would only be a typed report of the production data.

Instructions for the above program modification are provided in the Programmer's Manual (H20-0410).

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2. The IBM 1130 Dipmeter program (1130-MP-15X) containing specific plotting subroutines necessary to running the Decline Curve Analysis Program must be ordered from PID

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter. An IBM 1131 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0410-1) ... Operator's Manual (H20-0411-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Source code and sample problem.

Ordering Information: Program Number 1130MP03X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0409-1) ... System Manual (Y20-0048-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Schilthuis Material Balance Program: The Schilthuis material balance equation, for a reservoir which is subject to water influx, is evaluated at each past production data point (for up to 28 points). These values are weighted according to oil production and subjected to a least-squares solution to compute a most probable value of the original oil in place. (1130-MP-05X)

Description: This program is useful as an aid in predicting the performance of a reservoir. It allows the user to calculate gas volume to oil volume ratio, initial gas content, water influx constant, and volume stock tank oil initially in place.

Features: A least squares fit program is provided to furnish coefficients for fitting the laboratory pressure, volume, and temperature data ... the program uses Gaussian matrix solution and may be used as a general purpose program ... the program is versatile. It may be used for estimates of initial oil and gas present on reservoirs with water drives and with or without gas caps.

Use: The program accepts as input certain reservoir and fluid properties. Among these are: porosity, reservoir pressure, gas solubility, etc.

The Schilthuis Material Balance Equation is then solved to predict the original stock tank oil in place.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language described in C26-3715. It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0418) ... TNL N20-1973 ... Operator's Manual (H20-0419-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source code and sample problem.

Ordering Information: Program Number 1130MP05X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0417) ... TNL N20-1972 ... System Manual (Y20-0050-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Two-Dimensional Waterflooding Program: Allows the user to determine the pressure distribution throughout a reservoir, taking into consideration the effect of water injection. The pressure distribution data may then be used to compute the rate of frontal advance through the reservoir, and the flood front may be plotted using an on-line plotter. As an additional feature, this program provides for analysis of complete injection patterns in a reservoir in order that the optimum pattern might be selected. (1130-MP-06X)

Description: The design of an optimum waterflood is one of the most important and difficult problems facing today's petroleum engineers. To help solve this problem, a program has been written which can be used as a guide in the design and analysis of optimum waterflood patterns.

Basically, the waterflood program consists of two phases. The first phase involves the solution of the Laplace equation, which yields the pressure distribution throughout a reservoir. This solution considers reservoir geometry, boundary conditions, location of producing and injection wells, rate of injection and production, reservoir conductivity, and reservoir conditions (initial or fixed). The development of the pressure distribution within a given waterflood yields the pressure gradients and streamlines necessary to plot frontal advance, which the program also performs.

The solution of pressure distribution is obtained by establishing a grid network over the reservoir. Values are determined at each grid point (Kh/u, pressure, well type, boundary) and are used to solve for the pressure.

Frontal advance is computed by moving a series of pre-selected points (which are initially placed around each injection well) along the streamlines of the reservoir. These points are moved at discrete time intervals based on the velocity function at each point location until producing wells are reached or floodout occurs.

Basically, the solution is steady-state; however, provision has been made to analyze unsteady-state behavior by resolving the pressure distribution at various flood stages as the injection and production pattern changes. Flood fronts are plotted using a 1627 Plotter.

Features: The solution considers reservoir geometry, boundary conditions, location of producing and injection wells, rates of injection and production, reservoir conductivity, and reservoir condition ... flood fronts are plotted on an on-line plotter which allows the user to watch the reservoir performance as the computations proceed. The user may stop the flood at any time and change conditions.

Use: The program accepts as input the reservoir geometry, boundary conditions, location of producing and injection wells, rate of injection and production, reservoir conductivity, and reservoir conditions. This information is analyzed and the flood front pattern is developed and plotted on an on-line plotter. By visual analysis of this plot, the user can arrive at optimum well spacing and rates of injection and production.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System, Version 2. The IBM 1130 Dipmeter Program (1130-MP-15X), containing specific plotting subroutines necessary to running the Waterflood Program must be ordered from PID.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0422) ... TNL N20-1975 ... Operator's Manual (H20-0423-1). If only the form numbered manuals are available order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source code and sample problem.

Ordering Information: Program Number 1130MP06X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0421) ... TNL N20-1974 ... System Manual (Y20-0051-1)

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Gas Deliverability Program: Allows the user to project the annual rate at which volumes of gas reserves may be received into gathering systems. A printed report may be obtained by quarters showing a breakdown of the deliverability and daily takes for each well, as well as deliverability and production, both daily and cumulative for the reservoir. (1130-MP-07X)

Description: The complete job of computing gas deliverability is performed by two routines, the first of which is the computational phase. Future absolute open flow and future deliverabilities are predicted for up to 40 individual wells. The daily production is then reported as the smaller of the deliverability or the allowable, which may be a fixed quantity or a percentage of the absolute open flow. For the reservoir as a whole, the daily production, the cumulative production for the year, and the total cumulative production are reported by quarter. When the production drops below a specified rate, the line pressure is decremented until a minimum line pressure is reached.

The second routine prepares reports and input data for the Economic Evaluation Program. Output reports may be typed on the console typewriter or may be created offline by listing punched cards.

Features: The program computes absolute open flow and future deliverabilities for up to 40 individual wells ... daily production cumulative production for the year and total cumulative production are reported quarterly ... output can be read directly by the Economic Evaluation program (1130-MP-01X).

Use: The program accepts as input reservoir pressure and volume, well flow rates, gathering line pressures, and allowables.

From this information, flow rates from individual wells and cumulative reservoir production are projected for up to 30 years into the future.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0426) ... TNL N20-1976 ... Operator's Manual (H20-0427-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source codes and sample problem

Ordering Information: Program Number 1130MP07X

Program Number	Distribution Medium		User Volume Requirement
	Extension	Type Code	
Basic	none	cards 15	none

Additional Program Support Material*: Application Description Manual (H20-0425-1) ... System Manual (Y20-0052-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Multi-State Flash Calculation Program:

Is a general purpose flash calculation program that can be used for a variety of the computations made by the Petroleum Engineer. The program may be used to design surface separators or to determine the physical properties of the oil and gas from a surface facility. A laboratory differential liberation may be simulated. (1130-MP-08X)

Description: This program was designed as a general purpose program to accommodate up to four stages of flash. The program is useful for simulating a laboratory differential depletion or for computing the recovery from various arrangements of surface traps.

The feed to the first stage may be computed from the separator liquid and vapor products for a high-pressure separator or from the separator products and the tank oil for a low-pressure separator; or, alternately, the user may evaluate a pre-computed well stream. If the user desires, the program converts the C7+ cut into five cuts (C7, C8, C9, C10, and C11+) based on either an ASTM (American Society of Testing Materials) or a true boiling point distillation. In all, the program accommodates up to 16 components which includes up to three non-hydrocarbons.

If specific K values are desired, these may be entered for each stage. Optionally, the program accepts the NGPA (Natural Gas Processors Association) coefficients which represent a surface fit of the NGPA K values as a function of pressure and temperature. The fit is performed for each component at each of nine convergence pressures. The program performs the flash calculation at each stage at pre-selected convergence pressures.

The computer calculates a new convergence pressure after each flash reported.

Output reports may be typed on the console typewriter or may be created off-line by listing punched cards.

Features: The program will accommodate up to four stages of flash ... the feed to the first stage may be entered directly or computed from separator products ... under user option, the C7+ cut can be broken down into five cuts (C7, C8, C9, C10, and C11+) ... specific K values can be entered; or, optionally, the program will compute K values from the NGPA (Natural Gas Processing Association) Equilibrium Coefficients.

Use: The program accepts as input a definition of the well stream feeding the first separator stage, along with the temperatures and pressures at which the separator stages will be operated. From this input definition, the program simulates the flash process at each separator stage.

Customer Responsibility: The customer is responsible for placing his data in the proper machine readable format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0430-1) ... Operator's Manual (H20-0431) ... TNL N20-1977. In only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source code and sample problem

Ordering Information: Program Number 1130MP08X

Program Number	Distribution Medium		User Volume Requirement
	Extension	Type Code	
Basic	none	cards 15	none

Additional Program Support Material*: Application Description Manual (H20-0429-1) System Manual (Y20-0053-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Velocity Functions From Time-Depth Data Program: Permits a geophysicist to derive a velocity function and to prepare a tabulated Time-Depth

Chart from well velocity data. The principal use of the Time-Depth Chart is to provide an easy method for the geophysicist to convert seismic reflection times to depths. (1130-MP-09X)

Description: Velocity, or time-depth, information is commonly obtained by recording travel times of sound energy at a well. This information is of paramount importance in the subsequent conversion of seismic reflection times to depths.

In the above conversion process, a velocity function (in which the time-depth relationship is expressed by an equation) is a widely used tool of the geophysicist. The technique of least-squares curve fitting is used to derive velocity functions to represent time-depth data. Up to 80 time-depth points can be accommodated. Five function forms may be employed at the option of the user.

- (1) $Z = \frac{V_0}{A} (e^{AT} - 1)$
- (2) $Z = V_0 / ((1/T) - A)$
- (3) $Z = V_0 T + AT^2$
- (4) $Z = C_1 T + C_2 T^2 + C_3 T^3$
- (5) $Z = C_1 T + C_2 T^2 + C_3 T^3 + C_4 T^4$

Z = depth and T = time.

Output consists of the coefficients of the equation selected.

The coefficients determined in the curve fit may be used to create a time-depth table in which depth is tabulated for every millisecond of two-way reflection time.

The coefficients may also serve as input to the program for Wave-Front Ray-Path Determination. A linear interpolation of the input time-depth points may also be computed and plotted.

Features: Up to 80 time-depth points can be used ... five velocity function forms and a linear interpolation between the time-depth points can be selected by the user ... results can be tabulated or plotted ... coefficients developed in this program can serve as input to the Wave-Front Ray-Path Determination Program.

Use: The program accepts as input up to 80 time-depth points normally obtained from a check shot survey run in a well.

An optional set of equations can be least square fitted to the data. The resulting velocity function is then solved at discreet time intervals, providing the user with a tabulation or plotted output giving time to depth conversion for any given time value.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output description section of the Programmer's Manual. The customer assumes the responsibility for program modification if plotting is not desired. Instructions for the above program modification are provided in the Programmer's Manual (H20-0434).

Programming Systems: The program is written in FORTRAN language as described in C26-3715. It is designed to run under control of the 1130 Disk Monitor System Version 2.

The IBM 1130 Dipmeter Program (1130-MP-15X), containing specific plotting sub-routines necessary to running the Velocity Functions Program must be ordered from PID.

Minimum System Requirements: An 8K disk IBM 1131 Model 2B and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0434) ... TNL N20-1978 ... Operator's Manual (H20-0435-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Source code and sample problem.

Ordering Information: Program Number 1130MP09X

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0433-1) ... System Manual (Y20-0054-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Wave-Front Ray-Path Determination Program: Provides a flexible method to compute and tabulate a seismic wave-front ray-path chart; the geophysicist uses such a chart to restore seismic reflections to their true subsurface position. (1130-MP-10X)

Description: Conversion of seismic time horizons to depth by a time-depth function or table is not adequate in areas of steeply dipping reflecting horizons. However, time-depth data provides input by means of which the geometry of successive wave-fronts emanating from a shot can be computed. Depth and horizontal offset data derived in a wave-front ray-path computation provide the means for effective two-dimensional migration of reflection segments which are in the plane of the section.

This program calculates the depth and horizontal components of migration based on velocity function coefficients derived from the program "Velocity Functions from Time-Depth Data" or from time-depth data points. When time-depth points serve as input rather than an analytic equation, the maximum number of such points is 20. By successive solution of Snell's Law, and by numerical integration of increments of depth and offset, the depth and horizontal components of migration are computed for inter-sections of wave fronts and ray paths. Increments of two-way travel time and movement may be specified by the user. The paths of 30 rays are computed, consisting of vertical ray-path and 29 paths on one side of the vertical path.

Features: 30 ray paths are computed ... results are plotted to scale ... depth and horizontal offsets can be obtained from a tabulation or from a wave-front ray-path plot.

Use: The program accepts as input the coefficients which define the velocity function in the area. From this information, the depth and horizontal components of migration are computed for a series of discreet time intervals. These results are then plotted in the form of a wave-front ray-path chart. From this chart, the user can obtain for any given time a corresponding depth and horizontal offset.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output description section of the Programmer's Manual. The customer assumes the responsibility for program modification if plotting is not desired. Instructions for the above program modification are provided in the Programmer's Manual (H20-0438).

Programming Systems: The program is written in FORTRAN language described in C26-3715. It is designed to run under control of the 1130 Disk Monitor System Version 2.

The IBM 1130 Dipmeter Program (1130-MP-15X) containing specific plotting sub-routines necessary to running the Wave Front Ray Path Determination Program must be ordered from PID.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0438) ... TNL N20-1980 ... Operator's Manual (H20-0439-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Source code and sample problem

Ordering Information: Program Number 1130MP10X

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0437) ... TNL N20-1980 ... System Manual (Y20-0055-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Synthetic Seismogram Program: Computes and plots a one-dimensional seismic model from well log data. The synthetic seismogram aids the seismic interpreter in understanding the relation between the geologic section, as represented by a well log, and the seismic results obtained at the location of the wells. (1130-MP-11X)

Description: The analysis of reflection seismic records is often facilitated by the construction of a seismic model of the substrata. This model, or synthetic seismogram, is useful in the analysis of ghosts and multiples, in the interpretation of stratigraphic conditions such as pinchouts, in the analysis of the filtering characteristics of the earth, and in the study of seismic wave propagation.

This program enables creation of a synthetic seismogram by passing an assumed seismic pulse through a layered earth, computing at each velocity interface the reflected and transmitted energy, and determining the strength of the seismic signal returning to the origin point at the surface as a function of time.

The velocity of the layered earth is obtained from a sonic log which has been digitized at equal time intervals, the maximum permissible number of intervals being 600. For seismic pulse input, it is customary to use a number of pulses, with the assumption that the range of pulse forms encompasses an actual seismic pulse. Each pulse is represented by digital values, in the range of +999 to -999, measured at equal time intervals along the pulse. A reflection coefficient for the earth's surface is assumed.

Output of the Synthetic Seismogram program is normally plotted on the 1627 Plotter. Traces showing primaries only, multiples only, and combined primaries and multiples may be plotted. In each instance, traces may be computed assuming either that transmission losses occur at the velocity interfaces (similar to recording without automatic gain control) or, on the other hand, that transmission losses do not occur (similar to recording with automatic gain control).

Features: The model of the layered earth can contain up to a maximum of 600 levels ... primaries only, multiples only, and combined primaries and multiples for both the transmission loss and no transmission loss cases can be computed ... results are plotted on an IBM 1627 Plotter.

Use: The program accepts as input a digitized sonic or continuous velocity log (CVL) and a definition of an assumed input seismic pulse form. From this information, a synthetic seismogram or seismic model of the substrata is generated. This model is useful in the analysis of ghosts and multiples, in the interpretation of stratigraphic conditions, and in the study of seismic wave propagation.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

The IBM 1130 Dipmeter Program (1130-MP-15X), containing specific plotting subroutines necessary to running the Synthetic Seismogram program, must be ordered from PID.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0442) ... TNL N20-1982 ... Operator's Manual (H20-0443-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Source code and sample problem

Ordering Information: Program Number 1130MP11X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0441) ... TNL N20-1981 ... System Manual (Y20-0056-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Gravity and Magnetics Continuations, Derivatives, and Residual Program: Provides a method for computing:

- (1) Upward and downward continuations of gravity and magnetic fields ...
- (2) First and second derivatives of these fields ...
- (3) Residuals of arbitrary type for gravity and magnetic values. All gravity and magnetics interpreters should be able to make use of this program to analyze potential field data. (1130-MP-12X)

Description: Commonly used tools of the gravity and magnetics interpreter are the techniques of continuations, derivatives, and residuals. Though historically such techniques have been applied in localizing the anomalies of potential fields, derivative and residual methods have recently been used in structural and stratigraphic applications to remove regional gradients in geologic and seismic data.

This program enables computation of upward and downward continuations by a circle averaging technique in which the circle averages of ten circles are each multiplied by a weighting factor and then summed. Continuations may be computed to a maximum of five levels above the datum and five levels below.

Input to this routine must be numerical values of the data at the mesh points of a square grid.

The routine for computation of derivatives and residuals also employs a circle averaging technique which operates on a square grid of input data. Both first and second derivatives may be computed by a ten-circle method very similar to that employed in the computation of continuations. First derivatives may be calculated to a maximum

of four levels below datum and second derivatives to a maximum of three levels below datum. Residuals are computed by applying coefficients of the user's choice to the averages of circles which are specified by the user.

Features: Program computes upward and downward continuation of potential fields, first and second derivatives, and residuals ... the maximum gravity or magnetic station array size is 100 x 100.

Use: The program accepts as input X and Y coordinates of a rectangular array of gravity or magnetic stations and the value of the potential field associated with the station. The computations derive new sets of values for the original rectangular array. If these arrays are contoured, the resulting maps emphasize and highlight the important geologic features in the area of coverage.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0446-1) ... Operator's Manual (H20-0447-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source codes and sample problem.

Ordering Information: Program Number 1130MP12X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0445-1) ... System Manual (Y20-0057-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Theoretical Gravity of a 3-D Mass Program: Allows the user to establish a synthetic gravity anomaly by computing the theoretical gravity of an assumed mass.

It permits the comparison of the synthetic anomaly with an anomaly actually mapped and thereby allows the user to find out the reasonableness of his structural interpretation. The program will type and/or punch the gravity values for a grid of simulated gravity stations. (1130-MP-13X)

Description: Inferences drawn from gravity data about subsurface structures which cause a gravity effect can be checked by comparing the observed potential field with the computed field for a buried mass of assumed configuration and density.

The configuration of the mass is represented by a 30 x 30 x 10 array of vertical prisms of square cross section. Depths to top and bottom of each prism define the geometry of the mass. Gravity is determined at assumed stations on a plane representing the earth's surface. At each station, gravity is computed by summing the gravity contribution of each prism. Assumed stations are located on a square grid; the station interval and dimensions of the grid are selected by the user.

This program is of particular value in such interpretive projects as the analysis of salt domes and reef buildups. Seismic and well data may be used to develop the configuration of the anomalous mass, and the computed gravity may be compared with observed gravity to establish the degree of correspondence.

Features: The mass is represented by a three-dimensional array with maximum dimensions of 30 x 30 x 10 ... each prism can be assigned a different density or the densities can be assigned on a layer-by-layer basis.

Use: The program accepts as input a three-dimensional array of rectangular prisms representing the shape and density distribution within an assumed buried mass and a two-dimensional rectangular array of gravity stations. At each gravity station, the theoretical gravity of the buried mass is computed.

The computed gravity station values can be contoured and the resulting theoretical gravity map can be compared with the actual gravity map. Agreement between the two maps suggests that the assumed buried mass is close to the actual buried mass in both shape and density distribution.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0450) ... TNL N20-1984 ... Operator's Manual (H20-0451) ... TNL N20-1985. If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source codes and sample problem

Ordering Information: Program Number 1130MP13X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0449) ... TNL N20-1983 ... System Manual (Y20-0058-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Quantitative Log Analysis Program: Permits the user to compute the porosity and water saturation on prospective hydrocarbon zones in a well, using data from several log combinations. This program aids in evaluating the zones in a well to enable decisions concerning the setting of casing, testing programs, reserve calculations, etc. (1130-MP-14X)

Description: Quantitative analysis of well logs is of vital importance to exploration and development geologists and reservoir engineers in the evaluation of rock characteristics which are indicative of the presence of oil and gas. Of chief interest to the oil finder are the porosity and water saturation of the rock units penetrated by the drill. In addition, he is aided in his interpretation by knowledge of the resistivity of the interstitial water, the resistivity of the flushed zone, the resistivity of the formation if completely filled with interstitial water, and the true resistivity of the zone.

Manual computation of the above characteristics is a laborious, error-prone process. However, the Quantitative Log Analysis Program enables computer determination of these characteristics for the following log combinations: Induction-Electric, Microlog; Induction-Electric, Sonic; Electric Log, Microlog; and Electric Log, Sonic.

Data is obtained by scanning the logs and preparing a data card for each zone of interest. Calculations are based on the Schlumberger "Log Interpretation Charts." Output consists of both detail and summary listings of rock characteristics.

Features: Allows fast quantitative analysis on an unlimited number of prospective hydrocarbon bearing zones in a well ... Induction Logs, Electric Logs, Micrologs, and Sonic Logs can all be processed ... both a detailed report giving many intermediate results of the calculations and a summary output report are available.

Use: The program accepts as input a number of rock properties as recorded by various combinations of well log logs. The recorded values on the logs are converted by the program into more meaningful rock properties; i.e., porosity, water saturation, and permeability. A geologist using the results of this program can better evaluate the potential worth of hydrocarbon bearing zones found in a well.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0454) ... TNL N20-1987 ... Operator's Manual (H20-0455-1). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID

Machine Readable -- FORTRAN source code and sample problem.

Ordering Information: Program Number 1130MP14X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0453) ... TNL N20-1986 ... System Manual (Y20-0059-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Dipmeter Program: Is designed to assist in the analysis of the continuous dipmeter log by calculating the true dip of intervals in a well. Structural information is required in most phases of petroleum exploration and production; and, sometimes, the dipmeter is the only source of this information. Output is in the form of tabulation on the typewriter, flying arrow plot, or polar plot on the 1627 Plotter. (1130-MP-15X)

Description: The dip and direction of dip of the formations penetrated by an oil well are of great stratigraphic and structural value to the petroleum geologist. Not only may dipmeter data be of value in the determination of local structural dip and in establishing the presence of faulting, but also detailed analysis of dipmeter data may reveal extremely local stratigraphic conditions which control accumulation of hydrocarbons. Decisions concerning the sidetracking of a well or the drilling of an offset are frequently influenced by dipmeter data. Manual computation of such data is an involved, laborious procedure.

The Dipmeter Calculation program provides a computer calculation of true dip and azimuth of dip. The method is not rigorous for drift angles in excess of about 30 degrees. However, the error introduced for high drift angles may be expected to be less than 10%. After the three microresistivity curves have been visually corrected and the depths of correlative points punched in cards, these depth points, together with the diameter of the hole, the azimuth of the number 1 electrode, the dip of the borehole and the azimuth of the borehole axis, are entered into the computer as input. Output may take the form of either a tabulated listing of depth vs dip and direction, or a flying arrow plot or polar coordinate plot made by means of a 1627 Plotter.

Features: Allows fast calculation of the magnitude of dip and direction of dip of rock strata in a well bore ... results of the calculations can be presented in tabular form, a polar coordinate plot, or a cartesian coordinate plot.

Use: The program accepts as input a definition of the borehole and formation geometry as defined by a Continuous Dipmeter Log. From this information, the program computes the true dip and direction of dip of the rock strata immediately adjacent to the borehole. A geologist using the results of this program has an additional aid in piecing together the structural picture of an area.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: The program is written in FORTRAN language (described in C26-3715). It is designed to run under control of the 1130 Disk Monitor System Version 2.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442 Model 5 Card Punch, and an IBM 1627 Plotter. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0458-1) ... Operator's Manual (H20-0459). TNL N20-1989. If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- FORTRAN source code and sample problem. Object code for the IBM 1627 plot subroutines.

Optional Program Package -- Assembly Language and FORTRAN Language source codes, for the IBM 1627 plot subroutines.

Ordering Information: Program Number 1130MP15X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none
Optional	none	cards	15	none

Additional Program Support Material*: Application Description Manual (H20-0457) ... TNL N20-1988 ... System Manual (Y20-0060-1).

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System, Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Commercial Subroutine Package: Provides the scientific user with added capabilities for handling functions and techniques applicable to commercial programming. All twenty-eight subroutines are callable by the FORTRAN programmer in a similar manner to such standard functions as sine, cosine, square root, etc. (1130-SE-25X)

Description: These subroutines will provide the scientific 1130 user with flexibility to add commercial applications such as payroll, cost accounting, and others.

Features: Variable length alphanumeric move, compare, edit and fill ... variable length conversion from EBCDIC to real, and from real to EBCDIC ... zone manipulation ... stacker select ... variable length decimal add, subtract, multiply, divide and compare ... sign manipulation ... overlapped printing and carriage control on the 1403 and 1132 Printers ... overlapped reading of cards with conversion of card codes on the 1442 and 2501 Card Readers ... punching of cards on the 1442 Model 5, 6, or 7 ... overlapped printing on the Console printer ... conversion from one character per word to two characters per word ... conversion from one character per word to three characters per word ... conversion from one digit per word to four digits per word.

Programming Systems: All subroutines are written in the 1130 Assembler Language. The internal format of data is one character per word.

Minimum System Requirements: An 8K 1130 card system will be required to execute a mainline program using the Commercial Subroutines. All I/O devices must use either FORTRAN I/O exclusively or Commercial Subroutine Package I/O exclusively.

Basic Program Material:

Publications* -- Program Reference Manual, including operating instructions, listings, flowcharts and narrative, (H20-0241-3) ... Application Directory.

Machine Readable -- Object Decks and Sample Problem Decks available in card form.

Optional Program Material:

Machine Readable** -- Source decks and sample problems as card images on a 9-track DTR (800 or 1600 bpi).

Ordering Procedure:

*If only the form numbered manual is required, order it from the IBM Distribution Center in Mechanicsburg -- not from PID.

**DTRs supplied by PID; no tape submittal required.

Reference Material: Application Description (H20-0520) ... IBM 1130/1800 Basic FORTRAN TV Language (C26-3715).

Civil Engineering Coordinate Geometry (COGO): COGO is a simple, efficient tool designed especially to assist the civil engineer with a wide variety of geometric calculations. With COGO, the engineer can state his problems using familiar terminology common to the engineering field. No knowledge of traditional programming is necessary. (1130-EC-02X)

Description: The civil engineer requires a simple but efficient means to solve geometric problems now being done laboriously by hand. 1130 COGO provides the solution to his problem by allowing the engineer to enter the data for the job into the computer by typewriter or punched card using a language he is familiar with, and to have solutions automatically printed out for him. COGO is especially useful because it provides the facility for the engineer to try many different methods of solving a problem.

COGO can be used for many different types of jobs, e.g., control surveys, highway design, right of way surveys, bridge geometry, subdivision calculations, land surveying, construction layout.

COGO can, in fact, be used wherever geometric calculation is required.

Features: 1130 COGO is a new, powerful and versatile coordinate geometry program modeled after and encompassing the capabilities of 1620 COGO. Some 1620 customer-written COGO programs now in use may require modifications to run on the 1130 system since some 1620 COGO commands have been deleted. The following new features have been added to 1130 COGO:

- Commands to process spirals
- Commands to process vertical geometry
- Reference to distances, angles and azimuth by specifying point numbers
- 999 points may be stored vs. 99 in 1620 COGO I-D
- Local origins

Use: To use 1130 COGO, the engineer writes a description of the problem and the method to be used to solve it. No special forms are required. The problem may be stated on any piece of paper or a surveying field book. Data are punched into cards in free form for entry into the 1130, or entered directly from the console typewriter. The programming system provides the engineer with direct communication with the 1130 for the most complete use of his judgment, experience, and imagination in solving each problem.

Customer Responsibilities: All that is required is that the customer be familiar with the 1130 COGO language. The COGO program is ready to run as distributed. The customer need only load the cards onto a disk. COGO is written in FORTRAN and if the user wishes to add any of his own special subroutines he may do so with a minimum of effort.

Programming Systems: COGO is written in 1130 FORTRAN and runs under the 1130 Disk Monitor System.

Minimum System Requirements: A card-oriented 8K disk 1130. The addition of an 1132 Printer will increase the speed of the system but is not required.

Basic Program Material:

Publications* -- Application Directory ... Users Manual (H20-0301-1)

Machine Readable -- Object decks and sample program are available in card form.

Optional Program Material:

Machine Readable** -- Source cards are available on one 9-track DTR (800 or 1600 bpi).

Ordering Procedure:

*If only the form numbered manual is required, order it from the IBM Distribution Center in Mechanicsburg -- not from PID.

**If the distribution medium is not specified on the back of the program order card, 9-track at 800 bpi will be forwarded.

DTRs will be provided by PID; no tape submittal is required.

Reference Material: System Manual (Y20-0064) ... Application Description Manual (H20-0143-3).

Scientific Subroutine Package: A collection of 121 FORTRAN subroutines which provide a major additional to those built into FORTRAN. They are input/output free, computational building blocks that can be combined with a user's input, output, or computational routines to meet his individual needs. The package has widespread application to the solution of problems in research, development, and design, in both science and engineering, wherever FORTRAN is used. (1130-CM-02X)

Individual subroutines, or a combination of them, can be used to carry out the following functions:

In statistics -- analysis of variance (factorial design) ... correlation analysis ... multiple linear regression ... polynomial regression ... canonical correlation ... factor analysis (principal components, varimax) ... discriminant analysis (many groups) ... time series analysis ... data screening and analysis ... non-parametric tests.

In matrix manipulation -- inversion ... eigenvalues and eigenvectors (real symmetric case) ... simultaneous linear algebraic equations ... transposition ... matrix arithmetic (addition, product, etc.) ... partitioning ... tabulation and sorting of rows or columns ... elementary operations on rows or columns.

In other mathematical areas -- integration of given or tabulated functions ... integration of up to six first order differential equations ... Fourier analysis of given or tabulated functions ... Bessel and modified Bessel function evaluation ... gamma function evaluation ... Legendre polynomial evaluation ... elliptic, exponential, sine, cosine, Fresnel Integrals ... finding real roots of a given function ... finding real and complex roots of real polynomial equations ... polynomial arithmetic (addition, division, etc.) ... polynomial evaluation, integration, differentiation.

Features: All subroutines are free of input/output statements ... subroutines do not contain permanent maximum dimensions for the data arrays named in their calling sequences ... all subroutines are written in FORTRAN ... many matrix manipulation subroutines handle symmetric and diagonal matrices (stored in economical, compressed formats) as well as general matrices ... the use of important subroutines (or groups of them) is illustrated in the program documentation by sample main programs with input/output ... all subroutines are documented uniformly.

Use: As a library of subroutines, SSP/1130 allows the user to select functions he needs, while not being burdened with unneeded routines.

Programming Systems: The subroutines will compile and execute with the IBM 1130 Disk Monitor and Card FORTRAN Compilers (1130-OS-001 and 1130-FO-001).

Machine Configuration: The machine configuration necessary to run SSP/1130 is dependent upon the use that is to be made of the package. Each of the subroutines is I/O free, compiles to less than 1,200 words of core, and is, therefore, configuration independent. However, many of the routines are intended to be used in conjunction with other subroutines or to solve problems using large arrays of data. For this reason, many of the subroutines are not useful with less than 8K words of core.

The following items should be taken into consideration when deciding upon the applicability of the package to a particular machine configuration:

1. The size of problem which may be executed on a given 1130 depends upon the number of subroutines used, the size of the compiled subroutines, the size of the compiled main program, the size of the control program and the data storage requirements.
2. SSP/1130 will be distributed in card form only.
3. The sample programs for SSP/1130 illustrate the same functions as the SSP/360 sample programs. Three of the sample programs, canonical correlation, discriminant analysis and factor analysis, use the overlay facilities of the 1130 Disk Monitor Programming System (*LOCAL) and therefore require a disk system and 8K words of core. The remaining sample programs do not require disk but do require 8K words of core.

Basic Program Material:

Publications* -- Application Directory ... Application Description (H20-0225) ... Programmers Manual (H20-0252).

Machine Readable -- Source program cards and sample program cards.

Optional Program Material: Systems Manual containing flowcharts for all subroutines in the package

*If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Reference Material: IBM 1130 FORTRAN Language (C26-5933).

Type Composition Program: This Program (1130-DP-04X - for card systems, 1130-DP-04X and 1130-DP-06X for 8-Channel Paper Tape Systems) extends the speed and flexibility of a digital computer into the composing rooms of the printing industry. Type compositors can use this program to provide significant time savings in transcribing textual material into a form required by linecasting machines for setting type.

Description: The program is designed to allow computer acceptance of perforated paper tape, containing the copy to appear in print and instructions pertaining to a desired printing format, from which a tape suitable for controlling the operations of a linecasting machine is produced and allocated to the proper point in the composing room. The output tape contains the original copy in the form of properly justified lines arranged according to the stylistic and graphic requirements described by the user with the format instructions. The programs are capable of producing justified lines in any format within the inherent limitations of the linecasting machine.

Feature: Printer-oriented format control language which does not require extensive knowledge of type composition techniques ... controllable style limited only by inherent limitations of linecasting machine ... consistent graphic quality ... 1130 Disk Storage offers automatic access to a large number of type fonts and hyphenation exception words ... up to 16 input readers and 16 output punches can be accommodated on the system ... program controlled polling of input readers ... program controlled selection of output punch based on font and column width required permits automatic allocation of output tapes ... extensive error detection and recovery procedures ... Systems Installation Workbook and several utility programs to aid the user in gathering and loading information concerning user's operation.

Use: Printing organizations that use paper tape operated linecasting machines in composing type are potential users of this program. Tape perforator operators will now prepare tape for input to the computer instead of the linecasting machine. Since the computer assumes the burden of all justification decisions, hyphenation decisions, and the insertion of proper linecasting machine control functions, the operators can now concentrate on speed and accuracy of copy perforation with resulting benefits in total type composition speed.

Customer Responsibilities: To produce a functioning system the user must gather and incorporate into the system detailed linecaster descriptions and factors relating to the user's method of operation and stylistic requirements. A Systems Installation Workbook has been provided to enable the user to gather the required information in a systematic and complete fashion. A series of utility programs are provided for loading this data into the system in the required form. The workbook and utility programs greatly increase the speed and ease with which the user produces a functioning system. Customers that use 8-channel paper tape systems must load and/or assemble their programs and installation dependent data on a system equipped with a card reader and a disk drive following system generation procedures specified for the card system (1130-DP-04X). The system's cartridge is then transferred to the customer's paper tape oriented system for operation, using the 8-channel paper tape Skeleton Monitor (1130-DP-06X) for system initialization.

Programming Systems: 1130 Assembler Language. For 1130-DP-04X, the user should order 1130-UT-001 from PID; for 1130-DP-06X, 1130-UT-002.

Minimum Systems Requirements:

For the 1130-DP-04X -- An 1131 Processor Model 2B with 2315 Disk Cartridge ... 1442 Card Read Punch Model 6 or 7 ... Typesetting RPQs listed below.

For the 1130-DP-06X -- An 1131 Processor Model 2B with 2315 Disk Cartridge ... 1134 Paper Tape Reader ... 1055 Paper Tape Punch ... Typesetting RPQs listed below.

1130-DP-04X and 1130-DP-06X Typesetting RPQs

The following RPQs for user-provided 6-channel advanced feed hole paper tape readers (PTRs)* and paper tape punches (PTPs)* are required.

- | | |
|----------------------------------|--|
| RPQ 834398 | Basic interface (required to attach any number of PTRs and PTPs). |
| RPQ 834399 | Paper Tape Attachment (required to attach any number of PTRs and PTPs). |
| For more than one PTR and PTP -- | |
| RPQ 834400 | Interface Expander (required to attach PTR numbers 2 through 8 and/or PTP numbers 2 through 8). |
| RPQ E36610 | Second Interface Expander (required to attach PTR numbers 9 through 16 and/or PTP numbers 9 through 16). |
| RPQ 834401 | Additional PTR Interface (one required for each PTR numbers 2 through 16). |
| RPQ 834402 | Additional PTP Interface (one required for each PTP numbers 2 through 16). |

*A maximum of sixteen PTRs and sixteen PTPs may be attached.

Basic Program Material for 1130-DP-04X: Application Directory, Programmers Manual (H20-0287), Operators Manual (H20-0288), Systems Manuals (Vol. I, Y20-0040; Vol. II, Y20-0041) ... 23 Core Image Card Decks, 1 Relocatable Card Deck, Hyphenation Exception Words Card Deck will be distributed on a 2315 Disk Cartridge (supplied by user) together with a starter card to punch the decks.

Basic Program Material for 1130-DP-06X: 1 Core Image Paper tape ... Application Directory.

Note: When ordering 1130-DP-06X, the user must also order the Basic Program Material for 1130-DP-04X.

Optional Program Material for 1130-DP-04X & 1130-DP-06X: The optional material for 1130-DP-06X consists of 18 source card decks available on a 9- or 7-track (Data Conversion feature required) 2400' MT. Optional material for 1130-DP-04X consists of 18 source card decks available on a 9/1600 DTR or 7-track (Data Conversion feature required) 2400' MT.

Reference Material: Application Description Manual (H20-0139).

Statistical System: A collection of four major tools: Stepwise Regression Analysis, Factor Analysis, Analysis of Variance, and Orthogonal Polynomial Curve Fitting. (1130-CA-06X)

Description: This flexible statistical system accepts user supplied control cards (and data) which instruct the system to perform one or more of the above analyses. Many options are available to the user, as described below.

Features:

- Orthogonal Polynomials Curve Fitting -- derivatives can be obtained ... the polynomials are available for unequal point spacing ... a scaling option is included ... polynomials can be re-entered for evaluation at a specified set of points.
- Analysis of Variance -- four factors are allowed ... balanced designs can be analyzed, using factorial techniques ... a program for arranging the Analysis of Variance table to conform to specific design needs is included.
- Factor Analysis -- thirty variables are allowed ... eigenvalues are produced using the QR algorithm ... matrix output from programs can be used as input for later analyses ... orthogonal and oblique reference frames are possible.

Stepwise Regression -- matrix output can be used and pooled with other matrices for use as input in later analyses ... thirty variables are allowed ... deletion and entry of variables are automatic.

In addition, input card format can be specified by the user; many output report options can be selected.

Customer Responsibility and Usage: Before performing analyses with the 1130 Statistical System, the user must prepare a disk with the IBM Disk Monitor System (1130-05-001) and then generate the 1130 Statistical System under monitor control. After system generation (explained in detail in the Users Manual, H20-0333) analyses are defined by the use of program control cards.

Programming Systems: The system, distributed in source card form, will compile and execute using the IBM 1130 Disk Monitor System (1130-05-001). The system consists of forty-two routines, thirty-seven written in the IBM 1130 FORTRAN Language (C26-5933) and five use the IBM 1130 Assembler Language (C26-5927).

Machine Configuration: 8K words of core, disk, and 1132 Printer (optional) are used with the IBM 1130 Computing System.

Basic Program Material:

Publications* -- Application Directory ... Users Manual (H20-0333).

Machine Readable -- System Source Decks and a Sample Problem Deck will be distributed on a 2315 Disk Cartridge (supplied by user) together with a starter card to punch the decks.

Ordering Procedure:

*If only the form numbered manual is required, order it from the IBM Distribution Center in Mechanicsburg -- not from PID.

Reference Material: Application Description Manual (H20-0341) ... Systems Manual (Y20-0093).

Economic Evaluation of Petroleum Projects Program: The IBM Economic Evaluation of Petroleum Projects Program (1130-MP-01X) can be used

to screen drilling proposals and rank them according to their profitability. Given the investment schedule and production forecast for an exploration and drilling prospect, the programs compute the payout period and rate of return using the discounted cash flow method.

Description: Many reservoir and petroleum engineering problems require an analysis not only of production and reservoir performance, but also of what a given performance means in terms of economics. This economic analysis normally includes consideration of such factors as producing rates, investment, expense, taxes, working interest factors, product prices, value of money, and depreciation. An economic evaluation program is offered to evaluate all these factors and to provide as an end result the rate of return and payout for any given project.

The program is set up to handle a project life of 30 years or less. Input includes (on an annual basis) production schedules for oil and gas, investment schedules for tangibles and intangibles, and well schedules. Additional data includes working interest, oil and gas price, depreciation rate, lifting cost and operating expense, and investment discount factor.

The computation has been set up to provide the user with various options. For example, the program calculates depreciation using either the straight-line or declining-balance method, or both. Depletion is calculated using both statutory and cost depletion. Rate of return is calculated using the discounted cash flow method, in which investment may also be discounted at any rate, at the user's discretion.

The program is well suited to perform multiple analyses of a given project so that the engineer may determine the effects of all variables on a given project.

Output is in such a form as to provide the user with a detailed tabulation of all computations. Hence, in a given case such factors as expense, depreciation, depletion, taxes, etc., may be analyzed.

Features: The program considers producing rates, investment schedule, expense, taxes, working interest factors, product prices, time value of money and depreciation ... the program computes rate of return and payout for any given project ... a project life of 30 years can be handled ... the program will accept directly the output of both the Decline Curve Analysis Program (1130-MP-03X) and the Gas Deliverability Program (1130-MP-07X).

Use: The program accepts as input the factors affecting the economics of a project. These factors include producing rates, investment schedules, expenses, taxes, working interest factors, product prices, value of money, and depreciation.

These factors are analyzed and a rate of return on investment and a payout in years is computed. The user can then objectively compare competing projects and select the more lucrative ones.

Customer Responsibility: The customer is responsible for placing his data in a machineable form and in the format described in the Input/Output Description section of the Programmer's Manual.

Programming Systems: Program is written in FORTRAN language described in C26-3715. It is designed to run under control of the 1130 Disk Monitor System Version 2.

The IBM 1130 Dipmeter Program (1130-MP-15X), containing specific plotting sub-routines necessary to running the Economic Evaluation program must be ordered from PID.

Minimum System Requirements: An 8K disk IBM 1131 and an IBM 1442 Card Read Punch or an IBM 2501 Card Reader and a 1442, Model 5 Card Punch, and an IBM 1627 Plotter. An IBM 1132 Printer or an IBM 1403 Printer is optional.

Basic Program Package:

Documentation -- Application Directory ... Programmer's Manual (H20-0402) ... TNL N20-1964 ... Operator's Manual (H20-0403). TNL N20-1965. If only the form numbered manuals are required, order from the IBM Distribution Center -- not from PID.

Machine Readable -- Source code, and sample problem.

Ordering Information: Program Number 1130MPO1X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	cards	15	none

Additional Program Support Material*: Application Description (H20-0401) ... ADM TNL (N20-1963) ... System Manual (Y20-0046-1)

Reference Material*: 1130 FORTRAN Language (C26-3715) ... 1130 Disk Monitor System Version 2 (C26-3717) ... 1130 Input/Output Units (A26-5717).

*Available from MDC

Problem Language Analyzer (PLAN): PLAN (1130-CX-25X) is a submonitor and application development support system especially designed to support problem solving and other highly variable applications.

Description: PLAN furnishes five closely related program sets that are mutually dependent. These provide the basic PLAN functions: the submonitor ... the PLAN input language interpreter ... the PLAN input language definer ... the PLAN subroutine package for FORTRAN application programmers ... the Diagnostic Supervisor.

Because PLAN is designed to support highly variable applications, it offers a new type of modularity. Program linkage definition and intermediate DADS specifications are deferred until execution time when they can be varied by input data. As a result, much program recoding and reorganization can be avoided.

In further support of this idea, input languages used for application control under PLAN are also defined at the statement level. Both new statement definitions and new program modules can be added to a PLAN application without forcing changes in existing programs and statement definitions.

Features: Free form input ... four levels of input statement hierarchy ... user controlled error recovery and diagnostic features ... powerful input data options, such as default value, override, algebraic and logical expressions for data values, automatic mode conversion and scaling ... dynamic program loading ... extensive subroutine support for FORTRAN application programmers.

Use: The problem solver (application user) communicates with PLAN through PLAN statements designed by the customer to suit his needs. Each PLAN statement contains a maximum of 450 characters; terminated by a semicolon. A new statement may immediately follow the semicolon. Each statement usually contains both a command and data. Processing a PLAN statement causes execution of one or more program modules, using accumulated data and the partial results available at that time.

Programmers communicate with the PLAN system to obtain program linkage, error handling, data management and utility functions by entering PLAN subroutines through CALL linkages (normally from FORTRAN).

Customer Responsibilities:

Program Requirements -- Functional program modules must be written for new applications, following FORTRAN conventions. These modules are named and stored in the Operating System or Monitor Program Library.

Certain FORTRAN operations may terminate the execution of PLAN. In general, these are the functions that return control to the monitor. Substitute functions are provided for these under PLAN and should be used.

For each PLAN application, the customer must also design and define the input language that he wants to use.

Staffing -- Capable personnel are necessary for good results. Creating a PLAN application involves three groups of people. They are (a) users who are to be served by the application (b) programmers who implement functional logic modules and (c) system designers who actually design the application input language in detail and specify the data and program modules to be used for each kind of input statement.

Education -- Initial education for system designers and key programmers can be accomplished in a 4-day workshop school. No more than a few hours of PLAN training will be needed for those who are simply using a PLAN based application. Customers should expect to prepare simplified users' manuals for application users. Their direct use of PLAN program documents is not intended.

Evaluation -- PLAN is designed to support change. An important factor in the long term success of PLAN applications is user feedback to and continued attention and documentation maintenance from the application designer.

Programming Systems: PLAN runs under 1130 Disk Monitor System Version 2 (1130-OS-005). It is programmed in the 1130 Assembly language and 1130 FORTRAN language.

Minimum Systems Configuration: An 8K disk 1131 Central Processing Unit with one card reader and punch unit from the set supported by the 1130 Disk Monitor.

Larger 1131 models, alternate card input/output devices and printers supported by the 1130 Disk Monitor are also supported by PLAN.

Basic Program Material:

Publications -- Application Directory ... Program Description Manual (H20-0594) ... Operations Manual (H20-0595). If only the form numbered manuals are required, order from Mechanicsburg -- not from PID.

Machine Readable -- Object decks and sample problem decks.

Optional Program Material:

Machine Readable -- Source decks and source listings are generated by a self-loading BPS program contained on the tape, using a System/360 Model 30 D or larger.

Ordering Information:

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	2315	58	01
Optional	none	DTR 9/800	28	none
		DTR 9/1600	29	none
		DTR 7DC/800	26	none

Additional Program Support Material: Application Description (H20-0490) ... Systems Manual - Volume 1, Narratives (Y20-0343); Volume 2, Flowcharts (Y20-0344); Volume 3, Listings (Y20-0349) ... User's Introduction Manual (H20-0626).

Data Presentation System: The Data Presentation System is a three-level graphic support system for the IBM 1130. (1130-CX-14X)

Description: The IBM 1130 Data Presentation System supplies high quality, hardcopy graphic output at exceptionally low cost. This system can be used independently as a Graphic Report Generator. The user can choose one or two levels of subroutines from the system for inclusion in his own graphic output programs. The scope and flexibility of this program make it valuable in many applications of the 1130.

Analysis and synthesis of data are a difficult part of most significant jobs. Important facts are often hidden by routine output. Recognizing this, it is common for managers, engineers, and analysts to draw graphs, plots, and diagrams.

There are three levels of control. The Graphic Report Generator, Level III, is the highest level. It is a self-contained system that requires no further programming to operate. It is controlled by input statements that describe the plot to be generated and data files to be processed.

Level II subroutines utilize the routines of Level I to perform larger, logical tasks such as scale annotation and curve fitting. Over 30 subroutines, callable from the program library, are included in Level II.

Level I of this system provides subroutines to generate, scale, and rotate characters and lines using the 1627 plotter attached to the 1130. These routines include interrupt handling and overlapped processing capability.

Features: Up to eight data scales may be drawn at any chosen location on the graph; scales may be linear, logarithmic, polar, monthly or calendar date ... several graphs may be plotted from data contained in a single data file or in multiple data files; data from different data files may be plotted against each other ... the automatic scaling feature of the Graphic Report Generator eliminates the need for manual scanning of data; the minimum and maximum data values are automatically extracted and used to select a scale, within the requirements specified by the user, that is convenient to use and that keeps all data on the graph ... scale limits may be user specified to restrict the range of plotting ... scales and scale annotations are automatically system generated but may be suppressed, if desired ... data may be plotted as point plots, line plots, polynomial series, histograms, or horizontal or vertical bar graphs ... the number of data points which may be plotted on one curve or the number of curves on one graph is effectively unlimited ... existing data can be extracted from card or disk files in a variety of formatted or unformatted arrangements ... data may be in any format acceptable to 1130 FORTRAN; in addition, data may be punched in a continuous manner

separated with commas ... data may be written onto disk by user programs with PLAN Subroutines in one application and then plotted by the Graphic Report Generator in a subsequent operation ... special reference axis may be generated at any output grid coordinate; reference axis serve such functions as the separation of negative and positive areas ... alphanumeric commentary may be plotted at any coordinate on the plotting grid. Characters may be rotated to any angle and may have any x and y font size .06 inch or larger ... the proportionally spaced character set can be modified to any users special requirements ... graph elements such as scales, labels or data may be saved from graph to graph to eliminate redundant entry of repetitive information ... standard user exits allow easy incorporation of user written modules for purposes of executing functions not provided for in the Graphic Report Generator ... the macro language feature allows one-time definition of repetitive shapes for permanent storage in a macro file ... macro elements may be executed with variable rotation, variable x and y scale factors and at variable locations ... additional commands may be added to the system without recompilation of any modules; the added commands have the result of making the Graphic Report Generator an integral part of a larger engineering, design or analysis information system ... perspective plots of vectors can be drawn from any vantage point; the data used is a series of vectors defined in three-dimensional (x, y, z) coordinates ... equations may be evaluated and plotted over a defined range ... only the programs that are required to be executed for any run are loaded ... new FORTRAN source decks may be generated with new sequence/identification, reasigned, sequential statement numbers, BCD characters converted to EBCDIC, and program text reformatted into standard arrangement ... features of the Graphic Report Generator which will not be used at any installation can be removed from the program library without any required recompilation.

Use: The Graphic Report Generator is controlled by user-written PLAN commands that describe the plot to be generated and the data to be processed.

Customer Responsibilities: The customer should be thoroughly familiar with the use of the system as described in the Program Description Manual.

Special Sales Information: A partial list of applications that could advantageously use the 1130 Data Presentation System is engineering analysis ... statistical studies ... schematics ... sales analysis ... machine performance ... semi-standard drawings ... quality control ... inventory control ... mathematical analysis ... schedules ... data reduction ... wage studies ... forecasting ... data verification ... product evaluation ... program documentation.

Programming Systems: The Data Presentation System runs under 1130 Disk Monitor System Version 2 (1130-OS-005) Modification Level 5 or higher and 1130 Problem Language Analyzer (PLAN) (1130-CX-25X). If only Level II and Level I are to be used, PLAN is not a required component.

The Data Presentation System is programmed in the 1130 (BASIC) FORTRAN and 1130 Assembly Language.

Minimum Systems Configuration: An 8K disk 1131 Central Processing Unit ... 1442 Card Read Punch or 2501 Card Reader ... 1627 Plotter Model 1 or 2. Larger 1131 models, alternate card input/output, printers, and additional disk storage supported by the 1130 Monitor are also supported by the Data Presentation System.

Basic Program Package:

Documentation* -- Application Directory ... Program Description Manual (H20-0338-1) ... Operations Manual (H20-0337-1).

Machine Readable -- Object code, language definition cards, and sample problem.

Optional Program Package:

Machine Readable -- Program source decks. Decks and listings are generated by the self-loading program on the tape using a System/360 Model 2030 D.

Ordering Information: Program Number 1130CX14X

	Program Number Extension	Distribution Medium		User Volume Requirement
		Type	Code	
Basic	none	2315	58	01
Optional	none	DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Material:** Application Description Manual (H20-0235-2) ... Systems Manual -- Flowcharts and Narrative (Y20-0089-1), Listings (Y20-0436).

Reference Material:** PLAN Application Description Manual (H20-0490) ... PLAN Program Description Manual (H20-0594) ... 1130 PLAN Operations Manual (H20-0595).

* If only the form numbered manuals are required, order from Mechanicsburg -- not PID.

** Available from the Mechanicsburg Distribution Center.

IBM 1800 Data Acquisition and Control System

Traffic Control System: A modular, flexible, and efficient programming system used to control vehicular traffic through proper signal settings in a real-time atmosphere. Any city interested in increasing the efficiency of its city streets through proper setting of traffic signals would be interested in this 1800 Vehicular Traffic Control System. (1800-UG-06X).

Description: The advantages of using the 1800 Vehicular Traffic Control System to control traffic can be illustrated best by listing the capabilities of the type of control that this programming system provides that do not exist in conventional techniques and equipment: on-line, real-time system evaluation ... depending on the number of sub-systems, 500 signal setting choices are available when using one sub-system to over 30 choices of traffic patterns when using 16 sub-systems ... capability of reaction in seconds to traffic changes ... optional control strategies for different traffic conditions ... easy adaptation to new traffic control techniques ... adaptability to system growth ... instant access for information and control ... automatic resynchronization of a controller out of synchronization ... the computer is available for related applications as time-space diagram plotting, data reduction and analysis, traffic simulation for developing new control strategies, etc., when not controlling the system.

By using the microloop control algorithm option, individual intersections can be controlled utilizing the pre-selected pattern as a background ... the microloop allows for extensions of green time for each phase based upon demand, density and weighting factors ... it may be free running or timed to hold a strict offset ... one option also allows for a learning process to take place by automatically adjusting the main street-side street weight factors while iterating for a minimum stop probability.

It is also capable of positive computer control of all phases of controller actuations ... adherence to strict timing requirements with one second definition on computer commands ... verification of successful operation of the controller through monitoring ... guaranteeing minimum walk, don't walk, and amber time periods ... smooth, synchronous phasing of all signal changes, without destroying normal flow ... pick up and dropping (with message) controllers that are malfunctioning ... real-time detection of special functions and emergency conditions ... printing controller settings and control technique ... automatic generation of traffic statistics upon request ... analysis of detector performance which reports counting failures ... simplified communications between operators or traffic engineers and the entire controlling system ... manual changes of any step time (walk, don't walk) as well as split, offset, and cycle ... synchronizing of subsystems operating under the same cycle length ... making allowance for safe experimentation of new methods and techniques of controlling traffic ... redefinition of arteries and boundaries without physical changes.

The actual time to drive the controllers through each of their steps is insignificant. The modifications of split, cycle, and offset, in addition to the measurement programs, will take up the majority of the running time of the system.

Customer Requirements: A customer is required to have a thorough knowledge of the system before installation ... define the area to be controlled including the number of intersections ... establish the location and number of detectors in the system ... define the measurements to be made and the maximum allowable count per cycle for each detector in the system ... define the communications network ... create a series of traffic patterns including the split, cycle length, and offset for each intersection in the system ... define the intersections in the system that normally run on the same cycle length ... select the method of changing traffic patterns (if time of day is selected, define this time; if limit checks are required, define the type of measurements, the limits, and the detectors used to obtain these measurements) ... define the number of steps per cycle for all controllers and the function that can be performed by the controller ... define the minimum time periods for each phase of all controllers (this includes the minimum walk, don't walk, and amber time periods) ... determine the need for additional programming required for special functions or options, such as pedestrian indicators, cycle lengths greater than 128 seconds, controllers that require more than 32 steps, and intersections that contain more than 4 directions of flow ... define kinds of microloop control, at which intersections and for which lanes it will function ... install all street equipment, including communications, detectors and controller modifications.

Programming Systems: All programs in the system are written in the 1800 Assembler Language (1800-AS-005).

Minimum System Requirements: An 8K 1801 with 1816 Printer-Keyboard ... Digital and Analog Output Data Channel Adapter (#3290) ... Digital Input Data Channel Adapter (#3291) ... Digital Input - Contact* (#3285) ... Digital Input Adapter* (#3262) ... Electronic "Contact" Operate** (#3612) ... Digital Output Adapter** (#3295) ... Digital Output Control** (#3296) ... 1826 Data Adapter Control† ... Relay Card Housing (RPQ) ... Reed Relay Cards (RPQ) ... Contact Operate Cards (RPQ) ... Power Supply (RPQ) ... Card Read Punch Adapter (#4430) ... 1442 Card Read Punch ... Data Channel (#3222) ... 1810 Disk Storage ... 2315 Disk Cart-ridge ... minimum of 16K required for microloop system, with larger systems requiring up to 32K.

Basic Program Material:

Documentation -- Application Directory ... Program Description Manual (H20-0335-1)* Operations Manual (H20-0336-1)* ... System Manual (Y20-0082-1).# If only the form numbered manuals are required, order them from the IBM Distribution Center, Mechanicsburg -- not from PID.

Machine Readable -- Source card decks.

Ordering Information: Program Number 1800UG06X

	Program Number	Distribution Medium	User Volume	Requirement
	Extension	Type Code	Code	
Basic	none	Cards	15	none
Optional	none	none	none	none

Reference Material: Application Description Manual (H20-0212).*

A Sales and Systems Guide on Vehicular Traffic Control is available (Y20-0007#). Besides a basic introduction to traffic control, this also defines how to configure an 1800 system for traffic control with timing and storage requirements.

Total capacity of any system will depend upon the number of controllers and detectors, as well as the number of intersections requiring special microloop control. The maximum capacity is a combination of controllers and detectors adding up to 800. This maximum, however, can be influenced in either direction by the degree to which all measurement routines are used.

The guide also describes the RPQ features that are needed, all of which must be approved by your Regional or San Jose Special Equipment Department.

Fundamentals of Traffic Engineering by Norman Kennedy, J. H. Kell, and W. S. Hornburger (1963).

Quality and Theory of Traffic Flow by B. D. Greenshields, H. P. George, N. F. Guerin, M. R. Palmer, R. P. Underwood (Bureau of Highway Traffic, Yale University 1961).

Traffic Surveillance, Simulation and Control (U.S. Department of Commerce, Bureau of Public Roads, Washington, D. C. September 14-15, 1964, -- proceeding# of highway conference on the future of research and development).

Vehicular Traffic Control -- A Time-Space Design Model (1964 Proceedings [34th Annual Meeting], Institute of Traffic Engineers, L. A. Yardeni, IBM Corporation, White Plains, New York).

* The number of intersections and detectors will determine the number of Digital Input Contacts (No. 3285) and the number of Digital Input Adapters (No. 3262) required. One input point is required for each intersection and one for each detector.

** The number of intersections will determine the number of Electronic Contact Operate (No. 3612), Digital Output Adapters (No. 3295), and Digital Output Control Adapters (No. 3296) required. Two output points are required for each intersection.

† The total number of digital input and output points will determine the number of 1826 Data Adapter Units required.

Available from Mechanicsburg.

Control Optimization Program: COP is a general-purpose non-linear optimization program. When used on the 1800 system its features make it particularly suited to on-line use in an optimizing system. (1800-CC-01X)

Description: COP/1800-1130 uses a method of "sectional linear programming" to optimize a non-linear mathematical model. Using partial derivatives, the model and objective function are linearized about some starting point. Linear programming is applied to find the local optimum within the area in which the linearized model equations are valid approximations to the true non-linear equations. The model and objective function are re-linearized about the solution, and another local optimum is found. Alternate re-linearization and optimizations are performed until a solution is obtained which approximates an optimal solution to the non-linear system.

COP/1800-1130 may be used for a variety of optimization studies on the IBM 1800 Data Acquisition and Control System or the IBM 1130 Computing System. On the IBM 1800 Data Acquisition and Control System it may be used to determine optimum steady-state control adjustments in open- or closed-loop process control systems.

Features: On-line input is from disk storage and output may be printed on disk, written, or both ... off-line input is from punched cards and output may be written on a typewriter or line printer ... extensive checking features are incorporated ... special features of the modified simplex LP algorithm permit bounds to variables, move penalties, and target constraints without increasing the size of the LP matrix ... extended precision floating point subroutines are used (customer's model may be in normal or extended precision) ... the on-line version can be used to optimize several independent processes.

Customer Responsibilities: COP/1800-1130 provides all input and output functions, interface with the user's model, and all of the linearization and optimization calculations. Two items are required of the user for off-line operation --

1. A properly formulated mathematical model and the objective function to be optimized, or a programmed routine for calculating partial derivatives, or a matrix of partial derivatives.
2. A set of data defining the initial values of model variables, limits (bounds and constraints) on model variables and the required logical control parameters.

When COP/1800-1130 is to be used on-line in a process control system, the above two items apply. The user must also provide programs to perform the necessary instrument scans, averaging and digital filtering of process data and routines to transform optimized solutions into appropriate signals to effect control variable changes.

The model may be written in either FORTRAN or Assembler language.

Note that customer options must be specified by changing source cards prior to assembling COP/1800-1130.

Programming Systems: COP/1800-1130 operates under control of the IBM 1800 Time-Sharing Executive System (both Process and Non-Process Supervisor, 1800-05-001) or IBM 1130 Disk Monitor System (1130-05-005). The program is written in Assembler language.

IBM 1800 Data Acquisition and Control System

Minimum Machine Configurations:

- For on-line use on the 1800: an 1801 or 1802 with a minimum of 8,192 words of core storage ... one 1810 Disk Storage ... 1442 Card Read Punch.
- For off-line use on the 1800: an 1801 or 1802 with a minimum of 8,192 words of core storage ... one 1810 Disk Storage ... 1442 Card Read Punch ... 1443 Printer or 1816 Printer-Keyboards.
- For use on the 1130: an 1131 Model 2B or 3B and either a 1442 Card Read Punch Model 6 or 7 or a 2501 Card Reader and a 1442 Model 5.

Core storage requirements vary with the size of the optimization problems to be solved. Information required to determine core storage requirements is contained in the Application Description Manual.

Basic Program Package:

Documentation -- Application Directory ... Program Description and Operations Manual (H20-0351-2)*.

Machine Readable -- Source code and sample problem.

Ordering Information: Program Number 1800CC01X

	Program Number Extension	Description Medium Type	Code	User Volume Requirement
Basic	none	Cards	15	none
Optional	none	none		none

Additional Program Support Material: Application Description Manual (H20-0208-3)* ... System Manual (Y20-0110-2)*.

Reference Material: 1130 Disk Monitor System Reference Manual (C26-3750)* ... 1130 Assembler Language (C26-5927)* ... 1800 Time Sharing Executive System Concepts and Techniques (C26-3703)* ... 1800 Assembler Language (C26-5882)*.

* If you want the H20-0351 Manual and not the rest of the basic program package, order it from the IBM Distribution Center, Mechanicsburg -- not from PID. All other form numbered manuals are available from Mechanicsburg.

PROSPRO/1800: A real-time on-line system for implementing control of continuous processes. By using the "fill-in-the-blanks" technique, the user can describe the process and develop the control scheme.

The system receives its necessary process operating data and control instructions from cards punched according to the entries on standard data forms. The various tables, data records and control schemes required by the system are automatically generated by PROSPRO/1800 and become operational.

Expected frequent modifications in the process and the control strategy are easily accommodated by PROSPRO/1800.

No knowledge of computer programming is required to complete the forms. However, special programs can be written in Assembler Language or FORTRAN and added to PROSPRO/1800. (1800-CC-02X)

Features: Organization of engineering and control information by providing "fill-in-the-blanks" forms ... versatile programs to process information effectively and to execute control actions consistently ... accommodation of special programs (written in FORTRAN or Assembler Language) to fulfill more complex requirements ... simplification of program modification and maintenance in addition to initial system generation ... uniform and complete system documentation.

Use: Using the Language Specification Manual, the customer fills out the data forms with information on each variable (processing frequency, maximum and minimum limits, etc.) and control action (constants, type of control, etc.). The information is punched into cards and entered into the 1800 through the card reader. PROSPRO/1800 reads the cards and builds various data tables. These data tables provide the necessary logic and constants used during execution of the program. The forms become the documentation of the process control application. Changes may be made by entering new and/or different data cards.

Customer Responsibilities:

- Know the process to be controlled and the desired control strategy.
- Describe the process and the control action using the standard data forms.
- Write any routines for functions not handled by the PROSPRO/1800 system.
- Develop any mathematical models that may be required.

Programming System: PROSPRO/1800 operates under the IBM 1800 Time-Sharing Executive System (TSX). The application programs are written in Assembler Language or FORTRAN.

Minimum System Requirements: 1801 or 1802 Processor-Controller Model 1C or 2C, 1442 Adapter (#4430), two Data Channels (#3222), Analog Input Data Channel Adapter 1 (#1233), Analog Input Data Channel Adapter 2 (#1234), Digital and Analog Output Data Channel Adapter (#3290), Analog-Digital Converter Model 1 or 2 (#1231 or #1232), Comparator (#2185), Digital Output Control (#3296)†, Digital Output Adapter (#3295)†, Pulse Output (#5863)† ... 1816 Printer Keyboard ... 1826 Data Adapter Unit† ... 1828 Enclosure† ... 1851 Multiplexer Terminal† ... 1810 Disk Storage Model A1 ... 2315 Disk Cartridge ... 1442 Card Read-Punch Model 6 or 7.

Other input/output units may be specified to satisfy individual user requirements. Consideration should be given to a Model A2 or A3 1810 Disk Storage for applications with large numbers of variables and/or complex control actions and user-written routines.

†The number required depends on the specific application.

The PROSPRO/1800 System normally uses analog signals as measured variables and set-point positioners for control output. The set-point positioners must be equipped with feedback to the computer of the actual value of the set-point.

Basic Program Package:

Documentation .. Application Directory ... User's Manual (H20-0474)* ... Process Operator's Manual (H20-0472)*.

Machine Readable -- System generation decks which include control cards and object programs.

Optional Program Package:

Machine Readable -- Source code.

Ordering Information: Program Order Number 1800CC02X

	Program Number Extension	Distribution Medium Type	Code	User Volume Requirement
Basic	none	Cards	15	none
Optional	none	DTR 9/800	28	none
		DTR 9/1600	29	none

Additional Program Support Material: Application Description Manual (H20-0261)* ... System Manual (Y20-0128)* ... Language Specification Manual (H20-0473)* ... Dat Forms (X20-1752 through 1757)*.

* If you want the Manuals that are a part of the basic program package and not the rest of the package, order from Mechanicsburg -- not from PID. All other form numbered items are available from Mechanicsburg.

General

IBM System Control Programming (SCP) is described in this section. For detailed information, see supporting System Reference Library (SRL) publications.

System control programming (SCP) is fundamental to the operation and support of the system and is available without additional charge. It serves as an interface for program products as well as user programs and is directly involved with the management of available systems resources. System control programming controls various input/output devices and the execution of programs.

System control programming provides functional support for varying operational environments such as batch mode for jobs entered locally or remotely, or sharing of resources during the concurrent execution of other programs. It supports configurations of different minimum requirements in terms of processing units, storage and devices.

System Control Programming Identification

Each SCP is assigned a seven character identification code for ordering purposes. The first two digits (57) identify it as a program. The next two digits identify the Processor/Program Environment. The last three characters are identifiers which distinguish it from other SCPs.

Processor/Program Environment Codes

01 - System/3 Model 10 Card	42 - S/370 OS/VS2 (SVS)
02 - System/3 Models 8, 9 and 10 Disk	44 - S/370 OS/VS Independent SCP
03 - System/3 Models 4,6	45 - S/370 DOS/VS
04 - System/3 Model 15	47 - S/370 DOS/VS Independent SCP
05 - System/3 Model 12	
07 - System/7	49 - S/370 VM/370
41 - S/370 OS/VS1	52 - S/370 OS/VS2 (MVS)

Additional codes will be used as SCPs become available within other Processor/program environments.

	Reference		Reference
Operating System/Virtual Storage 1	SCP 4.101	Conversion/Service	
Highlights	SCP 4.101	1401/1440/1460 Emulator for Models 135, 145, 155II, 158 with Compatibility Feature (OS/VS)	SCP 4.501
Supervisor	SCP 4.101	1410/7010 Emulator for Models 145, 155II, 158 with Compatibility Feature (OS/VS)	SCP 4.501
Scheduler/JES	SCP 4.102	DOS/VS Emulator Under OS/VS, Version 3	SCP 4.502
Remote Entry Services	SCP 4.102	3704/3705 Emulation and System Support for DOS/VS and OS/VS	SCP 4.504
Job Scheduling	SCP 4.103	EP/VS and NCP/VS	
Command Processing	SCP 4.103	3704/3705 System Support Programs for OS/VS2 and DOS/VS	SCP 4.601
System Management Facilities	SCP 4.103	Network Control Program/Virtual Storage NCP/VS	SCP 4.602
Recovery Management Support	SCP 4.104	SCP Support for Advanced Function Systems and Terminals	
Operator Communications	SCP 4.104	3600 Finance Communication System	SCP 4.701
Virtual Storage Access Method	SCP 4.104	3650 Programmable Store System	SCP 4.702
Sequential Access Method	SCP 4.105	3650 Retail Store System	SCP 4.703
3850 Mass Storage System	SCP 4.106	3660 Supermarket Scanning System	SCP 4.704
Virtual Telecommunications Access Methods	SCP 4.106	3660 Supermarket Key-Entry System	SCP 4.704
Teleprocessing Online Test Executive Program	SCP 4.107	3770 Data Communication System	SCP 4.705
Telecommunications Access Method	SCP 4.107	3790 Communication System	SCP 4.705
Basic Telecommunications Access Method	SCP 4.108	System/32	SCP 4.706
Graphic Programming Services	SCP 4.108	System/34	SCP 4.706
Graphic Subroutine Package	SCP 4.108		
Shared DASD	SCP 4.109		
System Support Program	SCP 4.109		
System Assembler	SCP 4.109		
System Utilities	SCP 4.109		
System Data Set Utilities	SCP 4.109		
Online Test Executive Program	SCP 4.110		
Dynamic Support System	SCP 4.110		
Service Aids	SCP 4.110		
Display Exception Monitoring Facility	SCP 4.110		
Generalized Trace Facility	SCP 4.110		
Conversational Remote Job Entry	SCP 4.111		
Current System Programs under OS/VS	SCP 4.111		
Minimum VS1 Configuration	SCP 4.111		
System Generation	SCP 4.111		
Starter System	SCP 4.111		
Starter System Requirement Chart	SCP 4.112		
Device Support Chart	SCP 4.116		
Terminals and Terminal Feature	SCP 4.117		
Terminal Support Charts	SCP 4.122		
Operating System/Virtual Storage 2			
SVS Highlights	SCP 4.201		
MVS Highlights	SCP 4.201		
Supervisor	SCP 4.203		
Job Management	SCP 4.203		
Job Entry Subsystem 2	SCP 4.204		
Job Entry Subsystem 3	SCP 4.208		
Remote Job Processing	SCP 4.208		
Recovery Management Support	SCP 4.211		
Multiprocessing with Shared Real Storage	SCP 4.211		
Timesharing Option	SCP 4.212		
Data Management	SCP 4.214		
Virtual Telecommunications Access Method	SCP 4.216		
Telecommunication Access Method	SCP 4.216		
Basic Telecommunication Access Method	SCP 4.217		
System Support Programs	SCP 4.219		
Service Aids	SCP 4.220		
Optional Processor Features Supported	SCP 4.221		
SVS Device Support Chart	SCP 4.225		
MVS Device Support Chart	SCP 4.226		
SVS Terminal Support Chart	SCP 4.232		
MVS Terminal Support Chart	SCP 4.234		
ASP	SCP 4.237		
HASP-II	SCP 4.237		
Disk Operating System/Virtual Storage	SCP 4.301		
Control and Service Programs	SCP 4.301		
The POWER/VS Program	SCP 4.303		
The Assembler	SCP 4.306		
Data Management	SCP 4.306		
Device Support Chart	SCP 4.310		
Telecommunications Support	SCP 4.311		
Terminal Support Chart 1	SCP 4.318		
Terminal Support Chart 2	SCP 4.319		
Utility Programs	SCP 4.320		
Error Recovery	SCP 4.321		
Diagnostic Aids	SCP 4.321		
Emulator Program	SCP 4.321		
Virtual Machine Facility/370 (VM/370)	SCP 4.401		

OPERATING SYSTEM/VIRTUAL STORAGE 1 - OS/VS1

The Operating System/Virtual Storage 1 (OS/VS1, also known as VS1) programs perform the systems control programming functions for the System/370 Models 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 165II, 168, and 3031 Processor, utilizing Dynamic Address Translation (DAT), and the Extended Control Mode (EC) of these systems.

The maximum size real storage supported by OS/VS1 is 8,388,608 bytes.

The minimum systems supported by OS/VS1 are the 3135 model GD (147,456 bytes), the 3138 model I (524,288 bytes), the 3145 model GE (163,840 bytes), the 3148 model J (1,048,576 bytes), the 3155II model H (262,144 bytes), the 158 model I (524,288 bytes), the 3165II model J (1,048,576 bytes), the 3168 model J (1,048,576 bytes) processor and the 3031 Processor model U2 (2,097,152 bytes).

A system with processor storage size of 160K bytes of available real storage is sufficient for all VS1 standard features, but the use of optional SCP features will probably require additional real storage. In general, function, advantages and performance depend upon the amount of real storage available; therefore, most users will find a processor storage size of 240K bytes or larger to be more effective for their VS1 system.

The virtual storage size which can be supported is highly dependent on a number of factors, such as application characteristics, programming techniques, and system resources. VS1 supports a maximum virtual storage size of 16,777,216 bytes provided there are enough system resources to support the workload.

Smaller Main Storage Considerations

Lack of available real storage reduces the capabilities and performance of OS/VS1. The following restrictions apply to the 144K real storage programming design point:

- The release 6 or later starter systems are not supported.
- Two-partition support is the recommended maximum.
- The external trace option of the Generalized Trace Facility is not supported.
- Two megabytes of virtual storage is the recommended maximum.
- Only one partition is allowed if the system includes RES.

OS/VS1 is a compatible extension of OS/360 Multiprogramming with a Fixed Number of Tasks (MFT), providing up to 16,777,216 bytes (hereafter referred to as 16 million or 16 megabytes) of virtual storage for a customer's installation independent of the real main storage size of his installation. Virtual Storage is the name given to the address space referenced by a System/370 processor that is equipped with the Dynamic Address Translation feature. This address space may be as large as the logical addressing capability of the system; that is, if a user can write an address, the location addressed can be included in virtual storage.

Although the addressing range of virtual storage is equal to the address range of the system, the user is limited to a virtual storage capacity that is determined by the installation at System Generation time or at IPL on the basis of such factors as real storage capacity, job characteristics, number and size of virtual partitions, secondary storage capacity, and control program storage requirements.

OS/VS1 virtual storage organization is similar to OS/360 MFT real storage organization. OS/VS1 virtual storage is divided into two main areas: the Control Program area (containing the supervisor and Job Entry Subsystem - JES) and the Problem Program area. The Problem Program area is divided into fixed partitions (maximum of 15) at 64K bytes (or multiples thereof) or system task partitions (maximum of 37), with a total maximum of 52 partitions.

As in OS/360 MFT, the partition size, class, and other attributes can be changed by the operator while the system is in operation. Partition allocation appears to the problem programmer and to the operator just as it appears in OS/360 MFT with one exception: maximum partition size is not limited by the real storage size, but by virtual storage size as defined at System Generation or IPL. Partitions must be allocated in 64K multiples with a minimum of 64K.

Real storage in OS/VS1 is automatically managed by the operating system in discrete blocks of 2K bytes called pages. As a page in virtual storage is referenced, it is brought into real storage for processing, if it is not already in real storage. When pages are not being used and the processor storage is needed for another task, they are written out to auxiliary storage unless an exact copy already exists (i.e. the page was not modified during execution). Some sections of the control program are not paged but are fixed in real storage. OS/VS1 divides real storage into two sections: one fixed and the other paged.

The fixed section of real storage contains the resident supervisor. Any jobs that are currently executing in the "Virtual Equals Real" mode are also fixed in real storage. This "Virtual Equals Real" mode makes provision for the types of programs that cannot run in a paged environment: programs that modify the channel program while it is active; programs that are highly time-dependent; programs that have user written I/O appendages to support EXCP where the appendages do not adhere to VS1 appendage programming rules; and programs

that require all of their pages in processor storage while they are executing.

The paged section of real storage contains the active pages of the virtual tasks and the active portions of the paged section of the supervisor.

A section of the supervisor called the Page Supervisor is responsible for allocating and deallocating pages in real storage and for initiating page-in and page-out operations between auxiliary storage and processor storage.

OS/VS1 includes features to improve the security/integrity of the system: Fetch Protect, DEB Validity Checking, Password Protected Page File, Protected TIOT (Task I/O Table), and APF (Authorized Program Facility). Fetch Protect is optional support that combines hardware and software support to protect a user's main storage from disclosure to any task but a system task. The entire dynamic storage area (virtual partitions assigned to job steps and system tasks) and all region key subpools are protected. The Data Extent Block (DEB) Validity Checking is an option that prevents the user from unauthorized modification of direct access extents or gaining control in the supervisor state. Password Protection capability for the Page File available in VS1 also includes special processing to allow the size of a protected SYS1.PAGE to be varied at IPL time. Protected TIOT prevents a problem program from accidentally or intentionally storing into the TIOT. APF (Authorized Program Facility) is a function that permits designated problem programs access to certain restricted system functions.

The SU's integrated into Release 6.7

Additional OS/VS1 Facilities

I/O Load Balancing in VS1 provides a method of allocating non-specific requests for data sets based upon the utilization of devices across the entire configuration.

Dynamic Dispatching provides for the alteration of the dispatching priorities of selected users tasks. Processor and I/O characteristics of these tasks are constantly monitored during execution and changes are dynamically taken into account in the dispatching process.

Automatic IPL can be performed when system initialization parameters have been included in a data set (SYS1.PARMLIB). The operator can avoid keying in responses to system initialization message requests by indicating a list of SYS1.PARMLIB members which contain most of the necessary system initialization parameters needed for a particular IPL.

The time of day can be requested in Greenwich Mean Time (GMT). Interrupts can be requested at a specific time of day based on Greenwich Mean Time.

ISSP (Installation Specified Selection Parameters) permits system programmers to control the handling of job input and output classes, job priorities and message classes.

VS1 can execute as a virtual machine under VM in an arrangement called *VM/VS Handshaking*. Some of the most significant features include: Closing of CP (Control Program) spool files at job end instead of virtual machine termination; elimination of VS1 paging control, which would otherwise be redundant with similar VM function; and the ability to perform task switching within the VS1 subsystem during VM processing of VS1 real page faults caused by VS1 real page faults.

The IBM System/370 135-3, 138, 145-3, and 148 includes Extended Control-Program Support. This hardware assist provides improved supervisor performance. The assist may be used if VS1 is running native or under VM/370. The VS1 hardware assist is designed to be executed only by the VS1 Supervisor. Access to the assist is generated at SYSGEN time.

Supervisor

The OS/VS1 Supervisor is a part of the System Control Programming that monitors each unit of work being done in the system. The Supervisor, in general, controls the use of the processor, I/O, and real and virtual storage automatically or as requested by a user through system macro instructions or higher level language statements. It provides a variety of services such as allocating virtual storage space, performing I/O operations, loading programs into virtual storage, moving pages of programs into and out of real storage, and maintaining the address space (virtual storage) on an auxiliary storage device. To perform its function, the supervisor receives control of the processor following an interruption which may have resulted from a specific service request or through an asynchronous interruption by the computing system.

The OS/VS1 Supervisor performs the same functions as the OS/360 Supervisor. In addition to interruption handling, the OS/VS1 Supervisor performs: Task Dispatching in up to 15 problem program partitions ... Task Supervision ... Fetch ... Contents Supervision ... Timer Supervision ... Storage Supervision (virtual) ... I/O Supervision ... Exception Condition Handling ... System Management Facilities (SMF).

Functions that have been added to support Dynamic Address Translation are real storage supervision and paging supervision.

OS/VS1 is designed to take advantage of Dynamic Address Translation hardware. The system operates on the basis of virtual storage and real storage. Real storage is the storage of System/370 from which the central processing unit can directly obtain instructions and data and to which it can directly return results. Virtual storage is address space that appears to the user as real storage. From this address space, instructions and data are mapped into real storage locations. Partitions are assigned from available virtual storage; the system assigns real storage only as it is actually needed for program use.

The OS/VS1 relocate concept operates through Dynamic Address Translation. When a program is executing, the system translates each virtual address into a corresponding real storage address as the instruction is executed.

With address translation, all 24 bits of an address are usable. Thus virtual address space can be (and real storage can appear to be) 16,777,216 bytes. This address space is divided into 256 segments of 64K bytes each. The segments are subdivided into 32 pages of 2K bytes each.

OS/VS1 real storage contains a fixed section and a paged section. The fixed section located in the lower portion of real storage contains the resident supervisor and any jobs executing in a virtual = real (V = R) mode. The size of the fixed area depends on the amount of storage the user requires to execute his programs in (V = R) space (which is fixed only while the V = R program is executing), the resident supervisor requirements, the System Queue Area (SQA), and the Recovery Management Support (RMS) area. In OS/VS1, the fixed area is that part of real storage into which the nucleus is loaded at IPL.

The Paged section in the upper portion of real storage contains portions of the problem programs currently executing and the pageable portions of the Supervisor as they are needed. It also contains, as needed, two transient areas: the SVC transient area and the I/O transient area. JES is also located in this section.

Before an instruction can be executed, it must be brought into real storage. As instructions are required, the addresses are translated and the page(s) containing the instructions is moved into real storage. When pages are not being used and the real storage space is needed by another task, the page is written out onto auxiliary storage unless an exact copy already exists (i.e. the page was not modified during execution). This procedure is called demand paging. The Page Supervisor task for OS/VS1 consists of a set of functions that efficiently manages the contents of real storage as tasks are executing in a multiprogrammed, demand paging environment. It is responsible for: Ensuring that the contents of real storage are addressable through the hardware DAT feature ... Exchanging virtual pages between auxiliary storage and real storage on a demand paging basis ... Keeping the most frequently referenced pages in real storage where possible ... Interfacing with and servicing auxiliary requests such as fixing virtual pages in real storage prior to I/O ... Providing these additional SMF statistics: Number of page-ins; Number of page-outs; Number of reclaimed pages.

The Page Supervisor task directly initiates page movement from real storage to auxiliary storage, when required. All other page movement comes about as a consequence of an implicit or explicit request from an external source. Thus, OS/VS1 is able to assume the image of a large contiguous real storage by keeping only required virtual pages in real storage during execution.

The default size of the allowable virtual equals real area is equal to 512K or the real storage size of the machine, whichever is smaller. Users with systems larger than 512K may set a higher (than 512K) upper boundary of the virtual equals real area so that large V=R programs can be run.

In addition to the paging support provided by OS/VS1, the user can elect to utilize the virtual = real execution facility. This allows him to specify that real storage should be made available in which to run programs that cannot run in the paged environment or those that the installation determines should not be executed in the paged portion of real storage. Real storage will be allocated at the time of job execution for the equivalent amount of storage he has defined on the JOB or EXEC card for the partition (and task) involved.

Thus the job of the supervisor is to provide the resources and services that programs need in such a way that at any given time as many services and resources as possible are in use.

Scheduler/JES

The OS/VS1 scheduler is an extension of the OS/360 MFT scheduler. It provides an integrated Job Entry Subsystem (JES) for efficient job submission and control. The job scheduling services direct and control the flow of one or more jobs through the system. In general these services are: Analysis of the input stream ... Allocation of I/O devices ... Selecting jobs for execution ... Reading and writing job data ... Communication between the operator and the system.

Job Entry Subsystem

The Job Entry Subsystem is a standard centralized facility that provides spooling and scheduling of OS/VS1 primary input and output streams. The Job Entry Subsystem contains many features of the Type

III HASP program of OS/360 MFT. The Scheduler/JES of OS/VS1 is pageable and will only occupy as much real storage as is necessary to execute a specific function.

JES performs three basic functions: All primary input streams are read from the input device and stored on a direct access storage device (DASD) in a format convenient for later processing by OS/VS1 and problem programs ... System (and selected user) print and punch output is similarly stored on DASD until a convenient time for producing a hard copy on a printer or punch device or via 3540 Diskette Input/Output Unit ... If system resources are in contention, JES schedules its activities to best utilize these resources.

JES is responsible for getting jobs into and out of the system as quickly as possible to enhance system throughput and performance. It accomplishes this by reading jobs into the system, dividing them into various segments (job control statements and data, for example), and storing them. When the jobs are selected for execution, the JCL is interpreted separately. This procedure reduces the need for executing system reader and interpreter functions sequentially when jobs are first read into the system, as in past operating system environments.

During execution of a job, JES spools the output into a data set; that is the data is stored on a DASD device in a manner that reduces the movement of the access mechanism.

JES supports a Logical Cylinder function that provides the user with the ability to more efficiently use the DASD workspace that is allocated for spooling.

JES supports a Writer Checkpoint function that provides the user with the capability of checkpointing his SYSOUT data sets.

JES supports an Output Separator facility that provides a means of identifying and separating the output of various jobs that are processed by the same output device.

JES also supports a Checkpoint/Restart Capability, thereby complementing other RAS facilities to ensure continuous operation.

JES supports a Job Log Facility that collects all WTOs, WTORs and replies to WTORs and includes them in the JCL listing.

The two components of JES are the Job Entry Peripheral Services (JEPS) and the Job Entry Central Services (JECS).

The functions provided by JEPS are System READER and System WRITER. All input to OS/VS1 except console entered commands, passes through the JES Reader(s). OS/VS1 allows as many readers and writers as can be contained within the limits of the virtual storage allocation made for the JES area during SYSGEN. The readers/writers are part of JES and do not occupy separate partitions. They are resident in the JES area of storage and operate concurrently with problem programs.

All resource management for JES is consolidated in the Job Entry Central Services facility. JECS has three logical functions, each of which provides a management service for JES:

Buffer Management - A central buffer handling facility for JES

Spool Management - Has the responsibility to logically handle data such as JCL text, in line input data, procedure libraries, system messages, WTP, and spooled output data.

DASD Work Area Management - Suballocates DASD work space and performs I/O operations on DASD work space for JES.

All other scheduler operations such as interpretation, allocation, command processing, initiation and termination of system and program tasks, data management and system management facilities (SMF) interface with JES.

Remote Entry Services - RES

RES is a logical and functional extension of the Job Entry Subsystem (JES). It extends the JES functions so that remote users can be attached to OS/VS1. Using RES, jobs and commands can be submitted from remote terminals, and output can be routed back to the terminals. RES makes OS/VS1 available to teleprocessing terminals so that more users can have direct access to the central system for their job submission.

RES provides all remote batch processing facilities. Using normal JCL (no special statements or parameters), the user can submit a job or a batch of jobs from his terminal directly into the system. He avoids the inefficient procedure of putting the jobs together, submitting them to the computer center, having the operator enter the jobs into the computer, and waiting for his output to be processed on the same local facilities as the output from other users' jobs. By using a true subset of system operator commands, the remote user can inquire about and manipulate his jobs. Remote Entry Services supports the following stand-alone workstations and features:

BSC Terminals

2772 Multipurpose Control Unit

2780 Data Transmission Terminal

3741 Data Station, Model 2 (in basic communications mode)

3741 Programmable Work Station, Model 4 (in basic communications mode)

3771 Communication Terminal, Models 1,2,3 (as a 2772)

3773 Communication Terminal, Models 1,2,3 (as a 2772)
 3774 Communication Terminal, Models 1,2,P1,P2, (as a 2772)
 3775 Communication Terminal, Model 1,P1 (as a 2772)
 3776 Communication Terminal, Models 1,2 (as a 2772/3780)
 3777 Communication Terminal, Model 1 (as a 2772/3780)
 3777 Communication Terminal, Model 2 (as a System/360 Model 20 MULTI-LEAVING Workstation)
 3780 Data Communications Terminal
 1131 Central Processing Unit
 5110 Computer (as a 2772)
 System/3
 System/32 (as a S/3)
 System/34 (as a S/3)
 System/360 Model 20
 System/360 Models 25-195 (Model 25 requires ICA - #4580)
 All virtual storage S/370 Processor in BC (Basic 360 Control) mode only (115, 125 with 1052 Compatibility Feature)
 System/370 Model 195
 8100 with DPPX (as a System/360 Model 25 MULTI-LEAVING Work Station)

SDLC Terminals

3771 Communication Terminal, Models 1,2,3
 3773 Communication Terminal, Models 1,2,3
 3774 Communication Terminal, Models 1,2
 3775 Communication Terminal, Model 1
 3776 Communication Terminal, Models 1,2,3,4
 3777 Communication Terminal, Models 1,3
 3791 Controller, Configuration Feature #9165 or #9169
 8130 Processor with DPCX, Models A21, A23 (as a Multiple Logical Unit (MLU), SNA device)
 8140 Processor with DPCX, Models A31, A33, A51, A53 (as a Multiple Logical Unit (MLU), SNA device)
 System/32 (as a 3770)
 System/34 (as a 3770)
 System 8100 - DPPX (as a Multiple Logical Unit (MLU) SNA device)

Features

Point-to-point nonswitched lines
 Point-to-point switched lines
 Line error recovery

RES supports the SDLC non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals, the System/32 (as a 3770) and the System/34 (as a 3770). Transmission to the 3770 terminals (except 3777-2) is via Synchronous Data Link Control (SDLC). This provides RES remote entry support for SDLC terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, RES uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode.

Functional characteristics of the RES support for SDLC terminals are as follows: Half-duplex flow ... Multipoint operation ... Serial data transmission operation - e.g., no concurrent operation of printer and punch on the outbound flow from RES to the SDLC terminals ... 3770 disk operation is transparent to RES ... Data stream provides compression of repeated characters.

SDLC Terminals supported by RES are the non-programmable models of the 3771, 3773, 3774, 3775, 3776, and 3777-1,3 Communication Terminals, the System/32 (as a 3770), and the System/34 (as a 3770). Additional 3770 products include the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader, the 2502 Card Reader, and the 3203 Printer.

Multiple Logical Unit (MLU) 3776 Models 3,4 and 3777 Model 3, with up to six independent and concurrent sessions are supported.

RES communication with the 8130/DPCX, 8140/DPCX and 3791 uses VTAM/SDLC. An 8100 or 3790 system can support a single RJE workstation which will allow spooling of output data, batching of input data, and editing of input data. A work station can support up to five logical concurrent sessions with RES. Workstations will accept compacted and compressed RES output.

The 3790 and 8100 RJE workstations have Network Control Program (NCP) support in the 3704/3705.

System Requirements - For BSC Transmission, Remote Entry Services (RES) requires a 2701, 2703, 3704/3705 (in emulation mode), or Model 135 Integrated Communications Adapter (#4640) equipped for Binary Synchronous Communications. A minimum processor storage size of 144K bytes will allow the use of one terminal subject to the restrictions that apply to the 144K real storage design point (see Smaller Main Storage Considerations). However, to obtain more effective function and performance it is recommended that a processor storage size of 240K bytes or larger be available. For SDLC transmission, RES requires a 3704 or 3705 in network control mode and a minimum processor size of 384K of real storage. The real storage requirements are dependent upon the user's definition of VS1 and the RES line and terminal configurations.

Job Scheduling

The Initiator for OS/VS1 is pageable and has no resident modules. When the command is entered from the console specifying an Initiator procedure, the initiating task is established in the specified partition to schedule job execution. The Initiator job selection routine dequeues the highest priority job from the first job input queue associated with its partition.

A program required for execution is fetched from the program library and placed in virtual storage. It is paged as needed and execution begins after the entire program's relative addresses (created by the Linkage Editor) are resolved into absolute virtual addresses.

When the final step of the job is terminated, or if the job is bypassed, any temporary or deleted data sets are returned to the system and the Initiator is ready to select another job.

The OS/VS1 Interpreter operates as a subroutine of the Initiator. Its function is to analyze the contents of job control statements and build tables that are used during the initiation and execution of job steps.

The Allocation function operates as a subroutine to the Initiator. Its function is to analyze the I/O device requirements of job steps, allocate devices to them, issue volume mounting instructions, and verify that the volumes were mounted on the correct device. OS/VS1 Allocation also supports dedicated data sets. The use of dedicated data sets reduces the time required to schedule a job step by eliminating the time normally required for allocating prespecified data sets.

When a job completes execution, the OS/VS1 termination routines free (deallocate) all resources used by the program and performs the necessary "cleanup" operations to allow the system to continue functioning for other problem programs.

Command Processing

Programmer and operator commands can be entered into the system via the console or the input job stream. Some commands may be entered only through the console. Others may be entered through either the console or the input job stream. OS commands are compatible with OS/VS1 with one notable enhancement: The WRITER command provides the ability for the operator to manipulate printed output.

This command can only be entered from the console and enables the user to: Obtain multiple copies of job output on a data set or job basis, within a job output class ... Immediately stop the job output stream and start writing again from the beginning ... Forward space and back space the output data ... Go to the next data set or restart the output writing of the current data set ... Suspend the writing of a job's output data and requeue it on the output queue to be written out later.

OS compatible command facilities available in OS/VS1 include:

Providing the flexibility to manipulate jobs by displaying the class, priority, and the number of jobs to be processed; suspending the execution of certain jobs or classes of jobs; releasing jobs that have been suspended; direct canceling of a particular job; and changing the priority or class of a particular job.

Redefining the size of a partition. In a virtual storage environment, the partitions actually reside in virtual storage so that the change in partition size is made in virtual storage and not in real storage as in OS.

Preparing for shutting down the system at the end of the day by enabling the operator to save important statistics and data records.

Modifying certain processing characteristics such as: changing output writer classes and conditions under which the output writer pauses for servicing; changing job classes associated with direct system output processing (DSO); changing programmer-specified values providing the programmer has set the proper indicators in his program to allow such revision.

Starting a job called via the console from a procedure library to override the normal selection of jobs entered via the input job stream.

Establishing the date, time of day, or the device to be used as the input work queue and whether this queue is to be formatted, as well as specifying the location of the library containing certain program procedures (procedure library), and which automatic commands the user wishes to override.

Mounting an input/output device for all job steps that require a particular volume, without intervening demountings and remountings of the volume. (The volume must be removable).

Placing input/output devices (other than a communication line) into an online or offline status.

System Management Facilities - SMF

System Management Facilities (SMF) is an optional support in OS/VS1 that collects and records system information. The information obtained can be used in management information reports that describe system

efficiency, performance and usage. The SMF records collect such data as: System Configuration ... Job and job step termination ... Processor wait time ... Processor and input/output device usage ... Temporary and non-temporary data set usage and status ... Virtual and real storage usage ... Status of removable direct access volumes ... Paging statistics.

SMF provides exits to installation-supplied routines that can monitor the operation of a job or job step and generate the installation's own SMF records. The exit routines can cancel jobs, write records to the SMF data set, open and close user-defined data sets, suppress the writing of certain SMF records, and enforce installation standards (such as identification of users). Dummy routines are automatically provided for all unused exits.

Recovery Management Support

OS/VS1 recovery management consists of five functions: machine check handling, channel check handling, dynamic device reconfiguration, alternate path retry, and missing interrupt checker.

The Machine Check Handler (MCH) records all machine checks and determines if recovery from a malfunction was made by the Instruction or Micro Instruction Retry or Error Checking and Correction facilities of the System/370 Processor. If the malfunction is not corrected by the machine facilities, MCH assesses the damage and attempts to repair intermittent real storage errors. If recovery is not possible, MCH determines whether operation can continue either in full or degraded mode and isolates the failure to a task for orderly selective termination of the task. Failing real storage is isolated on a page size basis.

The Channel Check Handler (CCH) analyzes information which results from Channel Data Checks, Channel Control Checks, and Interface Control Checks. CCH attempts to have the error corrected and determines whether or not the system can continue operation. In all cases, the channel check handler passes data to OBR for formatting and recording appropriate error records.

Dynamic Device Reconfiguration (DDR) allows a demountable volume to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error. This support may be deleted at the user's option. Additional support for non-standard tape labels may be included at the user's option.

Alternate Path Retry (APR) automatically retries input/output operations in error and marks offline those data paths that are unusable. APR is automatically included when optional channel paths are specified.

The operator may vary paths online and offline by using the VARY path command. He may not vary the last remaining path to a device offline, nor may he vary teleprocessing paths or paths to shared DASDs.

The Machine Check Handler and Channel Check Handler are standard parts of the OS/VS1 control program. They reside in the control program area of virtual storage and operate in the fixed section of processor storage. Dynamic Device Reconfiguration is a user option while Alternate Path Retry is an optional extension to the Input/Output Supervisor.

The Missing Interrupt Checker (MIC) polls active I/O operations to determine if a channel end and/or device end interruption has been pending for more than a three (3) minute period. In this manner, it provides the operator a reminder message for outstanding mount requests.

Operator Communications

Communications Task - The communications task processes communications between the operator and the operating system via the system console. Write-to-operator (WTO) and write-to-operator with reply (WTOR) macro instructions, operator commands and replies, and switching from the primary console to an alternate are all processed by this task. JES supports a Job Log Facility that collects all WTOs, WTORs and replies to WTORs and includes them in the JCL listing.

Optional Multiple Console Support (MCS) enables systems to be configured with a Master Console and one or more secondary consoles with each console dedicated to one or more system facilities. The Multiple Console user, by selecting which routing codes each console is to receive, tailors his system to his requirements. Through the use of routing codes, both system and problem programmers can indicate to which functional area(s) a message is to be sent.

A hard copy log may be selected to record system and problem program messages and operator commands and responses. The hard copy log can be either a console or the System Log (SYSLOG).

The hard copy log is mandatory when (1) there is more than one active console in the console configuration, or (2) a graphic console is being used as the Master Console.

Device Independent Display Operator Console Support (DIDOCS) is an additional option under Multiple Console Support that provides uniform operator console support for graphic display units.

Status Display Support provides for writing multiple-line messages to the operator using the WTO macro instructions. It also provides

time-interval updating for the display of active job status, and provides a means of separating status displays and certain WTO messages from operator's message traffic. This is done by designating certain consoles or separate areas of the display console screen exclusively for these displays and messages.

Console device support is summarized in the following matrix.

SYSTEM CONSOLE SUPPORT

Console Type	Standard (Single Console)	Multiple Console Support (8)	MCS with DIDOCS (8)
3215	X	X	X
3210	X	X	X
1403 (1)	X	X	X
3203-4 (1)	X	X	X
3286-2 (9)	X	X	X
3211 (1)	X	X	X
2540 (1)	X	X	X
2250 (2)			X
2260 (3)			X
2740		X	X
3274 (4)			X
3277 (4)			X
3066 (5)	X	X	X
138 Console	X	X	X
148 Console	X	X	X
158 Console (6)	X		
3213-1 (6)	X		
1052-7/2150 (7)	X		

Notes:

- (1) A console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard.
- (2) 2250 Models 1 and 3.
- (3) 2260 Model 1 on a 2848 Model 3 (local attachment).
- (4) Support for the 3270 under DIDOCS. The 3277 Model 1 attaches via a 3272 Model 1 or 2. The 3277 Model 2 attaches via a 3272 Model 2 only. The 3278 Models 1-4 are only supported in default mode via 3274 Model 1B.
- (5) Model 165 II and Model 168 only.
- (6) Printer-Keyboards mode only and only on Model 158.
- (7) Model 155 II, 165 II, and 168.
- (8) Maximum of 32 devices.
- (9) When attached to Model 138, 148.

Data Management

Data management controls all operations associated with input/output devices, such as allocation of space on volumes, storing, naming, and cataloging data sets, and movement of data between main and auxiliary storage.

Virtual Storage Access Method - VSAM

VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the data set to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: a data organization which minimizes data movement and which is suitable for data base applications; and routines for creating data sets in the VSAM organization, adding and deleting records, and performing other data management functions. Because the VSAM data organization and the access method routines are supported for both OS/VS and DOS/VS, VSAM provides full data portability between these systems.

The VSAM user can expect to see performance improvements relative to OS/VS ISAM and DOS ISAM. Performance gains with VSAM can become increasingly significant as the number of insertions to the data set rises. This is due to the elimination of the "chained record overflow" concept employed by ISAM. VSAM effectively maintains its sequential, non-inserted performance as records are added to the data set. Also, VSAM requires less time to perform a record insert than does ISAM. These factors, coupled with the efficient VSAM index structure and with the VSAM performance options, offer the potential of performance improvements relative to ISAM.

VSAM Highlights

- Access to data via VSAM is controlled by macro instructions written under the conventions of Assembler language. Access to data sets may be either direct or sequential, and may either be

keyed (controlled by index key) or addressed (controlled by relative byte address).

- With VSAM, certain device-dependent calculations such as the optimum block sizes for a given device type are carried out automatically and all data addressing is by relative bytes within the storage space allocated to the data set. These features minimize programmer effort when he wants to change device types.
- Most existing and new COBOL, PL/I, and Assembler language programs written for use with ISAM data sets may be used with VSAM data sets by means of the VSAM ISAM Interface Program. The ISAM Interface Program maps ISAM macro instructions into the corresponding VSAM requests. Refer to the Program Product section of the sales manual for details regarding COBOL and PL/I support of VSAM.

VSAM functional extensions relative to ISAM include concurrent direct and sequential processing, expanded catalog support for OS/VS and enhanced device independence. A single VSAM OPEN macro instruction may be used to initiate both direct and sequential accessing, without the need of issuing an intervening CLOSE instruction.

- VSAM offers a multi-function service program (Access Method Services) to facilitate overall management of data. Such services as defining data sets initially, deleting VSAM data sets from the VSAM catalog, printing and copying data, listing the VSAM catalog, and providing backup and portability features are controlled by this multi-function program. Converting data sets from the VSAM or SAM format to the ISAM format is another important function of this program.
- A significant feature of VSAM is that of data set and volume portability between DOS/VS and OS/VS systems. Portability of data sets and volumes is made possible by the user catalogs and the multi-function service program, Access Method Services.
- VSAM offers multiple levels of password protection to enhance data set security. VSAM also offers a user exit so that user-written security routines may be included.
- VSAM operating under OS/VS1 establishes its own master catalog independently from the OS/VS1 catalog. VSAM operating under OS/VS1 also supports user catalogs to reduce contention for the master catalog and to enhance data set integrity and portability. Each VSAM catalog defines VSAM volumes, whether mounted or not. This enhances space allocation because it is not necessary to mount a volume in order to determine whether or not space is available. Each VSAM catalog also supports non-VSAM data sets. Volumes may contain a mixture of VSAM data sets and non-VSAM data sets.

The primary objective of these features is to provide functions which reduce the need to schedule redundant work. These optional features are:

Alternate Indexes

This new feature permits application programs to access the records of a VSAM entry or key sequenced data set on the basis of keys other than the prime key. These alternate keys may be non-unique and must be contained in the base data record. Once an Alternate Index has been constructed by using Access Method Services, it may optionally be automatically updated whenever a data record is changed in the base data set to which it relates.

Relative Record Data Set

With this feature the data set is viewed as a numbered sequence of fixed length slots. Records may be inserted, updated, read, or erased in these slots using VSAM keyed processing, with the slot (i.e., record) number as the key. No index is used since each record's physical location is calculated directly by VSAM from its record number and the characteristics of the data set.

Get Previous

This feature permits retrieval and update processing on the basis of descending key values, relative record numbers, or relative byte addresses. Processing may begin either within or at the end of the data set.

Reusable Data Set

This "new" capability allows a data set to be reused (i.e., reset to "empty" when opened and reloaded) many times without being deleted and redefined. A reusable data set may be any key sequenced, entry sequenced, or relative record data set that does not have an alternate index associated with it and that does not reside on unique space. However, an alternate index may be a reusable data set.

Spanned Record

Originally VSAM did not permit a record to exceed a control interval in size. The Spanned Record feature removes the restriction, allowing a record to occupy multiple control intervals within a control area. If indexed, the keys must be in the first control interval.

Recovery

Extensions to the facilities within VSAM Catalog Management and Access Method Services will now permit limited access, via Access Method Services, to data that is not addressable by the catalog (due to the loss of, or damage to, the catalog). Further, the user can restore addressability of the data and reconstruct the associated catalog entries.

Improved Control Interval Processing

This feature is designed to reduce processor utilization for users of control interval processing with user buffers and with minimal processing options.

VSAM Shared Resources

This option provides new interfaces to allow the user to create and control his own resource pool, permitting buffers and control blocks to be shared among data sets. Its use minimizes the storage requirement in a data base environment in which a large number of data sets may remain open over an extended period.

Catalog Recovery

Additional catalog recovery capability has been added to Access Method Services for VSAM users on OS/VS1 Release 6. The RESETCAT command provides the capability for validity checking and rebuilding a VSAM catalog from information contained in its catalog recovery areas without the necessity of moving VSAM data Sets.

VSAM Minimum System Configuration

These VSAM options retain the same general system configuration requirements as the original version, however, one of the following no charge special features is required for either S/370-135 or S/370-145.

#1001 Advanced Control Program Support*
S/370-145 Models IH, J2, JI2, or K2
(* standard on 145-3 and 148)

#1051 Conditional Swapping**
S/370-135 All models
S/370-145 All models
(* standard on 135-3 and 138)

Note: Insert PSW Key and Set PSW Key from Address which are part of Advanced Control Program Support are standard on the S/370 135-3 and 138 and are called PSW Key Handling.

VSAM coexists with existing data management access methods. The data management functions supplied by VSAM are: opening data sets, closing data sets, end of volume processing, cataloging VSAM data sets, allocating space, Checkpoint/Restart processing, and processing records by index key or by address.

The operating system job control language (JCL) is expanded to include VSAM catalogs and access method parameters.

Sequential Access Methods

In the Basic Sequential Access Method (BSAM), data is sequentially organized and physical blocks of data are stored or retrieved. The READ/WRITE macro instruction causes the initiation of an input/output operation. The completion of these operations is tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

In the Queued Sequential Access Method (QSAM) logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have the desired record in virtual storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record had been written immediately, although the access method routines may block it with other logical records and defer the actual writing until the output buffer has been filled. As with BSAM, automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

Basic Partitioned Access Method - BPAM

This access method, when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a Direct Access device. The data set includes a directory that relates the member name with the address where the sequence begins. Each member has a simple name. Members may be added to a partitioned data set as long as space is available in the directory and the data set. Other than directory manipulation, all I/O is performed by BSAM.

Basic Direct Access Method - BDAM

In the Basic Direct Access Method (BDAM), records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage and retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set where a search for the

record, based on a key furnished by the programmer, begins. Addresses are also used by BDAM as a starting point for searching for available space for new records.

Indexed Sequential Access Methods

Sequential and direct processing are provided by the Indexed Sequential Access Methods (ISAM). Records are maintained in control field sequence by key. A multilevel index structure is system maintained, allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without rewriting the data set.

The Basic Indexed Sequential Access Method (BISAM) stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed using the READ macro instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

The Queued Indexed Sequential Access Method (QISAM) is used to create an indexed sequential data set or to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/deblocking are automatic. QISAM is also used to reorganize an existing data set.

3850 Mass Storage System - MSS OS/VS1 supports attachment of a single 3850 Mass storage System MSS (up to two A Model 3851's).

The 3850 Mass Storage System (MSS) programming support includes an MSC (Mass Storage Control) Table Create program, Access Method Services functions to aid in mass storage volume management, and a Mass Storage System Communicator (MSSC) which communicates the Staging/Destaging commands to the MSC and contains Mass Storage Volume Control (MSVC) functions to assist in volume management. In addition, most of the facilities available for the control and management of real 3333/3330 Disk Storage drives and the data sets contained on 3336 Model 1 and 11 Disk Packs are applicable to virtual 3333/3330 addresses and the data sets contained on mass storage volumes. 3350 Disk Storage devices may be attached to the 3830 model 3 Storage Control or the appropriate ISC with the Staging Adapter as a real device in 3350 native mode. Brief descriptions of the significant areas of support follow. More detailed information can be found in the publication *OS/VS Mass Storage System (MSS) Planning Guide*.

MSC Table Create: Creates and initializes the tables required by the Mass Storage Control (MSC). The tables are of four types:

Configuration Information: describes the hardware present in the 3850 Mass Storage System and the interconnections between the various hardware components.

Cartridge Information: describes the locations and volume serial numbers of the mass storage volumes in the 3851 MSF.

Activity Information: describes the status of staging and destaging of data.

Control Information: contains information required to locate all the above tables and also the basic information required to start the MSC initial microprogram load.

This program must be run at the initial installation of the 3850 MSS and whenever the configuration changes. It must be run prior to an OS/VS1 System Generation, if the 3851 IODEVICE macros are being changed, because it generates IODEVICE and UNITNAME card images to be used in Stage I of SYSGEN.

OS/VS1 System Generation: The 3851 Mass Storage Facility is a new device type for which an IODEVICE macro must be included. The number of virtual 3333/3330 addresses will be limited by the OS/VS1 UCB limit (see *OS/VS1 System Generation Reference*) and by the available subchannels (see appropriate Processor or channel functional characteristics manual). An IODEVICE macro for each virtual 3333/3330 address is required. Certain system data sets must reside on real direct access units known to OS/VS1. The four real unit addresses 0, 1, 8 and 9 on Staging Adapter 0 and Staging Adapter 1 are reserved for direct access to the MSC tables. More detailed information can be found in the publication *OS/VS1 Planning & Use Guide, GC24-5070*. If the only direct access units in an installation are the 3333/3330 Disk Storage drives included in the 3850 MSS, then one or more of these 3333/3330 drives must be assigned addresses that have been identified to OS/VS1 as real 3333/3330 units. These 3333/3330 drives can then be used for the system data sets. All 3350 drives must be identified as real devices during system generation. For further information on system generation, refer to the publication *OS/VS1 System Generation Reference, GC26-3791*.

Staging/Destaging Initiation: Staging and destaging is based upon Job Control Language (JCL) Data Definition (DD) statement parameters. UNIT = 3330V indicates that the data set defined by DSNAME resides on a mass storage volume whose serial number is identified either by the VOLUME parameter or in the catalog. This mass storage volume is "mounted", i.e. made active, by the Mass Storage Control at job step initiation. If DISP = OLD, SHR, or MOD is specified, the staging of the data set is initiated when the data set is OPENed. Staging will be initiated for new data sets only when the space request is not on a cylinder boundary. Destaging of new data sets for which DISP =

KEEP or CATALOG and the portions of old data sets that were modified is initiated when the mass storage volume is demounted.

Mass Storage System Communicator (MSSC): The MSSC includes Mass Storage Volume Control (MSVC) functions to assist users of the 3850 MSS to control and manage the use of mass storage volumes. MSVC centers around a new system data set, usercat.MSVI, which is a keyed sequential VSAM data set containing space and activity information about mass storage volumes and groups of mass storage volumes. It is created, initialized, and maintained by the user via the Access Method Services functions for creating a VSAM data set and for the manipulation of mass storage volumes. Usercat.MSVI is used by OS/VS1 for the allocation of mass storage volumes to satisfy non-specific volume requests for new data sets. An Access Method Services function which produces a report of the status of mass storage volumes and groups of mass storage volumes is available. Access Method Services also list information concerning cartridges similar to the information listed concerning volumes. Included are two commands which enable the user to list or scratch and uncatalog non-VSAM data sets according to his specified criteria (e.g., creation date, expiration date or name qualifier). Access Method Services also list information on cartridges similar to the information listed on volumes. Included are two functions which enable the user to list or scratch non-VSAM data sets according to specified criteria such as: creation date, expiration date or name Qualifier. It is an installation responsibility to analyze these reports to determine the extent of space utilization on mass storage volumes and then to initiate the appropriate utility functions to scratch or copy inactive data sets.

Data Management Support: BSAM, QSAM, BPAM, BDAM, VSAM, EXCP, and XDAP may be used for data sets contained on mass storage volumes. The staging of such data sets is initiated at OPEN. ISAM data sets can be contained on mass storage volumes. However, staging for ISAM data sets is not initiated at OPEN but, rather, at the time a data record is accessed. One cylinder at a time is staged as requested by the "cylinder fault" mode of operation. The Direct Access Device Space Management (DADSM) facilities are applicable to mass storage volumes as well as to real direct access volumes. All of the catalog facilities of OS/VS1 can be used for data sets contained on mass storage volumes.

Data Sharing: The catalog, user program libraries, and user data sets can be accessed by any processor. If 3333s are shared between hosts, the 3330V devices with paths to the shared 3330 drives may be SYSGENed as shared or unshared at user option.

Data Security: The password protection data security facilities of OS/VS1 can be used to control access to MSC tables and data sets contained on mass storage volumes.

Data Set Utility Programs: All non-standalone OS/VS1 Data Set Utilities can be used with data sets contained on mass storage volumes.

System Utility Programs: All non-standalone OS/VS1 System Utility Programs except IEHDASDR and IEHATLAS can be used on mass storage volumes.

IEHDASDR Utility Function: OS/VS1 System Utility Program IEHDASDR provides support for formatting the IBM 3336 Models 1 and 11 Disk Packs for use as the real volume staging pack. This utility function can only be performed external to the MSS.

Access Method Services Functions: Access Method Services provides mass storage volume commands which allow a user to initialize, modify, copy, and scratch mass storage volumes, to add and remove mass storage volumes from the 3850 MSS, and to convert real 3336 Model 1 Disk Packs to mass storage volumes and back again. There are commands which allow a user to create, modify, and scratch groups of mass storage volumes in usercat.MSVI, and to list the contents of usercat.MSVI.

Additional Commands allow the user to copy, swap, and compare the Mass Storage tables, to dump portions of the MSC or Staging Adapter storage, to dump the MSC tables, to audit cartridge locations within the MSF, and to check the consistency of the MSC tables, SA tables and Mass Storage Volume Inventory data set.

VIRTUAL TELECOMMUNICATIONS ACCESS METHOD - VTAM (Also refer to the Program Products section for licensed options provided for TCAM).

A functionally superior alternative to BTAM, VTAM provides telecommunication support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM provides for the direct transmission of messages between application programs and terminals. Using NCP/VS, it makes the lines and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM initially supports switched and nonswitched lines. A switched line connection requires system operator assistance. Manual dial service is supported. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. VTAM subsequently supports SDLC terminals in switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upward compatible for the three virtual storage operating systems (DOS/VS, OS/VS1, and OS/VS2). It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer data base/data communications systems. TCAM application programs can use certain VTAM facilities through TCAM Message Control Program.

Network operator control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored OS/VS1 RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of 3790 Communication Systems and the host communications subsystem.

To aid in installing the 8100 Information System with DPPX, the Host Command Facility program product with an SNA 3270 display station running under VTAM or TCAM, can be used to:

- Remotely operate an 8100/DPPX system from a 3270 display station.
- Run 8100/DPPX checkout routines remotely.
- Verify the operation of a link connecting S/370 and 8100 DPPX.
- Modify DPPX Network profiles.

VTAM System Requirements: VTAM operates in OS/VS1 on a System/370 and requires the Compare and Swap and the Compare Double and Swap instructions. These instructions are provided via the Conditional Swapping Feature (#1051) for the Model 135, and via the Advanced Control Program Support Feature (#1001), or the Conditional Swapping Feature (#1051) for the Model 145, (see **Note**). The minimum OS/VS1 system under which VTAM operates is 256K of real storage.

See *Terminal Support Chart 1* for the devices supported by VTAM with OS/VS1.

Note: Conditional Swapping is standard on the Models 135-3 and 138. Advanced Control Program Support is standard on the Models 145-3 and 148. Insert PSW Key and Set PSW Key from Address, which are part of Advanced Control Program Support, are standard on the S/370 135-3 and 138 and are called PSW Key Handling.

Teleprocessing Online Test Executive Program - TOLTEP

TOLTEP is a component of VTAM and is designed to control the selection, loading, and execution of teleprocessing online terminal tests (OLTTS) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTS of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTS concurrently with other processing programs, with VTAM, and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, TOTE and OLTEP are still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

Telecommunications Access Method - TCAM (Also refer to the Program Products section for licensed options provided for TCAM).

The Telecommunications Access Method (TCAM) is a teleprocessing support program which may execute in conjunction with VTAM or as a separate access method. It provides:

- A regionalized, general-purpose TP access method providing facilities that permit exchange of data between a central S/370 and remote terminals.
- A control program designed to optimize the allocation and scheduling of a computer's resources in a real-time teleprocessing environment. Resources optimized include processor time, real-storage space and I/O paths (lines and channels).
- A high-level language composed of macro instructions designed specifically to facilitate the construction of a TP message control program. Please refer to the TERMINAL SUPPORT CHART(S) in this section for specific terminals and how supported.

TCAM provides unified management of terminal devices, local and remote, including BSC and SDLC devices, through a single Message Control Program. The TCAM application-program interface has been defined to provide maximum compatibility with BSAM (READ/WRITE level) and QSAM (GET/PUT level), yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications using TCAM are constructed by providing a Message Control Program and one or more TCAM application programs.

TCAM does not provide emulation of the QTAM interface.

TCAM Message Control Program: The TCAM Message Control Program (MCP) serves as an interface between remote terminals, user-written application programs, and secondary storage devices on which messages are queued until their destinations are available to receive them. The MCP's job is to control the flow of messages to and from these terminals, application programs, and queuing media, in a manner that optimizes allocation and scheduling of the computer's resources.

By handling all line control and scheduling of I/O operations for remote terminals, the TCAM MCP insulates user-written application programs from the complex device-dependent considerations inherent in a TP environment.

In TCAM, messages entered by remote terminals or application programs are queued by destination. Queuing by destination permits overlap of line usage in I/O operations; messages having a common destination may be received simultaneously from more than one source, even while the destination itself is busy sending or receiving a message. Disk queuing permits a high volume of concurrent terminal operations to proceed without requiring excessive real storage for buffering. TCAM destination queues may be located in main storage or on disk.

A TCAM MCP contains one or more message handlers. These are user-coded sets of routines that process messages as they enter and leave the TCAM MCP. Message handler functions are included by the selection and coding of TCAM supplied macros; among these functions are the following: message editing ... validity checking ... message routing ... record keeping ... error handling ... system control.

Special message-handler facilities are furnished for inquiry and conversational applications. The path of a message through a message handler may be varied dynamically based on the source or destination of the message, or on the presence or absence of certain character strings in the message header. To supplement TCAM-provided functions, the user may code open or closed subroutines consisting of assembler macro instructions and include these in his message handlers. Assembly, linkage-editing, and execution of the MCP is similar to that for any other problem program. For performance reasons, the MCP is usually executed as the highest priority user task in the system, but this is not a requirement.

TCAM Application Programs: TCAM permits the user to code one or more application programs and interface these with the MCP. Application programmers are insulated from the TP environment; they issue ordinary GETs and PUTs or READs and WRITEs to move data between the MCP and application program work areas.

TCAM application programs can be SAM compatible, and may be debugged in a non-TP environment using BSAM or QSAM as the access method, and a tape, card-reader, disk, card punch, printer, etc., as I/O devices. Once debugged, many application programs can be plugged into TCAM without reassembly by changing a single job-control statement. The user can specify that either messages or user-defined records be transferred when he issues his GET/READ or PUT/WRITE macros.

TCAM application programs can be attached dynamically during execution by the MCP.

TCAM Service Facilities: TCAM offers an extensive set of service facilities. Among these are:

- A set of operator commands allowing the user to determine the status of his TP system and alter, activate, or deactivate portions of that system by entering appropriate commands from the system console, remote terminals, or application programs. An NCP may be referred to by its NCP name, and SNA entities are allowed as operands where applicable.
- A checkpoint/restart facility which allows the user to specify that his MCP environment be restored following system failure or closedown.
- A facility for selectively logging incoming or outgoing messages or message segments.
- Comprehensive debugging aids, including error-recovery and event-recording facilities, and utilities which permit debugging information to be dumped to tape or disk and then printed out.
- An online test facility (TOTE) that allows the user to test transmission control units (270X and 3704/3705) and remote terminals without closing down the MCP or deallocating the device being tested. When TCAM uses VTAM, TOLTEP provides testing facilities for the VTAM network.

TCAM MFT, MVT/VS Compatibility: OS TCAM Message Control Programs must be reassembled to run in the OS/VS environment. This reassembly allows the MCPs to benefit from the virtual storage capability of OS/VS. Under OS/VS, TCAM runs as a subsystem in a virtual partition. Certain TCAM elements, such as the buffer pool, I/O appendages, control blocks, and tables are fixed in main storage for the duration of the TCAM task.

System Requirements and Device Support: TCAM operates under OS/VS1 on a System/370 having at least 144K bytes of main storage. Normally space on one or more 2314 or 3330/3333/3340 DASD units will be needed for intermediate storage of message queues.

TCAM supports a wide variety of start/stop and binary-synchronous terminals attached remotely via a 2701, 2702, 2703, 3704/3705 (in emulation mode) or System/370 Model 135, 138 with ICA (#4640); remote terminal and network configurations supported by OS/VS1. TCAM in this fashion is itemized in *Terminal Support Charts 1 and 2*. In addition to remotely attached terminals, OS/VS1 TCAM supports direct attachment to either the multiplexer or selector channel of the 2260-2848 Display Complex (Local), and direct attachment to the multiplexer channel of the 7770 Model 3 Audio Response Unit. These devices are not supported by TCAM when running through VTAM.

TCAM/VTAM Relationship in OS/VS

VTAM controls the telecommunications environment that includes 3704/3705s in network control mode and, optionally for TCAM, locally attached 3270s. VTAM permits sharing of this telecommunications network among different applications including those applications which used TCAM 3704/3705 network control mode support in previous releases of the operating system. When the TCAM Message Control Program schedules a read or write operation for a station in the TCAM/VTAM network, this I/O request is routed to VTAM. To the TCAM applications, the message looks as if it were handled only by TCAM.

If a TCAM application program or a TCAM terminal operator issues TCAM 3704/3705 control commands, a unique return code and a response message is provided. This code and message indicate the command has been intercepted and cannot be executed. Similar 3704/3705 control functions are available through VTAM network operator commands. TCAM now shares this network with VTAM and is no longer the sole "owner" of the telecommunications network.

The installation can provide an interface to the terminal user similar to the TCAM interface by using the "simulated logon" capability of VTAM. However, to use the full sharing capabilities of VTAM, the installation instructs the terminal user to enter an installation-defined sequence requesting logon to TCAM and includes in the system the VTAM facility to monitor logons.

This VTAM facility provides the capability to interpret the sequence entered by the terminal user and to route the interpreted logon request to the appropriate VTAM application (e.g., TCAM).

Note: A TCAM MCP must be re-assembled for proper operation through VTAM.

Basic Telecommunications Access Method - BTAM

The facilities of the Basic Telecommunications Access Method (BTAM) are designed chiefly to provide the basic tools required to write a telecommunications program. BTAM provides support for terminals attached other than to the 3704/3705 in network control mode. These include facilities for creating terminal lists and for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Code translation ... Retransmitting messages which are received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

The support of Binary Synchronous Communications combined with that of the various start/stop devices gives BTAM a varying degree of applicability and flexibility. BTAM supports low, medium, and high speed devices.

BTAM supports Binary Synchronous Communication over nonswitched (leased or private direct connection) and switched (dial) networks in a System/370 to terminal communication.

All terminals (except Binary Synchronous Communication) on a multipoint nonswitched line must be the same type. Terminals may be mixed within the same problem program.

Further information on terminal support is provided by *Terminal Support Charts 1 and 2*.

Optional communication serviceability facilities are available in BTAM including error recovery procedures, diagnostic error information, error counts, and online terminal tests. It is strongly recommended that these facilities be included since they increase system availability.

OS/VS1 BTAM supports the same functions as OS BTAM and, therefore, requires no additional programmer training. The user is cautioned regarding any internal changes that he may have made to OS/MFT BTAM.

Graphic Programming Services

Graphic Programming Services consists of the functions necessary to handle graphic input/output, and a set of macro instructions and problem oriented routines that can be used as building blocks in the construction of graphic processing programs. These services support the 3250 Graphic Display System, the 2250 Display Unit, Models 1 and 3, and the 2260 direct attachment (local). This access method includes:

Macro instructions to generate orders for the 3250 and the 2250 Models 1 and 3, including the Model 1 with the graphic design feature ... Data handling aids for arranging orders and data in virtual storage prior to transferring them to the graphic display buffer ... Problem-oriented routines that dynamically generate orders and data for displaying on the 3250 and the 2250 Models 1 and 3: alphameric characters, rectangular grids (linear or semi-log), polar coordinate grids (linear or semi-log) and circles and arcs ... Input to these routines can be either fixed point or floating point and can be scaled by the routines ... Graphic Data Generation Subroutine to generate data, during program execution, for use with the 2-byte incremental data modes of the 3250 and the 2250 Model 1 with the Graphic Design Feature and the 2250 Model 3 ... Light Pen Tracking Subroutine - Generates a buffer subroutine during program execution which may be used on a 3255 or a 2840 Model 2 to track the pen movement on the CRT and display a pattern showing its current position ... The Graphics Access Method (GAM) includes: Read/Write level macro instructions for transferring data between real storage and the graphic display buffer; Buffer management facilities that allocate, control, and protect sections of the 3255 or the 2250 Model 1 or 2840 buffer; Routines that facilitate man-machine communication using 3250, or 2250 or 2260 local, at both the express and basic attention handling levels (provides synchronous attention handling).

Graphic Subroutine Package - GSP

The Graphic Subroutine Package provides support for graphic programs written in Assembler Language or for the following compilers:

FORTRAN IV E, G or H
PL/1 (F)
FORTRAN IV H-Extended or G1 (Program Products)
PL/1 Optimizing or Checkout Compilers (Program Products)

These services consist of subroutines and functions that enable a programmer to create a display on one or more 3251 Display Stations or 2250 Display Units (Models 1 and 3) under OS/VS1. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs, rectangles, etc. The subroutines are requested through the use of CALL statements in a sequence that produces desired characters or graphic forms on the 3251 or 2250 screen, and that provide two-way communication between the user's program and the 3251 or 2250 operator (if desired). In producing desired displays, the subroutines automatically: Generate necessary graphic orders and data for the displays ... Transfer the generated orders and data to the 3255 or the 2250 buffer for execution, relocating them as necessary ... Allocate, control and protect sections of virtual storage and of the 3255 or the 2250 buffer as required by the user's application program ... Diagnose asynchronous errors and accomplish necessary error handling.

Features available are:

- Two levels of graphic order and data grouping, each of which can be referenced by an entity: (1) element - all orders and data produced as one call to a GSP subroutine, and (2) sequences - all orders and data produced by several calls to GSP subroutines.
- Acceptance of input data in any two-dimensional rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.

- Provision for temporarily removing an image from a display while its associated orders and data are in the buffer, and later redisplaying the image.
- Modification of graphic orders and data produced by a single call wherever they are located (in real storage or in a buffer) by another call to the same subroutine.
- Display of alphanumeric characters using either the character generator of the 3250, or 2250 or a series of lines called strokes.
- Capability to read information from the buffer into real storage.
- Capability to locate the position of the light pen on the screen even if the light pen is pointed to a blank portion of the screen.
- Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 3250 or 2250 operator with the light pen (restricted to 3250 or 2250 Model 3).
- Allowance for in-buffer subroutines that can be repeatedly invoked through in-buffer linkage (restricted to 3250 or 2250 Model 3).
- Ability to check the status of the program while it is being processed.
- Calling any of the subroutines from an assembler language program.
- Single and multiple queueing of attention information, and inline processing of that information.

Shared DASD

A pool of direct access storage devices may be shared by two to four S/370 Processors. Devices supported are 2314/2319, 3333 Models 1 and 11, 3330 Models 1, 2 and 11, 3340 Models A2, B1 and B2, 3344 Models B2 and B2F, and 3350 Models A2, A2F, B2 and B2F. Two S/370 Models 145, 148, 155II, 158, 165II, and 168 Processors can share a pool of 2305-2 DASD. Two S/370 Model 165II and 168 Processors can also share a pool of 2305-1 DASD. The catalog, program libraries, and user data sets may be accessed by any processor. Advantages are reduced file maintenance, improved operational flexibility, and reduced disk space requirements. The system establishes access for each catalog generation. Exclusive access for all other data sets is controlled by using the RESERVE macro.

System Support Programs

Linkage Editor

The Linkage editor combines separately compiled or assembled object modules into one or more load modules that is in a format suitable for loading by the control program and for subsequent execution. It also combines previously edited load modules with each other or with object modules.

Features - Although linking or combining of program modules is its primary function, the linkage editor also:

Provides CSECT ordering and page boundary alignment facilities.

Incorporates modules from data sets other than those in its primary input, either automatically or upon request.

Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.

Defines the storage requirements for the common control sections generated by the assembler and by FORTRAN compilers, and the static external areas generated by PL/I compilers.

Provides processing options and logs diagnostic error messages.

Maintains an audit trail of compilation, linkage editing dates and levels and modifications on a CSECT basis within a load module via the Identification Record (IDR).

System Requirements - The linkage editor is designed for a virtual partition of 192K bytes, but can operate in the minimum virtual partition of 64K bytes.

Loader

The Loader combines the basic editing and loading functions of the linkage editor with program loading (fetch) in one job step. It loads object modules produced by a language processor and load modules produced by the linkage editor directly into virtual storage for program execution.

System Assembler

The OS/VS1 System Assembler is a programming tool for the implementation of programs using the IBM System/370 instruction set. The System Assembler gives the user access to hardware and operating system functions and permits the user to generate and maintain the Operating System/Virtual Storage 1. Among the features supported by this assembler are:

Macro Instructions - The macro capability provided by the assembler is a programming tool providing interfaces to the OS/VS1 Input/Output Supervisor by means of Data Management macros, access to the complete OS/VS1 capabilities through the use of Supervisor Macros, and the ability to include programmer defined macros in assembler programs for special applications.

Conditional Assembly Statements - Conditional assembly statements are used to alter the sequence in which statements are processed,

or to specify selective assembly of instructions. The conditional assembly mechanism is a key element in the macro feature.

Private Libraries - A private library may contain assembler language statements. These can be macro definitions or code that is to be inserted into the program by the COPY statement.

Dynamic Work Areas - The assembler provides a mechanism for establishing addressability to independently allocated storage areas.

System Requirements - The OS/VS1 System Assembler uses the S/370 Standard Instruction Set. This assembler runs efficiently in 128K of virtual storage and requires a minimum of 64K of virtual storage. In addition to the standard OS/VS1 requirements, the System Assembler requires space in auxiliary storage for the following data sets: System Input and three Intermediate data sets for work storage.

Depending on program requirements, additional data sets may be needed for Macro Definition library, print output, object module output, and punch output.

The OS/VS1 System Assembler contains the following enhancements to OS Assembler F: SETC values and character relation terms may be up to 255 characters in length (the old limit was 8 characters) ... Fewer restrictions and extended functions for conditional assembly language ... Three additional system variable symbols (&SYSPARM, &SYSTIME and &SYSDATE) ... Extended mnemonics for RR-type branch instructions ... Improved diagnostics and debugging facilities.

System Utilities

These programs are used to maintain system control data at an organizational or system level. The functions performed by the system utility programs are:

- **IEHPROGM** - Builds and maintains system control data and modifies the password data set.
- **IEHMOVE** - Moves or copies logical collections of IBM System/370 OS/VS1 data.
- **IEHLIST** - Lists system control data such as data sets cataloged in the system catalog, directory entries of partitioned data sets, and VTOC entries.
- **IEHIOSUP** - Updates entries in the supervisor call library.
- **IEHDASDR** - Initializes direct access volumes for use with the operating system and dumps data to or restores data from these volumes.
- **IFCDIPOO** - Reinitializes the system data set, SYS1.LOGREC.
- **IEHINITT** - Writes volume label sets in EBCDIC, in BCD, or in ASCII code on magnetic tapes.
- **IEHATLAS** - Locates and assigns an alternate track to replace a defective track.
- **IFHSTATR** - Selects, formats, and writes information from Type 21 (error statistics by volume) records.
- **Device Support Facilities** - Initializes direct access storage volumes for use with the Operating System, analyzes DASD tracks and conditionally reclaims tracks previously flagged as defective.

System Data Set Utilities

These programs reorganize, change or compare data at the data set and/or record level, and are required for the proper generation and maintenance of the system control program. The following general functions are performed by these utilities:

- **IEBCOPY** - Copies, compresses, merges, loads, and unloads partitioned data sets.
- **IEBGENER** - Copies a sequential data set or members of a partitioned data set, or converts a data set from sequential to partitioned organization.
- **IEBPTPCH** - Prints or punches records residing in a sequential or partitioned data set.
- **IEBUPDTE** - Updates a symbolic library.
- **IEBEDIT** - Edits input job stream data set from a master input job stream.
- **IEBTCRIN** - Constructs records from input read from the IBM 2495 Tape Cartridge Reader. Generation of a 2495 is required for the inclusion of the IEBTCRIN utility into the operating system.
- **IEBDG** - Can create output data sets either with internally generated test data or externally supplied input. These data sets can be sequential, indexed sequential, or partitioned.
- **IEBCOMPR** - Compares two identically organized sequential or partitioned data sets at the logical record level.
- **IEBISAM** - Can copy, reorganize, load, or unload an indexed sequential data set.
- **IEBIMAGE** - New 3800 Utility provides means for the user to create or modify and to store in SYS1.IMAGELIB Forms Control Buffer records, Copy Modification records, Graphic Character Modification records, and Character Arrangement tables. Input to the Utility consists of simple control statements. User can specify for FCB records forms sizes, number of lines at each vertical spacing, and line positions for simulated channel control punches. For Copy Modification, control statements include the text and its position within each copy of the pages of a data set. Existing Copy Modification records can also be modified. Graphic Character Modification statements provide means for combining and naming groups of graphic characters, including

any characters already in SYS1.IMAGELIB, and to assist in storing in the system new graphic characters of user's own design. Character Arrangement tables can be created or modified to print with different character sets, to include Graphic Character Modifications, and to assign data codes to graphics or to change existing assignments.

- **IEHDASDR** - Dumps and restores data sets.

Independent Utilities

The following independent utilities do not operate under the OS/VS1 control program, but they support OS/VS1 with the following services:

- **IBCDASDI** - Initializes direct access volumes for use with the operating system.
- **ICAPRTBL** - Performs stand-alone buffer loading for the IBM 3211 and 3203-4 printers.
- **IBCDMPRS** - Performs unloading and loading of data between DASD and a removable volume.
- **Device Support Facilities** - Initializes direct access storage volumes for use with the Operating System, analyzes DASD tracks and conditionally reclaims tracks previously flagged as defective.

An online test facility (TOLTEP) is provided for telecommunications networks under VTAM. See *Virtual Telecommunications Access Method - VTAM* for a description of TOLTEP.

Online Test Executive Program - OLTEP

The Online Test Executive Program (OLTEP) is a function designed to direct the selection, loading and execution of the Online Test sections (OLT's) in OS/VS1.

OLTEP with the related OLT allows the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs. Concurrent debug with OLTEP is supported in OS/VS1 for systems with 144K or more.

The OLTEP/OLT system is designed for: Diagnosing I/O errors ... Verifying I/O hardware repairs and Engineering Changes ... Exercising a device requiring dynamic adjustments ... Checking I/O Hardware ... Integrity of customer data.

As a job under OS/VS, it is called by standard Job Control Language and is under the control of the operating system at all times. It uses the facilities of OS/VS to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of Test Runs can be entered via console or non-console devices. Prompting is available on consoles to aid in defining tests to be run.

Customer Engineering will supply the OLTs to the customer on magnetic tape or cards. The OLTs must be reformatted and link edited into a partitioned data set in order to be used under the operating system.

OLTEP executes in the pageable area of real storage. It requires a minimum of 64K of virtual storage for the OLTEP modules, and a minimum of 4K of real storage for the OLTs to be loaded and executed.

Dynamic Support System - DSS

Dynamic Support System (DSS) is no longer supported on OS/VS1 and is deleted from the OS/VS1 Release 6.7 distribution libraries.

Additional Service Aids

The following service aid facilities are also available under the Operating System/Virtual Storage 1. These programs aid in the diagnosing of system or application program errors by: Gathering information about the cause of a failure ... Formatting and printing information in a form that makes it easy to use ... Aiding in the development and application of a fix for a given problem.

HMAPTFLE - This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies information on the module and CSECT to which the PTF is to be applied. The program then either produces the necessary Job Control Statements for application of the PTF; or, if specified, dynamically invokes the Linkage Editor to update the operating system. The program executes in the paged section of real storage and requires a virtual partition of 64K bytes unless the Linkage Editor is dynamically invoked, then a 128K virtual partition is required.

IFCEREPO - Edits and prints environment error records.

HMBLIST - This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on HMBLIST control statements, the following listings may be produced: Formatted load module listings ... Formatted object module listings ... Load module map and cross-reference listings ... Map and cross-reference listings of the system nucleus ... Listings of the data stored in the CSECT Identification records of load modules ... Load module map and cross-reference listings showing relocated addresses ... Load module summary data including alias names entry point address(es), module

attributes, and the contents of the module's System Status Index (SSI) ... Listing of program modifications to a load module library ... Map of the resident reenterable load module area.

The minimum virtual storage requirement for HMBLIST is 64K bytes. In addition to the standard system residence, HMBLIST requires space in auxiliary storage for at least the following data sets: System Input, Print Output, and one or more load modules and/or object module data sets (load module data sets require DASD).

HMASPZAP - This service aid program assists user authorized personnel to: Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set ... Inspect and modify data in a specific data record that exists in a direct access data set ... Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

HMDSADMP - This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. HMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the control registers, contents of real storage, and, optionally, the page data set onto a tape volume in large blocks. The low-speed version can write the control registers and the contents of real storage to a printer or tape volume in unblocked, printable format.

HMDPRDMP - This service aid allows the user to format and print a storage dump of either virtual or real storage when utilizing the dump tape produced by the high-speed version of the HMDSADMP service aid, dumps in the SYS1.DUMP data sets, or print a real storage dump when utilizing the tape produced by the low-speed version of HMDSADMP. It also edits and prints the Generalized Trace Facility trace data set and formats the SYS1.DUMP data set.

IMCJOBQD - This service aid produces a formatted copy of the contents of the job queue data set and related scheduler work area data sets. This program operates independent of the OS/VS1 control program, and does not alter the existing status of the records that are displayed.

JESDUMP - This service aid provides selective, non-destructive main storage dumps of JES and Queue Manager errors. This facility should only be used when a spool or Queue Manager error is suspected.

JOB LIST VERIFICATION - A service aid that provides selective non-destructive main storage dumps of Job List Manager errors. This facility should only be used when a Job List Manager error is suspected.

HMASMP - This program is used for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DAS error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error-related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

Display Exception Monitoring Facility

The Display Exception Monitoring Facility (DEMF), Selectable Unit (SU) 24 is a serviceability aid, which offers users of 3270 Information Display Systems in local or BSC mode assistance in locating a hardware problem in a communication network. In remote mode, the 3270 must communicate through a 270x or 370x on E.P. mode.

DEMF is logically composed of two tasks: a logging function and a display function. The logging function runs as a system task under OS/VS1. It is passed communication error records created for the SYS1.LOGREC data set. The display function is a component that runs under TCAM, CICS/VS, or IMS/VS. It presents a structured display of the errors accumulated by the logging function at the user request.

Generalized Trace Facility

The Generalized Trace Facility (GTF), is a standard feature in the OS/VS1 system operating on S/370 Processors of 144K bytes or more. It is a program service that assists users in performing problem determination and diagnosis by tracing system events, user events, or both. GTF consists of two major functions, the Generalized Trace function and the Trace Edit function.

The Generalized Trace function is a system service that can be optionally started from the master console. It executes as a system task in a partition. When the Generalized Trace function is started, the user also has the option of tracing internally in the GTF partition or externally to a data set on an auxiliary device. The Generalized Trace

function supports a S/370 Processor storage size of 144K bytes or more for internal tracing and 160K bytes or more for external tracing.

The Trace Edit function is a feature of the HMDPRDMP service aid and provides the user with a selective data reduction capability for the trace data set or formats GTF trace data contained within a storage dump produced by HMDSADMP or dumps in the SYS1.DUMP data set. It runs as a problem program and can be invoked via JCL. The Trace Edit function supports the minimum system support size.

Conversational Remote Job Entry - CRJE

Conversational Remote Job Entry (CRJE) allows remote access to OS/VS1 via low-cost printer-keyboard terminals. Terminal users share a central System/370 to submit jobs for execution, update and prepare programs and data, list job output, all concurrently with normal background OS/VS1 operations. An easy-to-use command language is provided to control entry, editing, inquiry and other control functions provided.

Among the features supported are: Supports 2740, 2741, 3767 (as a 2740-1 or 2741), and 1052 Printer-Keyboards terminals using BTAM ... Logon security ... Data set protection ... Library storage of remotely entered programs and data ... Administrative aids ... Data editing and manipulation capability ... Operator control of network ... Job status inquiry at terminal or console ... Routing of output data to central computer output devices or selectively to a remote terminal.

DASD space on a 2314, 2319 or 3330-1,-2/3333-1 Disk Storage Facility is required for CRJE tables, System Data Sets and Work Areas. Additional DASD space must be provided for user library data sets and directories, the exact amount must be established by the using installation. The 3350, 3344, 3330 Model 11 and 3333 Model 11 DASDs are not supported by CRJE.

A 2701, 2702, 2703, 3704 or 3705 (in emulation mode only) or Model 135 ICA (#4640) with a Type I terminal control is required on the multiplexer channel with appropriate features for attachment of 1050 (1051 control unit Model 1 or 2), 2740 Model 1, 2741 or 3767 (as a 2740-1 or 2741) terminals over communication lines. All 2740 terminals must have the record checking feature and may not have the station control feature. If BTAM Online Test facilities are omitted from CRJE, full system resources must be made available to the Customer Engineer for terminal maintenance when required.

Program Products

There are a large number of program products which may be ordered to support OS/VS. The program product section of the sales manual pages should be referenced for more information and ordering instructions.

Current System Programs (CSP) Under OS/VS

Type I CSPs, such as Sort and the Language Compilers, are not distributed as part of the OS/VS SCP. Those wishing to continue using them may transfer them over from their OS Release 21.8 or later system. If the CSP is on a DASD device accessible to a VS system, then the VS system's SYS1.PROCLIB need only be updated to include the CSPs cataloged procedures. These procedures should contain a JOBLIB or STEPLIB DD card referencing the data set containing the CSP. If the CSPs reside on a DASD device not accessible to VS, then they should be copied to one with the IBM Utility IEBCOPY. The VS system's SYS1.PROCLIB should be updated accordingly.

Those customers not on OS Release 21.8 must order this or a later release of the OS DLIBs. They would then perform a processor only sysgen as described in the OS System Generation Guide (GC28-6554). In so doing, the CSP target library and the procedural library should be one accessible by the VS system.

Ordering instructions for the Release 21.8 DLIBs are the same as for Release 21.7, which are available in the Release 21.7 Guide (GC-6730).

Type I Current System Programs (CSP) Under VS

Program Name	Program Number	Notes
COBOL F	360S-CB-524	1
COBOL F Library	360S-LM-525	1
COBOL LCP	360C-CV-713	2
Full ANS COBOL V2	360S-CB-545	
Full ANS COBOL V2 Library	360S-LM-546	
FORTRAN G	360S-FO-520	
FORTRAN H	360S-FO-500	
FORTRAN G & H Library	360S-LM-501	
FORTRAN Syntax Checker	360S-FO-550	
PL/I F	360S-NL-511	3
PL/I F Library	360S-LM-512	
PL/I Syntax Checker	360S-PL-552	
SORT/MERGE	360S-SM-023	

Notes:

1. Programs withdrawn, but will operate on OS/VS1 Release 1.
2. Orderable as an Independent Component Release.
3. Teleprocessing support is not available in this environment since QTAM is not supported by VS, and PL/I F does not support TCAM.

Minimum VS1 Configuration

The minimum configuration required for VS1 operation or SYSGEN is:

- S/370 Model 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 165II, 168, or 3031 Processor.
- 144K bytes of available real storage †
- A multiplexer channel.
- A selector or block multiplexer channel.
- For VS1 operation, two of the following DASD spindles are required, 2314/2319, 3330 Models 1, 11 or 3333 Models 1, 2, 11, 3340/3344 or 3350. These spindles must be of the same type. Additional spindles may be required to meet customer needs.
- For VS1 distribution library installation and SYSGEN, three 3330 Models 1, 11 or 3333 Models 1, 2, 11, or three 3340 drives with 3348 Model 70 Data Modules, or four 3340 drives with 3348 Model 35 Data Modules, or four 2314/2319s are required. The required number of 3330/3333 spindles may be the 3350 in 3330 Model 1 or 11 compatibility mode, and the 3350 in native mode may be the new system residence device. The 3340 spindles may be provided by the appropriate logical 3340 volumes on the 3344.
- A SYSIN device (card reader or tape).
- A SYSOUT Printer (printer or tape).
- A SYSOUT Punch (punch or tape).
- A console.
- A 9-track tape drive*.

† The OS/VS1 starter systems require a minimum of 160K bytes of real storage (see the "Starter System" section for more information).

* Distribution of the SCP, component releases, emulator SCPs and PTFs are made on 9-track; therefore, a 9-track tape on the system or access to another system meeting the minimum configuration requirements and having a 9-track tape at the customer installation is required for system generation and maintenance. Note, a tape drive is also recommended for the output from the high-speed stand-alone dump program (HMDSADMP). This may be the same drive used for generation and maintenance.

System Generation

This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses the VS1 starter system or the user's current operational VS1 system, and requires the following programs: Control Program ... Data Management Data Set Control, BSAM, QSAM, BPAM ... Assembler ... Linkage Editor ... Utilities. PIDDistributes on tape for 2314/2319, 3330/3333, 3340 or 3350 residence the required libraries (Partitioned Data Sets) which contain the OS/VS1 system modules and the system macro instructions needed for the system generation process when OS/VS1 is ordered.

The same system requirements are required for maintenance as for generations since some changes may require a full or partial system generation.

Starter System

The standard starter system for OS/VS1 is a special VS1 system ordered separately.

The starter system has the basic elements necessary for system generation in a form that is directly usable by a majority of customers. The starter system functions with a variety of different I/O units at "standard" addresses. Customers may use the starter system to perform system generation if there are appropriate matching units and addresses in their own configuration.

Dedicated Data Set Support is used in SYSGEN for the utility data sets in assemblies, link edits, and data set copies.

The starter system runs on a System/370 which meets the minimum system requirements. RMS (Recovery Management System) routines for all S/370 Processors are included in the system libraries thus allowing processor independence of the Starter System SCP. The current levels of the starter systems require a minimum of 160K of real storage. If a customer requires a 144K starter system, then the Release 5 starter system should be ordered from the Manager of Order Control at PID.

Customers should be encouraged to match unit addresses with those of the starter system to the greatest degree practical. Unit address are established as part of the normal physical planning and cable order process; therefore, physical installation plans should be reviewed where appropriate.

The following chart shows the devices supported by the starter system, the system functions for which they may be used, and the three character address assigned to each unit. The OS/VS1 starter system supports all the devices at the address specified.

STARTER SYSTEM REQUIREMENTS CHART

Min. Reqd	Function	Device	MPX Channel	Device Address (Note 1)			
				Selector Channel 1	Selector Channel 2	Selector Channel 3	Selector Channel 4
1	System Console	3066 3158 (Note 3) 3213 (Note 4) 3210/3215 (Note 5)	019 010,014 011,015 009,01F		219 209,21F		
1	System Input	2540 Reader 3505 Reader 1442 Reader/Punch 2400/3400(7-Tr-DC) 2400/3400(9-track)	00C 012 00A	180,181 182,183,184	280,281 282,283,284	380,381 382,383	480,481 482,483
1	Punch Output	2540 Punch 1442 Reader/Punch 2400/3400(7-Tr-DC) 2400/3400(9-track) 3525 Punch	00D 00A 013	180,181 182,183,184	280,281 282,283,284	380,381 382,383	480,481 482,483
1	Print Output	3211 1403 2400/3400(7-Tr-DC) 2400/3400(9-track) 3800	002,004 00E,00F 018	180,181 182,183 118	202 20E 280,281 282,283 218	380,381 382,383	480,481 482,483
1	New system	2305-2 2314 (or 2319 on CHAN 1) 3330-1/3333-1 3330-1,-11/3333-11 3340/3344 3350		1D0 130,131,132 133,134 150,151,152 153 158,159,15A 15B 1C0,1C1,1C2 1C3 148,149,14A 14B	230,231,232, 233,234 250,251,252, 253 258,259,25A, 25B 2C0,2C1,2C2, 2C3 248,249,24A, 24B	330,331,332, 333,334 350,351,352, 353 358,359,35A, 35B 3C0,3C1,3C2, 3C3 348,349,34A 34B	
5	Starter System and Distribution Libraries (See Note 7)	2314 (or 2319 on CHAN 1) 3340 (M35) 3330-1/3333-1 3330-1,-11/3333-11 3340/3344(M70) 3350		130,131,132 133,134 150,151,152 153 158,159,15A 15B 1C0,1C1,1C2 1C3 148,149,14A 14B	230,231,232, 233,234 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	330,331,332, 333,334 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6
3	Three system generation utility data sets and the three object program data sets (Note 2)	2305-2 2314 (or 2319 on Chan 1) 3330-1/3333-1 3330-11/3333-11 3340/3344 3350		1D0 130,131,132 133,134 150,151,152 153 158,159,15A 15B 1C0,1C1,1C2 1C3 148,149,14A 14B	230,231,232, 233,234 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	330,331,332, 333,334 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6	Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6 Note 6

- Notes:
1. DASD 3330/3333 Models 1 and 11, 3340 and 3350 are generated on channel 1 and accessed on channel 1, with channels 2 thru 4 as optional channels.
 2. The three system generation utility data sets and the three object program data sets do not require additional direct access devices if sufficient space is available on the volumes that contain the new system and the starter system.
 3. The 3138 and 3148 consoles use the 3158 console support (Display Mode).
 4. 3286-2 optional printer for S/370 138/148.
 5. 3138 and 3148 Console when IMPLed in Printer/Keyboard mode.
 6. See the addresses under channel 1; use only those addresses for sysgen.
 7. The DLIB Installation and Build process requires space equal and additional to the distribution library space. The spindle(s) available after DLIB installation and build may be used for the new system being generated.

Feature Support

The following features are supported by the Operating System/Virtual Storage 1. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use OS/VS1 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device.

PROCESSOR SPECIAL FEATURES

Feature	135	135-3	138	145	145-3	148
Advanced Control Program Support	N/A	**	**	1001	STD	STD
Conditional Swapping	1051	STD	STD	1051	**	**
Block Multiplexer Channel	1421	1425-6	STD	1421-4	1 STD	STD
Block Multiplexer Subchannels, Additional	N/A	N/A	N/A	N/A	1450	1450
Channel-to-channel	N/A	N/A	N/A	1850	1850	1850
Clock Comparator and CPU Timer	2001	STD	STD	2001	Pre-Req	STD
Direct Control	3274	3274	3274	3274	3274	3274
Extended Control Program Support	N/A	STD	STD	N/A	STD	STD
Extended Precision Floating Point	3840	Pre-Req	STD	3910	STD	STD
Floating Point Arithmetic	3900	STD	STD	3910	STD	STD
Multiplexer Subchannels, Additional	3905-7	3906-7	3906-7	4951-4	4953	4953
1401/1440/1460 Compatibility	4457	4457	4457	4457	4457	4457
1401, 1410/7010 Compatibility	N/A	N/A	N/A	4458	4458	4458
Integrated Communications Adapter	4640	4640	4640	N/A	N/A	N/A
2319 Integrated File Adapter	N/A	4650	N/A	N/A	N/A	N/A
3330/3340 File Adapter	4655	4655	4655	*	N/A	N/A
Integrated Storage Controls	N/A	N/A	N/A	4660*	4660	4660
Integrated Printer Adapter	4670, 2,7	4670, 2,7	4670, 2,7	N/A	N/A	N/A
OS/DOS Compatibility	STD	STD	STD	STD	STD	STD
Selector Channel	6981-2	N/A	N/A	6982-4	N/A	N/A
3210 Adapter	7844-5	7844	N/A	7844-5	7844-5	N/A
3215 Adapter	7855	7855	N/A	7855	7855	N/A
Integrated 3203-4 Printer Attachment	N/A	N/A	8075-6	N/A	N/A	8075-6
Two Channel Switch for ISC Word Buffer	N/A	N/A	N/A	8100*	8100	8100
	N/A	N/A	N/A	8810	Pre-Req	STD

* 3345 Models 3, 4, 5, available on 145.
 ** Insert PSW Key and Set PSW Key From Address, which are part of Advanced Control Program Support, are standard on these machines, but are called PSW Key Handling.
 *** These instructions are part of Advanced Control Program Support.

Feature	155II	158	165II	168	3031
Advanced Control Program Support	STD	STD	STD	STD	STD
Conditional Swapping	STD	STD	STD	STD	STD
Block Multiplexer Channel	1433-5	1433-5	N/A	N/A	N/A
Buffer Expansion	N/A	N/A	1432	1435	N/A
Channel-to-Channel	1850	1850	N/A	N/A	1850
Clock Comparator and CPU Timer	STD	STD	STD	STD	STD
Direct Control	3274	3274	N/A	N/A	3274
Extended Precision Floating Point	3700	3700	STD	STD	STD
Extended Channels	N/A	N/A	3850	3855	N/A
Floating Point Arithmetic	STD	STD	STD	STD	STD
1401/1440/1460 Compatibility	3950	3950	N/A	N/A	N/A
1401, 1410/7010 Compatibility	3950	3950	N/A	N/A	N/A
High Speed Multiply	N/A	N/A	4520	4525	N/A
Integrated Storage Controls	N/A	4650	N/A	4650	N/A
2nd Byte Multiplexer Channel	4990	4990	N/A	N/A	N/A
OS/DOS Compatibility	5450	5450	N/A	N/A	N/A
7070/7074 Compatibility	7117	7117	7117	7127	N/A
7080 Compatibility	N/A	N/A	7118	7128	N/A
709/7090/7094II Compat.	N/A	N/A	7119	7129	N/A
Staging Adapter for ISC	N/A	7220	N/A	7220	N/A
3213 Printer Attachment	N/A	7840	N/A	N/A	N/A
3210 Adapter	7844-5	N/A	N/A	N/A	N/A
3215 Adapter	7855	N/A	N/A	N/A	N/A
Two-Channel Switch for ISC	N/A	7905	N/A	7905	N/A
Extended Control Program Support	N/A	8750	N/A	N/A	STD

I/O Features

1052 Printer-Keyboard (see VTAM, TCAM and BTAM Terminals Supported)
 1287 Optical Reader (Models 1,2,3,4,5) :
 Supported: #3850 - Expanded Symbol Set
 #3945 - Farrington 7B Font
 #4470 - 1428 and ANSCS OCR Font
 #5300 - NCR Optical Type Font
 #5370 - Numeric Handwriting

#5479 - Optical Mark Reading
 1288 Optical Page Reader (Model 1) :
 Supported: #5370 - Numeric Handwriting
 #5479 - Optical Mark Reading
 1403 Printer (Models 2,3,7,N1) :
 Supported: #8640 - Universal Character Set
 #8641 - Universal Character Set
 1419 Magnetic Character Reader (Model 1) :
 Supported: #1445 - Batch Numbering
 #5739, #5741 - Program Control for Pocket Lights
 1442 Card Read Punch (Model N1) :
 Supported: #1532 - Card Image (for problem program use only)
 1442 Card Read Punch (Model N2) :
 Supported: #1531 - Card Image
 1443 Printer (Model N1) :
 Supported: #5558 - 24 Additional Print Positions
 2150 Console
 2250 Display Unit (Models 1,3)
 2260 Display Station (see VTAM, TCAM and BTAM Terminals Supported)
 2305 Fixed Head Storage (Models 1,2) :
 Required: 2835 Storage Control
 Not Supported: Model 2 on S/370-135
 2314 Direct Access Storage Facility (Model A1) :
 Supported: #8170 - Two-Channel Switch
 2319 Disk Storage
 2401 Magnetic Tape Unit (Models 1,2,3,4,5,6)
 2402 Magnetic Tape Unit:
 Supported: #3472 - Dual Density (800-1600 bpi)
 2403 Magnetic Tape Unit and Control:
 Supported: #3471 - Dual Density (800-1600 bpi)
 2415 Magnetic Tape Unit:
 Supported: #3471, #3472 - Dual Density (800-1600 bpi)
 2420 Magnetic Tape Unit (Models 5,7)
 2495 Tape Cartridge Reader
 2501 Card Reader (Models B1,B2) :
 Supported: #1531 - Card Image
 2520 Card Read Punch (Models A1,B1) :
 Supported: #1531 - Card Image
 2520 Card Punch (Models A2,A3,B2,B3) :
 Supported: #1531 - Card Image
 2540 Card Read Punch (Model 1) :
 Supported: #1531 - Card Image
 2596 Card Read Punch (Model 1)
 2671 Paper Tape Reader
 2740 Communication Terminal (Model 1) (see VTAM, TCAM and BTAM Terminals Supported)
 2741 Communication Terminal (see VTAM, TCAM and BTAM Terminals Supported)
 2780 Data Transmission Terminal (see VTAM, TCAM and BTAM Terminals Supported) :
 Supported: EBCDIC Transparency only
 2803,2804 Tape Control (Models 1,2,3) :
 Required: #3228, #3236 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended.)
 Supported: #7125-#7127, #7135 - 7-track Compatibility
 #7185 - 16 Drive Addressing
 #7900 - 2420 Attachment
 2816 Switching Unit (Model 1) :
 Supported: #1050-#1052, #1055, #2285, #2286, #4455, #6392, #6393 - Additional Switching
 2821 Control Unit (Models 1,2,3,5,6) :

- Supported: #1990 - Column Binary (for problem program use only)
#8637-#8639 - Universal Character Set Adapter
- 2835 Storage Control (Models 1,2) :
Supported: #8170,#8171 - Two Channel Switch
- 2844 Auxiliary Storage Control:
Supported: #8171 - Two Channel Switch
- 2860 Selector Channel (Models 1,2,3) :
Supported: #1850 - Channel-to-Channel Adapter
- 2870 Multiplexer Channel:
Not Supported: Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer subchannel. Magnetic tapes are supported on the selector subchannels.
Cross channel devices (2804 Tape Control, 2816 Switching Unit, 3803 Tape Control with communicator feature and either 2-control switch, 3-control switch or 4-control switch, 3803 Tape Control with #8100 Two-Channel Switch) attached between any 2870 selector subchannel and any other selector channel, or between any 2870 selector subchannel and a selector subchannel of a different 2870.
- 2880 Block Multiplexer Channel (Models 1,2) :
Supported: #7850,#7851 - Two Byte Interface
- 3066 System Console (Model 1)
- 3158 Console Function
- 3203 Printer (Model 4) :
Required: S/370 Models 138, 148
- 3210 Console Printer-Keyboard
- 3211 Printer (Model 1) :
Required: 3811 Printer Control Unit
Supported: #5554 - 18 Additional Print Positions
- 3213 Console Printer
- 3215 Console Printer-Keyboard
- 3275 Display Station (Models 1,2) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3277 Display Station (Models 1,2) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3284 Printer (Models 1,2)
- 3286 Printer (Models 1,2)
- 3287 Printer (Models 1,2) [supported as a 3284/3286]
- 3288 Printer (Model 2) (supported as a 3286-2)
- 3330 Disk Storage (Models 1,2,11) :
Required: 3333 Disk Storage and Control, or 3830 Storage Control
- 3333 Disk Storage and Control (Models 1,11) :
Supported: #8150 - String Switch
- 3340 Direct Access Storage (Models A2,B1,B2) :
Required: 3340 Model A2
Supported: #4301, 4302 Fixed Head Feature
#6201,#6202 - Rotational Position Sensing
#8150 - String Switch
- 3344 Direct Access Storage (Models B2,B2F)
- 3350 Direct Access Storage Facility (Models A2,A2F,B2,B2F,C2,C2F) :
Supported: #8150 - String Switch
- 3410 Magnetic Tape Unit (Models 1,2,3) :
Supported: #3211 - Single Density
#3221 - Dual Density
#6550 - Seven-Track Tape Unit
#7360 - S/370 Attachment
- 3411 Magnetic Tape Unit and Control (Models 1,2,3) :
Supported: #3211 - Single Density
#3221 - Dual Density
#6550 - Seven-Track Tape Unit
#7360 - S/370 Attachment
- 3420 Magnetic Tape Unit (Models 3,5,7) :
Supported: #3550 - Dual Density
#6407 - 7-track
#6631 - Single Density
- 3420 Magnetic Tape Unit (Models 4,6,8) :
Supported: #6420 - 6250 Density
#6425 - 6250/1600 Density
- 3505 Card Reader (Models B1,B2) :
Supported: #5450 - Optical Mark Read
#6555 - Selective Stacker
- 3525 Card Punch (Models P1,P2,P3) :
Supported: #1533 - Card Read
#5272 - Multiple Card Print
#8338 - Two-Line Card Print
- 3540 Diskette Input/Output Unit (Models B1,B2)
- 3741 Data Station (Model 2) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3741 Programmable Workstation (Model 4) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3767 Communication Terminal (supported as a 2740-1 or 2741) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3770 Data Communication System (supported as a 2770; 3776/3777 also as a 3780) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3780 Data Communications Terminal (Model 1) (see *VTAM, TCAM and BTAM Terminals Supported*)
- 3800 Printing Subsystem (Model 1) :
Supported: #1490 - Burster-Trimmed-Stacker
#5401 - 127 Character Generation Storage Positions
#8170 - Two Channel Switch
- 3803 Tape Control (Model 1) :
Supported: #1792 - Two-Control Switch
#1793 - Three-Control Switch
#1794 - Four-Control Switch
#3551 - Dual Density
#6408 - Seven-Track
#9071 - Communicator 1-2
#9073 - Communicator 3-4
- 3803 Tape Control (Model 2) :
Supported: #1792 - Two-Control Switch
#1793 - Three-Control Switch
#1794 - Four-Control Switch
#5310 - Nine-Track NRZI
#6320 - Seven-Track NRZI
#8100 - Two-Channel Switch
#9071 - Communicator 1-2
#9073 - Communicator 3-4
- 3811 Printer Control Unit (Models 1,2) :
Supported: #5553 - Additional (18) Print Positions
- 3830 Storage Control (Models 1,2,3) :
Supported: #8170 - Two-Channel Switch
#8171 - Two-Channel Switch, Additional
- 3851 Mass Storage Facility (Models A1,A2,A3,A4,B1,B2,B3,B4)
Supported: #4901, 4902 MSC Twin Port
#8171 - Two-Channel Switch
#8172 - Two-Channel Switch, Additional
- 3886 Optical Character Reader (Model 1) :
Supported: #3210 - Additional Data Storage
#4610 - Additional Instruction Storage
#4720 - Line Marking
#5360 - Numeric Handprinting
#6450 - Serial Numbering
- 3890 Document Processor (Models A1,A2,A3,A4,A5,A6) :
Supported: #5111 - Microfilming
#4666 - Item Number/Endorsing
- 1130 Computing System (see *VTAM, TCAM and BTAM Terminals Supported*)
System/3 (see *VTAM, TCAM and BTAM Terminals Supported*)
System/360 (see *VTAM, TCAM and BTAM Terminals Supported*)
System/370 (see *VTAM, TCAM and BTAM Terminals Supported*)
- Device Support**
The *Device Support Chart* shows all devices that are supported by OS/VS1 for system functions and/or non-TP access methods. (For other telecommunications devices see *VTAM, TCAM and BTAM Terminals Supported*). The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under OS/VS1 and their existence is not recognized by the control program.

Notes:

- 1) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
- 2) BSAM (device-dependent only).
- 3) The Selective Tape Listing Feature is not supported.
- 4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
- 5) Supported for read or punch, but not both simultaneously.
- 6) Model 1 only.
- 7) Multiple Requesting supported.
- 8) File Scan not supported.
- 9) Rotational Position Sensing supported (optional feature on 3340).
- 10) For message queues under TCAM.
- 11) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
- 12) Punch Feed Read is not supported.
- 13) As a workstation for RES.
- 14) Space Compression/Expansion is not supported.
- 15) Support shown is for 3330s or 3333s as virtual device types. If real 3330/3333s are included as part of 3851, see the 3330/3333 lines above.
- 16) With 3330/3333 as staging device, Rotational Position Sensing supported.
- 17) User Program Libraries only.
- 18) QSAM (device-dependent only).
- 19) Supported on Model 138.
- 20) Supported on Model 148.
- 21) Supported as a 3213 on Model 138 or 148.

Legend:**I/O Device Support Chart**

The following units to a maximum of 768 devices are supported at the Release 6.0 level by OS/VS1, for the indicated functions.

- C = Console
- G = Graphic Programming Support
- S = Sequential Access Methods
- I = Indexed Sequential Access Methods
- P = Basic Partitioned Access Method
- D = Basic Direct Access Method
- A = Virtual Storage Access Method
- X = Function Supported

DEVICE SUPPORT CHART

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1052 Printer-Keyboard	X		X			X			
1287 Optical Reader								X1	
1288 Optical Page Reader								X2	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X2	
1442 Card Read Punch	X5		X5			X4		X	
1442 Card Punch			X					X	
1443 Printer			X			X4		X	
2150 Console						X			
2250 Display Unit						X6	X		
2260 Display Station						X	X		
2305 Fixed Head Storage (Notes 7,8)	X9	X9		X	X9			X9	X9
2314 Direct Access Storage Facility (Notes 8,10)	X	X		X	X			X	X
2319 Disk Storage (Notes 8,10)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2415 Magnetic Tape Unit	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2495 Tape Cartridge Reader								X11	
2501 Card Reader	X		X			X4		X	
2520 Card Read Punch	X5		X5			X4		X5	
2520 Card Punch			X			X4		X	
2540 Card Read Punch	X12		X12			X4		X	
2596 Card Read Punch								X	
2671 Paper Tape Reader								X	
2740 Communication Terminal	X								
2741 Communication Terminal	X								
2770 Data Communication System	X13		X13						
2780 Data Transmission Terminal	X13		X13						
3066 System Console						X6			
3138 Console (Note 19)						X6			
3148 Console (Note 20)						X6			
3158 Console Function						X6			
3203 Printer			X			X4		X	
3210 Console Printer-Keyboard						X			
3211 Printer			X			X4		X	
3213 Console Printer						X			
3215 Console Printer-Keyboard						X			
3251 Display Station						X			
3275 Display Station						X			
3276 (supported as a 3277)						X3			
3277 Display Station						X			
3278 (supported as a 3277)						X3			
3284 Printer						X			
3286 Printer						X			
3286-2 Console Printer (Note 21)						X4			
3287-1, -2 Printer						X			
3288 Printer						X			
3330 Disk Storage (Notes 8,10)	X9	X9		X9	X			X9	X9
3333 Disk Storage and Control (Notes 8,10)	X9	X9		X9	X			X9	X9
3340 Direct Access Storage Facility (Notes 8,10)	X9	X9		X9	X9			X9	X9
3344 Direct Access Storage (Notes 8,10)	X9	X9		X9	X9			X9	X9
3350 DASD (Notes 8,10)	X9	X9		X9	X9			X9	X9
3410 Magnetic Tape Unit	X		X					X	
3411 Magnetic Tape Unit and Control	X		X					X	
3420 Magnetic Tape Unit			X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X5		X5			X4		X	
3540 Diskette I/O Unit	X		X						
3741 Data Station	X		X						
3741 Programmable Workstation	X		X						
3767 Communication Terminal	X								
3770 Data Communication System	X		X						
3777-2 Communication Terminal (as a S/360-20 MULTI-LEAVING Workstation)	X		X						
3780 Data Communications Terminal	X14		X14						
3790 Communication System	X		X						
3800 Printing Subsystem			X					X	
3851 Mass Storage Facility (Note 15)	X16				X16,17			X16	X16
3886 Optical Character Reader								X2	
3890 Document Processor								X18	
1130 Computing System	X13		X13						
System/3	X13		X13						
System/360	X13		X13						
System/370	X13		X13						
S/8100/DPCX Information System	X		X						
S/8100/DPPX RJE Workstation Facility	X		X						

VTAM, TCAM and BTAM Terminals Supported

VTAM, TCAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, TCAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does (do) support the terminal/feature is (are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, TCAM or BTAM may also function satisfactorily with VTAM, TCAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any

changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS LINES:

IBM TERMINALS

- 1030 Data Collection System on nonswitched lines: (TCAM,BTAM)
 - 1031 Input Station (Models A1,A2,A3,A4,A5,A6,A7) :
 - Supported: Attachment of 1031,1033,1034,1035
 - 1031 Input Station (Models B1,B2,B3,B4,B5,B6,B7) :
 - Supported: Attachment of 1035
 - 1033 Printer
 - 1034 Card Punch
 - 1035 Badge Reader
- 1050 Data Communication System on switched or nonswitched lines:
 - 1051 Control Unit (Models 1,2) :
 - Supported: Attachment of 1052,1053,1054,1055,1056,1057,1058,1092,1093
 - #1313 - Automatic EOB
 - #4795 - Line Correction
 - #4796 - Line Correction Release
 - #5465 - Open Line Detection
 - #6100 - Receive Interrupt
 - #9698 - Text Time-Out Suppression
 - #9700 - Transmit Interrupt
 - 1052 Printer-Keyboard (Models 1,2) :
 - Supported: #1313 - Automatic EOB
 - #9567, #9597 - PTTC/BCD Code
 - #9571, #9591 - PTTC/EBCD Code
 - 1053 Printer (Model 1) :
 - Supported: #9567, #9597 - PTTC/BCD Code
 - #9571, #9591 - PTTC/EBCD Code
 - 1054 Paper Tape Reader (Model 1)
 - 1055 Paper Tape Punch (Model 1)
 - 1056 Card Reader (Models 1,3)
 - 1057 Card Punch (Model 1)
 - 1058 Printing Card Punch (Models 1,2)
 - 1092 Programmed Keyboard (Models 1,2)
 - 1093 Programmed Keyboard (Models 1,2)
- 2848 Display Control (Models 1,2,3) on nonswitched lines: (TCAM,BTAM)
 - Supported: Attachment of 2260,1053
 - 3901 - Extended Cursor Control
 - #4787 - Line Addressing
 - #5340 - Non-Destructive Cursor
 - #5341 - Non-Destructive Cursor Adapter
 - Not Supported: Attachment of 1053 (TCAM)
 - 2260 Display Station (Models 1,2) :
 - Supported: #3606 - Extended Cursor Control, Alpha-meric Keyboard
 - #4766 - Alphameric Keyboard
 - Not Supported: Tab feature of #3606
 - 1053 Printer (Model 4) : (BTAM)
 - Supported: #9567, #9597 - PTTC/BCD Code
 - #9571, #9591 - PTTC/EBCD Code
- 2845 Display Control (Model 1) on nonswitched lines: (TCAM,BTAM)
 - Supported: Attachment of 2265,1053
 - #3301 - Destructive Cursor
 - #4801 - Line Addressing
 - Not Supported: Attachment of 1053 (TCAM)
 - #7801 - Tab
- 2265 Display Station (Model 1) :
 - Supported: #4766 - Alphameric Keyboard
- 1053 Printer (Model 4) : (BTAM)
 - Supported: #9567, #9597 - PTTC/BCD Code
 - #9571, #9591 - PTTC/EBCD Code
- 2740 Communication Terminal (Model 1) on switched or nonswitched lines:
 - Supported: #3255 - Dial Up
 - #6114 - Record Checking
 - #7479 - Station Control
 - #8028 - Transmit Control
 - 8301 - 2760 Attachment (TCAM,BTAM)
 - #9567, #9597 - PTTC/BCD Code
 - #9571, #9591 - PTTC/EBCD Code
 - Correspondence Code
- 2740 Communication Terminal (Model 2) on nonswitched lines:
 - Supported: #1495, #1496 - Buffer Expansion
 - #1499 - Buffer Receive
 - #6114 - Record Checking
 - #9571, #9591 - PTTC/EBCD Code
- 2741 Communication Terminal (Model 1) on switched or nonswitched lines:
 - Supported: #3255 - Dial Up
 - #4708 - Receive Interrupt

- #7900 - Transmit Interrupt
- #9567, #9597 - PTTC/BCD Code
- #9571, #9591 - PTTC/EBCD Code
- Correspondence Code

- 2760 Optical Image Unit (Model 1) on switched or nonswitched lines (TCAM,BTAM)
- 3767 Communication Terminal (Models 1,2,3) (supported as a 2740-1) on switched or nonswitched lines:
 - Required: #7111 - 2740-1 Start/Stop
 - Supported: #9560 - Station Control
- 3767 Communication Terminal (Models 1,2,3) (supported as a 2740-2) on nonswitched lines:
 - Required: #7112 - 2740-2 Start/Stop
- 3767 Communication Terminal (Models 1,2,3) (supported as a 2741) on switched or nonswitched lines:
 - Required: #7113 - 2741 Start/Stop
- 5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines:
 - Required: #1525 - Communications Adapter
- CMCST (Communicating Magnetic Card Selectric® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:
 - Supported: The CMCST is functionally equivalent to a 2741 with Dial Up, Receive Interrupt and Transmit Interrupt

IBM PROCESSOR AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

- System/7 (supported as a 2740-1 with checking) on switched or nonswitched lines:
 - Required: #1610 - Asynchronous Communication Control

Non-IBM TERMINALS

- AT&T 83B3 Line Control Type on nonswitched lines
- CPT-TWX (Model 33/35) Line Control Type on switched lines
- World Trade Telegraph on nonswitched lines
- WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM TERMINALS

- 2790 Data Communication System on switched or nonswitched lines: (TCAM,BTAM)
 - 2715 Transmission Control Unit (Model 2) :
 - Required: 2740
 - Supported: Attachment of 2798,1035,1053
 - #3801 - Expanded Capability
 - #4850 - Local 2740 Adapter
 - #9401 - Point-to-Point Nonswitched
 - #9402 - Point-to-point Switched
 - #9403 - Multipoint Nonswitched
 - 2740 Communication Terminal (Model 1)
 - 2798 Guidance Display Unit (Model 1)
 - 1035 Badge Reader (Model 1)
 - 1053 Printer (Model 1)
- 2770 Data Communication System on switched or nonswitched lines:
 - 2772 Multipurpose Control Unit:
 - Required: #5010 - Multipoint Data Link Control (VTAM)
 - Supported: Attachment of 0050,0545,1017,1018,1053,1255,2203,2213,2265,2502,5496
 - #1340 - Automatic Answering
 - #1490 - Buffer Expansion (256 bytes)
 - #1491 - Buffer Expansion Additional (512 bytes)
 - #1910 - Conversational Mode
 - #3250 - Display Format Control
 - #3650 - EBCDIC Transparency
 - #3860 - 144 Character Print Line
 - #4610 - Identification
 - #4690 - Keyboard Correction
 - #5010 - Multipoint Data Link Control (TCAM,BTAM)
 - #5890 - Horizontal Format Control
 - #6555 - Space Compression/Expansion
 - #7705 - Synchronous Clock
 - #7950 - Transmit-Receive-Monitor-Print
 - #9140 - Extended Re-Entry
 - #9402 - Line Termination - 2-wire
 - #9761 - Transmission Code EBCDIC
 - #9762 - Transmission Code ASCII
 - #9936 - Immediate WACK

- 0050 Magnetic Data Inscrber
- 0545 Output Punch (Models 3,4)
- 1017 Paper Tape Reader (Models 1,2)
- 1018 Paper Tape Punch (Model 1)
- 1053 Printer (Model 1)
- 1255 Magnetic Character Reader
- 2203 Printer (Models A1,A2) :
Supported: #5558 - Print Positions, 24 Additional
- 2213 Printer (Models 1,2)
- 2265 Display Station (Model 2)
- 2502 Card Reader (Models A1,A2)
- 5496 Data Recorder

- 2780 Data Transmission Terminal on switched or nonswitched lines:
Supported: #1340 - Automatic Answering
#1350 - Automatic Turnaround
#3401 - Dual Communication Interface
#5010 - Multiple Record Transmission
#5020 - Multipoint Line Control
#5820 - 120 Character Print Line
#5821 - 144 Character Print Line
#6400 - Selective Character Set
#7850 - Terminal Identification
#8030 - EBCDIC Transparency
#9150 - Extended Retry Transmission
#9761 - ASCII Transmission Code
#9762 - EBCDIC Transmission Code

- 2980 General Banking System on nonswitched lines:
2972 Station Control Unit (Model 8 - RPQ 858160, Model 11 - RPQ 858231) :
Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer
- 2980 Teller Station (Model 1 - RPQ 835504, Model 4 - RPQ 858147)
- 2980 Administrative Station (Model 2 - RPQ 835505)
- 2971 Remote Control Unit (Model 3 - RPQ 858144)

- 3270 Information Display System on nonswitched lines:
3271 Control Unit (Models 1,2) :
Supported: Attachment of 3277,3284,3286,3287,3288
#1550 - Copy
#9761 - EBCDIC Code
- 3274 Control Unit (model 1C) [supported as a 3271]:
Supported: Attachment of 3277,3278,3284,3286,3287,3288,3289
- 3276 Control Unit Display Station (Models 1,2,3,4) [supported as a 3271]:
Supported: Attachment of 3278, 3287
#6350 - Selector Light Pen
#9082 - EBCDIC Character Set
- 3277 Display Station (Models 1,2) :
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4) [supported as 3277]:
Supported: #6350 - Selector Light Pen
#9082 - EBCDIC Character Set
- 3284 Printer (Models 1,2) :
Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2) :
Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286 attached to 3271-1 or -2]:
Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) (supported as a 3286-2) :
Supported: #9089 - EBCDIC Character Set
- 3289 Printer (Models 1,2) [supported as a 3286-2]

- 3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,TCAM,BTAM)
3275 Display Station (Models 1,2) :
Supported: Attachment of 3284
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code
- 3284 Printer (Model 3) :
Supported: #9089 - EBCDIC Character Set

- 3650 Programmable Store System (Supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (Models A25, B25, A75, B75, C75 D75)
Supported: Attachment of 3653, 3663, 3657, 3275, 3659, 3669, 3784
- 3653 Point of Sale Terminal (Model 1)
- 3663 Supermarket Terminal (Model 1P, 2 and 3P)
- 3657 Ticket Unit (not available on 3651 Models A25 and B25)
- 3275 Display Station (Model 3)
Supported: Attachment of 3284
- 3284 Printer (Model 3)
- 3659 Remote Communications Unit (Model 1)
Required: 2400 BPS non-switched line
- 3784 Printer (Model 1) not available on 3651 Models A25 and B25.

- 3669 Remote Communications Unit. Not available on 3651 Model A25 and B25.

- 3660 Supermarket Scanning System (supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (Models A60,B60) :
Supported: Attachment of 3663,3669
- 3663 Supermarket Terminal (Models 1,2) :
Supported: Attachment of 3666
- 3666 Checkout Scanner (Model 1)
- 3669 Store Communications Unit (Model 1)

- 3660 Supermarket Key-Entry System (supported as a S/3) on switched lines: (BTAM)
3661 Store Controller:
Supported: Attachment of 3663
- 3663 Supermarket Terminal (Models 1,2)

- 3670 Brokerage Communication System on nonswitched lines: (TCAM)
3671 Shared Terminal Control Unit (Model 1) :
Supported: Attachment of 3672,3673,3674
#3250 - Display Expansion
- 3672 Executive Console (Model 1)
- 3673 Data Display (Model 1)
- 3674 Printer-KeyBoard (Model 1)

- 3735 Programmable Buffered Terminal (Model 1) on switched or nonswitched lines:
Supported: Attachment of 5496,3286
5010 - Multipoint Data Link Control
#9761 - EBCDIC Code
#9762 - ASCII Code
- 3286 Printer (Model 3)
- 5496 Data Recorder (Model 1)

- 3741 Data Station (Model 2) on switched or nonswitched lines:
Supported: Attachment of 0129,3713,3715,3717
#1680 - Expanded Communications
#1685 - Expanded Communications/
Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
- 3713 Printer (Model 1)
- 3715 Printer (Models 1,2)
- 3717 Printer (Model 1)

- 3741 Programmable Workstation (Model 4) on switched or non-switched lines:
Supported: Attachment of 0129,3713,3715
#1680 - Expanded Communications
#1685 - Expanded Communications/
Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
- 3713 Printer (Model 1)
- 3715 Printer (Models 1,2)

- 3747 Data Converter (Model 1) on switched or nonswitched lines:
Supported: #1660 - Communications Adapter

- 3770 Data Communication System (supported as a 2770) on switched or nonswitched lines:
3771 Communication Terminal (Models 1,2,3) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3773 Communication Terminal (Models 1,2,3,P1,P2,P3) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3774 Communication Terminal (Models 1,2,P1,P2) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3775 Communication Terminal (Models 1,P1) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3776 Communication Terminal (Models 1,2) (supported as a 2772/3780) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3777 Communication Terminal (Model 1) (supported as a 2772/3780) :
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint

Supported: #1201 - ASCII Code
3777 Communication Terminal (Model 2) (supported as a S/360-20 MULTI-LEAVING Workstation):
Required: #3701 - EIA Interface

3780 Data Communications Terminal (Model 1) (supported as a 2772 without component select) on switched or nonswitched lines:
Supported:

#3601 - EBCDIC Transparency
#5010 - Multipoint Data Link Control
#5701 - Print Positions, Additional
#9761 - EBCDIC Code

5110 Computer (supported as a 2770) on switched and nonswitched lines:

Required: #2074 BSCA
Supported: Attachment of a 5103, 5106, 5114
The 5110 emulates the following 2770

features:
Auto Answer
Buffer expansion additional (512)
EBCDIC Transparency
144 Character print line
Identification
Multipoint Data Link Control (TCAM, BTAM)
Horizontal Format Control
Space Compression/expansion
Synchronous Clock
Transmission Code EBCDIC

5275 Direct Numerical Control Station (Model 1) [supported as a 3275 with EBCDIC Code and EBCDIC Character Set] on switched lines (BTAM) or nonswitched lines (VTAM, TCAM; BTAM).

IBM PROCESSOR AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

1130 Computing System on switched or nonswitched lines: (TCAM,BTAM)

1131 Central Processing Unit:
Required: #7690 - Synchronous Communications Adapter

1800 Data Acquisition and Control System on switched or nonswitched lines: (TCAM,BTAM)

1826 Data Adapter Unit:
Required: #7550 - Communication Adapter

Series/1 (supported as a System/3) on switched or nonswitched lines: (BTAM)

4953 or 4955 Processor:
Required: #2074, 2075, or 2094 Binary Synchronous Communications Adapter

System/3 on switched or nonswitched lines:

5406 or 5410 or 5415 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/7 (supported as a S/3) on switched or nonswitched lines:

5010 Processor Module:
Required: #2074 - Binary Synchronous Communications Adapter

System/32 (supported as a S/3) on switched or nonswitched lines:

5320 System Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/34 (supported as a S/3) on switched or nonswitched lines:

5340 System Unit:
Required: #2500 or 3500 - Communications Adapter Feature

System/360 Model 20 on switched or nonswitched lines: (TCAM,BTAM)

2020 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter

System/360 Models 25,30,40,50,65,65MP,67(65mode),75,85,91,195 on switched or nonswitched lines: (TCAM,BTAM)

Processing Unit:
Required: #4580 - Integrated Communications Attachment, or
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in emulation mode, or
3705-I Communications Controller in emulation mode, or
3705-II Communications Controller in emulation mode

All virtual storage S/370 Processor on switched or nonswitched lines:

Processing Unit:
Required:

#4640 - Integrated Communications Adapter (TCAM,BTAM), or
2701 Data Adapter Unit (TCAM,BTAM), or
2703 Transmission Control (TCAM,BTAM), or
3704 Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM), or
3705-I Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM), or
3705-II Communications Controller in network control (VTAM,TCAM) or emulation mode (TCAM,BTAM)

8100 with DPPX on nonswitched lines: (BTAM, TCAM, VTAM)

Required: Refer to 8100 sales pages for required features and for Program Products supported.

SDLC LINES:

COMMUNICATIONS CONTROLLERS

3704 Communications Controller in network control mode (VTAM,TCAM)

3705-I Communications Controller in network control mode (VTAM,TCAM)

IBM TERMINALS

3270 Information Display System on nonswitched lines: (VTAM,TCAM)

3271 Control Unit (Models 1,1,2):
Supported: Attachment of 3277,3284,3286,3287,3288
#1200 - ASCII Code
#1550 - Copy
#9761 - EBCDIC Code

3277 Display Station (Models 1,2):
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set

3284 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set

3286 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set

3287 Printer (Models 1,2) [supported as a 3284 or 3286 attached to 3271-11 or -12]

Supported: #9082 - EBCDIC Character Set

3288 Printer (Model 2) (supported as a 3286-2):
Supported: #9089 - EBCDIC Character Set

3275 Display Station (Models 1,1,2):
Supported: Attachment of 3284
#1200 - ASCII Code
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code

3284 Printer (Model 3):
Supported: #9089 - EBCDIC Character Set

3270 Information Display System on switched and nonswitched lines (VTAM) and on nonswitched lines only (TCAM/NCP Direct) [Supported as a 3790 with Configuration Support #9165]:

3276 Control Unit Display Station (Models 11,12,13,14):
Supported: Attachment of 3278, 3287
#6350 - Selector Light Pen
#9082 - EBCDIC Character Set

3278 Display Station (Models 1,2,3,4) [Supported as 3277]:
Supported: #6350 - Selector Light Pen
#9082 - EBCDIC Character Set

3287 Printer (Models 1,2) [Supported as a 3284 or 3286]:
Supported: #9082 - EBCDIC Character Set

3600 Finance Communication System on switched or nonswitched lines: (VTAM,TCAM)

3601 Controller (Models 1,2A,2B,3A,3B):
Supported: Attachment of 3603,3604,3606,3608,3610, 3611,3612,3614,3615,3618

3602 Controller (Models 1A,1B):
Supported: Attachment of 3603,3604,3606,3608,3610, 3611,3612,3614,3615,3618

3603 Terminal Attachment Unit (Model 1, 2):
3604 Keyboard Display (Models 1,2,3,4,5,6)
3606 Financial Services Terminal (Models 1,2)

3608 Printing Financial Services Terminal (Models 1,2)
3610 Document Printer (Models 1,2,3,4,5,12,13)
3611 Passbook Printer (Models 1,2)

3612 Passbook and Document Printer (Models 1,2,3,12,13)
3618 Administrative Line Printer (Model 1)

3614 Consumer Transaction Facility (Models 1,2,11,12):
Required: When attached to a 3601 or 3602 3601 or 3602 application programs

Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601,3602.

3615 Administrative Terminal Printer (Models 1,2)

3624 Consumer Transaction Facility (Models 1,2,11,12) :
Required: When attached to a 3601 or 3602, 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601, 3602.

3630 Plant Communication System on switched or non-switched lines (VTAM, TCAM)

3631 Controller (Models 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646,3842, 7430 (RPQ)

3632 Controller (Models 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646,3842, 7430 (RPQ)

3604 Keyboard Display Terminal (Model 6)

3641 Reporting Terminal (Models 1,2)

3642 Encoder Printer (Models 1, 2)

3643 Keyboard Display (Models 2,3,4)

3644 Automatic Data Unit (Model 1)

3646 Scanner Control Unit (Model 1)

3842 Loop Control Unit (Model 1)

7430 Document Printer (RPQ)

3650 Programmable Store System on switched or non-switched lines: (VTAM, TCAM via VTAM)

3651 Store Controller (Models A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3653, 3663, 3657, 3275, 3659, 3669, 3784

3653 Point of Sale Terminal (Model 1)

3663 Supermarket Terminal (Model 1P, 2 and 3P)

3657 Ticket Unit (Not available on 3651 Models A25 and B25)

3275 Display Station (Model 3)

Supported: Attachment of 3284

3284 Printer (Model 3)

3659 Remote Communications Unit (Model 1)

Required: 2400 BPS nonswitched line

3784 Printer (Model 1) not available on 3651 Model A25 and B25

3669 Remote Communications Unit (Model 1) not available on 3651 Model A25 and B25

3650 Retail Store System on switched or nonswitched lines: (VTAM,TCAM)

3651 Store Controller (Models A50,B50) :
Supported: Attachment of 3653,3657,3275,3659,3784

3653 Point of Sale Terminal

3657 Ticket Unit

3275 Display Station (Model 3) :

Supported: Attachment of 3284

3284 Printer (Model 3)

3659 Remote Communications Unit (Model 1)

3784 Printer (Model 1)

3660 Supermarket Scanning System on switched lines: (VTAM)

3651 Store Controller (Models A60,B60) :

Supported: Attachment of 3663,3669

3663 Supermarket Terminal (Models 1,2) :

Supported: Attachment of 3666

3666 Checkout Scanner

3669 Store Communication Unit (Model 1)

3660 Supermarket Key-Entry System on switched lines: (VTAM)

3661 Store Controller:

Supported: Attachment of 3663

3663 Supermarket Terminal (Models 1,2)

3730 Distributed Office Communication System on switched and nonswitched lines (VTAM and TCAM/NCP Direct).

3791 Controller, Model 11C, 12A or 12B with: SDLC with clock (#6301) or SDLC without clock (#6302 or 6303), and required modem

3732 Text Display Station

3736 Printer

3767 Communication Terminal (Models 1,2,3) on switched or nonswitched lines: (VTAM,TCAM)

Supported: SDLC adapter provided unless one of the Start/Stop features are specified #1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM,TCAM)

3771 Communication Terminal (Models 1,2,3) :

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code

3773 Communication Terminal (Models 1,2,3,P1,P2,P3) :

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code

3774 Communication Terminal (Models 1,2,P1,P2) :

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code

3775 Communication Terminal (Models 1,P1) :

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code

3776 Communication Terminal (Models 1,2) :

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code

3776 Communication Terminal (Models 3,4) [VTAM]:

Supported: #1201 - ASCII Code

3777 Communication Terminal (Model 1) :

Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code

3777 Communication Terminal (Model 3) [VTAM]:

Supported: #1201 - ASCII Code

3790 Communication System on switched or nonswitched lines (VTAM,TCAM/NCP)

8100/DPCX Information System on switched or nonswitched lines (VTAM, TCAM/NCP)

IBM PROCESSOR AS TERMINALS

System/32 (supported as a 3770) on switched or nonswitched lines: (VTAM,TCAM)

5320 System Unit:

Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Link Control

System/34 (supported as a 3770) on switched or nonswitched lines (VTAM) : 5340 System Unit:

Required: #2500 and 3500 Communications Adapter Feature

8100 with DPPX on switched or nonswitched lines (TCAM,VTAM)

Required: Refer to 8100 sales pages for required features and Program Products supported.

LOCAL ATTACHMENT

Transmission Control Units and Communications Controllers

Integrated Communications Adapter of S/370 Model 135: (TCAM,BTAM)

Required: #4640 - Integrated Communications Adapter

Supported: EBCDIC Code is a standard feature

#9763-#9780 - Transparency

#9681-#9688 - ASCII Code

#9689-#9696 - 6-bit Transcode

2701 Data Adapter Unit on local channel: (TCAM,BTAM)

Supported: #1302, #1303, #1314 - Autocall

#3455 - Dual Code

#3463-#3465 - Dual Communication Interface

#8029 - Transparency

#9060 - EBCDIC Code

#9061 - ASCII Code

#9062 - 6-bit Transcode

2702 Transmission Control Unit on local channel: (TCAM,BTAM)

Supported: #1290 - Autocall

#1319 - Autopoll

#8055 - 2741 Break

2703 Transmission Control Unit on local channel: (TCAM,BTAM)

Supported: #1340, #1341 - Autocall

#7715 - EBCDIC Code

#7716 - ASCII Code

#7717 - 6-bit Transcode

#8055 - 2741 Break

#9100 - Transparency for ASCII

2715 Transmission Control Unit (Model 1) on local channel: (TCAM,BTAM)

Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:

Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705

EP/VS (TCAM,BTAM)

NCP/VS (VTAM,TCAM)

PEP

#8002 - Two-Channel Switch (VTAM,TCAM)

LOCAL TERMINALS

2848 Display Control (Models 1,2,3) on local channel: (TCAM)

Supported: Attachment of 2260,1053

#3901 - Extended Cursor Control

#4787 - Line Addressing

- #5340 - Non-Destructive Cursor
- #5341 - Non-Destructive Cursor Adapter
- Not Supported: Attachment of 1053
- 2260 Display Station (Models 1,2) :
- Supported: #3606 - Extended Cursor Control, Alpha-
 meric Keyboard
- Not Supported: Tab feature of #3606
- 2790 Data Communication System on local channel: (TCAM,BTAM)
- 2715 Transmission Control Unit (Model 1) :
- Supported: Attachment of 2740,2791,2793
- #3801 - Expanded Capability
- #4850 - Local 2740 Adapter
- Not Supported: #8110 - Two Processor Switch
- 2740 Communication Terminal (Model 1)
- 2791 Area Station (Models 1,2) :
- Supported: Attachment of 1035,2795,2796,2797,2798,
 1053
- 1035 Badge Reader (Model 1)
- 2795 Data Entry Unit (Model 1)
- 2796 Data Entry Unit (Model 1)
- 2797 Data Entry Unit (Model 1)
- 2798 Guidance Display Unit (Model 1)
- 1053 Printer (Model 1)
- 2793 Area Station (Model 1) :
- Supported: Attachment of 2795,2796,2797,2798,1053
- 2795 Data Entry Unit (Model 1)
- 2796 Data Entry Unit (Model 1)
- 2797 Data Entry Unit (Model 1)
- 2798 Guidance Display Unit (Model 1)
- 1053 Printer (Model 1)
- 3270 Information Display System on local channel:
- 3272 Control Unit (Models 1,2) :
- Supported: Attachment of 3277,3284, 3286,3287,3288
- 3277 Display Station (Models 1,2) :
- Supported: #6350 - Selector Light-Pen
- #9089 - EBCDIC Character Set
- 3284 Printer (Models 1,2) :
- Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2) :
- Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286 attached
to 3272-1 or -2]
- Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) (supported as a 3286-2) :
- Supported: #9089 - EBCDIC Character Set
- 3270 Information Display System - on local channel: (Supported as a
3272)
- 3274 Control Unit (Model 1B)
- Supported: Attachment of 3277,3278,3284,3286,
 3287,3288,3289
- 3277 Display Station (Models 1,2)
- Supported: #6350 - Selector Light Pen
- #9089 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4) [Supported as 3277]
- Supported: #6350 - Selector Light Pen
- #9082 - EBCDIC Character Set
- 3284 Printer (Models 1,2)
- Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2)
- Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [Supported as a 3284 or 3286]
- Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) [Supported as a 3286-2]
- Supported: #9089 - EBCDIC Character Set
- 3289 Printer (Models 1,2) [Supported as a 3286-2]
- 3270 Information Display System on local channel: (VTAM, TCAM thru
VTAM) [Supported as 3790 with Configuration Support #9165]
- 3274 Control Unit (Model 1A)
- Supported: Attachment of 3277,3278,3284,3286,3287,
 3288,3289
- 3277 Display Station (Models 1,2)
- Supported: #6350 - Selector Light Pen
- #9089 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4)
- Supported: #6350 Selector Light Pen
- #9082 EBCDIC Character Set
- 3284 Printer (Models 1,2)
- Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2)
- Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [Supported as a 3284 or 3286]
- Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) [Supported as a 3286-2]
- Supported: #9089 - EBCDIC Character Set
- 3289 Printer (Models 1,2) [Supported as a 3286-2]
- 3730 Distributed Office Communication System on local channel
(VTAM)
- 3791 Controller, Model 11C, 12A or 12B with: Local Channel
Attachment (#1515)
- 3732 Text Display Station
- 3736 Printer
- 3790 Communication System on local channel (VTAM,TCAM)
- 7770 Audio Response Unit (Model 3) on local channel (TCAM)

Legend:
(VTAM) = VTAM only
(TCAM) = TCAM only
(BTAM) = BTAM only

TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (f)	TCAM or BTAM via EP/VS (g)	via 270X (h)	via M135 ICA	RES RTAM
SS Lines:							
1031				X	1,2,3		
1051	X	X	X	X	1,2,3	X	
2260				X	1	X	
2265				X	1	X	
2740-1,-2	X	X	X	X	1,2,3	X	
2741	X	X	X	X	1,2,3	X	
2760				X	1,2,3	X	
3767-1,-2 (2740-1)	X	X	X	X		X	
3767-1,-2 (2740-2)	X	X	X	X	1	X	
3767-3 (2740-2)	X	X	X	X	1		X
3767-1,-2 (2741)	X	X	X	X		X	
5100 (2741)	X	X	X	X		X	
5110 (2741)	X	X	X	X		X	
CMCST (2741)	X	X	X	X	1,2,3	X	
S/7 (2740-1)	X	X	X	X	1,2,3	X	
AT&T 83B3 or WU 115A							
Line Control Type	X	X	X	X	1,2,3		
CPT-TWX (M33/35)							
Line Control Type	X	X	X	X	1,2,3	X	
WT Telegraph	X	X	X	X	1,2,3		
BSC Lines:							
2715-2			X	X	1,3	X	
2772	X	X	X	X	1,3	X	X
2780	X	X	X	X	1,3	X	X
2972-8,-11	X	X	X	X (B)	1,3 (B)	X (B)	
3271-1,-2	X	X	X	X	1,3	X	
3274-1C (3271-1,-2)	X	X	X	X	1,3	X	X
3275-1,-2	X	X	X	X	1,3	X	
3276 (3276 (3271-1,-2))		X	X	X	1,3	X	X
3651-A25,-B25,-A75							
B75,C75,D75					6/79 (B)	6/79 (B)	
3651-A60,-B60 (S/3)				X (B)		X (B)	
3661 (S/3)				X (B)		X (B)	
3670				X (T)	1,3 (T)	X (T)	
3735	X	X	X	X	1,3	X	
3741-2,-4	X	X	X	X	1,3	X	X
3747	X	X	X	X	1,3	X	
3771-1,-2,-3 (2772)	X	X	X	X	1	X	X
3773-1,-2,-3 (2772)	X	X	X	X	1	X	X
3773-P1,-P2,-P3 (2772)	X	X	X	X	1	X	
3774-1,-2 (2772)	X	X	X	X	1	X	X
3774-P1,-P2 (2772)	X	X	X	X	1	X	X (i)
3775-1 (2772)	X	X	X	X	1	X	X
3775-P1 (2772)	X	X	X	X	1	X	X (i)
3776-1,-2(2772/3780)	X	X	X	X	1	X	X
3777-1 (2772/3780)	X	X	X	X	1	X	X
3777-2 (S/360-20)							X
5275 (3275-1,-2)	X	X	X	X	1		
3780 (2772)	X	X	X	X	1,3	X	X
5110 (2772)			X	X		X	X
1131			X	X	1,3	X	X
1826			X	X (B)	1,3 (B)	X (B)	
Series/1 (as S/3)				X (B)	1 (B)		
S/3	X	X	X	X	1,3	X	X
S/7 (S/3)	X	X	X	X	1,3	X	
S/32 (S/3)	X	X	X	X	1,3	X	X
S/34 (S/3)	X	X	X	X	1,3	X	X
S/360-20			X	X	1,3	X	X
S/360 (b)			X	X	1,3	X	X
S/370 (b)	X	X	X	X	1,3	X	X
S/8100/DPPX(j)	8/79		8/79	8/79	8/79	8/79	8/79
					(1,3)		

TERMINAL SUPPORT CHART 1 - cont'd

SDLC Lines:	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (T)	RES VTAM	
3704 Remote	X				
3705-I Remote	X				
3271-11,-12	X	X	X		
3274-1C (3791)	X	X	X		
3275-11,-12	X	X	X		
3276 (3791)	X	X			
3601	X	X	X (d)		
3602	X	X	X (d)		
3614	X	X	X		
3624	X (j)	X (j)			
3631	X				
3632	X				
3651-A25,B25,A75 B75,C75,D75	6/79	6/79			
3651-A50,-B50	X	X			
3651-A60,-B60	X				
3661	X				
3767-1,-2,-3	X	X	X		
3771-1,-2,-3	X	X	X	X	
3773-1,-2,-3	X	X	X	X	
3773-P1,-P2,-P3	X	X	X		
3774-1,-2	X	X	X	X	
3774-P1,-P2	X	X	X		
3775-1	X	X	X	X	
3775-P1	X	X	X		
3776-1,-2	X	X	X	X	
3776-3,-4	X			X	
3777-1	X	X	X	X	
3777-3	X			X	
3791	X	X	X	X	
3791(for 3730)	1/80	-	1/80	1/80(k)	
8130/DPCX -A21,-A23	8/79	8/79	8/79	8/79	
8140/DPCX-A31 -A33,-A51,-A53	8/79	8/79	8/79	8/79	
S/32 (3770)	X	X	X	X	
S/34 (3770)	X	X	X	X	
S/8100/DPPX(j)	8/79		8/79	8/79	
Local Channel Attach	VTAM (c)	TCAM via VTAM (c)	TCAM	BTAM	RES VTAM
ICA, TCUs, Local Communications Controllers:					
ICA			X	X	
2701			X	X	
2702			X	X	
2703			X	X	
2715-1			X	X	
3704 (EP/VS)			X	X	
3704 (NCP/VS)	X	X	X		
3705-I (EP/VS)			X	X	
3705-I (NCP/VS)	X	X	X		
3705-II (EP/VS)			X	X	
3705-II (NCP/VS)	X	X	X		
Local Terminals:					
2260			X		
3272-1,-2	X	X	X	X	
3274-1A (3791)	X				
3274-1B (3272-2)	X	X	X	X	X
3791	X (e)	X			X
3791(for 3730)	1/80	-	-	-	1/80(k)
7770-3			X		

- 115-168MP and 3031 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.
- (c) OS/VS1 Release 3.1 or later.
 - (d) Available with TCAM NCP/VS Direct.
 - (e) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s, and precludes concurrent operation of IBM 3704/3705 or IBM 3272 controllers through VTAM or TCAM through VTAM.
 - (f) OS/VS1 Release 3.0 only, or the current OS/VS1 release when TCAM direct NCP/VS support becomes available in July, 1977.
 - (g) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
 - (h) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.
 - (i) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).
 - (j) Nonswitched support only.
 - (k) Concurrent 3730-3790 systems only.

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- X = supported now
- (date) = date when support will be available.

Notes:

- (B) BTAM only.
- (T) TCAM only.
- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1".
- (b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. S/370 Models

TERMINAL SUPPORT CHART 2

Remote Attach (a)	Communications Code		Communication Network		
	EBCDIC norm	ASCII trans	sw	nonsw	MP
SS Lines:					
1031	-	-	-	-	X
1051	-	-	-	X	X
2260	-	-	-	-	X
2265	-	-	-	-	X
2740-1	-	-	-	X	X
2740-2	-	-	-	-	X
2741	-	-	-	X	X
2760	-	-	-	X	X
3767-1,-2 (2740-1)	-	-	-	X	X
3767-1,-2,-3(2740-2)	-	-	-	-	X
3767-1,-2 (2741)	-	-	-	X	X
5100 (2741) (b)	-	-	-	X	X
CMCST (2741)	-	-	-	X	-
S/7 (2740-1)	-	-	-	X	X
AT&T 83B3, WU 115A	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	X	-
WT Telegraph	-	-	-	-	X
BSC Lines:					
2715-2	-	X	-	S	X
2772	X	X	X	S	X
2780	X	X	X	S	X
2972-8,-11	X	-	-	-	M
3271-1,-2	X	-	X	-	M
3274-1C(3271-1,-2)	X	-	X	-	M
3275-1,-2	X	-	X	S	M
3276(3271-1,-2)	X	-	X	-	M
3651-A50,-B50 (S/3)	-	X	-	X	M
3651-A60,-B60 (S/3)	-	X	-	X	-
3661 (S/3)	-	X	-	X	-
3670	X	-	-	-	M
3735	X	-	X	S	M
3741-2,-4	X	X	X	S (e)	X
3747	X	X	-	S (e)	X
3771,3773,3774, 3775 (2772)	X	X	X	S	X
3776-1,-2, 3777-1 (2772/3780)	X	X	X	S	X
3777-2 (S/360-20)	X	X	-	S	X
3780 (2772)	X	X	X	S	X
5275 (3275-1,-2)	X	-	-	S (h)	M
5110 (2772)	X	X	-	S	X
1131	X	X	-	S	X
1826	X	X	X	S	X
Series/1 (as S/3)	X	X	X	S	X
S/3	X	X	X	S	X
S/7 (S/3)	X	X	X	X	(g) M
S/32 (S/3)	X	X	X	S	X
S/34 (S/3)	X	X	X	S	X
S/360-20	X	X	X	S	X
S/360 (c)	X	X	X	S	X
S/370 (c)	X	X	X	S	X
S/8100/DPPX DPPX/DSC DPPX/RJE	X	-	-	-	X
	X	X	-	-	X
SDLC Lines:					
3704 Remote	SDLC is insensitive		-	X	-
3705-I Remote			-	X	-
3271-11,-12	to data interchange		-	-	N
3274-1C (3791)			-	X	N
3275-11,-12	codes		-	-	N
3276 (3791)			D (f)	X	N
3601			X	X	N
3602			X	X	N
3614			-	X	N
3624			-	X	N
3631			X	X	N
3632			X	X	N
3651-A25,B25,A75 B75,C75,D75			D (f)	X	N
3651-A50,-B50			D (f)	X	N
3651-A60,-B60			D	-	-
3661			D	-	-
3767-1,-2,-3			D	X	N
3771,3773,3774, 3775,3776,3777			D	X	N
3791 (d)			D (f)	X	N
8130/DPCX-A21,A23			D(f)	X	N
8140/DPCX-A31,A33,A51,A53			D(f)	X	N
S/32 (3770)			D	X	N
S/34 (3770)			D	X	N
S/8100/DPPX			D	X	N

Local Channel Attach:

2260	-	-	-	-
2715-1	-	X	-	-
3272-1,-2	X	-	-	-
3274-1A (3791)	-	-	-	-
3274-1B (3272)	X	-	-	-
3791 (d)	3791 local attachment is code insensitive.			
7770-3	-	-	-	-

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control

X = supported
- = not supported

D = Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.

M = Group of terminals which can operate on same BSC MP line and same line speed.

N = Group of terminals which can operate on same SDLC MP line and same line speed.

S = Group of terminals which can share the same phone number(s).

Notes:

- If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1".
- Supports EBCD communications code only.
- S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. S/370 Models 115-168MP and 3031 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
- The 3791 Controller, as part of the 3790 Communication System/Data Entry Configuration, does not support ASCII code.
- The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, NCP/VS requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.
- Terminal operates on switched line using manual dial/manual and/or auto answer procedures and nonswitched VTAM-NCP/VS programming support. The 3651-A50,-B50 uses manual answer and the 3791 uses manual or auto answer procedures. These manual dial procedures will not be required when switched VTAM-NCP/VS support is available.
- IPL of S/7 is not supported in this network configuration.
- Switched network support by BTAM only.

OPERATING SYSTEM/VIRTUAL STORAGE 2

OS/VS2 (also known as VS2) is an operating system, upward compatible from MFT, MVT and OS/VS1.

OS/VS2 Release 1 (SVS) makes available a single address space of 16 megabytes for programs and data. In MVS (VS2 Release 2 and subsequent MVS releases), each job or timesharing user is provided with individual 16 megabyte virtual address space. The 16 megabytes include the space required for system code and tables.

OS/VS2 supports the System/370 Models 145, 155II, 158, 165II, 168, and the 3031, 3032 and 3033 Processors. In addition, MVS supports the 158MP and 168MP systems.

MVS Release 3.8 is a refresh release with SUs integrated in the release described in Chart 1 of the Announcement Letter.

In MVS Release 2, Job Entry Subsystem 2 (JES2), which is upward compatible with HASP, is provided. MVS Release 3 allows two to seven JES2 systems to operate in a JES2 Multi-Access Spool environment. JES3 is an SU to MVS Release 3.7 and Release 3.8 and is upward compatible with ASP. Both have been incorporated in the system control program as an SCP component. One or the other must be used for job entry.

Virtual storage can exceed the available main storage ("real storage") in the system. This is possible because virtual storage resides on direct access devices as well as in real storage.

Virtual storage is organized in 4K byte blocks called pages which are loaded from direct access storage into real storage for execution and written out to direct access storage when not actively being used and the space they occupy is needed and an exact copy does not exist on the paging device.

Virtual storage reduces the need for programmers to be aware of storage constraints.

Real storage utilization can be increased, providing the capability to increase multiprogramming and resource utilization.

TSO user regions are paged. Real storage utilization for TSO reflects actual requirements to execute the program as compared to fixed MVT time shared region.

Virtual storage allows most programs to run in a system with less real storage than the program was designed for. This enables testing and backup on smaller real storage systems.

Link Pack Area (LPA) is paged. All transient SVCs, transient ERPs, Appendages, most data management and most job management modules as well as any reentrant programs can be included in LPA without dedicating real storage for each program. A portion of the LPA may be fixed in real storage.

OS/VS2 includes features which are designed to improve the integrity of the system. These include Region Protection, Authorized Program Facility and DEB Validity Checking. The combination of fetch protection, a standard feature on VS2 supported Processors and the dispatcher's manipulation of segment table validity bits prevents unauthorized access of user regions. The use of control program services may be restricted to designated programs, using Authorized Program Facility (APF). The DEB Validity Checking facility aids in preventing an unauthorized user from modifying direct access extents or gaining control in supervisor state.

Note: For SVS restrictions, refer to the *OS/VS2 Planning Guide* (GC28-0600) and for MVS the *Introduction to OS/VS2 Release 2* (GC28-0661).

Facilities to Support Virtual Storage

Enhancements to the Linkage Editor permit the programmer to group related CSECTs together and place them on page boundaries. The result is the ability to localize references within a page, and help to reduce the number of pages brought into real storage.

Extensions to System Management Facilities (SMF) are made to record information regarding paging activity.

Additional VS2 Facilities Over MVT

An enhancement to IEBCOPY to allow unloading a partitioned data set to a removable volume and loading it at a later date to the same or a different type of volume.

RMS facilities are expanded to check for missing interrupts and alert the operator so that action can be taken.

VS2 Assembler supports all available S/370 instructions, improved macro instructions, conditional assembly statements and dynamic work area.

A Quick-Start IPL can be performed when a previously created LPA is in external page storage eliminating the necessity of having to recreate pageable LPA in external page storage and to reconstruct the BLDL table during each IPL.

SVS HIGHLIGHTS

In addition to the availability of 16 megabytes of virtual address space described previously, SVS provides the following facilities:

Virtual Telecommunications Access Method - VTAM: refer to the VTAM section below for a description.

Resource Management

Dynamic dispatching is a feature of the task supervisor included in the system when the automatic priority group (APG) option is selected. Installation-designated groups of tasks are dispatched based on their operational characteristics: Processor-oriented or I/O-oriented. Processor and I/O characteristics of the group of tasks are constantly monitored during their execution and changes are taken into account in the dispatching process.

VS2 will select low priority jobs and migrate their pages from the primary paging device to the secondary paging device when the system specified level of activity on the primary paging device is reached.

I/O load balancing provides an improved method of allocating data sets that do not have a specific volume assignment, based upon the use of devices across the entire configuration.

HASP II Version 4 and ASP Version 3.2 are supported under SVS.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DASD error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSPRINT.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

MVS HIGHLIGHTS

Multiprocessing With Shared Real Storage

Support either two Model 158MP processors or two Model 168MP processors providing flexibility in the use of computing resources through shared main storage, alternate path I/O control, and inter-processor communication.

Provide the potential for improved installation workload scheduling over that attainable with two separate uniprocessing systems by pooling resources such as main storage, secondary storage and central processing units.

Can be operated as an MP system or partitioned through operator commands. While one system continues operation, the other system may be reinitialized with another operating system. The two systems are then operated as two independent systems.

Extend MP availability with an alternate Processor recovery (ACR) facility allowing the non-failing Processor to attempt recovery processing for the operating system without using the failing Processor. The timing facility allows continued operation after failure of the time-of-day clock on one of the Processors. A new recovery facility allows resetting a specific channel or subchannel and attempts the restart of I/O operations by the non-failing Processor. Storage reconfiguration facilities allow logical isolation of failing main storage in 4K byte elements.

Provide less disabled code through the use of a new locking structure in the control program. The existence of multiple locks allows the processing of non-intersecting queue structures without interference from the other Processor.

Allow an installation to specify that a specific program (e.g., emulator) should run on a certain Processor.

On 168MP systems, channels attached to a stopped Processor may be accessed via the Channel 6 interface of the still running Processor via Channel Reconfiguration Hardware (CRH) support. With this support, all channels in both the stopped and the running Processor remain accessible for I/O. Note that CRH cannot be activated when DSS is active in the system.

Attached Processor support of the attachment of a 3052 or 3062 APU.

Work Scheduling

In MVS the job scheduler has been restructured so that the Job Entry Subsystem now performs: reading ... writing ... job queueing ... job selection ... warm start processing.

Job Entry Subsystem 2 (JES2) is upward compatible from HASP Versions 2, 3 and 4 and streamlines job processing by providing:

- preallocated external storage for SYSIN and SYSOUT data sets.
- transparent buffering and spooling.
- control of starting and stopping initiators.
- optional SYSOUT writing at data set close time rather than at the

end of a job.

- MULTI-LEAVING to intelligent workstations.
- support for IBM high-speed binary synchronous terminals through 270X or 3704/3705 in emulation mode.
- a warm start facility allowing installations to perform warm start processing concurrent with other jobs or following high priority jobs.

In MVS Release 3, JES2 support is extended to allow from two to seven systems to share the JES2 input, job, and output queues through use of Shared DASD to support a JES2 Multi-Access Spool environment.

An SU to MVS Release 3.7 provides Job Entry Subsystem 2 (JES2) Release 4 support for the non programmable models of the 3770 SDLC Terminals, the System/32, and the 3790 Communication System (as Remote Job Entry devices) via VTAM and the 3704/3705 in network control mode. The 3790 RJE workstation is also supported via Local Channel Attachment (LCA).

An SU to MVS Release 3.7 provides Job Entry Subsystem 3 (JES3) Release 2 support designed to be generally upward compatible from ASP Versions 3.0, 3.1, 3.2 and in addition to the basic JES facilities provides:

- generalized job selection
- deadline scheduling
- dependent job control
- dynamic system interchange
- centralized operator interface
- single Global control of access to a single job queue with shared spool for MVS Release 3.7 and Release 3.8 processors
- centralized device scheduling
- loosely coupled asymmetric system support
- support of OS/MVT and SVS operating systems as attached ASP main processors

Other job scheduler changes in MVS include:

The elimination of **SYS1.SYSJOBQE** - Each initiator now has its own scheduler work area (SWA), a pageable portion of each address space. The SWA contains most of the control blocks that were part of the job queue data set, thus reducing contention caused by frequent access to the job queue. To facilitate recovery, the control blocks can be recorded on direct access storage. Since control blocks are not built until a job is selected for execution, auxiliary storage requirements are less.

Revised I/O devices and data set allocation routines - installations can specify priorities for device types during allocation. Requests for different device types can now be satisfied in parallel. In addition, serialization on operator action is reduced. The routines also provide for more extensive recovery processing and data set release before job end. Permanently resident and reserved direct access devices have direct, unserialized allocation paths, allowing increased parallelism in allocation and deallocation.

Dynamic allocation extensions - dynamic allocation supports both background and foreground jobs. Support also includes most of the allocation options available via JCL such as all device types ... multi-volume or multi-unit data sets ... generation data groups ... concatenation of data sets ... optional freeing of data sets at CLOSE.

Data Management

In MVS the system paging mechanism can be used to perform data set access. This is known as virtual I/O; it handles data in page-size (4K) blocks. System-named temporary data sets accessed with BSAM, QSAM, BDAM, BPAM, XDAP, and EXCP can be processed by virtual I/O. This facility can be used without change to JCL or object code.

The VSAM master catalog has become the MVS system catalog. In addition to optionally containing pointers to VSAM user catalogs, it may also contain pointers to OS control volume catalogs. JCL extensions are also provided for the user to designate specific catalogs to be used for his job or job step.

The virtual telecommunications access method (VTAM) is a new direct-control teleprocessing access method. VTAM facilities are available to application programs including those using TCAM.

Virtual Storage Support

Extended virtual storage support in MVS provides each system user with a private 16-megabyte virtual address space (region) for user programs, system programs and work areas, and shared program and data areas. This design provides:

- more address space for jobs than could be provided in the fixed real regions of MVT or the virtual regions of SVS, permitting the

use of programming techniques such as real storage addressing for "spill files".

- a potential for a high level of multiprogramming, since the number of concurrent users or jobs is limited only by the amount of auxiliary storage available for paging and the amount of real storage available for required resident system programs and control blocks.
- elimination of inter-region virtual storage fragmentation.
- extended protection features, since each job or foreground user is isolated in an independent address space.
- effective management of large real storage.

Timesharing

Timesharing (an option in OS/MVT and SVS) is integrated and standard in the control program in MVS. With MVS:

Each timesharing user has a private virtual address space. Inter-user scheduling dependencies caused by sharing of storage regions by multiple users have been eliminated.

The data set handling commands are extended to allow allocation of multi-volume and multi-unit data sets, non-direct access data sets, and VSAM and virtual I/O data sets. Terminal users can allocate and unallocate concatenated data sets (other than VSAM and ISAM). Timesharing users may be selectively authorized by the installation to allocate data sets requiring volume mounting. Under installation control, timesharing users can direct SYSOUT data sets to remote stations defined to either Job Entry Subsystem.

The installation may specify a time interval which establishes a period that will permit a timesharing user to reconnect to the system in the event of a line disconnect. Should the interval lapse prior to the user reconnecting to the system, then the system will automatically save any data set which the user was in the process of editing.

Remote Entry Subsystem workstations are identified to the system in the same manner as TSO terminal users.

Resource Management

In MVS, the control program can dynamically regulate the utilization of most system resources. A central set of system resource management routines coordinates the scheduling of various system resources attempting to both maintain efficient resource utilization and also to satisfy installation specified performance objectives.

With this support ...

Each job/user will belong to one of several installation defined performance groups. The scheduling of system resources will then be controlled so that each job/user receives resources at a rate prescribed for the associated performance group by the installation.

The load on various system resources is monitored and resource scheduling decisions are made which will attempt to correct detected imbalances and overloads.

A measurement facility, MF/1, is provided which allows the installation to obtain System Profile reports on the utilization of Processor, paging activity, channels, devices, and performance groups. Overlap information between Processor and channels will also be available. This is in addition to SMF.

System Integrity

At the time MVS System Control Programming became available, it was stated that all known System Integrity exposures had been removed from MVS. This statement was based on IBM's knowledge of System Integrity at that time. Because it is never possible to certify that any system has perfect integrity, it was expected that additional exposures would come to light; and, therefore, it was also stated at that time that APARs describing additional exposures would be accepted. Since the release of MVS, a number of APARs on MVS System Integrity problems have been accepted as valid.

Since development of MVS began, a System Integrity Programming standard has been in place within IBM, and specific design and coding guidelines for System Integrity have been in use. As APARed integrity problems have been investigated and corrected, understanding of System Integrity has increased, more effective use has been made of the design and coding guidelines, and procedures have been established to make application of these guidelines a formal part of the design/development process.

System Integrity is defined for MVS as the inability of any program not authorized by a mechanism under the customer's control to:

1. Circumvent or disable store or fetch protection
2. Access a password-protected or a RACF-protected resource (RACF is the Resource Access Control Facility), or
3. Obtain control in an authorized state, that is, in supervisor state, with a protection key less than eight (8), or APF-authorized.

MVS documentation, subject to modification from time to time, tells the customer what actions he must take and what facilities he must restrict (e.g., Bypass Label Processing) to complement the System Integrity support provided by MVS. MVS System Integrity does not specifically include the protection of a subsystem's user's resources from another user in the same subsystem (e.g., a CICS user's in-storage data from another CICS user), except as data used by the subsystem as a whole (e.g., a data base) are protected by MVS.

SUPERVISOR (SVS and MVS)

The VS2 Supervisor is a part of the System Control Programming that monitors each unit of work being done in the system. The Supervisor, in general, automatically controls the use of the Processor, I/O, and real and virtual storage. It provides a variety of services such as allocating virtual storage space, performing I/O operations, loading programs into virtual storage, moving pages of programs into and out of real storage, and maintaining the address space (virtual storage) on auxiliary storage devices. To perform its function, the supervisor receives control of the Processor following an interruption which may have resulted from a specific service request or through an automatic interruption by the computing system.

SVS SUPERVISOR

The SVS Supervisor performs the same functions as the OS/MVT Supervisor. In addition to interruption handling, the SVS Supervisor performs Task Dispatching, Task Supervision, PCI Fetch, Contents Supervision, Timer Supervision - (using TOD Clock, Comparator and Processor Timer), Storage Supervision (virtual), I/O Supervision, Page Supervision, and Main Storage Supervision.

A function that has been added to support Dynamic Address Translation is paging supervision.

VS2 takes advantage of Dynamic Address Translation hardware. The system operates on the basis of virtual storage and real storage. Real storage is the storage of System/370 from which the central processing unit can directly obtain instructions and data and to which it can directly return results. Virtual storage is address space that appear to the user as real storage. From this address space, both system and user instructions and data are mapped into real storage locations. The size of virtual storage is limited by the addressing scheme of the computing system and available auxiliary storage space, not by the actual number of real storage locations. Regions are assigned from available virtual storage; the system assigns real storage only as it is actually needed for program use. In SVS, paged regions are assigned from one 16-megabyte virtual address space.

The VS2 virtual storage concept operates through Dynamic Address Translation. When a program executes, the system translates each virtual address into a corresponding real storage address as the instruction is executed.

With address translation, all 24 bits of an address are usable. Thus virtual address space can be (and real storage can appear to be) 16 megabytes. This address space is divided into 256 segments of 64K bytes each. The segments are subdivided into 16 pages of 4K bytes each.

VS2 requires that the system nucleus be in the non-paged part of real storage at IPL time. SQA and LSQA which is an extension of the TSO concept are fixed in real storage as required. An installation specifies a limit for the amount of real storage which can be used for non pageable jobs. However, the real storage for non pageable (virtual equals real) jobs, but not assigned to them, will be made available for paging tasks.

The remaining real storage is allocated for pages of the problem programs currently executing, paged system services and functions such as Link Pack Area, etc.

Real Storage is automatically managed by the operating system in discrete blocks of 4K bytes called pages. As a page in virtual storage is referenced, it is brought into real storage for processing, if it is not already in real storage. When pages are not being used and the real storage space is needed by another task, the page is written out onto auxiliary storage unless an exact copy already exists (i.e., the page was not modified during execution). This procedure is called demand paging. Paging Supervision consists of a set of functions that efficiently manages the contents of real storage as tasks are executing in a multiprogrammed, demand paging environment. It is responsible for:

- Ensuring that the contents of real storage are addressable through the hardware DAT feature.

- Exchanging virtual pages between auxiliary storage and real storage on a demand paging basis.

- Interfacing with and servicing auxiliary requests such as fixing virtual pages in real storage prior to I/O and while I/O is in progress.

Paging Supervision directly initiates page movement from real storage to auxiliary storage, when required. All other page movement comes about as a consequence of an implicit or explicit request from an external source.

VS2 is able to assume the image of a large contiguous real storage by keeping only required virtual pages in real storage during execution.

The job of the supervisor is to provide the resources and services that programs need in such a way that at any given time as many services and resources as possible are in use.

MVS SUPERVISOR

Additional supervisor functions are provided in MVS. These include: Resource management ... Multiprocessing ... Multiple address space supervision ... Service management ... Recovery management ... IOS redesign.

Multiple address space supervision is provided by real storage management routines, auxiliary storage management routines, and virtual storage management routines. The functions performed by the real storage manager (RSM) and the auxiliary storage manager (ASM) correspond to those performed by the SVS paging supervisor with some additions to support multiple virtual address spaces and the virtual I/O facility. The real storage manager: directs the movement of virtual pages between real storage and auxiliary storage ... creates a segment table for each job or timesharing (TSO) user in the system (each segment table defines an individual virtual address space) ... handles virtual page requests (e.g., fix, free, page-in, page-out).

The auxiliary storage manager: initiates the actual paging I/O necessary to transfer pages in and out of real storage ... performs space management for all external page storage which includes temporary virtual I/O data sets.

The virtual storage manager services the **GETMAIN** and **FREEMAIN** macro instructions by allocating/deallocating storage within the virtual address space.

The service management function consists of new dispatching and queueing techniques that provide the potential for system components to provide services that execute enabled, unserialized, and in parallel on a tightly-coupled multiprocessing (MP) as well as a uniprocessing system. The basic control structure used by the service manager incorporates two levels of system priority; global and local. Service requests queued at the global level are given a higher priority than that of any address space, regardless of the address space in which they will be dispatched. (An address space is allocated for each job.) Service requests queued at the local level are given a priority equal to that of the address space in which they will be dispatched, but higher than any task within that address space.

Recovery management monitors the flow of control through recovery processing for; system, address space, and task failures, and performs normal and abnormal task and address space termination processing. It provides to system functions, and optionally to problem programs, the means necessary to intercept, attempt recovery, and record unexpected or expected error situations. The recovery processing is designed to operate at different levels of control. If a recovery routine for a process operating at one level of control is unable to recover from an error, the error is passed to a recovery routine at a previous (higher) level of control.

The I/O supervisor (IOS) routines have been redesigned for MVS to provide the potential for greater parallelism on multiprocessing systems as well as a reduced amount of page fixing for I/O operation. Concurrent execution of I/O operations and other supervisory functions on multiprocessing systems is made possible by a hierarchical structure of locks.

MVS Release 3 Supervisor Additions

The number of UCBs supported is increased to up to 1,023. They may reside between locations 4,096 and 65,535.

A new **EVENTS** macro allows the user to wait on the completion of one of n events without the POST routine and the user application repeatedly scanning a long list of Event Control Blocks.

Additional recovery capability for the 168MP system (Channel Reconfiguration Hardware support) permits all channels in a running Processor and a stopped Processor to remain accessible for I/O. The channels attached to the stopped Processor can be accessed via the Channel 6 interface of the still running Processor. It should be noted that CRH cannot be activated when DSS is active in the system.

JOB MANAGEMENT (SVS and MVS)

VS2 job management is a part of the system control program that controls the processing of jobs. It performs a variety of functions that include processing commands, reading and interpreting job and step definitions, allocating data sets and I/O devices, scheduling jobs, and writing system messages and job output.

SVS JOB MANAGEMENT

The master scheduler and job scheduler are major parts of the operating system that control the processing of jobs. The master scheduler initializes the system and responds to operator commands by initiating the requested actions. The job scheduler reads and interprets job definitions, schedules the jobs for processing, initiates and terminates the processing of jobs and job steps, and records job output data.

Master Scheduler

The master scheduler is one of the system tasks established when the system is loaded. Its functions can be divided into two categories: initializations and command processing.

Master scheduler initialization functions are: Initializing the time-of-day clock ... Initializing the system log ... Initializing the System Management Facilities (SMF) ... Initializing the Resource Manager ... Initializing Missing Interrupt Handler Task ... Establishing an ESTAE environment to handle system task failure during initialization.

Command processing is the reading, scheduling, and executing of operator commands issued via either a console device or an input job stream.

The reading of commands entered via a console device is performed by routines operating under a console communication task; the reading of commands entered via an input job stream is performed by routines operating under a converter task associated with JES2.

The scheduling of a command consists of storing the command and the readying of a task to continue processing the command. A command scheduling routine operates under either the console communications task (when the command was issued via a console device) or a JES2 task (when the command was issued via an input job stream).

The executing of a command is the performance of the function specified in the command. The functions are performed either as new tasks established by the master scheduler or as parts of existing system tasks.

Job Scheduler

The job scheduler is divided into three major parts: the converter/interpreter, the initiator/terminator, and the output writer. Each part is a separate task and thus can be executed concurrently with and independently of the others.

Converter/Interpreter

The converter/interpreter performs as a subroutine of JES2, analyzes the definitions, and builds control blocks and tables that are used during execution of the job steps. The converter also analyzes commands encountered in the input stream.

The control blocks and tables constructed by the interpreter contain job attributes, job step attributes, information needed to assign devices to data sets, and data set attributes.

Initiator/Terminator

The initiator/terminator invokes JES2 to obtain jobs and job steps to be executed. It analyzes the I/O device requirements of the job steps, allocates devices to them, creates tasks for them, and at completion of the jobs, supplies control information to JES2 for writing job output on a system output unit.

After receiving an interpreted job to be executed, the initiator/terminator examines the types of regions requested for the job. If the job requires nonpageable storage for execution, the initiator/terminator reserves a unique non-zero protection key for the job.

During allocation, in order to reduce contention for I/O devices, a new algorithm for I/O load balancing is used. The new algorithm allocates devices for data sets that have nonspecific device requests. Rather than basing the algorithm on a count of allocated data sets on a device (as in MVT), in VS2 the actual number of I/O requests to a tape or direct access device will be monitored to get a more accurate picture of I/O load. The device determined to be the best candidate for allocation to a given data set is then selected.

All user pageable regions have the same protect key value, that is "8" including TSO regions. Each non pageable region is assigned a unique protect key value within the range of 9 to 15. Pageable regions are allocated virtual storage in 64K byte segments while non pageable regions are allocated real storage in 4K byte increments.

Output Writer

The output writer transfers system messages and system output data sets from the direct access volume on which they were initially written by the system to a specified output device.

Output data sets can be directed to a class of devices, and references to the data are then placed on an output work queue. Because the queue is maintained in priority sequence, the system output writers can select jobs in the output work queue on a priority basis.

MVS JOB MANAGEMENT

In MVS, job management functions are performed by the master scheduler, JES2, and the job scheduler.

The master scheduler initializes the system and responds to operator commands by initiating the requested actions. The job entry subsystem reads job definitions, schedules the jobs for processing, and records job output data. The job scheduler builds control blocks in the

scheduler work area (SWA) and initiates and terminates the processing of jobs and job steps.

Master Scheduler

The master scheduler is a system-initiated task that is established when the system is loaded. Its functions can be divided into two categories: initialization and command processing.

Master scheduler initialization consists of:

- Initializing the communications task to handle all communication with the operator console.
- Initializing the time-of-day clock.
- Creating the subsystem CVTs.
- Initializing the SWA management function.
- Initializing the system management facilities (SMF).
- Initializing the missing interruption checker.
- Establishing an ESTAE environment to handle system task failures during initialization.

Command processing includes the reading, scheduling, and executing of operator commands issued through a console device, an input job stream or a remote workstation.

The scheduling of a command consists of storing the command and readying of a task to continue processing the command. A command scheduling routine operates under either the console communications task (when the command was issued from a console device), or the reader task (when the command was issued through an input job stream).

The executing of a command is the performance of the function specified by the command. The functions are performed either as new tasks established by the master scheduler or as parts of existing system tasks.

JOB ENTRY SUBSYSTEM 2 - JES2 (MVS)

JES2 is an integral part of MVS and provides support in the areas of job management, data management for subsystem data sets, and Remote Job Entry. JES2 operates as a system task in a private address space and communicates with MVS via formally defined subsystem interfaces.

Features that may add to system performance are efficient SPOOL management routines and the MULTI-LEAVING line manager. MULTI-LEAVING is employed with all Processor workstations and will tend to maximize line effectiveness and provide concurrent operation of all supported workstation devices.

The job input and output services provided for local peripheral devices along with a subset of the JES2 operator command capability are optionally extended to remote workstations, including both Processor and non-Processor terminals. Workstation programs for System/360/370 Processors, 1130, and System/3 are generated as extensions to JES2 and operate in the workstation on a "stand-alone" basis. The JES2 RJE implementation for binary synchronous Processor workstations is based upon the HASP MULTI-LEAVING philosophy which provides the capability for concurrent operation for all supported terminal job input, output, and console devices. Concurrent operation of devices on SNA Workstations is provided through support for the Multiple Logical Unit (MLU) protocols of SNA.

JES2 Description

JES2 is a specialized program which operates in the same Processor with MVS to perform the peripheral functions associated with batch job processing. JES2 is started as a job entry subsystem. Control of designated unit-record devices is taken, the specified intermediate storage direct access device(s) are initialized, and job processing begins. JES2 has four major processing stages which relate to its four major external functions. These are:

1. **INPUT STAGE** - This stage reads jobs simultaneously from a variable number of various types of online card readers and remote terminals. These jobs are then entered into a priority queue to await processing by the next stage.
2. **CONVERTER STAGE** - This stage passes the Job Control Language (JCL) to the MVS Converter which merges the specified procedures from the appropriate Procedure Library, performs a basic syntactical scan, and converts the JCL statements into an "internal text" format which JES2 SPOOLS for later use by the MVS Interpreter. The jobs are then queued by job class to await processing by the next stage.
3. **EXECUTION STAGE** - This stage removes jobs based upon priority and class from the queue established by the Converter Stage and passes those jobs to MVS for processing. Input cards are supplied as required to the executing program; and print and punch records are received and written onto JES2 intermediate storage. This stage can simultaneously control all jobs being processed by MVS. At the completion of a job, it is placed in a queue to await processing by the next stage.
4. **OUTPUT STAGE** - This stage transcribes the print and punch output generated by jobs in the previous stage to printers and punches. A

variable number of various types of printers, punches, and remote terminals can be operated simultaneously.

All of these processes are controlled by reenterable code so that no additional code is required to support multiple, simultaneous functions. Since all of the above functions can occur simultaneously and asynchronously, a continuous flow of jobs may pass through the system.

Following are some of the more significant algorithms employed by JES2 to improve function and performance:

Specialized Direct-Access Storage Allocations

JES2, through the use of an allocation bit map in main storage, dynamically allocates space for intermediate storage on a record basis, within definable track groups, for jobs. The use of this technique offers the following advantages:

1. Disk-arm motion and interference is minimized by dynamically allocating space based upon the position of the access mechanism.
2. Disk area fragmentation is automatically eliminated by allocation of the smallest possible increment of space.
3. The data for a single data set can be spread across multiple direct-access volumes. In addition to further optimizing arm motion, this capability allows for multiple selector channels to increase the data rate for a given job.
4. Space is allocated as required, minimizing the loss of space as a result of over-estimated output requirements.
5. The release of previously used space is accomplished by a simple algorithm which requires no I/O operations.

Unit Record Device Command Chaining

While operating any reader, printer or punch, rather than handling each record separately, JES2 constructs a chained sequence of channel command words to pass to the channel. Thus, instead of the overhead of the EXCP and the ensuing interrupts for each record transmitted, only one EXCP and associated interrupt is required for a series of records. For example, when reading a job into the system, JES2 might chain 40 commands together to instruct a card reader. This would cause the next 40 cards to be read into storage without requiring the execution of any Processor instructions.

Transparent Blocking

All input, print and punch for every job is automatically blocked by JES2 to improve performance. Since all deblocking is also done by JES2, any program, even if designed to operate with unblocked records, can benefit from the blocking.

JES2 Standard Features

The standard features of JES2 are as follows:

- **Job input service** provides for low-overhead reading of job streams and storing of data on SPOOLing volumes for later high-speed retrieval for up to 99 concurrently active local card readers in any combination of devices as follows: 2540 reader ... 2501 reader ... 2520 punch (with read feature) ... 3505 reader (80-column punched cards only) ... 3525 punch (with read feature).
- **Converter service** provides for the merging of the submitted JCL with user or installation selected procedure libraries and for an early scan of this combined JCL for syntactical errors.
- **Execution service** provides for selection of jobs and execution monitoring for up to 99 concurrently executing jobs as follows: selection of jobs based upon job class and initiator priority class list of up to 36 classes for each initiator ... automatic delaying of jobs with duplicate OS jobnames ... automatic deblocking and blocking of user SYSIN/SYSOUT data ... counting of lines, cards, and execution duration with optional operator notification and/or cancellation ... interface for SMF counting of SYSIN data.
- **Multiple SPOOLing volume support** provides for balanced utilization of up to 36 volumes for any combination of any models of the following devices (one required): 2314 ... 3330 ... 2305.
- **Warm start capability** provides for checkpointing critical JES2 information sufficient for: optionally restarting jobs which were executing ... restarting print and punch at the last checkpoint.
- **Job output print service** provides for low overhead printing of job stream, system message, and user data print output for up to 99 concurrently active local printers in any combination of devices as follows: 1403 Printer ... 3211 Printer.
- **Special forms support** provides for the routing of print (on a job or data set basis) and punch data (on a data set basis) to special forms output queues for output as directed by the operator.
- **Internal Reader facility** provides the ability for any task within the system to submit jobs to JES2 for batch execution as though entered from a JES2 card reader.

- **Console Support** provides for direct entry for JES2 commands and JES2 abbreviated replies to WTORs through MVS operator consoles.
- JES2 interfaces directly with the MVS SMF writer to produce seven SMF records (types 6, 26, 43, 45, 47, 48, and 49). JES2 also provides two user SMF exits (IEFUSO and IEFUJP).

JES2 Optional Features

In addition to the standard features, the following optional features are available:

- **Job output punch service** provides for low overhead punching of job stream user punch output for up to 99 concurrently active local punches in any combination of devices as follows: 2520 punch ... 2540 punch ... 3525 punch.
- **Execution Batching** provides the facility for passing jobs directly to a processing program such as a "one-step" monitor, reducing the overhead of OS scheduling and allocation for short running jobs requiring limited system facilities.
- **Priority Aging** provides for automatically increasing the JES2 scheduling priority of jobs which have been in the system for extended periods of time.
- **Remote Job Entry** provides for high speed communications with binary synchronous and SDLC batch workstations which may be used for job stream input and output as well as operator control of the devices and jobs associated with the remote (see *JES2 RJE Features*).

JES2 RJE Features

Those features common to all JES2 RJE configurations are as follows:

- JES2 RJE supports up to 255 remote workstations communicating over nonswitched (point-to-point) or switched lines.
 - JES2 RJE provides for concurrent operations over up to 255 lines assigned to unique communication line adapter addresses of the following types: SDA Type II on a 2701 for Binary Synchronous ... Synchronous Base on a 2703 for Binary Synchronous ... 3704 providing 270X emulation ... 3705 providing 270X emulation.
 - Output routing control provides for print and punch output to be directed to the devices attached to the remote, to the central system, or to other remotes as designated by JES2 initialization parameters, by control cards submitted with the job, or by operator command.
 - Remote operator control provides a subset of the JES2 operator commands for display of information and control of jobs and devices associated with the remote.
 - Operator message output provides for transmission of messages and responses to remote operators with online MULTI-LEAVING workstations with consoles immediately and optional saving of messages for all other remotes until the remote is online and has a printer available.
 - Workstation programs, when required, are supplied as extensions of JES2 and are contained on the JES2 distribution libraries in source form.
 - Terminal support on the central system provides for communication with: 2772 (Binary Synchronous) ... 2780 (Binary Synchronous) ... 3780 (Binary Synchronous) ... 5110 Computer (as a 2772 BSC) ... S/360 Models 20, 25, 30, 40, 50, 65, 65MP, 67 (in 65 mode), 75, 85, and 195 (MULTI-LEAVING) ... All virtual storage S/370 Processors (MULTI-LEAVING) ... 1131 (MULTI-LEAVING) ... S/3 Model 10 (MULTI-LEAVING) ... S/32 or S/34 (MULTI-LEAVING as a S/3) and S/32 or S/34 (SDLC as a 3770).
 - The sign-on feature provides for remote identification and line security through remote and line passwords.
 - Remote characteristics support utilizes the unique features on each remote as follows: full text transparency (required for object decks) ... text compression ... print line width truncation ... buffer size and blocking capabilities.
- Note:** Multipoint or multidrop line features are prohibited.
- Remote job priority adjustment provides for favoring or limiting the JES2 scheduling priority of jobs submitted from each remote workstation.
 - Line restart feature provides for warm starting of print output after remote workstation or line failures.
 - Line error recovery provides for continuous retry until successful transmission.

JES2 MULTI-LEAVING RJE Features

MULTI-LEAVING is a term which describes a computer-to-computer communication technique developed for use by the HASP system. In a gross sense, MULTI-LEAVING can be defined as the fully-synchronized, pseudo-simultaneous, bi-directional transmission of a variable number of data streams between two or more computers

utilizing binary synchronous communications facilities. Those features common to all JES2 RJE configurations are provided with MULTI-LEAVING configurations with additional features as follows:

- **Concurrent device operation capability** provides for all supported devices to operate concurrently in accordance with the device characteristics, line speed, and characteristics of the data streams.
- **Dual reader/punch device support** provides for use as both reader and punch under automatic or operator control.
- **Unit record error recovery** provides a minimum of operator intervention and continued operations using unaffected devices on operator console configurations.

JES2/2770 RJE Workstation

The IBM 2770 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support of the 2772 provides for job stream input and output on the following devices: 2213 Model 2 Printer ... 2203 Model A1 or A2 Printer ... 2502 Model A1 or A2 Reader ... 0545 Model 3 or 4 Output Punch.

Note: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job stream input (a job stream must fit entirely within the 2772 buffer).

Extended support provides for special features: Buffer expansion ... Buffer expansion additional ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Space compression/expansion ... Horizontal format control ... 144 character print line (2203 only, requires buffer expansion).

The Terminal ID and Security ID features may be present but are not supported by JES2.

Note: Other features not prohibited by JES2 RJE and transparent to line control programming are permitted.

JES2/2780 RJE Workstation

The IBM 2780 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support provides for job stream input and output on the following 2780 configurations: Model 1 Printer and Reader ... Model 2 Printer, Reader, and Punch.

Extended support provides for special features: Multi-record transmission ... 120 and 144 character print line ... Horizontal format control ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC.

The Terminal ID and Security ID features may be present but are not supported by JES2.

Note: Other features not prohibited by JES2 RJE and transparent to line control programming are permitted.

JES2/3741 RJE Workstation

The IBM 3741 Data Station, Model 2, and 3741 Programmable Work Station, Model 4, are supported by the JES2 RJE feature as Binary Synchronous workstations for submission (and control) of jobs to JES2 for MVS processing. The support operates in 2780-compatible mode and allows for diskette jobstream input and output to diskettes. Supported features are: Fixed, unblocked input up to 80 character records ... Fixed, unblocked output up to 128 characters, including printer control characters ... EBCDIC or ASCII Transmission Code ... Multiple data sets on multiple diskettes or a single data set on multiple diskettes can be transmitted to MVS, however, the data will be concatenated into a single job or data set ... Null records (STX ETX) are accepted but not used as data set delimiters ... Status message (SOH) is accepted.

No special features are required.

JES2/3777-2 MULTI-LEAVING Workstation

The IBM 3777 Model 2 is supported as a System/360 Model 20 Binary Synchronous MULTI-LEAVING Workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RMTM20 workstation program is generated by JES2 remote generation procedures for a S/360-20 Submodel 5 with 12K of main storage.

Device support provides concurrent operations on each reader, printer, punch and console device: 3203-3 Printer (required) (specify 1403) ... 2502 Reader (required) (specify 2501) ... 3521 Punch (optional) (specify 1442) ... Console Display (optional) (specify 2152).

JES2/3780 RJE Workstation

The IBM 3780 is supported by the JES2 RJE feature as a Binary Synchronous workstation for submission (and control) of jobs to JES2 for MVS processing and has the following features:

Device support provides for job stream input and output on the following devices: Card Reader ... Line Printer ... Card Punch.

Supported features are: 512 character buffer ... Variable length record ... Space compression/expansion ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Print positions (additional) for 144 character print line ... Horizontal format control.

The Terminal ID and Security ID features may be present but are not supported by JES2.

JES2/360-20 MULTI-LEAVING Workstation

The IBM System/360 Model 20 with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The RMTM20 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage on a Model 20 submodels 2, 4, 5, and 6. Larger core (up to 32K) may be used for additional buffer storage if available.

Device support provides concurrent operations on one of each reader, printer, punch, and console device: 2203 Printer or 1403 Printer (one required) ... 2501, 2520, or 2560 Reader device (one required) ... 1442, 2520, or 2560 Punch device (optional) ... 2152 Console (optional).

Dual 2520 device support provides automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Dual 2560 device support provides selection of functions by feed hopper as follows: Primary feed assigned to reader ... Secondary feed assigned to punch.

Unit record data checks which require operator intervention may be corrected without stopping other functions when the 2152 console is available.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) over all available Binary Synchronous line speeds; however, speeds requiring the high speed feature (19.2K baud and above) are not recommended for the submodels 2 or 4.

JES2/360/370 MULTI-LEAVING Workstation

Any S/360/370 Processor except 2022 and 2020 with Binary Synchronous adapter and JES2-provided workstation programs are supported as Binary Synchronous MULTI-LEAVING workstations for submission of jobs to JES2 for MVS processing and have the following features:

The RMTM360 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to support single reader, printer, punch, and console device configurations. Larger storage (up to 32K) may be used as space for additional buffers and to support additional devices for up to seven readers, printers, punches (the number of printers when added to the number of punches must not exceed eight).

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch and Punch ... 2520 Reader/Punch and Punch ... 2540 Reader Punch ... 1403 Printer ... 3203 Printer ... 3211 Printer ... 5203 Printer ... 1052 Printer-Keyboard ... 3210 Printer-Keyboard ... 3215 Printer-Keyboard.

Notes: At least one reader and one printer along with the printer-keyboard are required ... Each device (including communications adapter) must be on a separate non-shared subchannel.

Dual reader/punch support for 1442 and 2520 provides for automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Note: 2540 reader/punch has two independent card paths which operate concurrently.

Communications adapter support on the workstation provides for EBCDIC transmission (transparency optional) via: SDA Type II on a 2701 ... Synchronous base on a 2703 ... 270X emulation mode in a 3704 or 3705 ... Integrated Binary Synchronous adapter on Models 25, 115, 125, and 135.

JES2/1130 MULTI-LEAVING Workstation

The IBM 1130 Computing System with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to

JES2 for MVS processing and has the following features:

The RTP1130 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core (up to 32K) may be used for additional buffer storage.

Device support of the 1131 provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch or Punch ... 1132 Printer ... 1403 Printer ... Standard Printer-KeyBoard.

Note: At least one reader required.

Dual reader/punch support for the 1442 provides for operator assignment of function.

Console output support provides for color-coded messages for separation of JES2 messages from workstation messages and operator input.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the standard Binary Synchronous adapter attachable to the 1131.

JES2/System/3 MULTI-LEAVING Workstation

The IBM System/3 Model 10 with Binary Synchronous adapter and JES2-provided workstation program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

The System/3 workstation program is generated by JES2 remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core is utilized when available.

Device support provides for concurrent operations on each of the supported devices as follows: 5424 Reader/Punch ... 1442 Reader/Punch ... 5203 Printer ... 1403 Printer ... 5471 Printer-KeyBoard (console) ... 5475 Data Entry Keyboard (in lieu of 5471). **Note:** At least one card reader and printer are required.

Dual reader/punch support for 1442 and 5424 provides for automatic determination of each card path as follows: Operator places blank cards in feed to designate punch ... Operator places job stream in feed to designate reader.

Each 96-column card punched is interpreted.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the Binary Synchronous adapter selected (either Binary Synchronous Adapter #1 or Binary Synchronous Adapter #2).

Printer support provides for extra print positions and UCS images of LC and PN trains (PN recommended).

System/32 MULTI-LEAVING Work Station for JES2

The IBM System/32 with Binary Synchronous Communications Adapter and its associated MRJE/WS System Utility Program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/32 must be specified as a System/3. The System/32 MRJE/WS System Utility Program is supplied as a component of the System/32 SCP.

Device support provides for concurrent operations on each of the supported facilities of the 5320 System Unit: Disk storage simulation of card I/O and/or printer data streams ... Line or serial printing ... Keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Binary Synchronous Communications Adapter special feature.

System/34 MULTI-LEAVING Workstation for JES2

The IBM System/34 with Communications Adapter and its associated MRJE System Utility Program is supported as a Binary Synchronous MULTI-LEAVING workstation for submission of jobs to JES2 for MVS processing and has the following features:

For remote workstation support by JES2, the System/34 must be specified as a System/3. The System/34 MRJE System Utility Program is supplied as a component of the System/34 SSP.

Device support provides for concurrent operations on each of the supported facilities of the 5340 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text transparency optional) at any speed available to the Communications Adapter.

Job Entry Subsystem 2 (Release 4.1)

Subsequent to MVS Release 3, JES2 supports the non-programmable models of the 3770 Data Communication System, the System/32 (as a 3770), and the 3790 Communication System as Remote Job Entry devices. Transmission to the 3770 terminals is via Synchronous Data Link Control (SDLC). Transmission to the 3790 system is via SDLC and LCA. This provides JES2 remote entry support for SDLC terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, JES2 uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode.

SDLC Terminal Support

SDLC terminals supported by JES2 in MVS are the non-programmable models of the 3771, 3773, 3774, 3775, 3776 and 3777 Communication Terminals, the System/32 (as a 3770), the System/34 (as a 3770), and the 3790 Communication System. Support for the 3770 family of devices includes the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader, and the 2502 Card Reader.

Functional characteristics of the JES2 support for 3770 SDLC terminals are as follows: Half duplex flow ... Multipoint operation ... Serial data transmission operation (e.g., no concurrent operation of printer and punch on the outbound flow from JES2 to the SDLC terminals) ... 3770 disk operation is transparent to JES2 ... Data stream provides compression of repeated characters outbound (3771, 3773, 3774, 3775), inbound and outbound (3776, 3777). Multiple Logical Unit (MLU) 3776 Models 3, 4 and 3773 Model 3, with up to six independent and concurrent sessions are supported.

Support for the 3790 Data Communication System includes support for the Printer Feature, Disk (spool), 3277 Models 1 and 2 and 3793 Keyboard Printer as consoles and the 3277 Model 2 and 3793 Keyboard Printer as Input devices.

Functional characteristics of the JES2 support for the 3790 System are as follows: Half Duplex flow ... Multipoint Operation ... Concurrent device operation (Multiple printer features, maximum 2; Reader and Printer functions; Keyboard to disk and host communications) ... Outbound remote spooling - allowing data from host to be stored on disk for subsequent printing ... Full outbound compression of Printer data sets with an additional technique called compaction (combining pairs of characters into a single byte) to further improve transmission line efficiency.

In addition, the JES2 Output Service function is extended to include support for the IBM 3800 Printing Subsystem as a standard JES2 output device.

The JES2 support of the IBM 3344 and 3350 Direct Access Storage devices is extended to incorporate a new technique for track address allocation called "Track Ceiling" and to provide for simultaneous formatting of SPOOL volumes.

The JES2 installation procedure is simplified by the elimination of all JES2 generation parameters. JES2 will now use parameters defined in the initialization parameter library to establish table values at initialization time rather than build the system from input parameters supplied during generation. This allows more dynamic changes to processing options and simplifies user tuning techniques.

Output device routing is enhanced by allowing symbolic names to be assigned to output devices and output to be routed to these symbolic names through user-coded control cards (JCL) and through operator commands.

Improvements are made to operator commands including modifications to make the commands more keyword oriented, and to provide routing extensions which allow routing to specific local devices using symbolic destination names.

JES2 serviceability is enhanced through the integration of all applicable updates and through a new service map concept which permits rapid and accurate diagnosis of current code level. A new module and control block map eases analysis of diagnostic dumps by providing a quick reference to the location of all modules and control blocks.

Job Entry Subsystem 2 Multi-Access Spool (MVS Release 3)

In addition to those functions supported in JES2 in MVS Release 2, a new feature of the JES2 allows from two to seven MVS Release 3 systems to share the JES2 input, job, and output queues through the use of Shared DASD. This feature may be used to share the workload or a pool of JES2-controlled devices among processors. Jobs may be routed to any specific system or all systems in this multi-access spool complex. Furthermore, JES2-controlled unit record and remote devices need not, but may, be attached to each processor.

Each processor operates asynchronously within the multi-access spool complex, i.e., there is no master-slave relationship. Because of this operating design, any system in the complex can recover the workload accepted into the complex by any other system. Another system in the complex can have the RJE, TSO and unique unit record devices of the failing system physically switched to it and continue processing those jobs previously entered into the spool queue.

Another function supplied by the JES2 multi-access spool feature is the ability to isolate a processor for testing purposes. A processor may be designated as operating in independent mode, and in so doing, will only process jobs that are both routed to it and are themselves designated to be executed on that processor in independent mode.

The operator command set for JES2 in MVS Release 3 is much the same as the JES2 command set used in MVS Release 2. Additional facilities, however, have been added to control the multi-access spool complex. These facilities allow an operator to:

Add, delete, or explicitly identify the system affinity (routing) of jobs;

Display active and queued jobs for any processor or group of processors in the complex;

Take a system in the complex out of or place it into independent mode.

JOB ENTRY SUBSYSTEM 3 - JES3 (SU on MVS Release 3.7 and Release 3.8)

JES3 provides a generally compatible extension of ASP Release 3.2 and is designed to improve the operational environment of the computer installation by aiding many of the operator functions. JES3 can improve installation workload scheduling, increase the workload capacity, and reduce turnaround time. JES3 provides a single system image for the execution of many jobs concurrently on the connected processors.

JES3 can support up to eight JES3 processors, any of which can be a tightly coupled multiprocessor, operating under the control of MVS Release 3.7 and Release 3.8. JES3 can also support ASP main processors, operating under the control of OS/MVT or SVS. JES3 can logically interconnect up to 32 processors. A JES3 configuration consists of a global processor that controls all job input and output, and the scheduling of time sharing users, batch jobs and, optionally, devices. One to seven additional JES3 processors, called *JES3 local processors*, can be connected to the JES3 global processor. Each processor is attached to the JES3 global processor by a channel-to-channel (CTC) adapter which is used to interchange control information. The JES3 global processor handles all SYSIN and SYSOUT to and from peripheral devices.

JES3 design and the shared spool concept help to improve the overall availability of MVS Release 3 by permitting any JES3 local processor, if properly configured, to assume JES3 global functions. Should the JES3 global processor fail in a loosely coupled multiprocessing configuration, the operator can move the JES3 global function to any properly configured JES3 local processor. The degree of this availability depends on the presence of appropriate alternate CTC paths and switchable peripheral devices.

The JES3 global processor must operate under MVS Release 3.7 or Release 3.8. JES3 supports ASP main processors. Remote job processing from binary synchronous communication (BSC) and system network architecture (SNA) terminals is supported. JES3 also provides multiprogrammed background utilities which the operator can invoke.

As the installation workload grows, capacity can be increased by increasing the size of processors, by using multiprocessor configurations, and/or by adding additional JES3 local processors, operating under the control of MVS Release 3.7 or Release 3.8 or ASP main processors, operating under the control of OS/MVT or SVS. JES3 enables such expansion with minimal disruption to the operational environment. Jobs are distributed to available processors depending on job priority, device requirements, user specification, and processor dependencies. (A processor dependency is an attribute of a job that requires it to execute on a specific JES3 or ASP main processor. For example, if a job uses a device that is attached to only one processor, then the job has a processor dependency and must execute on the processor than can access the device).

Some of the features of JES3 are:

- Automatic scheduling of attached OS/MVT and SVS ASP main processors and MVS Release 3 JES3 local processors (including multiprocessors).
- New JCT Access Method with optional core resident JCTs. This access method facilitates reduced contention for JCT resources.
- Single operator interface to the entire system.
- Centralized console service.
- Logical device grouping with consoles defined for the group.
- Installation-specified, operator-controlled job selection algorithms for scheduling JES3 and ASP processors.
- Automatic scheduling of interdependent jobs (dependent job control).
- Deadline scheduling.

- Simulated console support for non-programmable remote terminals (2770, 2780, 3780).
- Multitasking of the MVS Release 3.7 or Release 3.8 Converter and Interpreter and the SVS Reader/Interpreter.
- Checkpoint/Restart support for jobs that execute under MVS Release 3.7 or Release 3.8.
- SMF support.
- Generalized peripheral scheduling and improved output service that includes related **INQUIRY/MODIFY** processing.
- Early JCL diagnosis through JES3's use of the VS2 Converter and Interpreter or the Reader/Interpreter.
- ASP to JES3 migration features.
- Support of TSO Foreground Initiated Background functions.
- Extensive RAS capability, for example:

Functional recovery routines

Alternate Path Channel to Channel (ACTC)

Shared DASD for spool and JES3 checkpoint data sets

Dynamic system interchange

Spool I/O error recovery

Dynamic device reconfiguration (DDR) support for non-shared setup devices

HOTSTART of JES3 address space

WARMSTART of JES3 system

- IBM 3850 Mass Storage System data and device management is provided with the JES3/3850 MSS Selectable Unit.

The JES3 Selectable Unit for JES3 Release 2 will continue to provide cohabitation with the IBM 3850 MSS in an MVS Release 3.7 system.

- Operation in a virtual machine in the IBM Virtual Machine Facility (VM/370).

REMOTE JOB PROCESSING (RJP)

Binary Synchronous Communication (BSC)

JES3 Remote Job Processing (RJP) permits the input, processing, and output of jobs to and from terminals remote from the installation. This function is achieved through the use of the IBM 3704 or 3705 Communications Controller (emulator mode), the IBM 2701 Data Adapter, or the IBM 2703 Transmission Control Unit to interface with binary synchronous communication (BSC) terminals. BSC remote terminals are used as remote card readers, printers, and card punches, with job output routed optionally to any remote terminal or local output device.

For detailed information related to JES3 BSC RJP see *Introduction to JES3 GC28-0607*.

Synchronous Data Link Control (SDLC)

JES3 SNA RJP will support the 3790 Communication System and the 3770 Data Communication System (non-programmable models) in September 1978. Transmission to the 3770 and the 3790 is via Synchronous Data Link Control (SDLC) through VTAM and NCP. This provides JES3 remote job processing support for SNA terminals in a terminal-sharing environment where multiple applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, JES3 uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704/3705 in network control mode. This use of the performance oriented authorized path of VTAM enhances the performance of JES3 SNA RJP.

SDLC job entry stations supported by JES3 are the 3790 Communication System and the 3770 Data Communication System (non-programmable models: 3771, 3773, 3774, 3775, 3776, and 3777-1 Communication Terminals). Multiple Logical Unit (MLU) 3776 Models 3,4 and 3777 Model 3 with up to six independent and concurrent sessions are supported. Also supported are the 3784 Line Printer, the 3203-3 Printer, the 3521 Card Punch, the 3501 Card Reader, and the 2502 Card Reader when attached to a 3770.

Functional characteristics of the JES3 SNA RJP support for SDLC terminals are as follows:

- Half duplex session flow
- Multidrop operation.
- 3770 diskette and 3790 disk operations are transparent to JES3
- Data stream provides compression of repeated characters outbound to the 3790 Communications System and to the 3770 Data Communications System.

- Data compaction is supported outbound to the 3790 Communications System.
- Single or multiple LU's (allowing multiple sessions) in a job entry station.
- Provides device setup for the 3790 by use of the Peripheral Data Stream Information Record (PDIR).

Job Scheduler

The job scheduler is divided into two major parts: the Converter and Interpreter and the Initiator/Terminator. The Converter and Interpreter consists of two separate subroutines that can be executed concurrently. The Converter may be executed independently of the Initiator/Terminator.

Converter/Interpreter

JCL interpretation is performed in two phases. The first phase (Converter) syntax checks the JCL and converts it along with procedures read from **SYS1.PROCLIB** into an internal text data set. The second phase (Interpreter) processes the internal text data set and builds control blocks for the job into a JES3 system data set. The job entry subsystem was designed to invoke the Converter and Interpreter before job selection so that jobs with JCL syntax errors will not be passed to an initiator for execution.

After job selection, the initiator invokes a job entry subsystem routine which reads the job's control blocks from the JES3 system data set and builds control blocks in the scheduler work area (SWA). The tables and control blocks constructed by the Interpreter contain the following information: job attributes ... job step attributes ... information needed to assign devices to data sets ... data set attributes.

Initiator/Terminator

The initiator/terminator requests a job from the job entry subsystem. It analyzes the I/O device requirements of the job steps, allocates devices to them and creates tasks for them. At the completion of the job, it informs the job entry subsystem the job has ended.

After the job entry subsystem selects a job, the initiator examines the type of address space requested for the job. If the job requires non-pageable real storage for execution, the initiator reserves a unique non-zero protection key for the job.

All user pageable address spaces, including timesharing address spaces, have the same protect key value, that is "8". Each non-pageable region is assigned a unique protect key value within the range of 9 to 15.

I/O device and data set allocation routines have been revised for VS2. Installations can now specify priorities for allocation of device types. Data sets may be released before job completion. Increased parallel processing is provided by changes such as the direct unserialized path through allocation for permanently resident and reserved direct access. Dynamic allocation processing is extended to background users and provides new functions for both foreground and background users.

Device, Volume and Data Set Management

JES3 device, volume and data set management provides for reservation of system resources ('SETUP'). JES3 3850 MSS Features include:

Allocation to mounted volumes for non-specific requests for new, non-VSAM data sets.

Access to Mass Storage Volumes can be shared by all JES3 system processors physically connected to the same 3850

Virtual units may be partitioned (fenced) for use by specific job class groups or dependent job networks

Data reuse is encouraged (without access to 3850 controller tables)

JES3 algorithms attempt to equalize the amount of staging/destaging activity across Staging Drive Groups

Multiple 3850's can be supported in a JES3 loosely coupled processor configuration, where each 3850 is attached to a separate host (as previously announced, one operating system can only be attached to one MSS)

The JES3/3850 Selectable Unit extends the 'SETUP' facility of JES3 Release 2 to include the IBM 3850 Mass Storage System. SETUP highlights include:

Centralized scheduling and control of pooled and non-pooled I/O devices

High watermark setup

Early resource release

Dynamic allocation and unallocation of data sets and devices

Reserving of devices to dependent job control networks and job class groups

Projected mounting and verifying of private data volumes, including:

DASD data set setup on a system-wide basis which honors JCL disposition parameters

Volume location control, i.e., use awareness

Job Management

Some of the major facilities provided by job management are multiple console support, system log, hardcopy log, checkpoint/restart, and system management facilities.

Multiple Console Support - MCS

Multiple console support (MCS) allows one operating system to use many operator consoles. Each console in a multiple console configuration is defined by specifying the operator commands the system will accept from that console, a console to act as an alternate if a failure occurs, and the types of messages the console will receive.

In a system with MCS, one console acts as the master console and the rest (up to thirty-one) are secondary consoles. The master console is the basic console required for operator-system communication; it alone can accept all possible operator commands, change the status of the hardcopy log and the messages to be recorded on it, switch to a different master console, and receive all messages not specifically assigned to any other console. A secondary console is any console other than the master console; it handles one or more functions assigned to it (for example, it might handle tape activity).

Console devices supported: 158 Console (5) (6) ... 1403 (1) ... 1443-N1 (1) ... 2150/1052-7 ... 2260 (3) (5) ... 2540 (1) ... 2520 (1) ... 2740-1 ... 3036 (5) ... 3066 (5) ... 3505 (1) ... 3210 ... 3211 (1) ... 3215 ... 3525 (1) ... 3277 (4) (5) ... 3284 (4) (5) ... 3213 (1) (6) ... 3286 (4) (5) ... 3287-1,2 (as a 3284/3286) (5) (7) ... 3288-2 (as a 3286-2) (4) (5) ... 3767 (as a 2740-1) ... 2250 (2) (5).

Notes:

- (1) A composite console must consist of a printer-keyboard or a card reader and printer to simulate the actions of a printer-keyboard. MCS allows output only consoles as secondary consoles.
- (2) 2250 Models 1 and 3
- (3) 2260 Model 1 on 2848 model 3 (local attachment).
- (4) The 3277 Model 1, 3284 Model 1 and 3286 Model 1 attach via a 3272 Model 1 or 2. The 3277 Model 2, 3284 Model 2, 3286 Model 2 and 3288 Model 2 attach via a 3272 Model 2 only. The 3278 Models 1-4 are only supported in default mode via 3274 Model 1B attachment.
- (5) DIDOCS supported
- (6) 158 Display Console is supported in printer-keyboard or display mode. When in printer-keyboard mode, a 3213 is required. When used in display mode, it is suggested that addresses 014 or 016 be used for the console and 015 or 017 for the 3213.
- (7) 3287 Models 1 and 2 with 3271/3272 Attachment (8330) and 480 character print operation (9520) attaches via a 3272 Model 1 or 2. 3287 Models 1 and 2 with 3271/3272 Attachment (8330) and 1920 character print operation (9522) attaches via a 3272 Model 2 only.

Device Independent Display Operator Console Support (DIDOCS) Status Display Support (SDS)

Device independent display operator console support (DIDOCS) is a facility of VS2 that enables graphic display devices to be used as operator consoles. Its use can result in faster communication between the system and the operator than can be achieved with standard printer-keyboard or composite console devices.

DIDOCS provides the following advantages to the operator: He can respond to a message or enter a command while messages are being written to the screen ... He sees action messages to be answered and can delete any he no longer needs ... He can use the cursor, or selector light-pen when available, to delete messages and perform other display-oriented functions ... He can initiate automatic command entry either with the selector light-pen or with the program function keyboard (PFK) by an operator command.

Status display support (SDS) provides a clear and understandable presentation of information to a system operator. It provides the following advantages to the operator: He can obtain a contiguous out-of-line display within specified display screen areas ... He can obtain a dynamic status display from an operator command.

System Log

The system log consists of data sets on which the communication between problem programs, operators, and the system is recorded. It may contain the following kinds of information: Operating data entered by problem programs using a write-to-log (WTL) macro instruction ... Descriptions of unusual events that occurred during a shift ... Write-to-operator (WTO) and write-to-operator with reply (WTOR) messages ... Accepted replies to WTOR messages ... Commands issued through operator's consoles and the input stream, and commands issued by the operating system.

Hardcopy Log

The hardcopy log is a permanent record of system activity that is mandatory for systems with an active graphic console or multiple active consoles; for other systems, the primary console device serves as the hardcopy log. The hardcopy log is kept on another, non-graphic, console device or can also be kept on the system log.

Since multiple console support allows more than one console in a system, an installation might find it helpful to record all the messages issued by and to a system. The hardcopy log is a place to collect these messages, and therefore, an installation can review system activity by reviewing message activity.

Checkpoint/Restart

If a job step is terminated before successful completion, checkpoint/restart can make it possible to resume execution from the beginning of the step or from a place within the step. Either way, the restart can be made to occur automatically when the failure occurs.

The CHKPT macro instruction is coded in the user's program at a checkpoint to be taken. A checkpoint is the point at which information about the status of a job can be recorded so that the job step can be later restarted.

Checkpoint/restart includes a checkpoint routine and several restart routines.

The checkpoint routine gathers and records on a checkpoint data set enough information about the status of the job step and its related control blocks to allow a restart from the place where the checkpoint is taken.

The restart routines can be invoked when a job step is resubmitted for restart, or they can be invoked automatically when a failure occurs. The functions performed by restart routines depend upon the type of restart that is requested.

If the restart is to be made from the beginning of a job step, for deferred restart only, the RESTART parameter of the JOB statement must contain the name of the step to be restarted, and routines of the initiating task simply bypass preceding steps and begin processing with the named step.

If a step is to be restarted from the beginning automatically, the RD parameter is used, then restart processing begins during step termination. The step termination routine of job management invokes routines to verify that a restart can be performed and requests the operator to authorize the restart.

If a step is to be restarted from a place where a checkpoint was taken and the job is resubmitted, the RESTART parameter of the JOB statement must identify the step and checkpoint identifier and a SYSCHK DD statement must describe the checkpoint data set.

If a step is to be restarted automatically from a place where a checkpoint was taken, the step termination routine invokes routines to ensure that all data sets for the step are kept.

In MVS, restarted jobs are processed by the job entry subsystem, JES, which returns them to its job execution queue for subsequent initiation based upon priority and resource availability.

System Management Facilities - SMF

System Management Facilities (SMF) collect and record system information. The information obtained can be used in management information reports that describe system efficiency, performance, and usage. The SMF records contain such data as: System configuration ... Job and job step identification ... Processor wait time (SVS only) ... Processor and input/output device usage ... Temporary and non-temporary data set usage and status ... Virtual and real storage usage ... Status of removable direct access volumes ... Allocation recovery records ... Paging statistics.

SMF provides exits to installation-supplied routines that can monitor the operation of a job or job step and generate the installation's own SMF records. The exit routines can cancel jobs, write records to the SMF data set, open and close user-defined data sets, suppress the writing of certain SMF records, and enforce installation standards (such as identification of users). Dummy routines are automatically provided for all unused exits. Changes to SMF for VS2 are: SMF is a standard facility of VS2 ... SMF records in VS2 contain additional accounting information to reflect new system environmental characteristics ... SMF in VS2 provides one new exit from the system control program, which receives control each time an SMF record has been

formatted and is ready to be written out; this exit can prevent the record from being written ... In MVS a new exit is provided whenever a job is ready to be purged from the system ... In VS2, SMF recording data sets must reside on a direct access device ... In SVS, the OUTLIM facility is not supported; in MVS, OUTLIM is supported.

System Activity Measurement Facility - MF/1 (MVS)

The system activity measurement facility (MF/1) is a standard feature in MVS. It collects information about system activities, including hardware resource utilization, performance group management, and paging.

MF/1 produces, optionally, measurement outputs in two forms. Data may be written to the SMF data set and/or reports may be formatted and printed in real time. Measurements are obtained for such system areas as: Processor Activity ... Channel Activity ... Channel-Processor Overlap Activity ... I/O Device Activity and Contention: Unit Record; Graphics; Direct Access Storage; Communications Equipment; Magnetic Tape ... Paging Activity ... Performance Group Activity.

The measurement data and formatted reports produced by MF/1 can aid in: Improving system performance ... Analysis of system trends ... Evaluating future system requirements.

Interactive Problem Control System - MVS IPCS

The Interactive Problem Control System (IPCS) provides MVS TSO installations with expanded capabilities for diagnosing software failures and facilities for managing problem information and status.

IPCS (SU57) executes as a command processor under MVS TSO and provides both the customer's system programmer and the IBM Programming Service Representative (PSR) with facilities for interactive examination and analysis of MVS storage image dumps. In addition to the various data formatting options available, functions are provided to locate link pack area modules and key MVS control blocks and to validate them, where possible. The support also includes high-level summaries of several key system components.

IPCS provides functions in the installation to centrally maintain problem status data, including specifics associated with problem occurrence, environment, responsibility, severity and resolution, as well as an abstract and problem description. It also allows users to record the names of data sets containing problem-specific data.

The enhanced diagnostic capability provided by IPCS should improve the service by:

- Reducing problem analysis time.
- Reducing the number of dumps to be printed and thus printing costs.
- Providing a centralized reference point for locating problem-related data.
- Providing a structure within which the new interactive dump examination and analytic facilities can be used in conjunction with existing tools such as CLISTs and AMDPRDMP exits.

Highlights

- Dump Data Examination
 - IPCS need only be operational on one MVS/TSO system within an installation. It can be used to analyze any DASD-resident catalogued data set containing an MVS (Release 3.7 with SU7) high speed standalone SVC, or SYSDUMP (produced by SU 33) dump. For dump data sets not on devices accessible from that TSO system, MVS data set utility functions may be used to move or copy the dump.
 - The user may tailor the formatting of dumps to provide: hexadecimal displays character displays traditional dump formatting of combined hexadecimal and character displays.
 - Facilities are provided to scan control blocks and to search for specific values or character sequences within the dump.
 - The user can reference and find link pack area modules and key MVS control blocks by name.
 - Users can equate symbolic names to specific addresses in dump storage for debugging purposes and assign attributes to them such as length, offset, address space, or data type.
- Specific Analytic Routines
 - The status of auxiliary storage management is summarized, highlighting any outstanding WTOR messages, and those to which messages have been queued but not yet transmitted.
 - ENQ/DEQ resource management chains are summarized. A selective display of the chains associated with a major resource name is provided.
 - The status of the I/O supervisor component is summarized highlighting critical statistics and the location of key data areas.
 - The ASCBs, ASXBs, TCBs, and RBs are located, formatted and summarized.

- IBM and user-written command processors, as well as CLISTs, may be invoked from IPCS. CLISTs invoked from IPCS may contain IPCS subcommands interspersed among the normal command procedure language, TSO commands and TSO CLISTs invocation statements. Exceptions are command processors which require authorization, have an entry point name (except TIME), or do not expect the standardized command processor parameter list (e.g. TEST).
- User exits for the AMDPRDMP-supported interface for TCB, ASCB, and user control statement exits can be invoked under IPCS.
- For IBM Display Stations supported by TSO (3275 Model 2, 3277 Model 2, and 3276 Models 2 and 12 and the 3278 Model 2 via the 3276 and 3274), a full-screen option is available for examining virtual storage dumps. This option provides functions to utilize these display stations in a preformatted display mode. Data entry, cursor placement, or program function keys (where available) may be used for basic operations such as scrolling or splitting the screen to display multiple areas or multiple formats within a dump.
- IPCS function allows access to the titles of the dumps in the system dump data sets (SYS1.DUMPnn) so that the user may decide which dumps may be discarded without printing or copying.
- TSO HELP information is provided for IPCS commands and subcommands.

Account Facility (MVS)

The account facility is available in MVS. It enables a batch-entry or remote user to update the user attribute data set (UADS) and the broadcast data set in a background environment.

RECOVERY MANAGEMENT SUPPORT (SVS and MVS)

SVS recovery management consists of five functions: machine check handling, channel check handling, dynamic device reconfiguration, alternate path retry, and missing interrupt checking. In addition, MVS provides alternate Processor recovery.

SVS Recovery Management Support

The Machine Check Handler (MCH) records all machine checks and determines if recovery from a malfunction was made by the Instruction Retry or Error Correction Code facilities of the System/370 Processor. If the malfunction is not corrected by the machine facilities, MCH assesses the damage and attempts to repair intermittent storage errors. If recovery is not possible, a determination is made whether system operation can continue either in full or degraded mode and isolates the failure to a task for orderly, selective termination of the task.

The Channel Check Handler (CCH) analyzes information which results from Channel Data Checks, Channel Control Checks, and Interface Control Checks. CCH attempts to have the error corrected and determines whether or not the system can continue operation. The Channel Check Handler formats and records appropriate error records.

Dynamic Device Reconfiguration (DDR) allows a demountable volume not marked permanently resident to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error.

Alternate Path Retry (APR) automatically retries input/output operations in error and marks offline those data paths that are unusable. APR is automatically included when optional channel paths are specified.

The operator may vary paths online and offline by using the VARY path command. He may not vary the last remaining path to a device offline, nor may he vary teleprocessing paths or paths to shared DASDs.

The Missing Interrupt Checker support provides a function which performs polling of active units to assure that device and channel end interrupts are received within a specified time interval. The operator will be notified if any mounts or device and channel end interrupts that are left pending for longer than specified time interval. The operator may have to take specific actions depending upon the conditions encountered.

The Machine Check Handler, Channel Check Handler, Dynamic Device Reconfiguration and Interrupt Checker are standard parts of the VS2 control program. They reside in the control program area of virtual storage and operate in the unpagged section of processor storage except for part of DDR which resides in pageable LPA. Alternate Path Retry is an optional extension to the Input/Output Supervisor.

MVS Recovery Management Support

The Machine Check Handler (MCH) records, via recovery management, all machine checks and determines if recovery from a malfunction was made by the Instruction Retry or Error Correction Code facilities of the System/370 Processor. If the malfunction is not corrected by the machine facilities, MCH performs certain analyses

and provides a record of the analysis to the Recovery Termination Manager. The appropriate software recovery routines are then invoked. In a tightly-coupled multiprocessing (MP) environment, if MCH processing is unsuccessful in a failing Processor, or if a Processor enters a check-stopped state, MCH will attempt to initiate recovery processing by marking the failing Processor offline and invoking the Recovery Termination Manager in the non-failing Processor.

The Channel Check Handler (CCH) analyzes information that results from channel data checks, channel control checks, and interface control checks. CCH attempts to have the error corrected by passing error information to the error recovery procedure. The Channel Check Handler formats appropriate error records which are recorded. In MVS, when an error affects the entire channel, MVS will attempt to recover any active I/O on the failing channel.

Dynamic Device Reconfiguration (DDR) allows a demountable volume not marked permanently resident to be moved from one device to another. The request to move a volume may be initiated by the system or by the operator. The system will initiate a DDR request to the operator upon detection of a permanent error. In MVS, DDR is also available for volumes containing data sets used for paging.

Alternate Path Retry (APR) ensures that an alternate path to a device is tried (whenever possible) when a failing path is detected. MVS always includes APR.

The operator may vary paths to a device online or offline by means of the VARY PATH command. In MVS, he can vary offline all paths except those to shared direct access storage devices which have an outstanding RESERVE.

The Missing Interrupt Checker (MIC) is a standard facility of VS2 that notifies the operator if a device-end, channel-end, DDR exchange, or mount interruption is not received within a specified period of time. The absence of such interruptions may mean that a mount message has not been satisfied or that a device has malfunctioned. Specific actions an operator may have to take depend upon the conditions he encounters. He may be required to ready a device on which a volume has been mounted, examine indicator lights on the device for abnormal signs, or terminate the job. In the case of channel end interruptions, MIC will invoke I/O restart to attempt to retry. Additionally, MIC will record via recovery management when device-end or channel-end interruptions are not received.

Alternate Processor Recovery (ACR) processing is invoked when a Processor in a tightly-coupled multiprocessing (MP) environment can no longer function. ACR processing is invoked by a signal that is sent by the failing Processor before it enters a permanent wait or stopped state. This signal is either a hardware-generated malfunction alert (MFA) or a software-generated emergency signal (EMS). When ACR processing is invoked on the non-failing Processor, it monitors the recovery processing of tasks and I/O on the failing Processor in an attempt to recover those activities which were on the failing Processor and continue system operations.

Any common pageable system areas (e.g., Link Pack Area) will be written to two separate paging data sets which may be on two separate devices. The additional copy will be utilized if on the first attempt to access the information, an I/O failure occurs.

MULTIPROCESSING WITH SHARED REAL STORAGE (MVS)

Multiprocessing (MP) is an extension of the MVS control program that supports two tightly-coupled Processor with shared real storage. Available with MVS, MP is an integral part of the system control programming. The two Processors are treated as system resources and are assigned by the resource manager to process any task. (Programs can also be designated by the installation to run on a particular Processor). Multiprocessing is designed to provide more efficient and more flexible allocation of execution time, I/O units, and main storage for a single job stream than uniprocessing with two separate Processor. Availability is extended by:

Recovery management support that reduces the impact of software and solid hardware failures.

Real storage reconfiguration that bypasses failing storage components in 4K blocks and terminates only affected tasks.

Alternate Processor Recovery (ACR) processing that allows the non-failing Processor to attempt recovery of tasks and I/O in progress on a failing processor.

In MVS Release 3, an additional availability improvement is included for the 168 Multiprocessing System. (Channel Reconfiguration Hardware support - CRH.) This facility permits the channels attached to a stopped Processor to be accessed via the Channel 6 interface of the still running Processor. It also allows a channel to be varied online for use by the system while the attached Processor is in an offline state. CRH is activated by either an ACR condition or by operator intervention with the DIAGNOSE instruction used to switch between the Channel 6 interface of the running Processor and the remote channels of the stopped Processor. With CRH, all channels in both the running and the stopped processor remain accessible for I/O. It should be noted that CRH cannot be activated when DSS is active in the system.

A new locking structure providing a number of locks in the control program allows more parallelism over systems having only one lock. With the use of separate address spaces for jobs and subsystems, queues and control blocks associated with only one virtual address space can be manipulated without preventing the other Processor from performing similar control program functions in other address spaces.

TIMESHARING OPTION - TSO (SVS and MVS)

An extension which provides VS2 users general purpose timesharing capability in a compatible VS2 environment. Terminal users share remote access to the powerful facilities of OS/VS2 for conversational interaction — preparation, syntax checking, execution, updating of programs and data — concurrently with normal background VS2 operations. A comprehensive easy-to-use conversational command language is provided for the terminal user to communicate with the system. TSO provides conversational remote access to the VS2 environment for both the experienced professional programmer and the individual with little or no experience with computers.

Features:

- General purpose time sharing capability operating concurrently with VS2 background operation within one operating system.
- Data sets can be dynamically allocated in the time sharing region.
In MVS, devices can also be dynamically allocated.
- Real storage utilization reflects the actual requirements to execute the program in the time shared region as compared to a fixed requirement in OS/MVT.
- In SVS, multiple timesharing users share a timesharing region and their active pages (working set) are swapped (block paged) to the paging data sets.
- In MVS, each timesharing user is assigned to an individual virtual address space.
- Time sharing provides an environment for creating and executing conversational programs. A device-independent BSAM/QSAM interface to terminals is provided for ease of development and installation of terminal-oriented application programs.
- Programming languages and data management are compatible between conventional (batch) programs and programs developed at the terminal. Batch or terminal-developed programs can be stored, retrieved and executed locally (at the computer center) or from the remote terminal allowing the use of data sets by time shared or other regions/address spaces.
- Use of TCAM to handle timesharing terminal types (see Terminals Supported in this section) allows the same terminal and/or communications lines to be used for timesharing or other TCAM applications.
- Terminal-users may use any IBM language processors supported on VS2.
- The debugging command, **TEST**, allows system programmers and assembler language programmers to control the execution of a program, interrupting it at dynamically specified points.
- In MVS, The Interactive Problem Control System may be used to provide interactive examination and analysis of any MVS (Release 3.7 with SU7) high-speed stand-alone, SVC, or SYSDUMP (produced by SU33) dump.
- In MVS, the **ACCOUNT** facility may be executed in a background environment.
- In MVS, the installation may specify a time interval which establishes a period that will permit a timesharing user to reconnect to the system in the event of a line disconnect. Should the interval lapse prior to the user reconnecting to the system, then the system will automatically save any data set which the user was in the process of editing.

TSO offers comprehensive language support for online development, debugging and execution of programs in COBOL, FORTRAN, PL/I, BASIC, and Assembler.

Language facilities available to the terminal user include: Compilation, usually invoked with a single command ... Linkage editing or loading ... Program execution with terminal I/O capabilities for interactive application ... Interactive debugging, using the data names and labels of the source program, of a program in execution for rapid program checkout.

In MVS Release 3, Expanded Command Procedure allows the user to specify compiler type functions to control execution of his CLISTs, with control options to handle error exiting, including nesting of CLISTs, If/Then/Else and Do While/End Syntax, Read/Write to/from CLIST, extensions of local and global options, external file - I/O and enhanced symbolic substitution. Also, a number of EDIT improvements have been added in MVS Release 3. In MVS Release 3, the use of VTAM allows the use of some SDLC terminal types (see *TSO Terminals Supported* in this section).

For more detailed descriptions of the language products designed for use under TSO, see the program product section of the sales manual.

TSO Terminals Supported

TSO supports the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use TSO with unsupported features can cause unpredictable results.

The access methods that support TSO are TCAM (through the TCAM Message Control Program provided) and VTAM. The access method shown in parenthesis after each terminal/feature is the one providing support for that terminal/feature.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by TSO may also function satisfactorily with TSO; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

Start/Stop Lines

1050 Data Communication System on switched or point-to-point nonswitched lines: (TCAM)

1051 Control Unit (Models 1,2):

Required: Attachment of 1052
Recommended: 1313 - Automatic EOB (or RQ E28235)
6100 - Receive Interrupt
9698 - Text Time-Out Suppression
9700 - Transmit Interrupt

1052 Printer-Keyboard (Models 1,2):

Recommended: 1313 - Automatic EOB
9571,9591 - PTTC/EBCD Code

2741 Communication Terminal on switched or point-to-point nonswitched lines: (TCAM)

Recommended: 4708 - Receive Interrupt
5501 - Print Inhibit
7900 - Transmit Interrupt
9571 - PTTC/EBCD Print Element (P/N 1167963)
Supported: 9567 - PTTC/BCD (P/N 1167938)
9812 - Correspondence (P/N 1167043)
Not Supported: If 2741 is attached to a 2701:
4708 - Receive Interrupt
7900 - Transmit Interrupt

2845 Display Control (Model 1) on nonswitched lines: (TCAM)

Required: Attachment of 2265
If 2845 is attached to a 2701:
4646,4657 - IBM Terminal Adapter Type III
Recommended: 3301 - Destructive Cursor
Attachment of 1053
Not Supported: 4801 - Line Addressing
7801 - Tab

2265 Display Station (Model 1):

Required: 4766 - Alphameric Keyboard

2848 Display Control (Models 1,2,3)

on nonswitched lines: (TCAM)

Required: Attachment of 2260
Recommended: 3901 - Extended Cursor Control
5340 - Non-Destructive Cursor
5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053
4787 - Line Addressing

2260 Display Station (Models 1,2):

Required: 4766 - Alphameric Keyboard
Recommended: 3606 - Extended Cursor Control, Alphameric Keyboard
Not Supported: Tab feature of 3606

3767 Communication Terminal (Models 1,2) (supported as a 2741) on switched or nonswitched lines: (TCAM)

Required: 7113 - 2741 Start/Stop (which provides PTTC/EBCD and Correspondence Codes)

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines: (TCAM)

Required: 1525 - Communications Adapter

CPT-TWX (Model 33/35) Line Control Type on switched lines: (TCAM)

Supported: Data Interchange Code
(8 level) at 110 bps
even or forced parity

Binary Synchronous Lines

**3270 Information Display System on nonswitched lines:
(TCAM, VTAM)

3271 Control Unit (Models 1,2):
Required: Attachment of 3277
Supported: 9761 - EBCDIC Code
Not Supported: Attachment of 3284, 3286,
3287(as a 3284/3286)
or 3288
1550 - Copy

3274 (Model 1C) (Supported as a 3271):
Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3284, 3286, 3287,
3288 or 3289

3275 Display Station (Models 1,2):
Supported: 9089 - EBCDIC Character Set
9761 - EBCDIC Code
*User Supported: 4600 - Operator Identification
Card Reader
6350 - Selector Light-Pen
Program function keys
Additional flexibility in
controlling screen formats
Not Supported: Attachment of 3284

3276 Control Unit Display Station (Models 1, 2, 3, 4)
(Supported as a 3271)
Supported: Attachment of 3278
Not Supported: Attachment of 3287

3277 Display Station (Models 1,2):
Supported: 9089 - EBCDIC Character Set
*User Supported: 4600 - Operator Identification
Card Reader
6350 - Selector Light-Pen
Program function keys
Additional flexibility in
controlling screen formats

3278 Display Station (Models 1, 2, 3, 4) (Supported as a 3277)
Supported: 9082 EBCDIC Character Set

SDLC Terminals

**3270 Information Display System on nonswitched lines: (VTAM)

3271 Control Unit (Models 11,12):
Required: Attachment of 3277
Supported: 9761 - EBCDIC Code
Not Supported: Attachment of 3284, 3286, 3287
(as a 3284/3286), 3288
1550 - Copy

3275 Display Station (Models 11,12):
Supported: 9089 - EBCDIC Character Set
9761 - EBCDIC Code
*User Supported: 4600 - Operator Identification
Card Reader
6350 - Selector Light-Pen
Program function keys
Additional flexibility in
controlling screen formats
Not Supported: Attachment of 3284

3277 Display Station (Models 1,2):
Supported: 9089 - EBCDIC Character Set
*User Supported: 4600 - Operator Identification
Card Reader
6350 - Selector Light-Pen
Program function keys
Additional flexibility in
controlling screen
formats

3270 Information Display System on switched and nonswitched lines
(VTAM) and on nonswitched lines only (TCAM/NCP Direct)

3276 Control Unit Display Station (Models 11-14)
Supported: Attachment of 3278-2
Not Supported: Attachment of 3287

3278 Display Station (Models 1-4)
Supported: 9082 - EBCDIC Character Set

3767 Communication Terminal (Models 1,2,3) on switched or
nonswitched lines: (VTAM)
Supported: SDLC adapter provided unless
one of the Start/Stop features are
are specified
1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines:
(VTAM)

3771 Communication Terminal (Models 1,2,3):
Required: 1460 - SDLC/BSC, Switch Control,
or
1470 - SDLC

Supported: 1201 - ASCII Code

3773 Communication Terminal (Models 1,2,3,P1,P2,P3):
Required: 1460 - SDLC/BSC, Switch Control,
or
1470 - SDLC

Supported: 1201 - ASCII Code

3774 Communication Terminal (Models 1,2,P1,P2):
Required: 1460 - SDLC/BSC, Switch Control,
or
1470 - SDLC

Supported: 1201 - ASCII Code

3775 Communication Terminal (Model 1,P1):
Required: 1460 - SDLC/BSC, Switch Control,
or
1470 - SDLC

Supported: 1201 - ASCII Code

Local Channel Attachment

Local Terminals

2848 Display Control (Models 1,2,3) on a local channel: (TCAM)

Required: Attachment of 2260
Recommended: 3901 - Extended Cursor
Control

5340 - Non-Destructive
Cursor
5341 - Non-Destructive Cursor
Adapter

Not Supported: Attachment of 1053
4787 - Line Addressing

2260 Display Station (Models 1,2):

Required: 4766 - Alphameric Keyboard
Recommended: 3606 - Extended Cursor Control,
Alphameric Keyboard

Not Supported: Tab feature of 3606

**3270 Information Display System on a local channel: (TCAM,VTAM)

3272 Control Unit (Models 1,2):

Required: Attachment of 3277
Not Supported: Attachment of 3284, 3286,
3287 (as a 3284/3286)
or 3288

3274 (Model 1B) (Supported as a 3272)

Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3284, 3286, 3287
3288 or 3289

3277 Display Station (Models 1,2):

Supported: 9089 - EBCDIC Character Set
*User Supported: 4600 - Operator Identification
Card Reader
6350 - Selector Light-Pen
Program function keys
Additional flexibility in
controlling screen formats

3278 Display Station (Models 1, 2, 3, 4)(Supported as a 3277)
Supported: 9082 EBCDIC Character Set

3270 Information Control System on a local channel:
(VTAM, TCAM thru VTAM)

3272 Control Unit (Models 1,2):

Required: Attachment of 3277
Not Supported: Attachment of 3284, 3286 or 3288

3274 Control Unit (Model 1A)

Required: Attachment of 3278
Supported: Attachment of 3277
Not Supported: Attachment of 3284, 3286, 3287
3288 or 3289

3277 Display Station (Models 1, 2)

Supported: 6350 - Selector Light Pen
9089 - EBCDIC Character Set

3278 Display Station (Models 1, 2, 3, 4)

Supported: 6350 - Selector Light Pen
9082 EBCDIC Character Set

* Can be supported in user-written TSO Command
Processors and TSO Application Programs using the TGET/TPUT
ASIS macro instructions.

** TSO support of the 3270 utilizes brightness
control to differentiate system-generated output (brightened
intensity) from user input (normal intensity), and
suppresses display of information entered in response
to system prompt for password.

Transmission Control Units and Communication Controllers

2701 Data Adapter Unit on a local channel: (TCAM)

Required: 4640 - IBM Terminal Adapter
Type I and/or
4656, 4657 - IBM Terminal Adapter
Type III and/or
7860-7862 - Telegraph Adapter
Type I and/or
7885 - Telegraph Adapter
Type II

2702 Transmission Control Unit on a local channel: (TCAM)
Required: 4615 - IBM Terminal Control
Type I and/or
7912 - Telegraph Terminal Control
Type II
8200 - Type I Terminal Interrupt
(necessary to support the 2741
and 1050 Transmit Interrupt
and/or Receive Interrupt)

2703 Transmission Control Unit on a local channel: (TCAM)
Required: 4696 - IBM Terminal Control
Type I and/or
7912 - Telegraph Terminal
Control Type II
8200 - Type I Terminal Interrupt
(necessary to support the 2741
and 1050 Transmit Interrupt
and/or Receive Interrupt)

3704/3705-I/3705-II Communications Controller on a local channel:
Required: EP/VS (TCAM) or
NCP/VS (TCAM,VTAM)

DATA MANAGEMENT (SVS and MVS)

Data management controls all operations associated with input/ output devices, such as allocation of space on volumes, storing, naming, and cataloging data sets, and movement of data between real and auxiliary storage.

Virtual Storage Access Method - VSAM

VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the data set to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: a data organization which minimizes data movement and which is suitable for data base applications; and routines for creating data sets in the VSAM organization, adding and deleting records, and performing other data management functions. Because the VSAM data organization and the access method routines are supported for both OS/VS and DOS/VS, VSAM provides full data portability between these systems.

The VSAM user can expect to see performance improvements relative to OS/VS ISAM and DOS ISAM. Performance gains with VSAM can become increasingly significant as the number of insertions to the data set rises. This is due to the elimination of the "chained record overflow" concept employed by ISAM. VSAM effectively maintains its sequential, non-inserted performance as records are added to the data set. Also, VSAM requires less time to perform a record insert than does ISAM. These factors, coupled with the efficient VSAM index structure and with the VSAM performance options, offer the potential of performance improvements relative to ISAM.

VSAM Highlights

- Access to data via VSAM is controlled by macro instructions written under the conventions of Assembler language. Access to data sets may be either direct or sequential, and may either be keyed (controlled by index key) or addressed (controlled by relative byte address).
- With VSAM, certain device-dependent calculations such as the optimum block sizes for a given device type are carried out automatically and all data addressing is by relative bytes within the storage space allocated to the data set. These features minimize programmer effort when he wants to change device types.
- Most existing and new COBOL, PL/I, and Assembler language programs written for use with ISAM data sets may be used with VSAM data sets by means of the VSAM ISAM Interface Program. The ISAM Interface Program maps ISAM macro instructions into the corresponding VSAM requests. Refer to the Program Product

section of the sales manual for details regarding COBOL and PL/I support of VSAM.

VSAM functional extensions relative to ISAM include concurrent direct and sequential processing, expanded catalog support for OS/VS and enhanced device independence. A single VSAM OPEN macro instruction may be used to initiate both direct and sequential accessing, without the need of issuing an intervening CLOSE instruction.

- VSAM offers a multi-function service program (Access Method Services) to facilitate overall management of data. Such services as defining data sets initially, deleting VSAM data sets from the VSAM catalog, printing and copying data, listing the VSAM catalog, and providing backup and portability features are controlled by this multi-function program. Converting data sets from the ISAM or SAM format to the VSAM format is another important function of this program.
- A significant feature of VSAM is that of data set and volume portability between DOS/VS and OS/VS systems. Portability of data sets and volumes is made possible by the user catalogs and the multi-function service program, Access Method Services.
- VSAM offers multiple levels of password protection to enhance data set security. VSAM also offers a user exit so that user-written security routines may be included.

Additional features are available to VSAM users as an independent component release applicable to SVS Release 1.7 and MVS Release 3. The primary objective of these features is to provide functions which will reduce the need to schedule redundant work. These optional features are:

Alternate Indexes

This new feature permits application programs to access the records of a VSAM entry or key sequenced data set on the basis of keys other than the prime key. These alternate keys may be non-unique and must be contained in the base data record. Once an Alternate Index has been constructed by using Access Method Services, it may optionally be automatically updated whenever a data record is changed in the base data set to which it relates.

Relative Record Data Set

With this feature the data set is viewed as a numbered sequence of fixed length slots. Records may be inserted, updated, read, or erased in these slots using VSAM keyed processing, with the slot (i.e., record) number as the key. No index is used since each record's physical location is calculated directly by VSAM from its record number and the characteristics of the data set.

Get Previous

This feature permits retrieval and update processing on the basis of descending key values, relative record numbers, or relative byte addresses. Processing may begin either within or at the end of the data set.

Reusable Data Set

This new capability allows a data set to be reused (i.e., reset to "empty" when opened and reloaded) many times without being deleted and redefined. A reusable data set may be any key sequenced, entry sequenced, or relative record data set that does not have an alternate index associated with it and that does not reside on unique space. However, an alternate index may be a reusable data set.

Spanned Record

Originally VSAM did not permit a record to exceed a control interval in size. The Spanned Record feature removes the restriction, allowing a record to occupy multiple control intervals within a control area. If indexed, the keys must be in the first control interval.

Recovery

Extensions to the facilities within VSAM Catalog Management and Access Method Services will now permit limited access, via Access Method Services, to data that is not addressable by the catalog (due to the loss of, or damage to, the catalog). Further, the user can restore addressability of the data and reconstruct the associated catalog entries.

Improved Control Interval Processing

This feature is designed to reduce Processor utilization for users of control interval processing with user buffers and with minimal processing options.

VSAM Shared Resources

This option provides new interfaces to allow the user to create and control his own resource pool, permitting buffers and control blocks to be shared among data sets. Its use minimizes the storage requirement in a data base environment in which a large number of data sets may remain open over an extended period.

Programming Systems: VSAM is an SCP component of VS2 (SVS and MVS). The user is not required to code any additional routines or modify VSAM.

VSAM coexists with existing data management access methods. The data management functions supplied by VSAM are: Opening data sets ... Processing records by index key ... Processing records by address ... Closing data sets ... End of volume processing ... Cataloging VSAM data sets ... Data set password protection ... Allocating space ... Checkpoint/Restart processing.

Direct Access devices supported are the 2314, 2319, 3330/3333, 3340, 3344, 3350 and 2305. VSAM does not support the 2301, 2303, 2311 or 2321.

Sequential Access Methods

In the Basic Sequential Access Method (BSAM) data is sequentially organized and physical blocks of data are stored or retrieved. The **READ/WRITE** macro instruction causes the initiation of an input/output operation. The completion of these operations is tested by using synchronization macro instructions. Automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

In the Queued Sequential Access Method (QSAM) logical records are retrieved or stored as requested. The access method anticipates the need for records based on their sequential order, and normally will have the desired record in virtual storage, ready for use, before the request for retrieval. When writing data, the program normally will continue as if the record had been written immediately, although the access method routines may block it with other logical records and defer the actual writing until the output buffer has been filled. As with BSAM, automatic translation between EBCDIC and ASCII codes is provided for magnetic tape labels and record formats.

Basic Partitioned Access Method - BPAM

This access method, when used in conjunction with BSAM, is designed for efficient storage and retrieval of discrete sequences of data (members) belonging to the same data set on a Direct Access device. The data set includes a directory that relates the member name with the address where the sequence begins. Each member has a simple name. Members may be added to a partitioned data set as long as space is available in the directory and the data set. Other than directory manipulation, all I/O is performed by BSAM.

Basic Direct Access Method - BDAM

In the Basic Direct Access Method (BDAM), records within a data set are organized on direct access volumes in any manner chosen by the programmer. Storage and retrieval of a record is by actual or relative address within the data set. This address can be that of the desired record or a starting point within the data set where a search for the record, based on a key furnished by the programmer, begins. Addresses are also used by BDAM as a starting point for searching for available space for new records.

Indexed Sequential Access Methods

Sequential and direct processing are provided by the Indexed Sequential Access Methods (ISAM). Records are maintained in control field sequence by key. A multilevel index structure is system maintained, allowing retrieval of any record by its key. Additions can be made to an existing ISAM data set without rewriting the data set.

The Basic Indexed Sequential Access Method (BISAM) stores and retrieves records randomly from an indexed sequential data set. Selective reading is performed using the **READ** macro instruction, and specifying the key of the logical record to be retrieved. Individual records can be replaced or new records added randomly.

The Queued Indexed Sequential Access Method (QISAM) is used to create an indexed sequential data set or to retrieve and update records sequentially from such a data set. Synchronization of the program with the completion of input/output transfer, and record blocking/unblocking are automatic. QISAM is also used to reorganize an existing data set.

Virtual I/O (MVS)

The virtual I/O facility is available in MVS. It uses the system paging mechanism to transfer data set blocks between external page storage and real storage. The user can specify virtual I/O processing for system-named temporary data sets accessed through BDAM, BPAM, BSAM, QSAM, EXCP and XDAP interfaces. Virtual I/O processing for system-named temporary data sets is established at system generation time.

Page-size (4K bytes) physical blocks are dynamically allocated in external page storage as a virtual I/O data set is created. These blocks are not necessarily contiguous and the virtual I/O data set may span several volumes of external page storage. The blocks are released when the data set is deleted and the space is immediately made available for other paging needs.

Implementation of virtual I/O processing is compatible with the BDAM, BPAM, BSAM, QSAM, EXCP, and XDAP macro interfaces to a DASD data set, and requires no change to user-written code or JCL. When a

request is made for accessing a virtual I/O data set, the channel programs are intercepted and interpreted and the page table entries are manipulated if necessary, so that the desired data will be paged in or out of real storage as requested. For example, the control program reads a virtual I/O data set record into a virtual address space by modifying page table entries so that the 4K byte block(s) containing the record are identified as part of the virtual address space from which the request was made.

Restart processing currently available for temporary data sets is provided for virtual I/O data sets. Checkpoint and automatic step restart are provided for job failures. Checkpoint, step, and job restart through the Job Entry Subsystem and automatic step restart are provided for system restart processing.

Some of the advantages of virtual I/O are: Centralized direct access storage device management ... Elimination of channel program translation and page fixing requirements ... Use of the I/O balancing of the paging mechanism ... Elimination of normal I/O device allocation and DADSM overhead for temporary data sets ... Compatibility at the object code and JCL level.

3850 Mass Storage System - MSS (SVS and MVS)

SVS and MVS support attachment of a single 3850 Mass Storage System (MSS) (up to two A Model 3851's).

The 3850 Mass Storage System (MSS) programming support includes an MSC (Mass Storage Control) Table Create program, Access Method Services functions to aid in mass storage volume management, and a Mass Storage System Communicator (MSSC) which communicates the Staging/Destaging commands to the MSC and contains Mass Storage Volume Control (MSVC) functions to assist in volume management. In addition, most of the facilities available for the control and management of real 3333/3330 Disk Storage drives and the data sets contained on 3336 Model 1 and 11 Disk Packs are applicable to virtual 3333/3330 addresses and the data sets contained on mass storage volumes. The 3350 devices may be attached to the 3830-3 or the ISC with staging adapter as a real device in native mode only. Brief descriptions of the significant areas of support follow. More detailed information can be found in the publication *OS/VS Mass Storage System (MSS) Planning Guide*.

MSC Table Create: Creates and initializes the tables required by the Mass Storage Control (MSC). The tables are of four types:

Configuration Information: describes the hardware present in the 3850 Mass Storage System and the interconnections between the various hardware components.

Cartridge Information: describes the locations and volume serial numbers of the mass storage volumes in the 3851 MSF.

Activity Information: describes the status of staging and destaging of data.

Control Information: contains information required to locate all the above tables and also the basic information required to start the MSC initial microprogram load.

This program must be run at the initial installation of the 3850 MSS and whenever the configuration changes. It must be run prior to a VS2 System Generation, if the 3851 **IODEVICE** macros are being changed, because it generates **IODEVICE** and **UNITNAME** card images to be used in Stage I of SYSGEN.

VS2 System Generation: The 3851 Mass Storage Facility is a new device type for which an **IODEVICE** macro must be included. The expanded addressing capability of the 3830 Model 3 Storage Control and the Integrated Storage Controls (4650) with Staging Adapter special feature (7220) on System/370 Models 158 and 168 is identified to the system generation process as virtual 3333/3330 units. The number of virtual 3333/3330 addresses will be limited by the VS2 UCB limit (see *OS/VS2 System Generation Reference*) and by the available subchannels (see appropriate Processor or channel functional characteristics manual). An **IODEVICE** macro for each virtual 3333/3330 address is required. Certain system data sets must reside on real direct access units known to VS2. The four real unit addresses 0, 1, 8 and 9 on Staging Adapter 0 and Staging Adapter 1 are reserved for direct access to the MSC tables. If the only direct access units in an installation are the 3333/3330 Disk Storage drives included in the 3850 MSS, then one or more of these 3333/3330 drives must be assigned addresses that have been identified to VS2 as real 3333/3330 units. These 3333/3330 drives can then be used for the system data sets. For further information on system generation, refer to the publications *OS/VS System Generation Introduction (GC26-3790)* and *OS/VS2 System Generation Reference*.

Staging/Destaging Initiation: Staging and destaging is based upon Job Control Language (JCL) Data Definition (DD) statement parameters. **UNIT=3330V** indicates that the data set defined by **DSNAME** resides on a mass storage volume whose serial number is identified either by the **VOLUME** parameter or in the catalog. This mass storage volume is "mounted", i.e. made active, by the Mass Storage Control at job step initiation. If **DISP=OLD**, **SHR**, or **MOD** is specified, the staging of the data set is initiated when the data set is **OPENed**. Staging will be initiated for new data sets only when the space request is not on a cylinder boundary. Destaging of new data sets for which **DISP=KEEP**

or CATALOG and the portions of old data sets that were modified is initiated when the mass storage volume is demounted.

Mass Storage System Communicator (MSSC): The MSSC includes **Mass Storage Volume Control (MSVC)** functions to assist users of the 3850 MSS to control and manage the use of mass storage volumes. MSVC centers around a new system data set, **Usercat.MSVI**, which is a keyed sequential VSAM data set containing space and activity information about mass storage volumes and groups of mass storage volumes. It is created, initialized, and maintained by the user via the Access Method Services functions for creating a VSAM data set and for the manipulation of mass storage volumes. **Usercat.MSVI** is used by MVS for the allocation of mass storage volumes to satisfy non-specific volume requests for new data sets. An Access Method Services function which produces a report of the status of mass storage volumes and groups of mass storage volumes is available. Access Method Services also list information concerning cartridges similar to the information listed concerning volumes. Included are two commands which enable the user to list or scratch and uncatalog non-VSAM data sets according to his specified criteria (e.g., creation date, expiration date or name qualifier). It is an installation responsibility to analyze these reports to determine the extent of space utilization on mass storage volumes and then to initiate the appropriate utility functions to scratch or copy inactive data sets.

Data Management Support: BSAM, QSAM, BPAM, BDAM, VSAM, EXCP, and XDAP may be used for data sets contained on mass storage volumes. The staging of such data sets is initiated at **OPEN**. ISAM data sets can be contained on mass storage volumes. However, staging for ISAM data sets is not initiated at **OPEN** but, rather, at the time a data record is accessed. One cylinder at a time is staged as requested by the "cylinder fault" mode of operation. The Direct Access Device Space Management (DADSM) facilities are applicable to mass storage volumes as well as to real direct access volumes. All of the catalog facilities of VS2 can be used for data sets contained on mass storage volumes.

Data Sharing: The components of the 3850 MSS can be shared by a maximum of four System/370s and 3033 Processor complexes. The catalog, user program libraries, and user data sets can be accessed by any Processor. If 3333s are shared between hosts, the 3330V devices with paths to the shared 3330 drives may be SYSGENed as shared or unshared at user option.

Data Security: The password protection data security facilities of VS2 can be used to control access to MSC tables and data sets contained on mass storage volumes.

Data Set Utility Programs: All non-standalone VS2 Data Set Utilities can be used with data sets contained on mass storage volumes.

System Utility Programs: All non-standalone VS2 System Utility Programs except IEHDASDR and IEHATLAS can be used on mass storage volumes.

IEHDASDR Utility Function: VS2 System Utility Program IEHDASDR provides support for formatting the IBM 3336 Models 1 and 11 Disk Packs for use as the real volume staging pack. This utility function can only be performed external to the MSS.

Access Method Services Functions: Access Method Services provides mass storage volume commands which allow a user to initialize, modify, copy, and scratch mass storage volumes, to add and remove mass storage volumes from the 3850 MSS, and to convert real 3336 Model 1 and 11 Disk Packs to mass storage volumes and back again. There are commands which allow a user to create, modify, and scratch groups of mass storage volumes in **usercat.MSVI**, and to list the contents of **usercat.MSVI**.

Additional commands allow the user to copy, swap, and compare his Mass Storage tables, to dump portions of the MSC or Staging Adapter storage, to dump the MSC tables, to audit cartridge locations within the Mass Storage Facility, and to check the consistency of the MSC tables, Staging Adapter tables and Mass Storage Volume Inventory data set.

JES3: JES3 data and device management of the IBM 3850 MSS is available as a Selectable Unit. This support is described in the JES3 section under *Device, Volume and Data Set Management*.

VIRTUAL TELECOMMUNICATIONS ACCESS METHOD - VTAM (SVS Release 1.7 and MVS Release 3) (Also refer to the Program Products section for licensed options provided for VTAM).

A functionally superior alternative to BTAM, VTAM provides telecommunication support for the 3704/3705 in network control mode and for locally attached 3270s and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM is supported in SVS Release 1.7, but is not supported in SVS Release 1.0 or 1.6. VTAM is supported in MVS Release 3 and all subsequent MVS releases, but is not supported in MVS Release 2.

VTAM provides for the direct transmission of messages between application programs and terminals. Using NCP/VS, it makes the lines and communications controllers transparent to the application

program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM initially supports switched and nonswitched lines. A switched line connection requires system operator assistance. Manual dial service is supported. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. VTAM subsequently supports SDLC terminals in switched networks as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upward compatible for the three virtual storage operating systems (DOS/VS, OS/VS1, and OS/VS2). It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer DB/DC systems. In MVS Release 3, TCAM application programs can use certain VTAM facilities through the TCAM Message Control Program.

Network operator control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored VS2 RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of 3790 Communication Systems and the host communications subsystem.

Teleprocessing Online Test Executive Program - TOLTEP

TOLTEP is a component of VTAM and is designed to control the selection, loading, and execution of teleprocessing online terminal tests (OLTTS) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTS of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTS concurrently with other processing programs, with VTAM, and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, TOTE and OLTEP are still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

VTAM System Requirements

VTAM operates on all System/370 models supported by SVS Release 1.7 or MVS Release 3.

See *VTAM, TCAM and BTAM Terminals Supported* for a list of devices supported by VTAM with VS2.

TELECOMMUNICATIONS ACCESS METHOD - TCAM (Also refer to the Program Products section for licensed options provided for NCP/VS).

The Telecommunications Access Method (TCAM) is a teleprocessing support program which may execute in conjunction with VTAM or as a separate access method. It provides:

- A regionalized, general-purpose TP access method providing facilities that permit exchange of data between a central S/370 and remote terminals.
- A control program designed to optimize the allocation and scheduling of a computer's resources in a real-time teleprocessing

environment. Resources optimized include Processor time, real-storage space and I/O paths (lines and channels).

- A high-level language composed of macro instructions designed specifically to facilitate the construction of a TP message control program.

Please refer to the *Terminal Support Chart(s)* in this section for specific terminals and how supported.

TCAM provides unified management of terminal devices, local and remote, including BSC and SDLC devices, through a single Message Control Program. The TCAM application-program interface has been defined to provide maximum compatibility with BSAM (READ/WRITE level) and QSAM (GET/PUT level), yet provide the ability to identify or specify source and destination of terminal I/O. Network control functions may be provided in an application program able to issue TCAM operator control commands.

Teleprocessing applications using TCAM are constructed by providing a Message Control Program and one or more TCAM application programs.

TCAM does not provide emulation of the QTAM interface.

TCAM Message Control Program: The TCAM Message Control Program (MCP) serves as an interface between remote terminals, user-written application programs, and secondary storage devices on which messages are queued until their destinations are available to receive them. The MCP's job is to control the flow of messages to and from these terminals, application programs, and queuing media, in a manner that optimizes allocation and scheduling of the computer's resources.

By handling all line control and scheduling of I/O operations for remote terminals, the TCAM MCP insulates user-written application programs from the complex device-dependent considerations inherent in a TP environment.

In TCAM, messages entered by remote terminals or application programs are queued by destination. Queuing by destination permits overlap of line usage in I/O operations; messages having a common destination may be received simultaneously from more than one source, even while the destination itself is busy sending or receiving a message. Disk queuing permits a high volume of concurrent terminal operations to proceed without requiring excessive real storage for buffering. TCAM destination queues may be located in main storage or on disk.

A TCAM MCP contains one or more message handlers. These are user-coded sets of routines that process messages as they enter and leave the TCAM MCP. Message handler functions are included by the selection and coding of TCAM supplied macros; among these functions are the following: message editing ... validity checking ... message routing ... record keeping ... error handling ... system control.

Special message-handler facilities are furnished for inquiry and conversational applications. The path of a message through a message handler may be varied dynamically based on the source or destination of the message, or on the presence or absence of certain character strings in the message header. To supplement TCAM-provided functions, the user may code open or closed subroutines consisting of assembler and macro instructions and include these in his message handlers. The TCAM MCP is just another problem program to the operating system. Assembly, linkage-editing, and execution of the MCP is similar to that for any other problem program. For performance reasons, the MCP is usually executed as the highest priority user task in the system, but this is not a requirement.

TCAM Application Programs: TCAM permits the user to code one or more application programs and interface these with the MCP. Application programmers are insulated from the TP environment; they issue ordinary GETs and PUTs or READs and WRITEs to move data between the MCP and application program work areas.

TCAM application programs can be SAM compatible, and may be debugged in a non-TP environment using BSAM or QSAM as the access method, and a tape, card-reader, disk, card punch, printer, etc., as I/O devices. Once debugged, many application programs can be plugged into TCAM without reassembly by changing a single job-control statement. The user can specify that either messages or user-defined records be transferred when he issues his GET/READ or PUT/WRITE macros.

TCAM application programs can be attached dynamically during execution by the MCP.

TCAM Service Facilities: TCAM offers an extensive set of service facilities. Among these are:

- A set of operator commands allowing the user to determine the status of his TP system and alter, activate, or deactivate portions of that system by entering appropriate commands from the system console, remote terminals, or application programs. An MCP may be referred to by its MCP name, and SNA entities are allowed as operands where applicable.

- A checkpoint/restart facility which allows the user to specify that his MCP environment be restored following system failure or shutdown.
- A facility for selectively logging incoming or outgoing messages or message segments.
- Comprehensive debugging aids, including error-recovery and event-recording facilities, and utilities which permit debugging information to be dumped to tape or disk and then printed out.
- An online test facility (TOTE) that allows the user to test transmission control units (270X and 3704/3705) and remote terminals without closing down the MCP or deallocating the device being tested. In MVS Release 3 when TCAM uses VTAM, TOLTEP provides testing facilities for the VTAM network.

TCAM MFT, MVT/VS Compatibility: OS TCAM Message Control Programs must be reassembled to run in the OS/VS environment. This reassembly allows the MCPs to benefit from the virtual storage capability of OS/VS. Under OS/VS, TCAM runs as a subsystem in a virtual region. Certain TCAM elements, such as the buffer pool, I/O appendages, control blocks, and tables are fixed in main storage for the duration of the TCAM task.

TCAM/VTAM Relationship in MVS

TCAM users may elect to use VTAM to control the portion of their communications network attached to 3704/3705 operating with the Network Control Program/Virtual Storage (NCP/VS). When this option is chosen, VTAM controls the telecommunications environment that includes 3704/3705s in network control mode and, optionally for TCAM, locally attached 3270s. VTAM permits sharing of this telecommunications network among different applications including those applications which used TCAM 3704/3705 NCP/VS support in previous releases of the operating system. When the TCAM Message Control Program schedules a read or write operation for a station in the TCAM/VTAM network, the I/O request is routed to VTAM. To the TCAM applications, the message looks as if it were handled only by TCAM.

If a TCAM application program or a TCAM terminal operator issues TCAM 3704/3705 control commands, a unique return code and a response message is provided. This code and message indicate the command has been intercepted and cannot be executed. TCAM now shares this network with VTAM and is no longer the sole "owner" of the telecommunications network.

The installation can provide an interface to the terminal user similar to the TCAM interface by using the "simulated logon" capability of VTAM. However, to use the full sharing capabilities of VTAM, the installation instructs the terminal user to enter an installation-defined sequence requesting logon to TCAM and includes in the system the VTAM facility to monitor logons. This facility provides the capability to interpret the sequence entered by the terminal user and to route the intercepted logon request to the appropriate VTAM application (e.g., TCAM).

BASIC TELECOMMUNICATIONS ACCESS METHOD - BTAM

The facilities of the Basic Telecommunications Access Method (BTAM) are designed chiefly to provide the basic tools required to write a telecommunications program. These include facilities for creating terminal lists and for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Code translation ... Retransmitting messages which are received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

The support of Binary Synchronous Communications combined with that of the various start/stop devices gives BTAM a wide range of applicability and flexibility. BTAM supports low, medium, and high speed devices.

BTAM supports Binary Synchronous Communication over nonswitched (leased or private direct connection) and switched (dial) networks in a System/360 to System/370 and System/370 to terminal communication.

All terminals (except Binary Synchronous Communication) on a multipoint nonswitched line must be the same type. Terminals may be mixed within the same problem program.

Further information on terminal support is provided by Terminal Support Charts 1 and 2.

Optional communication serviceability facilities are available in BTAM including error recovery procedures, diagnostic error information, error counts, and online terminal tests. It is strongly recommended that these facilities be included since they increase system availability.

VS2 BTAM supports the same functions as OS BTAM and, therefore, requires no additional programmer training. The user is cautioned regarding any internal changes that he may have made to OS BTAM.

Graphic Programming Services

Graphic Programming Services consists of the functions necessary to handle graphic input/output, and a set of macro instructions and problem oriented routines that can be used as building blocks in the construction of graphic processing programs. These services support the IBM 3250 Graphic Display System, the IBM 2250 Display Unit Models 1 and 3, and the IBM 2260 direct attachment (local). This access method includes: Macro instructions ... Data handling aids ... Problem oriented routines ... Graphic Data Generation Subroutine to generate data ... Light Pen Tracking Subroutine ... The Graphics Access Method (GAM) includes: Read/Write level macro instructions ... buffer management facilities ... optional routines that facilitate man-machine communication ... Graphic Subroutine Package.

Graphic Subroutine Package

The Graphics Subroutine Package provides support for graphic programs written in Assembler Language or for the following compilers:

FORTRAN IV E, G or H
PL/I (F)
FORTRAN IV H - Extended or G1 (Program Products)
PL/I Optimizing or Checkout Compilers (Program Products)

These services consist of subroutines and functions that enable a programmer to create a display on one or more 3251 Display Stations or 2250 Display Units (Models 1 and 3) under OS/VS2. The displays produced consist of any figures that can be constructed with points, lines, or characters, including charts, circles, arcs, rectangles etc. The subroutines are requested through the use of CALL statements in a sequence that produces desired characters or graphic forms on the 3251 or 2250 screen, and that provides two-way communication between the user's program and the 3250 or 2250 operator (if desired). In producing the desired displays, the subroutines automatically:

- Generate the necessary display buffer orders and data for the displays.
- Transfer the generated orders and data to the 3255 or 2840 display buffer for execution, relocating them as necessary.
- Allocate, control, and protect sections of virtual storage and of the 3255 or 2840 display buffer as required by the user's application program.
- Diagnose asynchronous errors and accomplish necessary error handling.

Highlights include:

- Two levels of display buffer order and data grouping each of which can be referenced as an entity: (1) an element - all orders and data produced as one call to a GSP subroutine, and (2) sequences of orders and data produced by several calls to GSP subroutines.
- Acceptance of input data in any two-dimensional rectangular coordinate system; the data is scaled as appropriate for use by the graphic subroutine package.
- Provision for temporarily removing an image from a display while retaining its associated orders and data in the display buffer, and later redisplaying the image.
- Modification of display buffer orders and data produced by a single call wherever they are located (in S/370 virtual storage or in a display buffer) by another call to the same subroutine.
- Display of alphanumeric characters using either the character generator or the 3250 or 2250 or, a series of lines called strokes.
- Capability to read information from the display buffer into S/370 virtual storage.
- Capability to locate the position of the light pen on the screen even if the light pen is pointed at a blank portion of that screen.
- Capability to place a tracking symbol on the screen and follow its motion as it is moved by a 3250 or 2250 operator with the light pen (restricted to 3250, or 2250 Model 3).
- Allowance for display buffer subroutines that can be repeatedly invoked through display buffer order linkage, without recourse to the S/370 (restricted to 3250, or 2250 Model 3).
- Ability to check the status of the program while it is being processed.
- Single and multiple queuing of attention information, and in-line processing of that information

Shared DASD

A pool of direct access storage devices may be shared by up to four S/370 Processors. Devices supported are 2314/2319, 3330/3333, 3340, 3344 and 3350. Two Processors may share a pool of 2305 direct access storage devices. The catalog, program libraries, and user data sets may be accessed by any Processor. Advantages are reduced file maintenance, improved operational flexibility, and reduced disk space requirements. Exclusive access for all other data sets can be controlled by using the **RESERVE** and **DEQ** macro instructions.

VSAM user catalogs may be shared among OS/VS1, SVS, and MVS. OS control volume catalogs may be shared among the above plus the OS/MFT and OS/MVT systems. While VSAM user catalogs may be shared, reference to specific entry types (e.g., GDG) created by MVS may be accessed only by MVS. The master catalog cannot be shared. Program libraries and other system or user data sets may be shared on a read-only basis. The system does not automatically provide exclusive control of records, or prevent concurrent update or extensions to these data sets. Such data sets should be shared on a read-only basis until safeguards are instituted by each installation.

SYSTEM SUPPORT PROGRAMS

Linkage Editor

The Linkage Editor combines separately compiled or assembled object modules into one or more load modules that are in a format suitable for loading by the control program and for subsequent execution. It also combines previously edited load modules with each other or with object modules.

Features: Although linking or combining of program modules is its primary function, the linkage editor also:

- Provides CSECT ordering and page boundary alignment facilities to allow the user to improve paging characteristics of his programs.
- Incorporates modules from data sets other than those in its primary input, either automatically or upon request.
- Aids program modification by replacing and deleting control sections as directed by linkage editor control statements.
- Defines the storage requirements for the common control sections generated by the assembler and by FORTRAN compilers, and the static external areas generated by PL/I compilers.
- Provides processing options and logs diagnostic error messages.
- Maintains an audit trail of compilation, linkage editing dates and levels and modifications on a CSECT basis within a load module via the identification record (IDR).
- A service aid feature to allow for expansion of modules to provide maintenance space.
- A control card and parameter permit the user to supply his authorization level for APF.

Loader

The Loader provides improved performance in a compile-load-go environment, compared to a normal compile link-edit, execution sequence. The Loader combines the basic editing and loading functions of the linkage editor with program loading (fetch) in the job step. It loads object modules provided by the compilers and load modules produced by the linkage editor directly into virtual storage for program execution.

VS2 Assembler

The VS2 Assembler allows VS users to write programs in System/370 Assembler Language. Assembler Language gives the user access to equipment functions and permits the user to obtain a balance between real storage usage and execution time of his program. Programs written in Assembler language normally require more coding effort than if written in a higher level language. The Assembler allows the user to generate and maintain VS2. Among the features supported by this assembler are:

- Macro instructions - The macro capability provided by the assembler is a powerful programming tool providing interfaces to the VS2 Input/Output Supervisor by means of Data Management macros, access to the complete VS2 capabilities through the use of Supervisor macros, and the ability to include programmer defined macros in assembler programs for special applications.
- Conditional Assembly Statements - Conditional assembly statements are used to alter the sequence in which statements are processed, or to specify selective assembly of instructions. The conditional assembler mechanism is a key element in the macro feature.
- Private Libraries - A private library may contain assembler language statements. These can be macro definitions or code that is to be inserted into the program by the **COPY** statement.
- Dynamic Work Areas - The assembler provides a mechanism for establishing addressability to independently allocated storage areas.

The VS2 Assembler is a compatible subset of the Assembler H Program Product, 5734-AS1, which is available under VS2.

Assembler System Requirements: The VS2 System Assembler uses the S/370 Standard Instruction Set. This assembler is designed to run more efficiently in 128K of virtual storage, and requires a minimum of 64K bytes of virtual storage. In addition to the standard VS2 requirements, the System Assembler requires space in auxiliary

storage for system input data sets and three intermediate data sets for work storage. In MVS, virtual I/O may be used.

Depending on program requirements, additional data sets may be needed for Macro Definition library, print output, object module output, and punch output.

The VS2 Assembler provides extensions not found in OS/360 Assembler F such as: ... SETC values and character relation terms may be up to 255 characters in length (the old limit was 8 characters) ... Relaxed restrictions and extended functions for conditional assembler statements ... Three additional system variable symbols (&SYSPARM, &SYSTEM, and &SYSDATE) ... Extended mnemonics for RR-type branch instructions ... Improved diagnostics and debugging facilities ... Mnemonics for relocate and multiprocessing instructions.

System Utilities

These programs are used to maintain system control data at an organizational or system level to operate in pageable storage. The following functions are performed by the system utility programs.

IEHPROGM - modifies system control data and maintains data sets at an organizational level, scratch, rename, catalog data, etc.†

IEHMOVE - moves or copies logical collections of VS2 data.†

IEHLIST - lists system control data such as directory entries of partitioned data sets and VTOC entries.†

IEHDASDR - Initializes direct access volumes for use with the operating system and dumps data from and restores data to these volumes.

IEHINITT - Writes volume label sets in EBCDIC, in BCD, or in ASCII code on magnetic tapes.

IEHATLAS - Locates and assigns an alternate track to replace a defective track and copies usage records from the defective track to alternate track.

IFHSTATR - Selects, formats, and writes information from Type 21 (error statistics by volume) records.

Device Support Facilities - Initializes direct access storage volumes for use with the operating system, analyzes DASD tracks and conditionally reclaims tracks previously flagged defective.

† Because the SVS system catalog is replaced by a VSAM master catalog in MVS, some IEHPROGM, IEHMOVE, and IEHLIST functions are replaced by Access Method Services or no longer supported.

With MVS, IEHUCAT provides the capability of updating an OS/MFT, MVT, VS1 and SVS catalog from a record of changes made to the MVS catalog. This program may be executed under SVS, OS/MVT, OS/MFT, or VS1.

Access Method Services - The access method services multifunction service program for VSAM data sets is used to: Define a VSAM data set or catalog ... Convert a sequential or an indexed sequential data set to the VSAM format ... List VSAM catalog entries or records of a data set ... Copy a data set for reorganization ... Create a backup copy of a data set ... Make a data set portable from one operating system to another.

It can be invoked through an input job stream containing an Access Method Services command, by a processing program that passes it a command statement, or from a timesharing terminal.

In MVS, Access Method Services provides additional functions. It is also used to: Define and delete aliases for catalog names and non-VSAM data set names ... Support generation data groups (GDGs) ... Define and format paging data sets ... Convert an OS/MFT, MVT, VS1 and SVS catalog to an MVS catalog ... Move or copy a VSAM catalog ... Create the pointers in the master catalog to the OS control volume catalogs.

System Data Set Utilities

These programs reorganize, change, or compare data at the data set and/or record level, and are required for the proper generation and maintenance of the system control program. The following general functions are performed by these utilities for non-VSAM data sets:

IEBCOPY - Copies, compresses, merges, loads, and unloads partitioned data sets.

IEBGENER - Copies a sequential data set or members of a partitioned data set, or converts a data set from sequential to partitioned organization.

IEBPTPCH - Prints or punches records residing in a sequential or partitioned data set.

IEBUPDTE - Updates a symbolic library

IEBEDIT - Produces an edited input job-stream data set from a master input job-stream data set

IEBTCRIN - Constructs records from input read from the IBM 2495 Tape Cartridge Reader. Generation of a 2495 is required for the inclusion of the IEBTCRIN utility into the operating system.

IEBDG - Can create output data sets either with internally generated test data or externally supplied input. These data sets can be sequential, indexed sequential, or partitioned.

IEBCOMPR - Compares two identically organized sequential or partitioned data sets at the logical record level.

IEBISAM - Can copy, print, reorganize, load, or unload an indexed sequential data set.

IEBIMAGE - New 3800 Utility provides means for the user to create or modify and to store in SYS1.IMAGELIB Forms Control Buffer records, Copy Modification records, Graphic Character Modification Records, and Character Arrangement tables. Input to the Utility consists of simple control statements. User can specify for FCB records forms sizes, number of lines at each vertical spacing, and line positions for simulated channel control punches. For Copy Modification, control statements include the text and its position within each copy of the pages of a data set. Existing Copy Modification records can also be modified. Graphic Character Modification statements provide means for combining and naming groups of graphic characters, including any characters already in SYS1.IMAGELIB, and to assist in storing in the system new graphic characters of user's own design. Character Arrangement tables can be created or modified to print with different character sets, to include Graphic Character Modifications, and to assign data codes to graphics or to change existing assignments.

Independent Utilities

The following independent utilities do not operate with the VS2 control program, but they support VS2 with the following services:

IBCDASDI - initializes Direct Access Volumes for use with VS2

ICAPRTBL - performs stand-alone buffer loading for the IBM 3211 printer.

IBCDMPRS - performs unloading and loading of data between DASD and a removeable volume.

Device Support Facilities - Initializes direct access storage volumes for use with the operating system, analyzes DASD tracks, and conditionally reclaims tracks previously flagged defective.

These independent utilities are not supported for the 3066 console.

Online Test Executive Program - OLTEP

The Online Test Executive Program (OLTEP) is a function designed to direct the selection, loading, and execution of the Online Test sections (OLT's) within the VS2 environment.

OLTEP with the related OLT's is designed to allow the testing of Input/Output Hardware components of a system, concurrent with the running of customer jobs.

The OLTEP/OLT system is designed for: Providing an interface with RETAIN/370 ... Diagnosing I/O errors ... Verifying I/O hardware repairs and Engineering Changes ... Exercising a device requiring dynamic adjustments ... Checking I/O hardware ... Preserving integrity of customer data while testing.

As a job under VS2, it is called by standard Job Control Language and is under the control of the operating system at all times. It uses the facilities of VS2 to accomplish the testing and competes with other jobs in the system for use of these facilities when running in a multiprogramming environment.

Definition of test to be run can be entered via console or non-console devices.

Field Engineering supplies the OLT's and device configuration information to the customer on magnetic tape or cards. The Field Engineer reformats and link edits the OLT's into a partitioned data set so that they can be used under the operating system. Device configuration information is required for each device to be tested by OLTEP/OLT's.

The OLTEP interface to RETAIN/370 provides the ability to transfer Diagnostic Test results to the RETAIN/370 center and allows the RETAIN/370 center to modify Diagnostic Test requests and options. The RETAIN/370 interface is provided in OLTEP via the console.

OLTEP must normally be executed as a V = R job The Logout Analysis program operates in virtual storage. Since use of OLTEP is now restricted by APF, all OLTEP programs must be online in protected system libraries.

OLTEP must normally be executed in a minimum of 76K bytes in MVS and 64K bytes in SVS as a V = R job. The logout analysis program will operate in the paged virtual storage.

Teleprocessing Online Test Executive Program - TOLTEP
(MVS Release 3)

An online test facility is provided for telecommunications networks under VTAM. See description in sales manual pages of the Virtual Telecommunications Access Method (VTAM) for information on TOLTEP.

SERVICE AIDS

Dynamic Support System (DSS) is no longer supported on OS/VS2 MVS and is deleted from the OS/VS2 MVS Release 3.8 distribution libraries.

Generalized Trace Facility (GTF) is a standard feature in the VS2 system. It is a program service that assists users in performing problem determination and diagnosis by tracing system events, user events, or both. GTF consists of two major functions, the Generalized Trace function and the Trace Edit function.

The Generalized Trace function is a system service that can be optionally started from the master console. It executes as a system task in a region. When the Generalized Trace function is started, the user also has the option of tracing internally in the GTF region or externally to a data set on an auxiliary device.

The GTF internal trace mode has been enhanced in MVS to include the full tracing selectivity and capability that previously existed only for external trace mode. Additionally, all GTF records may now be optionally formatted as part of an ABEND/SNAP dump. Dumps produced by AMDSADMP or other system dumping facilities also contain GTF trace data. Several types of system trace records have been added to support function in MVS.

The Trade Edit function is a feature of the AMDPRDMP service aid and provides the user with a selective data reduction capability for the trace data set or formats GTF trace data from a storage dump produced by AMDSADMP or the **SYS1.DUMP** data set. It runs as a problem program and can be invoked via JCL.

AMAPTLE - This program aids in the application of a PTF to the system by producing the JCL statements that are required for the proper application of the temporary fix. When a PTF is to be applied to a module, the user supplies distribution library module name and status and level information for each CSECT being modified. The program then either produces the necessary Job Control Language statements for application of the PTF; or, if specified, dynamically invokes the linkage editor to update the operating system. The program executes in the paged section of processor storage.

AMBLIST - This Linkage Editor service aid program produces various formatted listings which may be used for system serviceability and diagnostic purposes. Depending on options specified on AMBLIST control statements, the following listings may be produced:

- Formatted load module listings.
- Formatted object module listing.
- Map of System link pack area.
- Load module map and cross-reference listings.
- Map and cross-reference listings of the system nucleus.
- Listings of the data stored in the CSECT Identification records of load modules.
- Load module map and cross-reference listings showing addresses relocated relative to a user-supplied address.
- Load module summary data including entry point address, APF access code, module attributes, and the contents of the module's System Status Index.
- Lists program modifications to a load module library.

The minimum virtual storage requirement for AMBLIST is 64K bytes.

AMASPZAP - This service aid program assists authorized personnel to:

Inspect and modify instructions and data in any load module that exists as a member of a partitioned data set.

Inspect and modify data in a specific data record that exists in a direct access data set.

Dump an entire data set, a specific member of a partitioned data set, or any portion of a data set residing on a direct access device.

AMDSADMP - This service aid is a macro instruction that allows the user to generate a stand-alone dump program that is specifically tailored to his needs. AMDSADMP can generate two types of dump programs: one high-speed, the other low-speed. The high-speed version can write the control registers, contents of real storage, and selected portions of paged out storage onto a tape volume in large blocks. The low-speed version can write the control registers and the contents of real storage to a printer or tape volume in unblocked, printable format.

AMDPRDMP - This service aid program formats and prints dump data sets produced by AMDSADMP and other system programs. The dump data sets may contain dumped real or virtual storage.

Selective printing and formatting of the dump data sets is completely controlled by the user of AMDPRDMP via control statements. The **SUMMARY** control statement in MVS may be used to obtain the following: A synopsis of the storage ranges contained in the dump data set ... A summary of the status of the system as the dump data set shows it.

The user may use this information to determine what further formatting is required and he proceeds to get the required formatting by selecting the proper AMDPRDMP control statements.

An interface is provided whereby the user may write formatting modules to do additional (user tailored) formatting during AMDPRDMP execution.

In MVS Release 3, the Fast Dump Scan facility is added which allows the user to scan a storage dump (SVC Dump or Stand-Alone Dump) from any TSO terminal (via the **CALL** subcommand) or the master console.

To use fast dump scan, the user executes AMDPRDMP. A new verb, **DISPLAY** (and subverbs **LIST**, **HARDCOPY**, **EQUATE**, **COMMENT**, **RETURN**), is used to display up to 256 storage locations starting at a specified hex or symbolic virtual storage address.

IMCOSJQD - This service aid produces a formatted copy of the contents of the job queue data set. This program operates as a problem program under the SVS control program. It is not supported in MVS. The stand-alone job queue dump program (IMCJQDMP) is not supported in VS2.

IFCEREPO - Edits and lists error environment records including software records with MVS.

IFCD1POO - Reinitializes the system data set, **SYS1.LOGREC**.

HMASMP - This program is used for the application of Program Temporary Fixes (PTFs) prepared in the new Systems Modification Program format. It is designed to improve the quality and reliability of the support process by recording the status of the system so that modifications will not be applied where inappropriate. Also, updating will be easier since libraries, modules, macros, and PTFs can all be updated and applied via one programming procedure.

Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DAS error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to **SYSPRINT**.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

Display Exception Monitoring Facility

The Display Exception Monitoring Facility (DEMF), Selectable Unit (SU) 68 for MVS, component release UY99958 for SVS, is a serviceability aid which offers users of IBM 3270 Information Display System in local or BSC mode assistance in locating a hardware problem in a communication network. In remote mode, the 3270 must communicate through a 270X or 370X in EP mode.

DEMF is logically composed of two tasks: a logging function and a display function. The logging function runs as a system task under SVS or MVS. It is passed communication error records created for the **SYS1.LOGREC** data set. The display function is a component that runs under TCAM, CICS/VS, or IMS/VS. It presents a structured display of errors accumulated by the logging function at the user request.

Program Products

There are a large number of program products which may be ordered to support OS/VS. The program product section of the sales manual should be referenced for more information and ordering instructions.

Current System Programs (CSP) Under OS/VS

Type I CSPs, such as Sort and the Language Compilers, are not distributed as part of the OS/VS SCP. Those wishing to continue using them may transfer them over from their OS Release 21.8 or later system. If the CSP is on a DASDI device accessible to a VS system, then the VS systems **SYS1.PROCLIB** need only be updated to include the CSPs catalogued procedures. These procedures should contain a **JOBLIB** or **STEPLIB** DD card referencing the data set containing the CSP. If the CSPs reside on a DASDI device not accessible to VS, then they should be copied to one with the IBM Utility **IEBCOPY**. The VS System's **SYS1.PROCLIB** should be updated accordingly.

Those customers not on OS Release 21.8 must order this or a later release of the OS DLIBs. They would then perform a processor only **SYSGEN** as described in the *OS System Generation Guide* (GC28-6554). In so doing, the CSP target library and the procedural library should be one accessible by the VS system.

Ordering instructions for the Release 21.8 DLIBs are the same as for Release 21.7, which are available in the Release 21.7 Guide (GC28-6730)

Please note that the following programs and program products which were announced for SVS are not supported on MVS (i.e., APARS against these programs running on MVS will not be accepted).

Program Name	Program Number
CALL/OS	360A-CX-42X,
COBOL F	44X,45X,46X
COBOL F Library	360S-CB-524
Full ANS COBOL V2	360S-LM-525
Full ANS COBOL V2 Library	360S-CB-545
FORTRAN G	360S-LM-546
FORTRAN H	360S-FO-520
FORTRAN G & H Library	360S-FO-500
PL/I F	360S-LM-501
PL/I F Library	360S-NL-511
PL/I F Syntax Checker	360S-LM-512
Sort/Merge	360S-PL-552
	360S-SM-023

Even though the above Type I language compilers are not supported under MVS, generated object code for customers programs using any of these higher-level Type I languages, together with the relevant library modules, will operate on the current release of MVS subject to the constraints outlined in the *Introduction to OS/VS2 Release 2* (GC28-0661). Further, if that object code (with relevant object modules) runs on MVT Release 21.8 or a previous release of VS2 but does not function with the current release of MVS, an APAR will be accepted against MVS.

System Configuration:

SVS supports System/370 Models 145, 158, 168, 155II, and 165II and the 3031, 3032 and 3033 Processors. The 158MP and 168MP processors are supported in uniprocessor mode (8 megabyte maximum). Real storage requirements for SVS are:

384K	Minimum concurrent batch and reader/writer
512K	Minimum concurrent batch, reader/writer, and TSO or Minimum ASP Support Processor
768K	Normally considered for concurrent batch, TSO, HASP
1,024K	Normally considered for ASP Support Processor with local main

MVS supports System/370 Models 145, 158, 168, 155II, 165II, 158MP, and 168MP and the 3031, 3032 and 3033 Processors. Real storage requirements for MVS are:

768K	JES2 design entry - not a production system
1,024K	JES3 design entry - not a production system
2,048K	Normally considered for a batch production system
3,072K	Normally considered for a batch and TSO or batch and IMS/VS production system
4,096K	Normally considered for a batch, TSO and IMS/VS production system

The recommended storage requirements for MVS production systems are guidelines only.

Minimum VS2 Configuration

The minimum configuration required for VS2 operation or SYSGEN is:

S/370 3145, 3155II, 3158, 3158MP, 3165II, 3168, 3168MP, 3031, 3032 or 3033 Processor. The 3145 requires the clock comparator and Processor timer feature (2001), the advanced control program support feature (1001) and floating point feature (3910).

384K bytes of available real storage for SVS or 768K bytes of available real storage for MVS.

A multiplexer channel.

A selector or byte multiplexer channel.

SVS; Three 3330/3333, three 3340, (with 3348 Model 70 Data Modules) or four 3340 (with 3348 Model 35 Data Modules) DASD spindles plus any additional online DASD capacity necessary to meet customers operational needs.

MVS; Five 3340 (with Model 70 Data Modules) or four 3330/3333 DASD spindles plus any additional online DASD capacity necessary to meet customers operational needs. The minimum spindle requirement for 3330/3333 Model 11 is four. The 3340 requirements may be satisfied by 3344 volumes if the starter system address requirements are met. The 3330/3333 requirements (all models) may be satisfied by 3350 spindles in the equivalent compatibility mode. Starter system and library tapes which restore to the 3350 in native mode or 2314 are not provided. The user with 3350 DASD only must satisfy the 3330/3333 requirements above with 3350 spindles in 3330 compatibility mode with one exception. The target device for the new system being generated may be a 3350 in native mode if the starter system address requirement for 3350 is met.

- A SYSIN device (card reader or tape).
- A SYSOUT printer (printer or tape).
- A SYSOUT punch (punch or tape).
- A console
- A 9-track 1600 bpi tape drive.*

* Distribution of the SCP, component releases, emulator SCPs and PTFs are made on a 9-track 1600 bpi tape; therefore, a 9-track tape on the system or access to another system meeting the minimum configuration requirements and having a 9-track tape at the customer installation is required for system generation and maintenance. Note - a tape drive is also recommended for the output from a high speed stand-alone dump program (AMDSADMP). This may be the same drive used for generation and maintenance.

If TCAM/VTAM/BTAM is specified, at least one transmission control unit or communications controller is required for operation of remote terminals (VTAM requires a 3704/3705-I/3705-II in network control mode).

System Generation: This is the process of preparing a specially tailored operating system to match the machine configuration and operating system options selected by the user. This process uses either the VS2 starter system or the user's current operational VS2 system (assuming the system generation is for the same release as the operational VS2 system) and requires the following programs: Control Program ... Data Management, Date Set Control, BSAM, QSAM, BPAM ... Assembler ... Linkage Editor ... Utilities.

PIDistributes on 9-track 1600 bpi tape for 2314/2319 (Not available for MVS) or 3330/3333 Model 11, or 3340 residence the required libraries (Partitioned Data Sets) which contain the Operating System modules the system generation macro instructions need for the system generation process when VS2 is ordered. The inclusion of JES into VS2 is accomplished via an additional generation phase which requires a card reader. The same system requirements are required for maintenance as for generation since some changes may require a full or partial system generation.

Tables showing the device supported, the system functions for which they may be used, and the three character address assigned to each of the units for the Starter System can be found in:

OS/VS2 System Generation Reference GC26-3792
OS/VS2 Release 2 Guide GC28-0671

Feature Support

The following features are supported by VS2. Other features, not listed, have no specific programming support; their existence is ignored by the control program. Attempts to use VS2 with unsupported features may cause unpredictable results. For brevity this list does not include those basic features or control units which are required to connect a supported device.

OPTIONAL PROCESSOR FEATURES SUPPORTED

Feature	System/370				
	145	155II	158	165II	168
Advanced Control Program Support	1001	STD	STD	STD	STD
Conditional Swapping	1051	STD	STD	STD	STD
Block Multiplexer Channel	1421-4	1433-5	1433-5	N/A	N/A
Buffer Expansion Channel-to-Channel	N/A	N/A	N/A	1432	1435
Clock Comparator and processor Timer	2001	STD	STD	STD	STD
Direct Control	3274	3274	3274	N/A	N/A
Extended Precision Floating Point	3910	3700	3700	STD	STD
Extended Channels	N/A	N/A	N/A	3850	3855
1401/1440/1460 Compatibility	4457	3950	3950	N/A	N/A
1401,1410/7010 Compatibility	4458	3950	3950	N/A	N/A
High Speed Multiply	N/A	N/A	N/A	4520	4525
Integrated Storage Controls	4660*†	N/A	4650	N/A	4650
Multiplexer Subchannels, Additional	4951-4	N/A	N/A	N/A	N/A
2nd Byte Multiplexer Channel	N/A	4990	4990	N/A	N/A
OS/DOS Compatibility	STD	5450	5450	N/A	N/A
Selector Channel 7070/7074	6982-4	N/A	N/A	N/A	N/A
Compatibility	N/A	7117	7117	7117	7127
7080					

Compatibility 709/7090/7094II	N/A	N/A	N/A	7118	7128
Compatibility Staging Adapter for ISC	N/A	N/A	N/A	7119	7129
3213 Printer Attachment	N/A	N/A	7220	N/A	7220
3210 Adapter	7844-5	7844-5	N/A	N/A	N/A
3215 Adapter	7855	7855	N/A	N/A	N/A
Two Channel Switch for ISC	8100*	N/A	7905	N/A	7905
Word Buffer	8810	N/A	N/A	N/A	N/A

* 3345 Models 3, 4, 5 available on the 145.

† Supported only with SVS.

3031, 3032 and 3033 Processors

Feature	3031	3032	3033
Block Multiplexer Channel	STD	STD	STD
Extended Precision Floating Point	STD	STD	STD
Multiplexor Subchannels	STD	STD	STD
2nd Byte Multiplexor	N/A	7850	7850
Extended Channels	N/A	3850	3850
Channel-to-Channel	1850	1850	1850
Direct Control	N/A	STD	STD
Clock Comparator	STD	STD	STD
Adv. Control Processor Support	STD	STD	STD

I/O Features

1052 Printer - Keyboard (see VTAM, TCAM and BTAM Terminals Supported)

1275 Optical Reader Sorter (Models 1, 2, 4):
Required: 2925 - Expanded Capability
9185 - Dual Address

1287 Optical Reader (Models 1,2,3,4,5):
Supported: 3850 - Expanded Symbol Set
3945 - Farrington 7B Font
4470 - 1428 and ANSCS OCR Font
5300 - NCR Optical Type Font (Models 2, 4 only)
5370 - Numeric Handwriting
5479 - Optical Mark Reading

1288 Optical Page Reader (Model 1):
Supported: 5370 - Numeric Handwriting
5479 - Optical Mark Reading

1403 Printer (Models 2,3,7,N1):
Supported: 8640 - Universal Character Set
8641 - Universal Character Set

1419 Magnetic Character Reader (Model 1):
Supported: 1445 - Batch Numbering (requires 3800 Expanded Capability and 7730 Dual Address)
5739,5741 - Program Control for Pocket Lights

1443 Printer (Model N1):
Supported: 5558 - 24 Additional Print Positions.

2150 Console

2250 Display Unit (Models 1, 3)

2260 Display Station (see VTAM, TCAM and BTAM Terminals Supported)

2305 Fixed Head Storage (Models 1,2):
Required: 2835 Storage Control

2314 Direct Access Storage Facility (Model A1):
Supported: 8170 - Two-Channel Switch

2319 Disk Storage

2400 Magnetic Tape Unit and Control:
Required: 2803 Tape Control (Model 2)
Supported: 3471, 3472 - Dual Density (800 - 1600 bpi)

2401 Magnetic Tape Unit (Models 1,2,3,4,5,6)

2420 Magnetic Tape Unit (Models 5,7)

2495 Tape Cartridge Reader

2501 Card Reader (Models B1,B2):
Supported: 1531 - Card Image

2520 Card Read Punch (Models A1,B1):
Supported: 1531 - Card Image

2520 Card Punch (Models A2,A3,B2,B3):
Supported: 1531 - Card Image

2540 Card Read Punch (Model 1):
Supported: 1531 - Card Image

2671 Paper Tape Reader

2803 Tape Control (Models 1, 2, 3):
Required: 3228 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended)
Supported: 7125,7127,7135 - 7-track Compatibility
7185 - 16 Drive Addressing
7900 - 2420 Attachment (2803 Model 2 only)

2804 Tape Control (Models 1, 2, 3):
Required: 3236 - Data Conversion (for all 7-track tapes that record binary data such as variable length, format V records and abnormal end dumps. Inclusion of 7-track tapes without this feature is not recommended)
Supported: 7126,7128,7136 - 7-track compatibility

2816 Switching Unit (Model 1):
Supported: 1050-1052,1055,2285,2286,4455, 6392,6393 - Additional Switching

2821 Control Unit (Models 1,2,3,5,6):
Supported: 1990 - Column Binary (for problem program use only)
8637-8639 - Universal Character Set Adapter

2844 Auxiliary Storage Control:
Supported: 8171 - Two Channel Switch
Not Supported: More than 2 paths to a device from one Processor with MVS Release 2.

2860 Selector Channel (Models 1,2,3):
Supported: 1850 - Channel-to-Channel Adapter (Available with MVS; for SVS support, see ASP)

2870 Multiplexer Channel:
Not Supported: Burst devices (including byte devices with burst mode options operating in burst mode) on a multiplexer sub-channel. Magnetic tapes are supported on the selector subchannels.
Cross channel devices (2804 Tape Control, 2816 Switching Unit, 3803 Tape Control with communicator feature and either 2-control switch, 3-control switch or 4-control control switch, 3803 Tape Control with 8100 Two-Channel Switch) attached between any 2780 selector subchannel and any other selector channel or between any 2780 selector subchannel and a selector sub-channel of a different 2870.

2880 Block Multiplexer Channel (Models 1,2):
Supported: 7850,7851 - Two Byte Interface

3036 Console

3066 System Console (Model 1)

3158 Console Function

3210 Console Function

3211 Printer (Model 1):
Required: 3811 Printer Control Unit

Supported:	5554 - 18 Additional Print Positions		8171 - Two-Channel Switch, Additional
3213 Console Printer		Not Supported:	More than 2 paths to a device from one Processor with MVS Release 2
3215 Console Printer-Keyboard			
3275 Display Station (Models 1, 2) (See VTAM, TCAM and BTAM Terminals Supported)		3830 Storage Control (Model 3):	
3284 Printer (Models 1, 2)		Supported:	8170 - Two-Channel Switch 8171 - Two-Channel Switch, Additional
3286 Printer (Models 1, 2)		3851 Mass Storage Facility (Models A1,A2,A3,A4,B1,B2,B3,B4):	
3288 Printer (Model 2) (supported as a 3286-2)		Supported:	8171,8172 - Two Channel switch, additional 4901,4902 - MSC Port
3277 Display Station (Models 1, 2) (see VTAM, TCAM and BTAM Terminals Supported)		3886 Optical Character Reader (Model 1):	
3330 Disk Storage (Models 1,2,11):		Supported:	3210 - Additional Data Storage 4610 - Additional Instruction Storage 4720 - Line Marking 5360 - Numeric Handprinting 6450 - Serial Numbering
Required:	3333 Disk Storage and Control, or 3830 Storage Control	Not Supported:	The 3886 is not supported by SVS.
3333 Disk Storage and Control (Models 1,11):		3890 Document Processor (Models A1,A2,A3,A4,A5,A6):	
Supported:	8150 - String Switch	Supported:	5111 - Microfilming 4666 - Item Number/Endorsing
3340 Direct Access Storage (Models A2,B1,B2):			
Required:	3340 Model A2		
Supported:	6201,6202 - Rotational Position Sensing 8150 - String Switch		
3344 Direct Access Storage (Models B2,B2F)			
3350 Direct Access Storage Facility (Models A2,A2F,B2,B2F,C2,C2F):			
Supported:	8150 - String Switch		
3410 Magnetic Tape Unit (Models 1,2,3):			
Supported:	3211 - Single Density 3221 - Dual Density 6550 - Seven-Track Tape Unit 7360 - S360/370 Attachment		
3411 Magnetic Tape Unit and Control (Models 1,2,3):			
Supported:	3211 - Single Density 3221 - Dual Density 6550 - Seven-Track Tape Unit 7360 - S/370 Attachment		
3420 Magnetic Tape Unit (Models 3,5,7):			
Supported:	3550 - Dual Density 6407 - 7-track 6631 - Single Density		
3420 Magnetic Tape Unit (Models 4,6,8):			
Supported:	6420 - 6250 Density 6425 - 6250/1600 Density		
3505 Card Reader (Models B1,B2):			
Supported:	5450 - Optical Mark Read 6555 - Selective Stacker		
3525 Card Punch (Models P1,P2,P3):			
Supported:	1533 - Card Read 5272 - Multiple Card Print 8338 - Two-Line Card Print		
3540 Diskette Input/Output Unit (Models B1, B2)			
3800 Printing Subsystem (Model 1):			
Supported:	1490 - Burster-Trimmed-Stacker 5401 - 127 Character Generation Storage Positions 8170 - Two Channel Switch		
3803 Tape Control (Model 1):			
Supported:	1792 - Two-Control Switch 1793 - Three-Control Switch 1794 - Four-Control Switch 3551 - Dual Density 6408 - Seven-Track 9071 - Communicator 1-2 9073 - Communicator 3-4		
3803 Tape Control (Model 2):			
Supported:	1792 - Two-Control Switch 1793 - Three-Control Switch 1794 - Four-Control Switch 5310 - Nine-Track NRZI 6320 - Seven-Track NRZI 8100 - Two-Channel Switch 9071 - Communicator 1-2 9073 - Communicator 3-4		
3811 Printer Control Unit (Models 1,2):			
Supported:	5553 - Additional (18) Print Positions		
3830 Storage Control (Models 1,2):			
Supported:	8170 - Two-Channel Switch		

SVS Device Support

The *SVS Device Support Chart* shows all devices that are supported by SVS for systems functions and/or non-TP access methods. (For other telecommunications devices see *VTAM, TCAM and BTAM Terminals Supported*). The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under SVS and their existence is not recognized by the control program.

Notes:

- 1) BSAM (device-dependent only).
- 2) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
- 3) The Selective Tape Listing feature is not supported.
- 4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
- 5) DIDOCS supported.
- 6) Multiple Requesting supported.
- 7) File Scan not supported.
- 8) Rotational Position Sensing support (optional feature on 3340).
- 9) For message queues under TCAM.
- 10) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
- 11) Supported for read or punch, but not both simultaneously.
- 12) For use with the VS2 Output Writer; not for system messages.
- 13) Punch Feed Read is not supported.
- 14) The 3540 is supported by the VS2 Diskette Copy Programming Support.
- 15) QSAM (device-dependent only).

Legend:

- C = Console
- G = Graphic Programming Support
- S = Sequential Access Method
- I = Indexed Sequential Access Method
- P = Basic Partitioned Access Method
- D = Basic Direct Access Method
- A = Virtual Storage Access Method
- X = Function Supported

SVS DEVICE SUPPORT CHART

I/O Unit Support: The following units to a maximum of 768 devices are supported at the SVS Release 1.7 level by the Operating System, for the indicated function:

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1052 Printer-Keyboards	X		X			X			
1275 Optical Reader								X1	
1287 Optical Reader								X2	
1288 Optical Page Reader								X1	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X1	
1443 Printer						X4		X	
2150 Console						X			
2250 Display Unit						X5	X		
2260 Display Station						X5	X		
2305 Fixed Head Storage (Notes 6,7)	X8	X8		X	X8			X8	X8
2314 Direct Access Storage Facility (Notes 7,9)	X	X		X	X			X	X
2319 Disk Storage (Notes 7,9)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2495 Tape Cartridge Reader								X10	
2501 Card Reader	X		X			X4		X	
2520 Card Read Punch	X11		X11,12			X4		X11	
2520 Card Punch			X12			X4		X	
2540 Card Read Punch	X13		X12,13			X4		X	
2671 Paper Tape Reader								X	
3036 Console (Note 20)						X5		X5	
3066 System Console (Note 20)						X5			
3158 Console Function						X			
3210 Console Printer-Keyboards						X4		X	
3211 Printer			X			X			
3213 Console Printer						X			
3215 Console Printer-Keyboards						X			
3275 Display Station	X					X3			
3276 (Supported as a 3277)	X					X3			
3277 Display Station	X					X3			
3278 (Supported as a 3277)	X					X3			
3284 Printer						X4			
3286 Printer						X4			
3288 Printer						X4			
3330 Disk Storage (Notes 7,9)	X8	X8		X8	X			X8	X8
3333 Disk Storage and Control (Notes 7,9)	X8	X8		X8	X			X8	X8
3340 Direct Access Storage Facility (Notes 7,9)	X8	X8		X8	X8			X8	X8
3344 Disk Storage (Notes 7,9)	X8	X8		X8	X8			X8	X8
3350 Direct Access Storage Facility (Notes 7,9)	X8	X8		X8	X8			X8	X8
3410 Magnetic Tape Unit	X		X						
3411 Magnetic Tape Unit and Control	X		X						
3420 Magnetic Tape Unit	X		X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X11		X11,12			X4		X	
3540 Diskette I/O Unit (Note 14)	X14		X14						
3800 Printing Subsystem			X					X	
3890 Document Processor								X15	

MVS DEVICE SUPPORT CHART

I/O Unit Support: The following units to a maximum of 1023 devices are supported at the MVS Release 3.7 level by the Operating System, for the indicated function:

Input/Output Units	Input Job Stream	In/Out Work Queue	System Output	Primary SYSRES	Program Libraries	C	G	S	I,P,D,A
1275 Optical Reader								X1	
1287 Optical Reader								X2	
1288 Optical Page Reader								X1	
1403 Printer			X3			X4		X3	
1419 Magnetic Character Reader								X1	
1443 Printer						X4		X	
2305-1 Fixed Head Storage (Notes 6, 7, 20)	X8	X8,9		X	X8			X8	X8
2305-2 Fixed Head Storage (Notes 6,7)	X8	X8,9		X	X8			X8	X8
2314 Direct Access Storage Facility (Notes 7,10)	X	X		X	X			X	X
2401 Magnetic Tape Unit	X		X					X	
2402 Magnetic Tape Unit	X		X					X	
2403 Magnetic Tape Unit and Control	X		X					X	
2420 Magnetic Tape Unit	X		X					X	
2501 Card Reader	X		X			X4		X	
2520 Card Read Punch	X12		X12,13			X4		X12	
2520 Card Punch	X		X13			X4		X	
2540 Card Read Punch	X14		X13,14			X4		X	
3036 Console							X5		
3066 System Console							X5		
3158 Console Function							X		
3210 Console Printer-Keyboard							X		
3211 Printer			X			X4		X	
3213 Console Printer						X			
3215 Console Printer						X			
3251 Display Station							X		
3275 Display Station	X					X3			
3276 (Supported as a 3277)	X					X3			
3277 Display Station	X					X3			
3278 (Supported as a 3277)	X					X3			
3284 Printer						X4			
3286 Printer						X4			
3288 Printer						X4			
3330 Disk Storage (Notes 7,10)	X8	X8		X8	X			X8	X8
3333 Disk Storage and Control (Notes 7,10)	X8	X8		X8	X			X8	X8
3340 Direct Access Storage Facility (Notes 7,10)	X8	X8		X8	X8			X8	X8
3344 Disk Storage (Notes 7,10)	X8	X8		X8	X8			X8	X8
3350 Direct Access Storage Facility (Notes 7,10)	X8	X8		X8	X8			X8	X8
3410 Magnetic Tape Unit	X		X						
3411 Magnetic Tape Unit and Control	X		X						
3420 Magnetic Tape Unit	X		X					X	
3505 Card Reader	X					X4		X	
3525 Card Punch	X12		X12,13			X4		X	
3800 Printing Subsystem			X					X	
3851 Mass Storage Facility (Note 16)	X17				X17,18			X17	X17
3886 Optical Character Reader								X1	
3890 Document Processor								X19	

MVS Device Support

The *MVS Device Support Chart* shows all devices that are supported by MVS for systems functions and/or non-TP access methods. (For other telecommunications devices see *VTAM, TCAM and BTAM Terminals Supported*). The chart shows for each device the relevant functions supported.

Devices which are not shown in this chart have no specific programming support under MVS and their existence is not recognized by the control program.

Notes:

- 1) BSAM (device-dependent only).
- 2) QSAM (device-dependent only) for journal tapes; BSAM (device-dependent only) for cut-form documents.
- 3) The Selective Tape Listing feature is not supported.
- 4) A console must consist of a printer-keyboard, or a card reader and printer to simulate the actions of a printer-keyboard (composite console).
- 5) DIDOCS supported.
- 6) Multiple Requesting supported.
- 7) File Scan not supported.
- 8) Rotational Position Sensing support (optional feature on 3340).
- 9) Not supported by JES3.
- 10) For message queues under TCAM.
- 11) A Data Set Utility (IEBTCRIN) is provided to read data from the 2495 and create a sequentially organized data set.
- 12) Supported for read or punch, but not both simultaneously.
- 13) For use with the VS2 Output Writer; not for system messages.
- 14) Punch Feed Read is not supported.
- 15) The 3540 is supported by the VS2 Diskette Copy Programming Support. SYSIN/SYSOUT support is provided by the Diskette Reader program and Diskette Writer program with JES2/JES3.
- 16) Support shown is for 3330s or 3333s as virtual device types. If real 3330/3333s are included as part of 3851, see the 3330/3333 lines above.
- 17) With 3330/3333 as staging device, Rotational Position Sensing supported.
- 18) User Program Libraries only.
- 19) QSAM (device-dependent only).
- 20) Supported on Models 165II, 168 and the 3033 Processor only.

Legend:

C = Console
 G = Graphic Programming Support
 S = Sequential Access Method
 I = Indexed Sequential Access Method
 P = Basic Partitioned Access Method
 D = Basic Direct Access Method
 A = Virtual Storage Access Method
 X = Function Supported

VTAM, TCAM and BTAM Terminals Supported

VTAM, TCAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, TCAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does(do) support the terminal/feature is(are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, TCAM or BTAM may also function satisfactorily with VTAM, TCAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT
Terminals and Terminal Features
SS LINES:
IBM TERMINALS

1030 Data Collection System on nonswitched lines:
 (TCAM,BTAM)

- 1031 Input Station (Models A1,A2,A3,A4,A5,A6,A7):
 Supported: Attachment of 1031,1033,1034,1035
- 1031 Input Station (Models B1,B2,B3,B4,B5,B6,B7):
 Supported: Attachment of 1035
- 1035 Badge Reader
 1033 Printer
 1034 Card Punch
 1035 Badge Reader

1050 Data Communication System on switched or nonswitched lines:

- 1051 Control Unit (Models 1,2):
 Supported: Attachment of 1052,1053,1054,
 1055,1056,1057,1058,1092,
 1093
 1313 - Automatic EOB
 4795 - Line Correction
 4796 - Line Correction Release
 5465 - Open Line Detection
 6100 - Receive Interrupt
 9698 - Text Time-Out Suppression
 9700 - Transmit Interrupt
- 1052 Printer-Keyboard (Models 1,2):
 Supported: 1313 - Automatic EOB
 9567,9597 - PTTC/BCD Code
 9571,9591 - PTTC/EBCD Code
- 1053 Printer (Model 1):
 Supported: 9567,9597 - PTTC/BCD Code
 9571,9591 - PTTC/EBCD Code
- 1054 Paper Tape Reader (Model 1)
 1055 Paper Tape Punch (Model 1)
 1056 Card Reader (Models 1,3)
 1057 Card Punch (Model 1)
 1058 Printing Card Punch (Models 1,2)

2848 Display Control (Models 1,2,3) on nonswitched lines:
 (TCAM,BTAM)

- Supported: Attachment of 2260,1053
 3901 - Extended Cursor Control
 4787 - Line Addressing
 5340 - Non-Destructive Cursor
 5341 - Non-Destructive Cursor
 Adapter
- Not Supported: Attachment of 1053 (TCAM)
- 2260 Display Station (Models 1,2):
 Supported: 3606 - Extended Cursor Control
 Alphameric Keyboard
 4766 - Alphameric Keyboard
 Tab feature of 3606
- Not Supported:
- 1053 Printer (Model 4): (BTAM)
 Supported: 9567,9597 - PTTC/BCD Code
 9571,9591 - PTTC/EBCD Code

2845 Display Control (Model 1) on nonswitched lines: (TCAM,BTAM)

- Supported: Attachment of 2265,1053
 3301 - Destructive Cursor
 4801 - Line Addressing
 Attachment of 1053 (TCAM)
 7801 - Tab
- Not Supported
- 2265 Display Station (Model 1):
 Supported: 4766 - Alphameric Keyboard
- 1053 Printer (Model 4): (BTAM)
 Supported: 9567,9597 - PTTC/BCD Code
 9571,9591 - PTTC/EBCD Code

2740 Communication Terminal (Model 1) on switched or nonswitched lines:

- Supported: 3255 - Dial Up
 6114 - Record Checking
 7479 - Station Control
 8028 - Transmit Control
 8301 - 2760 Attachment (TCAM,
 BTAM)
 9567,9597 - PTTC/BCD Code
 9571,9591 - PTTC/EBCD Code
 Correspondence Code

2740 Communication Terminal (Model 2) on nonswitched lines:

- Supported: 1495,1496 - Buffer Expansion
 1499 - Buffer Receive
 6114 - Record Checking
 9571,9591 - PTTC/EBCD Code

2741 Communication Terminal (Model 1) on switched or nonswitched lines:

- Supported: 3255 - Dial Up
 4708 - Receive Interrupt
 7900 - Transmit Interrupt
 9567,9597 - PTTC/BCD Code
 9571,9591 - PTTC/EBCD Code
 Correspondence Code

2760 Optical Image Unit (Model 1) on switched or nonswitched lines
 (TCAM,BTAM)

- Required: In the 2740-1: 6114 Record
 Checking and 8301 - 2760
 Attachment

3767 Communication Terminal (Models 1,2) (supported as a 2740-1)
 on switched or nonswitched lines:

- Required: 7111 - 2740-1 Start/Stop
 Supported: 9560 - Station Control

3767 Communication Terminal (Models 1,2,3) (supported as a 2740-2) on nonswitched lines:

Required: 7112 - 2740-2 Start/Stop

3767 Communication Terminal (Models 1,2) (supported as a 2741) on switched or nonswitched lines:

Required: 7113 - 2741 Start/Stop

5100/5110 Computer Systems (supported as a 2741) on switched or nonswitched lines:

Required: 1525 - Communications Adapter

CMCST (Communicating Magnetic Card SelectricR Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:

Supported: The CMCST is functionally equivalent to a 2741 with Dial UP, Receive Interrupt and Transmit Interrupt

IBM PROCESSORS AS TERMINALS

(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)

System/7 (supported as a 2740-1 with checking) on switched or nonswitched lines:

Required: 1610 - Asynchronous Communication Control

Non-IBM TERMINALS

AT&T 83B3 Line Control Type on nonswitched lines

CPT-TWX (Model 33/35) Line Control Type on switched lines

World Trade Telegraph on nonswitched lines

WU 115A Line Control Type on nonswitched lines

BSC LINES:

IBM TERMINALS

2790 Data Communication System on switched or nonswitched lines: (TCAM,BTAM)

2715 Transmission Control Unit (Model 1 and 2):

Required: 2740
Supported: Attachment of 2798,1035,1053, 2740
3801 - Expanded Capability
4850 - Local 2740 Adapter
9401 - Point-to-Point Nonswitched
9402 - Point-to-point Switched
9403 - Multipoint Nonswitched

2740 Communication Terminal (Model 1)

2798 Guidance Display Unit (Model 1)

1035 Badge Reader (Model 1)

1053 Printer (Model 1)

2770 Data Communication System on switched or nonswitched lines:

2772 Multipurpose Control Unit:

Required: 5010 - Multipoint Data Link Control (VTAM)
Supported: Attachment of 0050,0545,1017, 1018,1053,1255,2203,2213, 2265,2502,5496
1340 - Automatic Answering
1490 - Buffer Expansion (256 bytes)
1491 - Buffer Expansion Additional (512 bytes)
1910 - Conversational Mode
3250 - Display Format Control
3650 - EBCDIC Transparency
3860 - 144 Character Print Line
4610 - Identification
4690 - Keyboard Correction
5010 - Multipoint Data Link Control (TCAM,BTAM)
5890 - Horizontal Format Control
6555 - Space Compression/Expansion
7705 - Synchronous Clock
7950 - Transmit-Receive-Monitor-Print
9140 - Extended Re-Entry
9402 - Line Termination - 2-wire
9761 - Transmission Code EBCDIC
9762 - Transmission Code ASCII
9936 - Immediate WACK

0050 Magnetic Data Inscrber

0545 Output Punch (Models 3,4)

1017 Paper Tape Reader (Model: 1,2)

1018 Paper Tape Punch (Model 1)

1053 Printer (Model 1)

1255 Magnetic Character Reader

2203 Printer (Models A1,A2):

Supported: 5558 - Print Positions, 24 Additional

2213 Printer (Models 1,2)
2265 Display Station (Model 2)
2502 Card Reader (Models A1,A2)
5496 Data Recorder

2780 Data Transmission Terminal on switched or nonswitched lines:

Supported: 1340 - Automatic Answering
1350 - Automatic Turnaround
3401 - Dual Communication Interface
5010 - Multiple Record Transmission
5020 - Multipoint Line Control
5820 - 120 Character Print Line
5821 - 144 Character Print Line
6400 - Selective Character Set
7850 - Terminal Identification
8030 - EBCDIC Transparency
9150 - Extended Retry Transmission
9761 - ASCII Transmission Code
9762 - EBCDIC Transmission Code

2980 General Banking System on nonswitched lines:

2972 Station Control Unit (Model 8 - RPQ 858160, Model 11 - RPQ 858231)

Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer

2980 Teller Station (Model 1 - RPQ 835504, Model 4 - RPQ 858147)

2980 Administrative Station (Model 2 - RPQ 835505)

2971 Remote Control Unit (Model 3 - RPQ 858144)

3270 Information Display System on nonswitched lines:

3271 Control Unit (Models 1,2):

Supported: Attachment of 3277,3284,3286,3287, 3288
1550 - Copy
9761 - EBCDIC Code

3274 Control Unit (Model 1C)

(Supported as a 3271)

Supported: Attachment of 3277,3278,3284, 3286,3287,3288,3289

3276 Control Unit Display Station (Models 1,2,3,4)

(Supported as a 3271)

Supported: Attachment of 3278, 3287
6350 - Selector Light Pen
9082 - EBCDIC Character Set

3277 Display Station (Models 1,2):

Supported: 6350 - Selector Light-Pen
9089 - EBCDIC Character Set

3278 Display Station (Models 1, 2, 3, 4)

(Supported as a 3277)

Supported: 6350 Selector Light Pen
9082 EBCDIC character set

3284 Printer (Models 1,2):

Supported: 9089 - EBCDIC Character Set

3286 Printer (Models 1,2):

Supported: 9089 - EBCDIC Character Set

3287 Printer (Models 1, 2)

(Supported as a 3284 or 3286 attached to a 3271-1 or -2)

Supported: 9082 - EBCDIC character set

3288 Printer (Model 2) (supported as a 3286-2):

Supported: 9089 - EBCDIC Character Set

3289 Printer (Models 1,2) (Supported as 3286-2)

3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,TCAM,BTAM)

3275 Display Station (Models 1,2):

Supported: Attachment of 3284
6350 - Selector Light-Pen
9089 - EBCDIC Character Set
9761 - EBCDIC Code

3284 Printer (Model 3):

Supported: 9089 - EBCDIC Character Set

3660 Supermarket Scanning System (supported as a S/3) on switched lines: (BTAM)

3651 Store Controller (Models A60,B60):

Supported: Attachment of 3663,3669

3663 Supermarket Terminal (Models 1,2):

Supported: Attachment of 3666

3666 Checkout Scanner (Model 1)

3669 Store Communications Unit (Model 1)

3660 Supermarket Key-Entry System (supported as a S/3) on switched lines: (BTAM)

3661 Store Controller:

Supported: Attachment of 3663

3663 Supermarket Terminal (Models 1,2)

3670 Brokerage Communication System on nonswitched lines: (TCAM)

3671 Shared Terminal Control Unit (Model 1):

Supported: Attachment of 3672,3673,3674

- 3250 - Display Expansion
- 3672 Executive Console (Model 1)
 3673 Data Display (Model 1)
 3674 Printer-KeyBoard (Model 1)
- 3735 Programmable Buffered Terminal (Model 1) on switched or nonswitched lines:
 Supported: Attachment of 5496,3286
 5010 - Multipoint Data Link Control
 9761 - EBCDIC Code
 9762 - ASCII Code
- 5496 Data Recorder (Model 1)
 3286 Printer (Model 3)
- 3741 Data Station (Model 2) on switched or nonswitched lines:
 Supported: Attachment of 0129,3713,3715,3717
 1680 - Expanded Communications
 1685 - Expanded Communications/
 Multipoint Data Link Control
 5450 - Operator Identification Card Reader
 7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
 3713 Printer (Model 1)
 3715 Printer (Models 1,2)
 3717 Printer (Model 1)
- 3741 Programmable Work Station (Model 4) on switched or nonswitched lines:
 Supported: Attachment of 0129,3713,3715
 1680 - Expanded Communications
 1685 - Expanded Communications/
 Multipoint Data Link Control
 5450 - Operator Identification Card Reader
 7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
 3713 Printer (Model 1)
 3715 Printer (Models 1,2)
- 3747 Data Converter (Model 1) on switched or nonswitched lines:
 Supported: 1660 - Communications Adapter
- 3770 Data Communication System (supported as a 2770) on switched or nonswitched lines:
- 3771 Communication Terminal (Models 1,2,3):
 Required: 1460 - SDLC/BSC, Switch Control,
 or
 1461 - BSC Point-to-Point, or
 1462 - BSC Multipoint
 Supported: 1201 - ASCII Code
- 3773 Communication Terminal (Models 1,2,3,P1,P2,P3):
 Required: 1460 - SDLC/BSC, Switch Control,
 or
 1461 - BSC Point-to-Point, or
 1462 - BSC Multipoint
 Supported: 1201 - ASCII Code
- 3774 Communication Terminal (Models 1,2,P1,P2):
 Required: 1460 - SDLC/BSC, Switch Control,
 or
 1461 - BSC Point-to-Point, or
 1462 - BSC Multipoint
 Supported: 1201 - ASCII Code
- 3775 Communication Terminal (Models 1,P1):
 Required: 1460 - SDLC/BSC, Switch Control,
 or
 1461 - BSC Point-to-Point, or
 1462 - BSC Multipoint
 Supported: 1201 - ASCII Code
- 3776 Communication Terminal (Models 1,2) (supported as a 2772/3780):
 Required: 1460 - SDLC/BSC, Switch Control,
 or
 1461 - BSC Point-to-Point, or
 1462 - BSC Multipoint
 Supported: 1201 - ASCII Code
- 3777 Communication Terminal (Model 1) (supported as a 2772/3780):
 Required: 1460 - SDLC/BSC, Switch Control,
 or
 1461 - BSC Point-to-Point, or
 1462 - BSC Multipoint
 Supported: 1201 - ASCII Code
- 3777 Communication Terminal (Model 2) (supported as a S/360-20 MULTI-LEAVING Workstation):
 Required: 3701 - EIA Interface
- 3780 Data Communications Terminal (Model 1) (supported as a 2772 without component select) on switched or nonswitched lines:
 Supported: 3601 - EBCDIC Transparency
 5010 - Multipoint Data Link Control
 5701 - Print Positions, Additional
 9761 - EBCDIC Code
 9762 - ASCII Code
- 5110 Computer (supported as a 2772) on switched or nonswitched lines:
 Required: 2074 BSCA
 Supported: Attachment of a 5103 Printer,
 5106 Tape Cartridge and
 5114 Diskette Unit.
- The 5110 emulates the following 2772 features:
 Auto Answer, Buffer expansion
 additional (512), EBCDIC
 transparency, 144 char-
 acter print line, identi-
 fication, Multipoint
 Data Link Control (TCAM,
 BTAM), Horizontal Format
 Control, Space Compression/
 expansion, Synchronous
 clock, Transmission code
 EBCDIC.
- 5275 Direct Numerical Control Station (supported as a 3275 with EBCDIC code and EBCDIC Character Set) on switched lines (BTAM) or nonswitched lines (VTAM, TCAM, BTAM).
- IBM PROCESSORS AS TERMINALS**
- (For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)
- 1130 Computing System on switched or nonswitched lines: (TCAM,BTAM)
 1131 Central Processing Unit:
 Required: 7690 - Synchronous Communications Adapter
- 1800 Data Acquisition and Control System on switched or nonswitched lines: (TCAM,BTAM)
 1826 Data Adapter Unit:
 Required: 7550 - Communication Adapter
- Series/1 (Supported as a System/3 on switched or nonswitched lines:) (BTAM)
 4953 or 4955 Processor
 Required: 2074,2075 or 2094 Binary Synchronous Communications Adapter
- System/3 on switched or nonswitched lines:
 5406 or 5410 or 5415 Processing Unit:
 Required: 2074 - Binary Synchronous Communications Adapter
- System/7 (supported as a S/3) on switched or nonswitched lines:
 5010 Processor Module:
 Required: 2074 - Binary Synchronous Communications Adapter
- System/32 (supported as a S/3) on switched or nonswitched lines:
 5320 System Unit:
 Required: 2074 - Binary Synchronous Communications Adapter
- System/34 (supported as a S/3) on switched or nonswitched lines:
 5340 System Unit:
 Required: 2500 - Communications Adapter Feature
- System/360 Model 20 on switched or nonswitched lines: (TCAM,BTAM)
 2020 Processing Unit:
 Required: 2074 - Binary Synchronous Communications Adapter
- System/360 Models 25,30,40,50,65,65MP,67(65mode),75,85,91,195 on switched or nonswitched lines: (TCAM,BTAM)
 Processing Unit:
 Required: 4580 - Integrated Communications Attachment, or
 2701 Data Adapter Unit, or
 2703 Transmission Control, or
 3704 Communications Controller in emulation mode, or
 3705-I Communications Controller in emulation mode, or
 3705-II Communications Controller in emulation mode
- All virtual storage S/370 Processors on switched or nonswitched lines:
 Processing Unit:
 Required: 4640 - Integrated Communications Adapter, or
 2701 Data Adapter Unit, or
 2703 Transmission Control, or
 3704 Communications Controller in network control or emulation mode, or

5320 System Unit:
Required: 1005 - Additional Storage
(minimum of one)
6301 - Synchronous Data Link
Control

System/34 (supported as a 3770) on switched or nonswitched lines
(VTAM):
5340 System Unit:
Required: 2500 - Communications Adapter
Feature

1053 Printer (Model 1)
2793 Area Station (Model 1):
Supported: Attachment of 2795,2796,2797,
2798,1053

2795 Data Entry Unit (Model 1)
2796 Data Entry Unit (Model 1)
2797 Data Entry Unit (Model 1)
2798 Guidance Display Unit (Model 1)
1053 Printer (Model 1)

LOCAL ATTACHMENT

Transmission Control Units and Communications Controllers

2701 Data Adapter Unit on local channel: (TCAM,BTAM)
Supported: 1302,1303,1314 - Autocall
3455 - Dual Code
3463-3465 - Dual Communication
Interface
8029 - Transparency
9060 - EBCDIC Code
9061 - ASCII Code
9062 - 6-bit Transcode

2702 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: 1290 - Autocall
1319 - Autopoll
8055 - 2741 Break

2703 Transmission Control Unit on local channel: (TCAM,BTAM)
Supported: 1340,1341 - Autocall
7715 - EBCDIC Code
7716 - ASCII Code
7717 - 6-bit Transcode
8055 - 2741 Break
9100 - Transparency for ASCII

2715 Transmission Control Unit (Model 1) on local channel:
(TCAM,BTAM)
Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:
Supported: EBCDIC Code, ASCII Code, Autopoll
and EBCDIC Transparency do not
have special feature codes in the
3704/3705
EP/VS (TCAM,BTAM)
NCP/VS (VTAM,TCAM)
PEP
8002 - Two-Channel Switch
(VTAM,TCAM)

LOCAL TERMINALS

2848 Display Control (Models 1,2,3) on local channel: (TCAM)
Supported: Attachment of 2260,1053
3901 - Extended Cursor Control
4787 - Line Addressing
5340 - Non-Destructive Cursor
5341 - Non-Destructive Cursor
Adapter
Not Supported: Attachment of 1053

2260 Display Station (Models 1,2):
Supported: 3606 - Extended Cursor Control,
Alphameric Keyboard
Not Supported: Tab feature of 3606

2790 Data Communication System on local channel: (TCAM,BTAM)
2715 Transmission Control Unit (Model 1):
Supported: Attachment of 2740,2791,2793
3801 - Expanded Capability
4850 - Local 2740 Adapter
Not Supported: 8110 - Two Processor Switch

2740 Communication Terminal (Model 1)
2791 Area Station (Models 1,2):
Supported: Attachment of 1035,2795,2796,
2797,2798,1053

1035 Badge Reader (Model 1)
2795 Data Entry Unit (Model 1)
2796 Data Entry Unit (Model 1)
2797 Data Entry Unit (Model 1)
2798 Guidance Display Unit (Model 1)

3270 Information Display System on local channel:
3272 Control Unit (Models 1,2):
Supported: Attachment of 3277,3284,3286,
3287,3288

3277 Display Station (Models 1,2):
Supported: 6350 - Selector Light-Pen
9089 - EBCDIC Character Set

3284 Printer (Models 1,2):
Supported: 9089 - EBCDIC Character Set

3286 Printer (Models 1,2):
Supported: 9089 - EBCDIC Character Set

3287 Printer (Models 1, 2) (Supported as a 3284 or 3286
attached to 3272-1 or -2)
Supported: 9082 - EBCDIC character set

3288 Printer (Model 2) (supported as a 3286-2):
Supported: 9089 - EBCDIC Character Set

3270 Information Display System on Local Channel:
(Supported as a 3272)
3274 Control Unit (Model 1B)
Supported: Attachment of 3277,3278,3284,
3286,3287,3288,3289

3277 Display Station Models 1,2)
Supported: 6350 - Selector Light Pen
9089 - EBCDIC Character Set

3278 Display Station (Models 1,2,3,4)
(Supported as a 3277)
Supported: 6350 - Selector Light Pen
9082 - EBCDIC Character Set

3284 Printer (Models 1,2)
Supported: 9089 - EBCDIC Character Set

3286 Printer (Models 1,2)
Supported: 9089 - EBCDIC Character Set

3287 Printer (Models 1,2)(Supported as a 3284 or 3286)
Supported: 9082 - EBCDIC Character Set

3288 Printer (Model 2) (Supported as a 3286-2)
Supported: 9089 - EBCDIC Character Set

3289 Printer (Models 1,2)(Supported as a 3286-2)

3270 Information Display System on Local Channel: (VTAM,
TCAM thru VTAM) (Supported as a 3790 with
Configuration Support)

3274 Control Unit (Model 1A)
Supported: Attachment of 3277,3278,3284,
3286,3287,3288,3289

Legend:
(VTAM) = VTAM only
(TCAM) = TCAM only
(BTAM) = BTAM only

SVS TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS	TCAM via NCP/VS	TCAM or BTAM via EP/VS (d)	TCAM via 270X (e)	TSO via TCAM, NCP/VS	TSO via TCAM, EP/VS
SS Lines:						
1031			X	1,2,3		
1051	X	X	X	1,2,3	X	X
2260			X	1		X
2265			X	1		X
2740-1,-2	X	X	X	1,2,3		
2741	X	X	X	1,2,3	X	X
2760			X	1,2,3		
3767-1,-2 (2740-1)	X	X	X			
3767-1,-2,-3 (2740-2)	X	X	X	1		
3767-1,-2 (2741)	X	X	X		X	X
5100 (2741)	X	X	X		X	X
CMCST (2741)	X	X	X	1,2,3		
S/7 (2740-1)	X	X	X	1,2,3		
AT&T 83B3 or WU 115A						
Line Control Type	X	X	X	1,2,3		
CPT-TWX (M33/35)						
Line Control Type	X	X	X	1,2,3	X	X
WT Telegraph	X	X	X	1,2,3		
BSC Lines:						
2715-2		X	X	1,3		
2772	X	X	X	1,3		
2780	X	X	X	1,3		
2972-8,-11	X	X	X (B)	1,3 (B)		
3271-1,-2	X	X	X	1,3	X	X
3274-1C (3271-1,2)	X	X	X	1,3	X	X
3275-1,-2	X	X	X	1,3	X	X
3276 (3271-1,2)	X	X	X	1,3	X	X
3651-A60,-B60 (S/3)			X (B)			
3661 (S/3)			X (B)			
3670			X (T)	1,3 (T)		
3735	X	X	X	1,3		
3741-2,4	X	X	X	1,3		
3747	X	X	X	1,3		
3771-1,-2,-3 (2772)	X	X	X	1		
3773-1,-2,-3,-P1, -P2,-P3 (2772)	X	X	X	1		
3774-1,-2,-P1,-P2, (2772)	X	X	X	1		
3775-1,-P1, (2772)	X	X	X	1		
3776-1,-2 (2772/3780)	X	X	X	1		
3777-1 (2772/3780)	X	X	X	1		
3780 (2772)	X	X	X	1,3		
1131		X	X	1,3		
1826		X	X (B)	1,3 (B)		
S/3	X	X	X	1,3		
S/7 (S/3)	X	X	X	1,3		
S/32 (S/3)	X	X	X	1,3		
S/34 (S/3)	X	X	X	1,3		
S/360-20		X	X	1,3		
S/360 (b)		X	X	1,3		
S/370 (b)	X	X	X	1,3		

SVS Terminal Support Chart 1 - cont'd

SDLC Lines:	VTAM	TCAM		
	via NCP/VS	via NCP/VS		
3704 Remote	X			
3705-1 Remote	X			
3271-11,-12	X	X		
3274-1C(3271-1,2)	X	X		
3275-11,-12	X	X		
3276(3791)	X	X		
3601	X	X		
3602	X	X		
3614	X	X		
3624	X			
3767-1,-2,-3	X	X		
3771-1,-2,-3	X	X		
3773-1,-2,-3	X	X		
3773-P1,-P2,-P3	X	X		
3774-1,-2,-P1,-P2	X	X		
3775-1,-P1	X	X		
3776-1,-2	X	X		
3776-3,-4	X			
3777-1	X	X		
3777-3	X			
3791	X	X(f)		
S/32 (3770)	X			
S/34 (3770)	1/79			
Local Channel Attach	VTAM	TCAM	BTAM	TSO via TCAM
TCUs, Local Communications				
Controllers:				
2701		X	X	
2702		X	X	
2703		X	X	
2715-1		X	X	
3704 (EP/VS)		X	X	
3704 (NCP/VS)	X	X		
3705-1 (EP/VS)		X	X	
3705-I (NCP/VS)	X	X		
3705-II (EP/VS)		X	X	
3705-II (NCP/VS)	X	X		
Local Terminals:				
2260		X		
3272-1,-2	X	X	X	X
3274-1A(3791)	X			
3274-1B(3272-2)	X	X	X	X
3791	X(c)			
7770-3		X		

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- X = supported now
- (date) = date when support will be available

Notes:

- (B) BTAM only.
- (T) TCAM only.
- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1".
- (b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.
- (c) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s, and precludes concurrent operation of IBM 3704/3705 or IBM 3272 controllers through VTAM.
- (d) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
- (e) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.
- (f) Does not apply to versions earlier than Version 6 of the 3791 Controller.

MVS TERMINAL SUPPORT CHART 1

Remote Attach (a)	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS (f)	TCAM or BTAM via EP/VS (g)	TCAM or BTAM via 270X (h)	TSO via TCAM, NCP/VS	TSO via TCAM, EP/VS	TSO via VTAM	JES2 via RTAM	JES3 via RTAM
SS Lines:										
1031				X	1,2,3					
1051	X	X	X	X	1,2,3	X	X			
2260				X	1		X			
2265				X	1		X			
2740-1,-2	X	X	X	X	1,2,3					
2741	X	X	X	X	1,2,3	X	X			
2760				X	1,2,3					
3767-1,-2 (2740-1)	X	X	X	X						
3767-1,-2,-3 (2740-2)	X	X	X	X	1					
3767-1,-2 (2741)	X	X	X	X		X	X			
5100 (2741)	X	X	X	X		X	X			
5110 (2741)	X	X	X	X		X				
CMCST (2741)	X	X	X	X	1,2,3					
S/7 (2740-1)	X	X	X	X	1,2,3					
AT&T 83B3 or WU 115A Line Control Type	X	X	X	X	1,2,3					
CPT-TWX (M33/35) Line Control Type	X	X	X	X	1,2,3	X	X			
WT Telegraph	X	X	X	X	1,2,3					
BSC Lines:										
2715-2			X	X	1,3					
2772	X	X	X	X	1,3				X	X
2780	X	X	X	X	1,3				X	X
2972-8,-11	X	X	X	X (B)	1,3 (B)					
3271-1,-2	X	X	X	X	1,3	X	X	X		
3274-1C(3271-1,2)	X	X	X	X	1,3	X	X	X		
3275-1,-2	X	X	X	X	1,3	X	X	X		
3276(3271-1,2)	X	X	X	X	1,3	X	X	X		
3651-A25,B25,A75 B75,C75,D75(S/3)				X (B)						
3651-A60,-B60 (S/3)				X (B)						
3661 (S/3)				X (B)						
3670				X (T)	1,3 (T)					
3735	X	X	X	X	1,3					
3741-2,-4	X	X	X	X	1,3				X(j)	X
3747	X	X	X	X	1,3					
3771-1,-2,-3 (2772)	X	X	X	X	1				X	X
3773-1,-2,-3 (2772)	X	X	X	X	1				X	X
3773-P1, -P2,P3 (2772)	X	X	X	X	1					
3774-1,2 (2772)	X	X	X	X	1				X	X
3774-P1,-P2 (2772)	X	X	X	X	1				X(k)	X
3775-1 (2772)	X	X	X	X	1				X	X
3775-P1 (2772)	X	X	X	X	1				X(k)	X
3776-1,-2 (2772/3780)	X	X	X	X	1				X	X
3777-1 (2772/3780)	X	X	X	X	1				X	X
3777-2 (S/360-20)									X	X
3780 (2772)	X	X	X	X	1,3				X	X
5110 (2772)			X	X		X	X			
5275 (3275-1,-2)	X	X	X	X	1					
1131			X	X	1,3				X	X
1826			X	X (B)	1,3 (B)					
Series/1				X (B)	1 (B)					
S/3	X	X	X	X	1,3				X	X
S/7 (S/3)	X	X	X	X	1,3					
S/32 (S/3)	X	X	X	X	1,3				X	X
S/34 (S/3)	X	X	X	X	1,3				X	X
S/360-20			X	X	1,3				X	X
S/360 (b)			X	X	1,3				X	X
S/370 (b)	X	X	X	X	1,3				X	X

MVS Terminal Support Chart 1 - cont'd.

SDLC Lines:	VTAM via NCP/VS (c)	TCAM via VTAM (c)	TCAM via NCP/VS	TSO via VTAM	JES2 via VTAM	JES3 via VTAM		
3704 Remote	X9							
3705-1 Remote	X							
3271-11,-12	X	X	X	X				
3274-1C(3791)	X	X	X	X				
3275-11,-12	X	X	X	X				
3276(3791)	X	X	X	X				
3601	X	X	X					
3602	X	X	X					
3614	X	X	X					
3624	X							
3651-A25,B25,A75 B75,C75,D75		X	X					
3651-A50,-B50	X	X						
3651-A60,-B60	X							
3661	X							
3767-1,-2,-3	X	X	X	X				
3771-1,-2,-3	X	X	X	X	X	9/78		
3773-1,-2,-3	X	X	X	X	X	9/78		
3773-P1,-P2,-P3	X	X	X					
3774-1,-2	X	X	X	X	X	9/78		
3774-P1,-P2	X	X	X					
3775-1	X	X	X	X	X	9/78		
3775-P1	X	X	X					
3776-1,-2	X	X	X		X	9/78		
3776-3,-4	X				X	9/78		
3777-1	X	X	X		X	9/78		
3777-3	X				X	9/78		
3791	X	X (e)	X (e)		X	9/78		
S/32 (3770)	X				X			
S/34 (3770)	1/79				7/79			
Local Channel Attach	VTAM (c)	TCAM via VTAM (c)	TCAM	BTAM	TSO via TCAM	TSO via VTAM	JES2 via VTAM	JES3 via VTAM
TCU's Local Communications Controllers:								
2701			X	X				
2702			X	X				
2703			X	X				
3704 (EP/VS)			X	X				
3704 (NCP/VS)	X	X	X					
3705-1 (EP/VS)			X	X				
3705-1 (NCP/VS)	X	X	X					
3705II (EP/VS)			X	X				
3705-II (NCP/VS)	X	X	X					
Local Terminals:								
2260			X					
2715-1			X	X				
3272-1,-2	X	X	X	X	X	X		
3274-1A(3791)	X	X						
3274-1B(3272-2)	X	X	X	X	X	X		
3791	X(d)	X(e)					X	9/78
7770-3			X					

Legend:

SS = Start/Stop
 BSC = Binary Synchronous Communication
 SDLC = Synchronous Data Link Control
 X = supported now
 (date) = date when support will be available

Notes:

- (B) BTAM only.
- (T) TCAM only.
- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7(2740-1)" means "the S/7 is supported as a 2740-1"
- (b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.
- (c) MVS Release 3.0 or later.
- (d) The ICR for Special Programming Support for Key Entry (SPS/KE) supports only the local 3791 with Data Entry Configuration using 3760s. This support precludes concurrent operation of IBM 3704/3705 or IBM 3272 controllers through VTAM or TCAM through VTAM.

- (e) Does not apply to versions earlier than Version 6 of the 3791 Controller.
- (f) MVS Release 2.0 only.
- (g) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
- (h) 270X = 2701, 2702, 2703; column shows last digit of 270X support. All support without a date is available now.
- (i) Supported as a 2780.
- (k) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).

TERMINAL SUPPORT CHART 2

	Communications Code				Communication Network		
	EBCDIC		ASCII		sw	nonsw	MP
	norm	trans	norm	tran	PTP	PTP	MP
SS Lines:							
1031	-	-	-	-	-	-	X
1051	-	-	-	-	X	-	X
2260	-	-	-	-	-	-	X
2265	-	-	-	-	-	-	X
2740-1	-	-	-	-	X	X	X
2740-2	-	-	-	-	-	-	X
2741	-	-	-	-	X	X	-
2760	-	-	-	-	X	X	-
3767-1,-2 (2740-1)	-	-	-	-	X	X	X
3767-1,-2,-3(2740-2)	-	-	-	-	-	-	X
3767-1,-2 (2741)	-	-	-	-	X	X	-
5100 (2741)	-	-	-	-	X	X	-
5110 (2741)	-	-	-	-	X	X	-
CMCST (2741)	-	-	-	-	X	-	-
S/7 (2740-1)	-	-	-	-	X	X	X
AT&T 83B3, WU 115A	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	X	-
BSC Lines:							
2715-2	-	X	-	-	S	X	M
2772	X	X	X	-	S	X	M
2780	X	X	X	-	S	X	M
2972-8,-11	X	-	-	-	-	-	M
3271-1,-2	X	-	X	-	-	-	M
3274-1C(3271-1,2)	X	-	X	-	-	-	M
3275-1,-2	X	-	X	-	S	-	M
3276(3271-1,2)	X	-	X	-	-	-	M
3651-A25,B25,A75 B75,C75,D75(S/3)	-	X	-	-	X	-	-
3651-A60,-B60 (S/3)	-	X	-	-	X	-	-
3661 (S/3)	-	X	-	-	-	-	M
3670	X	-	-	-	-	-	M
3735	X	-	X	-	S	-	M
3741-2,-4	X	X	X	-	S(d)	X	-
3747	X	X	-	-	S(d)	X	-
3771,3773,3774, 3775 (2772)	X	X	X	-	S	X	M
3776, 3777-1 (2772/3780)	X	X	X	-	S	X	M
3777-2 (S/360-20)	X	X	X	X	S	X	M
3780 (2772)	X	X	X	-	S	X	M
5110 (2772)	X	X	-	-	S	X	M
5725 (3275-1,-2)	X	-	-	-	S(e)	-	M
1131	X	X	-	-	S	X	M
1826	X	X	X	-	S	X	M
S/3	X	X	X	-	S	X	M
S/7 (S/3)	X	X	X	-	X	X(f)	M
S/32 (S/3)	X	X	X	-	S	X	M
S/34 (S/3)	X	X	X	-	S	X	M
S/360-20	X	X	X	X	S	X	M
S/360 (b)	X	X	X	X	S	X	-
S/370 (b)	X	X	X	X	S	X	-
SDLC Lines:							
3704 Remote	SDLC is insensitive				-	X	-
3705-1 Remote					-	X	-
3271-11,-12	to data interchange codes.				-	-	N
3274-1C(3791)					-	X	X
3275-11,-12					-	-	N
3276(3791)					D	X	X
3601					X	X	N
3614					-	X	N
3624					-	X	N
3651-A25,B25,A75 B75,C75,D75					D(e)	X	N
3651-A50,-B50					D(e)	X	N
3651-A60,-B60					D	-	-
3661					D	-	-
3767-1,-2,-3					D	X	N
3771,3773,3774, 3775,3776,3777-1,3					D	X	N
3791 (c)					D(e)	X	N
S/32 (3770)					D	X	N
S/34 (3770)					D	X	N
Local Channel Attach:							
2260	-	-	-	-	-	-	-
2715-1	-	X	-	-	-	-	-
3272-1,-2	X	-	-	-	-	-	-
3274-1A(3791)	X	-	-	-	-	-	-
3274-1B(3272-2)	X	-	-	-	-	-	-
3791 (c)	3791 local attachment is code insensitive				-	-	-
7770-3	-	-	-	-	-	-	-

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- X = supported
- = not supported
- D = Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.
- M = Group of terminals which can operate on same BSC MP line and same line speed.
- N = Group of terminals which can operate on same SDLC MP line and same line speed.
- S = Group of terminals which can share the same phone number(s).

Notes:

- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1"
- (b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS or OS. All virtual storage S/370 Processors with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
- (c) The 3791 Controller, as part of the 3790 Communication System/Data Entry Configuration, does not support ASCII code.
- (d) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, NCP/VS requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.
- (e) Terminal operates on switched line using manual dial/manual and/or auto answer procedures and nonswitched VTAM-NCP/VS programming support. The 3651-A50,-B50 uses manual answer and the 3791 uses manual or auto answer procedures. These manual dial procedures will not be required when switched VTAM-NCP/VS support is available.
- (f) IPL of S/7 is not supported in this network configuration.

ASP - Asymmetric Multiprocessing System (360A-CX-15X)

For description, see *Programs Type I and II(ZZ20-3644)*.

HASP-II Version 4 (370H-TX-001) (SVS)

HASP II Version 4 is not System Control Programming (SCP). It is optionally available to replace SVS readers and writers. It provides the remote job entry (RJE) support for SVS. Installation remains the responsibility of the user. Programming service classification is A.

The HASP System is an extension of SVS and provides support in the areas of job management, data management, task management, and remote job entry. HASP operates as a systems task and is formally interfaced to SVS. When HASP is used, it supplants the normal SVS functions of reader - printer - punch input/output services, SYSIN-SYSOUT spooling and job scheduling.

Features that may add to systems performance are a high performing SPOOL management routine and the HASP MULTI-LEAVING line manager. MULTI-LEAVING is employed with all Processor workstations and will tend to maximize line effectiveness and provide concurrent operation of all supported workstation devices.

HASP operation is a V=V mode. The minimal storage that must be fixed is 12K bytes. The requirement for fixed storage will be approximately 25% of the total storage generated for a HASP System.

The job input and output services provided for local peripheral devices along with a subset of the HASP operator commands capability are optionally extended to remote workstations, including both Processor and non-Processor terminals. Workstation programs for BSC System/360 Model 20 or higher, BSC 1130, and BSC System/3 are generated as extensions to the central HASP System and operate in the workstation on a "stand-alone" basis. The HASP RJE implementation for BSC Processor workstations is based upon the HASP MULTI-LEAVING philosophy which provides the capability for concurrent operation for all supported terminal job input, output, and console devices.

HASP Description

HASP is a specialized program which operates in the same Processor with SVS to perform the peripheral functions associated with batch job processing.

HASP is loaded as a systems task. Control of all online unit record devices is assumed, the designated intermediate storage direct access device(s) are initialized and job processing begins.

HASP has three major processing stages which relate to its three major external functions. These are:

1. **INPUT STAGE** - This stage reads jobs simultaneously from an essentially unlimited number of various types of online card readers, tapes and remote terminals into the system. These jobs are then entered into a priority queue by job class to await processing by the next stage.
2. **EXECUTION STAGE** - This stage removes jobs based upon priority and class from the queue established by the Input Stage and passes those jobs to SVS for processing. Input cards are supplied as required to the executing program and print and punch records are received and written onto HASP intermediate storage. This stage can simultaneously control an essentially unlimited number of jobs being processed by SVS. At the completion of a job, it is placed in a queue to await processing by the next stage.
3. **OUTPUT STAGE** - One purpose of this stage is to transcribe the printed output generated by jobs in the previous stage to printers. An essentially unlimited number of various types of printers and remote terminals can be operated simultaneously. The output stage also transcribes the punch output generated by jobs in the execution phase to punches. An essentially unlimited number of various types of punches and remote terminals can be operated simultaneously.

All of these processes are controlled by reenterable code so that no additional code is required to support multiple, simultaneous functions. Since all of the above functions can occur simultaneously and asynchronously, a continuous flow of jobs may pass through the system.

Following are some of the more significant algorithms employed by HASP to improve function and performance:

Specialized Direct Access Storage Allocation

HASP, through the use of an allocation bit map in main storage, dynamically allocates space for intermediate storage on a record basis, within definable track groups, for jobs. The use of this technique offers the following advantages:

1. Disk-arm motion and interference is minimized by dynamically allocating space based upon the position of the access mechanism.
2. Disk area fragmentation is automatically eliminated by allocation of the smallest possible increment of space.

3. The data for a single data set can be spread across multiple direct access volumes. In addition to further optimizing arm motion, this capability allows for the simultaneous use of multiple selector channels to increase the data rate for a given job.
4. Space is allocated as required minimizing the loss of space as a result of over-estimated output requirements.
5. The release of previously used space is accomplished by a simple algorithm which requires no I/O operations.

Unit Record Device Command Chaining: While operating any reader, printer or punch, rather than handling each record separately, HASP constructs a chained sequence of channel command words to pass to the channel. Thus, instead of the overhead of the EXCP and the ensuing interrupts for each record transmitted, only one EXCP and associated interrupt is required for a series of records. For example, when reading a job into the system, HASP might chain 40 commands together to instruct a card reader. This would cause the next 40 cards to be read into storage without requiring the execution of any Processor instructions.

Transparent Blocking: All input, print and punch for every job is automatically blocked by HASP to improve performance. Since all deblocking is also done by HASP, any program, even if designed to operate with unblocked records can benefit from the blocking. Also, because all blocking and deblocking is done by HASP, program programs require buffers only the size of a single card or line. This can reduce a program's partition or region requirement by several thousand bytes over normal full track blocking.

Dynamic Buffer Pool: HASP maintains a dynamic area of storage which is allocated as required. This technique allows not only multiple data sets of a job but multiple jobs to share this area, thereby insuring optimum use of storage.

HASP Standard Features

The standard features of HASP are as follows:

Job input service provides for low overhead reading of job streams and storing of data on SPOOL volumes for later high speed retrieval for up to 99 concurrently active local card readers in any combination of devices as follows (one required): 2540 reader ... 2501 reader ... 3505 reader (80-column punched cards only).

Execution services provides for selection of jobs and execution monitoring for up to 63 concurrently executing jobs with services as follows: Selection of jobs based upon job class and initiator priority class list of up to 64 classes for each initiator ... automatic delaying of jobs with duplicate OS jobnames ... automatic deblocking and blocking of user SYSIN/SYSOUT data using the HASP dynamically shared buffer pool ... counting of lines, cards, and execution duration with optional operator notification and/or cancellation ... interface for SMF counting of SYSIN/SYSOUT data.

Execution services requires an OS Reader Interpreter to be active at all times.

Multiple SPOOL volume support provides for balanced utilization of up to 36 volumes for any combination of devices as follows (one required): 2314 ... 3330 ... 2305.

Warm start capability provides for checkpointing critical HASP information sufficient for: optionally restarting jobs which were executing ... restarting print at the last checkpoint ... restarting punch at the beginning of data set.

Job output print service provides for low overhead printing of job stream system message and user data print output for up to 99 concurrently active local printers in any combination of devices as follows (one required): 1403 Printer ... 3211 Printer.

Special forms feature provides for the routing of print (on a job or data set basis) and punch data (data set basis) to special forms output queues for output as directed by the operator.

Console Support provides for direct entry for HASP commands and HASP abbreviated reply to WTOR through SVS Operator Consoles.

HASP minimal System Message Block (SMB) output writer provides for retrieval of SMBs from the SYS1.SYSJOBQUE data set.

HASP interfaces directly with the SVS SMF writer.

HASP Optional Features

In addition to the standard features, the following optional features are available:

Internal Reader feature provides the ability for any non-swappable task within the system to submit jobs to HASP for batch execution as though entered from a HASP card reader.

Job output punching services provides for low overhead punching of job stream user punch output for up to 99 concurrently active local punches in any combination of devices as follows: 2520 punch ... 2540 punch ... 3525 punch.

Execution Batching feature provides the facility for passing jobs directly to a processing program such as a "one-step" monitor,

reducing the overhead of OS scheduling and allocation of facilities for short running jobs requiring limited system facilities.

Priority aging feature provides for automatically increasing the HASP scheduling priority of jobs which have been in the system for extended periods of time.

Remote Job Entry feature provides for high speed communications with BSC batch workstations which may be used for job stream input and output as well as operator control of the devices and jobs associated with the remote (see HASP Remote Job Entry for features).

HASP RJE Features

Those features common to all HASP RJE configurations are listed as follows:

HASP RJE supports up to 99 remote workstations communicating over nonswitched (point-to-point) or switched lines.

HASP RJE provides for concurrent operations over up to 99 lines assigned to unique communication lines adapter addresses of the following types: SDA Type II on a 2701 for BSC ... Synchronous Base on a 2703 for BSC ... 3704/3705 providing 270X emulation.

Output routing control provides for print and punch output to be directed to the devices attached to the remote, to the central system, or to other remotes as designed by HASP generation parameters, by control card submitted with the job, or by operator command.

Remote operator control feature provides a subset of the HASP operator commands for display of information and control of jobs and devices associated with the remote.

Operator message output feature provides for transmission of messages and responses to remote operators with online MULTI-LEAVING workstations with consoles immediately and optionally saving of messages for all other remotes until the remote is online and has its primary printer available.

Workstation programs, when required, are supplied as extensions of HASP and are contained on the HASP distribution tape in source form.

Terminal support on the central system provides for communication with: 2770 (BSC) ... 2780 (BSC) ... 3780 (BSC) ... S/360 Models 20, 25, 30, 40, 50, 65, 75, 85, and 195 (MULTI-LEAVING) ... 1130 (MULTI-LEAVING) ... S/3 Model 10 (MULTI-LEAVING) ... S/32 or S/34 (MULTI-LEAVING as a S/3).

The sign-on feature provides for remote identification and line security through line passwords.

Remote characteristics support utilizes the unique features on each remote as follows: full text transparency (required for object decks) ... text compression ... print line width ... buffer size and blocking capabilities.

Note: Multipoint or multidrop line features are prohibited.

Remote job priority adjustment provides for favoring or limiting the HASP scheduling priority of jobs submitted from each remote workstation.

Line restart feature provides for warm starting of print output after remote workstation or line failures.

Line error recovery provides for continuous retry until successful transmission.

HASP MULTI-LEAVING RJE Features

MULTI-LEAVING is a term which describes a computer-to-computer communication technique developed for use by the HASP System. In a gross sense, MULTI-LEAVING can be defined as the fully synchronized, pseudo-simultaneous, bi-directional transmission of a variable number of data streams between two or more computers utilizing binary synchronous communications facilities. Those features common to all HASP RJE configurations are provided with MULTI-LEAVING configurations with additional features as follows:

Concurrent device operation feature provides for all supported devices to operate concurrently in accordance with the device characteristics, line speed, and characteristics of the data streams.

Dual reader/punch device support provides for use as both reader and punch under automatic or operator control.

Unit record error recovery provides a minimum of operator intervention and continued operations using unaffected devices on operator console configurations.

HASP/2770 RJE Workstation

The IBM 2770 is supported by the HASP RJE features as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support of the 2772 provides for job stream input and output on the following devices: 2213 Model 2 Printer ... 2203

Models A1 or A2 Printer ... 2502 Models A1 or A2 Card Reader ... 0545 Models 3 or 4 Output Punch.

Note: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job stream input (a job stream must fit entirely within the 2772 buffer).

Extended support provides for special features: Buffer expansion and buffer expansion additional ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Horizontal Format Control ... 144 character print line (2203 only, requires Buffer Expansion) ... Space Compression/Expansion.

The Terminal ID and Security ID features may be present but are not be supported by HASP.

Note: Other features not prohibited by HASP RJE and transparent to programming are permitted.

HASP/2780 RJE Workstation

The IBM 2780 is supported by the HASP RJE feature as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support for job stream input and output on the following 2780 configurations: Model 1 Printer and Reader ... Model 2 Printer, Reader and Punch.

Extended support provides for special features: Multi-record transmission ... 120 and 144 character print line ... Horizontal Format Control ... EBCDIC or ASCII transmission codes ... Full text transparency for EBCDIC.

The Terminal ID and Security ID features may be present but will not be supported by HASP.

Note: Other features not prohibited by HASP RJE and transparent to programming are permitted.

HASP/3777-2 MULTI-LEAVING Workstation

The IBM 3777 Model 2 is supported as a System/360 Model 20 Binary Synchronous MULTI-LEAVING Workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

The RMTM20 Workstation program is generated by HASP remote generation procedures for a S/360-20 Submodel 5 with 12K of main storage.

Device support provides concurrent operations on each reader, printer, punch and console device: 3203-3 Printer (required) (specify 1403) ... 2502 Reader (required) (specify 2501) ... 3521 Punch (optional) (specify 1442) ... Console Display (optional) (specify 2152).

HASP/3780 RJE Workstation

The IBM 3780 is supported by the HASP RJE features as a BSC workstation for submission and control of jobs at the central HASP for OS processing and has the following features:

Device support provides for job stream input and output on the following devices: Card Reader ... Line Printer.

Supported features are: 512 character buffer ... Variable length record ... Space Compression/Expansion ... EBCDIC or ASCII transmission code ... Full text transparency for EBCDIC ... Print positions (additional) for 144 character print line ... Horizontal Format Control.

The Terminal ID and Security ID features may be present but are not be supported by HASP.

HASP/360-20 MULTI-LEAVING Workstation

The IBM System/360 Model 20 with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The RMTM20 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage on a Model 20 submodels 2, 4, 5, and 6. Larger core (up to 32K) may be used for additional buffer storage is available.

Device support provides concurrent operations on one of each reader, printer, punch and console device: 2203 Printer or 1403 Printer (one required) ... 2501, 2520 or 2560 Reader device (one required) ... 1442, 2520 or 2560 Punch device (optional) ... 2152 Console (optional).

Dual 2520 device support provides automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Dual 2560 device support provides selection of functions by feed hopper as follows: Primary feed assigned to reader ... Secondary feed assigned to punch.

Unit record data checks which require operator intervention may be corrected without stopping other functions when the 2152 console is available.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) over all available BSC line speeds; however, speeds requiring the high speed feature (19.2K baud and above) are not recommended for the submodels 2 or 4.

HASP/360 MULTI-LEAVING Workstation

The IBM System/360 Models 25, 30, 40, 50, 65, 75, 85 and 195 with BSC adapter and HASP provided workstation programs are supported as BSC MULTI-LEAVING workstations for submission of jobs to the central HASP for OS processing and have the following features:

The RMT360 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to support single reader, printer, punch, and console device configurations. Larger storage (up to 32K) may be used as space for additional buffers and to support additional devices for up to seven readers, printers, punches (the number of printers when added to the number of punches must not exceed eight).

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch and Punch ... 2520 Reader/Punch and Punch ... 2540 Reader/Punch ... 1403 Printer ... 1052 Printer-Keyboard.

Notes: At least one reader and one printer along with the 1052 console required ... Each device (including communications adapter) must be on separate non-shared subchannels.

Dual reader/punch support for 1442 and 2520 provides for automatic determination of function as follows: Operator places blank cards in feed designating punch ... Operator places job stream in feed designating reader.

Note: 2540 reader/punch has two independent card paths which operate concurrently.

Communications adapter support on the workstation provides for EBCDIC transmission (transparency optional), via: SDA Type II on a 2701 ... Integrated BSC adapter on Model 25.

HASP/1130 MULTI-LEAVING Workstation

The IBM 1130 Computing System with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The RTP1130 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to operate all supported devices concurrently. Larger core (up to 32K) may be used for additional buffer storage.

Device support provides for concurrent operations on each of the supported devices as follows: 2501 Reader ... 1442 Reader/Punch or Punch ... 1132 Printer ... 1403 Printer ... Standard Printer-Keyboard.

Note: At least one reader required.

Dual reader/punch support for the 1442 provides for operator assignment of function.

Console output support provides for color coded messages for separation of HASP messages from workstation messages and operator input.

Single 1403 printer configurations support 132 character lines (RPQ features required).

Note: This feature does not include support for UCS printers.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the standard BSC adapter attachable to the 1131.

HASP/System/3 MULTI-LEAVING Workstation

The IBM System/3 Model 10 with BSC adapter and HASP provided workstation program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

The System/3 workstation program is generated by HASP remote generation procedures and requires a minimum of 8K main storage to operate all supported devices currently. Larger core is utilized when available.

Device support provides for concurrent operations on each of the supported devices as follows: 5424 Reader/Punch ... 1442 Reader/Punch ... 5203 Printer ... 1403 Printer ... 5471 Printer-Keyboard (console) ... 5475 Data Entry Keyboard (in lieu of 5471).

Note: At least a card reader and printer required.

Dual reader/punch support for 1442 and 5424 provides for automatic determination of each card path as follows: Operator places blank cards in feed to designate punch ... Operator places job stream in feed to designate reader.

Each 96-column card punched is interpreted.

Communications adapter support on the workstation provides for EBCDIC code (transparency optional) at any speed available to the BSC adapter.

Printer support provides for extra print positions and UCS images of LC and PN trains (PN recommended).

System/32 MULTI-LEAVING Workstation for HASP

The System/32 with Binary Synchronous Communications Adapter and its associated MRJE/WS System Utility Program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/32 must be specified as a System/3. The System/32 MRJE/WS System Utility Program is supplied as a component of the System/32 SCP.

Device support provides for concurrent operations on each of the supported facilities of the 5320 System Unit: Disk storage simulation of card I/O and/or printer data streams ... Line or serial printing ... Keyboard/display (console).

Communications adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Binary Synchronous Communications Adapter.

System/34 MULTI-LEAVING Workstation for HASP

The System/34 with Communications Adapter in BSC mode and its associated MRJE System Utility Program is supported as a BSC MULTI-LEAVING workstation for submission of jobs to the central HASP for OS processing and has the following features:

For remote workstation support by HASP, the System/34 must be specified as a System/3. The System/34 MRJE System Utility Program is supplied as a component of the System/34 SSP.

Device support provides for concurrent operations on each of the supported features of the 5340 System Unit: Disk storage simulation of card I/O and/or printer data streams ... line or serial printing ... keyboard/display (console).

Communication adapter support on the workstation provides for EBCDIC code (Text Transparency optional) at any speed available to the Communications Adapter.

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DISK OPERATING SYSTEM/VIRTUAL STORAGE

(For information on the Disk Operating System, Basic Operating System, or Tape Operating System, see the "P 360" pages of your sales manual).

Introduction

The IBM Disk Operating System/Virtual Storage (DOS/VS), 5745-010, is a disk-resident system designed to provide operating system capabilities for any virtual storage S/370 Processor and attachable input/output devices.

Note: Model 155II does not have EREP support in DOS/VS.

DOS/VS is an operating system optimized to the function and performance needed by the small and intermediate users of the System/370. It gives the user the ability to multiprogram five jobstreams concurrently which generally include the POWER/VS spooling component, a real time subsystem, such as CICS/VS, one or two batch jobstreams, and an unscheduled work partition for quick turn-around jobs. The operating system supports most large DASD and most terminals and devices supported by the larger Operating System. This gives the DOS/VS user the capability to start out on a Model 115 or 125 and grow his system and workload up through the System/370 line, as his DP business needs increase.

DOS/VS is classified as IBM System Control Programming (SCP) for distribution, installation, and programming support purposes.

The system operates in extended control (EC) mode only and uses the BC mode format of the program status word (PSW) and low-order storage locations from 0 to 511. Dynamic Address Translation (DAT) is used to provide virtual storage support. The Program Event Recording (PER) Facility and Monitor Calling Facility are used to provide system debugging facilities (SDAIDS).

This section describes the individual components from which the DOS/VS Operating System is built. For a description of basic concepts and facilities of DOS/VS see the *Introduction to DOS/VS*, GN33-8800. To obtain more detailed information the reader should consult the appropriate IBM reference manuals.

SYSTEM CONCEPTS AND ORGANIZATION

Virtual Storage Support

Virtual storage is the address space available to the DOS/VS system. It starts at storage address 0, and its total size is determined by user specification at supervisor assembly time.

SYSTEM COMPONENTS

The Disk Operating System/Virtual Storage System Control Programming consists of the following components:

- Control and Service Programs:
 - Initial Program Load and Buffer Load
 - Supervisor
 - Job Control
 - Attention routines, Initiators, Terminators
 - Checkpoint/Restart
 - Linkage Editor
 - Librarian - Maintenance and Service
 - Display Operator Console Support
- The POWER/VS Program (Priority Output Writers, Execution Processors and Input Readers)
- The Assembler
- Data Management:
 - Sequential Access Methods:**
 - IOCS and Device Independent I/O
 - Magnetic Tape IOCS
 - Sequential Disk IOCS
 - Paper Tape IOCS
 - Diskette IOCS
 - Magnetic Character Recognition IOCS
 - Optical Character Recognition IOCS
 - Direct Access Methods:**
 - Direct Access Method
 - Indexed Sequential Access Method
 - Virtual Storage Access Method
- Telecommunications Support:
 - Virtual Telecommunications Access Method
 - Basic Telecommunications Access Method
 - Queued Telecommunications Access Method
- Utility Programs:
 - System Utility Programs
 - Utility Services
 - Access Method Services
- Error Recovery:
 - Recovery Management Support and Recording
 - Environmental Recording and Editing Program
 - Tape Error Recovery Procedures
 - Disk Error Recovery Procedures
- Diagnostic Aids:
 - Online Test Executive Program

- Problem Determination and System Debugging Aids
- Emulator Program:
 - System/360 Model 20 Emulator Program

The following sections describe each of these components in more detail.

Control and Service Programs

The control and service programs form the central part of the IBM Disk Operating System/Virtual Storage. The three control programs are initial program load, the supervisor, and job control; the two service programs are the linkage editor and the librarian. The functions of these five programs are outlined in the following paragraphs; details are in the *System Management Guide*.

Initial Program Load (IPL) initializes the system for execution by loading the supervisor into the real address area. At this time, the system operator has the option to alter the contents of the supervisor device address tables and to create the page data file. Job Control is then loaded into the virtual address area associated with the background partition, and control is passed to it.

The Supervisor provides resident and transient control functions for use by all other system and user programs. Supervisor assembly macro instructions allow the user to create an individual supervisor tailored to the needs of his own system. The assembly options he may select include:

- the size of the real address area to be supported
- the size of the virtual address area to be supported
- the size of the Shared Virtual Area
- the number of partitions to be supported
- the number of physical devices to be supported
- the number of symbolic logical units to be supported
- page fixing support
- asynchronous processing (multitasking) support
- telecommunications support
- relocating loader support
- extended catalog procedure support
- multiple timer support
- POWER/VS support (see *The POWER/VS Program* described later)
- Virtual Storage Access Method support
- Block Multiplex Channel support
- Rotational Position Sensing support
- Fast Channel Command Word Translation
- Cross Partition Event Control

This list is not exhaustive.

Specification of any of these or of any of the other available options will increase the processor storage requirement of the supervisor above the minimum requirements tabled below. Details of storage requirements of each individual option are in the *System Generation Manual*.

Minimum Supervisor:

Model 115	30K
Model 125	30K
Model 135, 135-3	30K
Model 138	34K
Model 145, 145-3	30K
Model 148	34K
Model 155II	30K
Model 158	30K
3031 Processor	34K

Installation improvement facilities are provided in DOS/VS to ease:

- System generation
- DOS/VS installation
- Transition to production system

Support Capabilities include:

- Pre-compiled supervisors
- Pre-compiled I/O modules
- Pre-linked system components for immediate use
- New backup/restore library utilities
- System generation in a virtual partition
- Coded samples
- PTFs pre-applied
- Default supervisor with RELDR =YES
- Automated merge of libraries
- New delete procedure to aid in tailoring the system
- UCS-buffer load modules for 1403-N1
- New, easy to follow documentation for systems generation

Highlights

- Pre-compiled supervisors

Seven supervisors (all RELDR =YES) are provided in the Core Image Library. Their source code (including JCL) is contained in the A sublibrary of the Source Statement Library.

Pre-assembled versions of all I/O modules required for RPG II and PL/I Optimizer are provided in the Relocatable Library.

- Pre-Compiled I/O modules
- IBM components pre-linked for immediate use

System components have been link-edited relocatable. This eliminates the effort previously required to link system components at each individual customer location. As a result, the elapsed time required for installing DOS/VS has been significantly reduced.
- New system utilities which allow for backup/restore of system and private libraries.

Two new programs are included which provide for backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries within a DOS/VS partition.
- Complete system generation in a virtual partition

Included are the necessary programs and documentation to completely sysgen in a partition of an existing release of DOS/VS (including restore and allocation of libraries). Since no stand-alone time is required to do the sysgen, production may continue during the generation of the new system subject to DASD and partition availability.
- Coded samples

Coded samples in the Procedure Library for:

 - procedures to delete and link system components
 - standard labels
 - private library creation
 - VSAM file definition
- PTFs pre-applied

The DOS/VS package will be periodically updated with the latest PTFs.
- Default supervisor with RELDR =YES

The default supervisor \$\$\$SUP1 has been generated with relocating loader feature. This allows the pre-linked IBM system components to be linked using the relocating loader. Since most DOS/VS users use this feature, this eliminates the need to relink the components that were previously linked without the relocating loader.
- Automatic merge of libraries

A program is included that will compare the directories of the old system with the directories of the newly created system and produce the necessary copy cards for use with the copy and reorganize program CORGZ. This program supports private libraries as well as the system libraries and eliminates the manual effort of comparing sorted directory listings and punching the required copy cards. As a result, the human error or missing a module in the directory comparison is eliminated. In addition, the accidental merge of an undesired module cannot occur.
- New delete procedures to aid in tailoring the system

Since all IBM system components are pre-linked into the system core-image library, new delete procedures are included to allow the DOS/VS user to delete any unwanted IBM components. These procedures are included in the DOS/VS procedure library.
- UCS-buffer load modules for 1403-N1

Pre-assembled versions of buffer load modules for several train arrangements for the 1403-N1 with universal character set feature are contained in the relocatable library.

Job Control provides job initiation and job-to-job transition facilities for all partitions on the basis of control statements read from the system console (SYSLOG) or from the system reader (SYSRDR) for the partition in question. The supervisor loads job control into a virtual partition whenever the previous job in that partition comes to an end, or, if the partition is not in active use, on request from the system operator. Job control is always executed in virtual mode; it may initiate execution of jobs in either virtual or real mode dependent on user specification.

The control statements that make up the job control language allow the user to: name the program phase or phases to be executed ... select either virtual or real mode for their execution ... specify the quantity of virtual or real storage required ... specify the physical devices to be used ... specify the file labels of program files ... call a cataloged procedure from the procedure library ... overwrite statements within a cataloged procedure ... exercise general control functions over program execution.

Operator commands allow the system operator to intervene in the process if it is necessary to modify control statements to meet abnormal conditions in the operating environment.

Attention Routines, Initiators, Terminators - The Initiators allow the operator to communicate with the system through the Attention

Routines. Terminator routines provide the support for program termination: under program control; through operator action; a program error; or certain I/O failures.

Checkpoint/Restart - The progress of a program that performs considerable processing in one job step can be protected against destruction in case the program is canceled. The checkpoint facility makes it possible to preserve information at regular intervals and in sufficient quantity to allow restarting a program at an intermediate point.

The Linkage Editor links and relocates separate program sections (relocatable modules) read from the system link device (SYSLNK) or from system or private relocatable libraries or from any combination of these three, creating executable object program phases which are then stored in the core image library selected by the user. If action REL has been specified, the linkage editor will form object program phases which can later be loaded for execution from any set of real or virtual storage locations. If action NOREL has been specified, object program phases will be absolute and must be executed from the storage locations to which they have been link-edited unless they have been written in such a way as to make them self-relocating. If neither has been specified, the linkage editor will make a decision based upon specifications of relocating loader support. A program may be link-edited for execution in the virtual or real part of any partition regardless of the partition in which the linkage editor itself is executed.

The Librarian provides maintenance and service functions for all system and private libraries. The librarian is a collection of programs which allow the user to catalog, delete, rename, display, output, copy, condense, and reallocate the contents of libraries and to create and use new private libraries. Certain functions are restricted so that system libraries may only be modified by programs executed in the background partition. Details of these restrictions are given in the *System Management Guide*.

The control and service programs use the system logical units shown in the following lists. The types of physical device that may be assigned to each specific logical unit are shown individually, and summarized in the table at the end of this section.

The 3344 Disk Storage may be used where the 3340 is specified. Consideration should be given to the effect of locating multiple logical volumes on one physical spindle.

The system as a whole requires one of each of the following system logical units:

- **SYSRES** - The System Residence is the direct access storage device on which the operator has mounted the volume containing the system residence extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1, 2 and 11/3333-1 and 11/3340/3350 Disk Storage.
- **SYSVIS** - The System Virtual Storage is the direct access storage device on which the operator has mounted the volume containing the page set extent. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330/3333/3340/3350 Disk Storage.
- **SYSLOG** - The System Log is the system console used for system and operator communication. It is normally assigned to one of the following physical devices: 3210 Console Printer-Keyboard ... 3215 Console Printer-Keyboard ... the Display Console for the Model 138 with or without the 3286 Model 2 Printer ... the Display Console for the Model 148 with or without the 3286 Model 2 Printer ... the Display Console for the Model 158 together with the 3213 Console Printer (supported in 3215 compatibility mode only) ... the display operator console for the Model 115 or 125 with or without the 5213 Model 1 Console Printer ... the 3277 Display Station (locally attached via 3272 control Unit). To obtain more detailed information, consult the appropriate IBM reference manuals.

Should the console printer-keyboard become inoperable, SYSLOG may be assigned to one of the following printers: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3800 Printing Subsystem ... 5203-3 Printer.

Such a printer assignment allows system operation to continue though with restricted operator-to-system communication.

- **SYSREC** - The System Recorder is the direct access storage device on which the operator has mounted the volume which is to contain records output by the Recovery Management Support Recorder. The following physical devices may be used: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage.
- **SYSCAT** - The System Catalog is the direct access storage device on which the operator has mounted the volume containing the VSAM file catalog. The following physical devices may be used: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage ... 3540 Diskette I/O Unit.

Note: Assignment of the System Catalog is not required if the Virtual Storage Access Method is not used.

Each partition requires one of each of the following logical units:

- SYSRDR** - The System Reader is the source of control statement input for the job control program. Each partition requires the assignment of a separate physical device as System Reader except when the assignment is made to a direct access storage device; in this case, separate System Reader extents may occupy the same direct access storage volume. System Readers may be assigned to any of the following devices: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504 Card Reader ... 3505 Card Reader ... 3525 Card Punch (with Read Feature) ... 3540 Diskette Input/Output Unit (Model 2 can be assigned to two partitions) ... 5425 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage.
- SYSIPT** - The System Input Device is the source of all system input other than that for the job control program. Each partition requires the assignment of a separate physical device as the System Input Device except when the assignment is made to a direct access storage device; in this case, separate System Input extents may occupy the same direct access storage volume. System Input Devices may be assigned to any of the physical devices listed under SYSRDR above.
- SYSLST** - The System List Device is the destination of print lines or print line images output by the system. Each partition requires the assignment of a separate physical device as the System List Device except when the assignment is made to a direct access storage device; in this case, separate System List extents may occupy the same direct access storage volume. System List Devices may be assigned to any of the following physical devices: 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3800 Printing Subsystem ... 5203 Printer ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage ... 3540 Diskette I/O Unit.
- SYSPCH** - The System Punch Device is the destination of all cards or card images output by the system. Each partition requires the assignment of a separate physical device as the System Punch Device except when the assignment is made to a direct access storage device; in this case, separate System Punch extents may occupy the same direct access storage volume. System Punch Devices may be assigned to any of the following physical devices: 1442 Card Read Punch ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 2400-Series Magnetic Tape Units ... 3400-Series Magnetic Tape Units ... 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage ... 3540 Diskette I/O Unit.

Within any one partition SYSRDR and SYSIPT may be assigned to the same physical device or to separate physical devices in accordance with user requirements.

The number of unit record devices required to operate the system in the multiprogramming environment can be greatly reduced by use of the POWER/VS program described later in these pages.

Each partition may also require one or more of the following system logical units in order to perform particular control and service functions:

- SYSLNK** - A System Link Device is a direct access storage device used to store input for the linkage editor program. It may be assigned to any of the following physical devices: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2,-11/3333-1/3340/3344/3350 Disk Storage.
- SYSCLB** - A Core Image Library Device is a direct access storage device on which the operator has mounted a volume containing a private core image library.
- SYSRLB** - A Relocatable Library Device is a direct access storage device on which the operator has mounted a volume containing a private relocatable library. It must be assigned to the same type of direct access storage device as SYSRES.
- SYSLLB** - A Source Statement Library Device is a direct access storage device on which the operator has mounted a volume containing a private source statement library. It must be assigned to the same type of direct access storage device as SYSRES.

Display Operator Console Support provides the functions to operate and control the Models 115, 125, 138, and 148. Operator input entered

through the alphameric keyboard and messages from system and problem programs are displayed on the screen of the cathode ray tube. System messages requiring operator reply or action will stay on the screen until the reply is received by the system. A hard copy record of the sequential activity on the video display is available and may be printed on the optional Console Printer via a utility.

Permissible Device Assignments for the System Logical Units

Logical Unit	SYSRDR SYSIPT	SYSLST	SYSPCH	SYSLOG	SYSRES SYSCLB SYSRLB SYSLLB SYSVIT SYSCAT	SYSREC SYSLNK
Model 115 DOC				X		
Model 125 DOC				X		
Device Type						
1403		X		X		
1442	X		X			
1443		X		X		
2501	X					
2520	X		X			
2560	X		X			
3203		X				X
2540	X		X			
3210						X
3211		X				X
3213						X
3215						X
3800						X
3504/3505	X					
3525	X		X			
3540	X	X	X			
2400-series	X	X	X			
3400-series	X	X	X			
2311	X	X	X			X
2314	X	X	X		X	X
2319	X	X	X		X	X
3330-1,-2,-11						
3333-1,-11	X	X	X		X	X
3340/3344/3350	X	X	X		X	X
5203		X		X		
5425	X		X			

The POWER/VS Program

The POWER/VS program is a spooling system which provides the user with automatic staging of unit record input and output and priority scheduling for all programs executed under its control. The POWER/VS program resides in one partition and is able to control all remaining partitions, provided these have a lower system dispatching priority than that of the POWER/VS partition.

The POWER/VS program runs on any model of System/370 that is supported by DOS/VS and has a minimum of 96K of real storage, and is executed in virtual mode in order to take advantage of the virtual storage environment provided by DOS/VS. POWER/VS makes extremely dynamic use of the address space and acquires real processor storage on an as-needed basis. Page frames released by POWER/VS tasks are freed and returned to the Page Pool. Programs executed under POWER/VS control may be executed not only in virtual mode but also in real mode.

The DOS/VS system contains a POWER/VS Reader/Writer version cataloged in the System Core Image Library, generated with default values for all POWER/VS generation parameters.

If these options are appropriate to the system environment of the user, no POWER/VS System Generation is necessary.

POWER/VS is generated by assembly of the POWER/VS macros, which allows the user to specify the options appropriate to his own system environment, and creates the POWER/VS generation table. The resultant object deck contains the code necessary to invoke the POWER/VS program.

The POWER/VS program maintains input and output queues on direct access storage for the card readers, Diskette I/O Units (input only), card punches, and printers associated with the partitions under its control. These queues are filled or emptied by the appropriate physical devices. When a program under POWER/VS control makes an input or output request to one of these devices, POWER/VS presents it with the next record from the appropriate input queue or collects the record and places it in the appropriate output queue. These operations take place at main storage or direct access storage speeds; hence, programs execute quicker and take better advantage of the system environment. POWER/VS is transparent to the programs executed under its control; these do not require modification to take advantage of POWER/VS.

Since the queues are under optional operator control, the system operator can modify the order in which programs are executed by manipulating the queues with POWER/VS operator commands. The effective substitution of direct access storage devices for unit record devices reduces the number of the latter needed to operate the system efficiently in a multiprogramming environment.

The use of partition-independent input classes simplifies the operational characteristics of the POWER/VS system. This dynamic partition scheduling provides automatic balancing of the input between the various partitions controlled by POWER/VS.

The POWER/VS program supports the following unit record devices for peripheral input and output: 1442 Card Read Punch ... 2501 Card Reader ... 2520 Card Read Punch ... 2540 Card Read Punch ... 2560 Multifunction Card Machine ... 3504/3505 Card Reader ... 3525 Card Punch ... 5425 Multifunction Card Unit ... 1403 Printer ... 1443 Printer ... 3203 Printer ... 3211 Printer ... 3800 Printing Subsystem ... 5203 Printer ... 3540 Diskette I/O Unit (input only). 51 column Interchangeable Read Feed features #4151 and #3921 are not supported in POWER/VS.

The following combinations are supported on the 3540: Job control statements from a card reader, data from one or more 3540 files ... Job control statements and data from a single 3540 file (multi-volume files are supported).

In addition the POWER/VS program requires direct access storage for its work files. Different POWER/VS direct access files may be on different direct access storage devices, which may be any of the following: 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330/3333 Disk Storage ... 3340 Disk Storage ... 3344 Disk Storage ... 3350 Disk Storage.

The POWER/VS program supports the following magnetic tape devices for output spooling only: 2400-series Magnetic Tape Units (2495 is not supported by POWER/VS) ... 3400-series Magnetic Tape Units.

POWER/VS Major Features

- Easy POWER/VS generation and start up procedures include automatic start up of a POWER/VS system via control cards.
 - As many partitions as provided with the individual DOS/VS installation, minus one partition each for POWER/VS and VTAM (optionally), may be controlled by POWER/VS. The user need not specify this number during the DOS/VS POWER/VS generation.
 - Jobs entered into the system are grouped into user-assigned input classes. Any class may be either partition-dependent or partition-independent. Within each class, jobs may be assigned different priorities for execution. The operator may call for execution of jobs of an individual class or of a group of up to four classes.
 - Job input may be retained after job execution to allow for repeated execution of the same job.
 - List and punch output is grouped into output classes. The list or punch class output of a job may be the same as or different from the input class assigned to the job. The operator may call for list or punch output of an individual output class or of a group of up to four classes.
 - Job output may be retained after printing or punching has been performed to allow production of further output copies at a later time.
 - A segmented output capability is provided. Physical output for a job can be started before all list or punch output for that job has been accumulated.
 - Output processing may be stopped, and later restarted from the point at which it was stopped, or from any other point. A large punch job on a card read punch can be stopped in this way to allow read operations to be started using the same physical device.
 - Multiple copies of printed or punched output may be requested at output time.
 - List or punch output from successive jobs may be separated by internally generated list separator pages or punch separation cards.
- Up to 8 printers and 8 punches may be associated with each POWER/VS controlled partition at the time the partition is started. Hence, concurrent multiple printer and punch output can be handled.
- POWER/VS job accounting records include the job accounting information provided through the DOS/VS job accounting interface.
 - The internal Reader/Writer interface allows any DOS/VS partition

- to put a jobstream into the POWER/VS reader queue
- to retrieve spooled output from the POWER/VS list queue and
- to submit POWER/VS commands.

- RJE support for ASCII as transmission code.

DOS/VS POWER/VS REMOTE JOB ENTRY (RJE)

The DOS/VS POWER/VS Remote Job Entry feature provides an efficient method to enter jobs from terminals into the system for execution and to obtain output either centrally or at a work station.

POWER/VS supports the following BSC terminals:

2770 Data Communication System
2780 Data Transmission Terminal
3741 Data Station (Model 2) in 2780 emulation mode
3741 Programmable Work station (Model 4) as a 2780
3770 Data Communication System (non-programmable models only)
3780 Data Communications Terminal

Only BSC point-to-point connections are supported.

DOS/VS POWER/VS supports the non-programmable models of the 3770 Data Communication System, the 3790 Communication System and the System/32 (as a 3770). Transmission to the terminals is via Synchronous Data Link Control (SDLC). This provides DOS/VS POWER/VS remote entry support for SDLC terminals in a terminal-sharing environment where several applications may establish logical connections with the terminal on a per-session basis. To achieve this flexibility of terminal-sharing, POWER/VS uses the VTAM application program interface for the support of the SDLC terminals which are attached to a 3704 or 3705 in network control mode.

SDLC terminals supported by POWER/VS are:

3771 Communication Terminal*
3773 Communication Terminal*
3774 Communication Terminal*
3775 Communication Terminal*
3776 Communication Terminal*
3777 Communication Terminal*
3790 Communication System

8100/DPCX Information System
System 32 (as a 3770)

*Non-programmable models only.

The functional characteristics of the DOS/VS POWER/VS support for SDLC terminals are as follows:

- Half-duplex flow for single logical unit work stations.
- Full duplex flows for multiple logical unit work stations.
- Multipoint operation.
- Serial data transmission operation for single logical unit work stations, that is, no concurrent operation of printer and punch on the outbound flow from POWER/VS to the SDLC terminals.
- Concurrent data transmission operation for multiple logical unit work stations, that is, concurrent inbound and outbound data flows between POWER/VS and SDLC terminals.
- Transparent 3770 and 3790 disk operation.
- Compression of repeated characters in data stream for printer output for 3770 and 3790 terminals. Compaction for printer output data streams for 3790 terminals.

Multiple Logical Unit (MLU) 3776 Models 3.4 and 3777 Model 3 with up to six independent and concurrent sessions are supported.

Up to 25 BSC terminals or up to 200 SDLC and BSC terminals can communicate concurrently with the central system via switched or nonswitched lines. Through the use of switched lines many more terminals may be in the POWER/VS network non-concurrently.

POWER/VS Terminals Supported

BSC Lines

2770 Data Communication System
2772 Multipurpose Control Unit:
Required: #3650 - EBCDIC Transparency (see note below)
#9140 - Extended Re-try
#9402 - Line Termination - 2-Wire
#9761 - Transmission Code EBCDIC, or
#9762 - Transmission Code ASCII
#9936 - Immediate WACK
Supported: Attachment of 0545, 2213, 2502, 2203
#1340 - Automatic Answering
#1490 - Buffer Expansion (256 bytes)
#1491 - Buffer Expansion Additional (512 bytes)
#3860 - 144 Character Print Line
#5890 - Horizontal Format Control
#6555 - Space Compression/Expansion

- Not Supported: Attachment of 0050,1017,1018,1255,2265
#4610 - Identification
#5010 - Multipoint Data Link Control
- 0545 Output Punch (Models 3,4)
2213 Printer (Models 1,2)
2502 Card Reader (Models A1,A2):
Supported: The standard keyboard provided with the 2772 may be used as a 2502 reader for text which is compatible with card input. Such input is limited to entry of commands and extremely short job-streams (the complete stream must fit entirely into the 2772 buffer).
- 2203 Printer (Models A1,A2)
Supported: #5558 - Print Positions, 24 Additional
- 2780 Data Transmission Terminal:
Required: #8030 - EBCDIC Transparency (see note below)
#9150 - Extended Retry Transmission
#9402 - Line Termination
#9761 - ASCII Transmission Code, or
#9762 - EBCDIC Transmission Code
Supported: #1340 - Automatic Answering
#1350 - Automatic Turnaround
#5010 - Multiple Record Transmission
#5800 - Printer Horizontal Format Control
#5820 - 120 Character Print Line
#5821 - 144 Character Print Line
#6400 - Selective Character Set
Not Supported: #5020 - Multipoint Line Control
#7850 - Terminal Identification
- 3741 Data Station (Model 2) on switched or nonswitched line (supported as 2780):
Required: The 3741 must be strapped for nonswitched line operation even though a switched line facility will be used. The Data Terminal Ready (DTR) pins must remain set for a switched line facility.
Supported: Attachment of 0129, 3713, 3715, 3717
#1680 - Expanded Communications
#1685 - Expanded Communications/
Multipoint Data Link Control
Not Supported: #5450 - Operator Identification Card Reader
#7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
3713 Printer (Model 1)
3715 Printer (Models 1, 2)
3717 Printer (Model 1)
- 3741 Programmable Workstation (Model 4) on switched or non-switched line (supported as a 2780):
Required: The 3741 must be strapped for nonswitched line operation even though a switched line facility will be used. The Data Terminal Ready (DTR) pins must remain set for a switched line facility.
Supported: Attachment of 0129, 3713, 3715
#1680 - Expanded Communications
#1685 - Expanded Communications/
Multipoint Data Link Control
Not Supported: #5450 - Operator Identification Card Reader
#7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
3713 Printer (Model 1)
3715 Printer (Models 1, 2)
- 3770 Data Communication System:
3771 Communication Terminal (Models 1,2,3) [supported as a 2772]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point
3773 Communication Terminal (Models 1,2,3) [supported as a 2772]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point
3774 Communication Terminal (Models 1,2,P1,P2) [supported as a 2772]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point
3775 Communication Terminal (Model 1,P1) [supported as a 2772]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point
3776/3777 Communication Terminal (Models 1,2) [supported as a 2772/3780]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point
- 3780 Data Communications Terminal [supported as a 2772]:
Required: #3601 - EBCDIC Transparency (see note below)
#9150 - Extended Retry Transmission
#9761 - EBCDIC Transmission Code, or
#9762 - ASCII Transmission Code
#9936 - WACK Response
Attachment of 3781
#1601 - Component Selection
#5701 - Print Positions, Additional
#7651 - Switched Network Control
Not Supported: #5010 - Multipoint Data Link Control
#9350 - Terminal and Security Identification
- 3781 Punch:
Required: #1601 - Component Selection
- SDLC Lines**
3770 Data Communication System:
3771 Communication Terminal (Models 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
3773 Communication Terminal (Models 1,2,3,P1,P2,P3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
3774 Communication Terminal (Models 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
3775 Communication Terminal (Model 1, P1):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
3776 Communication Terminal (Models 1,2,3,4):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
3777 Communication Terminal (Model 1,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1470 - SDLC
- 3790 Communication System
3791 Communication Controller
Required: Configuration Feature (#9165 or 9169)
- 8100/DPCX Information System
System/32 (supported as a 3770):
5320 System Unit:
Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Line Control
- System/34 (supported as a 3770): 5340 System Unit:
Required: #2500 - Communications Adapter Feature
- Host System Terminal Attachment Requirements**
Attachment of terminals to the host system requires one of the following minimum configurations:
System/370 Model 115 with:
#4640 - Integrated Communications Adapter
#7100 - Synchronous Line Group
#7141 - Synchronous Line Medium Speed with Clock, or
#7151 - Synchronous Line Medium Speed
Up to 4 lines can be attached with the additional features: #7142, 7143, 7144 or #7152, 7153, 7154.
System/370 Model 125, with:
#4640 - Integrated Communications Adapter
#7100 - Synchronous Line Group, with
#7141 - Synchronous Line Medium Speed with Clock, or
#7151 - Synchronous Line Medium Speed or
#4640 - Integrated Communications Adapter
#7131 - Synchronous Line Low Load
Up to 6 lines can be attached with the additional features: #7142, 7143, 7144 or #7152, 7153, 7154 or #7132
System/370 Model 135, 135-3, 138 with:
#4640 - Integrated Communications Adapter
#9649 - Synchronous Data Adapter Type II
#9673 - Transparency (see note below)
Up to 8 lines can be attached with the additional features: #4722-4728 or #9650-9656
Any System/370 supported by DOS/VS with BSC capability through one of the following attached devices:
2701 Data Adapter Unit with the following features:
#7698 - Synchronous Data Adapters Type II
#8029 - Transparency (see note below)
#9060 - EBCDIC code, or
#9061 - ASCII code

2703 Transmission Control Unit with the following features:

- #7702 - Synchronous Attachment
- #7703 - Synchronous Base, or
- #7704 - Synchronous Base, or
- #7706 - Synchronous Base
- #7710 - Synchronous Line Set
- #7715 - Synchronous Terminal Control EBCDIC or,
- #7716 - Synchronous Terminal Control ASCII

3704/3705-I/3705-II Communications Controller in emulation mode (BSC), or 3704/3705-I/3705-II Communications Controller in network control mode (SDLC), or 3705-I/3705-II Communications Controller in emulation mode (BSC) with the following line features:

- #4714 - Line Set 1D
- #4716 - Line Set 1F

#4714 and #4716 are line attachment features only; for full configuration, see M3704/3705 sales manual pages.

Note: Print output to a terminal is always sent in non-transparent mode. If the full range of data characters from X'00' to X'FF' (e.g., needed in case of sending an object deck to the punch) is not needed and the user is transmitting in non-transparent mode only, the EBCDIC Transparency Feature (#8030, #3650 or #3601) and Transparency (#8029 or #9673) may be omitted from the requirements. Transparent mode is provided as a standard option with the Model 138 ICA feature.

The Assembler

The Assembler is a programming tool for the implementation of programs written in System/370 Assembler Language. Assembler language gives the user access to machine and operating system functions and permits obtaining the best balance between storage utilization and speed of program execution. However, a problem solution expressed in Assembler language normally requires more coding effort than a solution to the same problem expressed in a higher level language.

The major features of the Assembler include:

Macro instructions, which provide the programmer with a powerful programming tool. Use of the system macro instructions provides access to all of the capabilities of DOS/VS. Use of programmer-defined macro instructions can simplify the programming of particular applications and makes possible the definition of special-purpose languages.

Performance has been improved by the introduction of a pre-edited macro library. Conditional assembly statements are used to alter the sequence in which statements are processed or to specify the selective assembly of sets of instructions. The conditional assembly feature is a key element of the macro feature.

Private libraries, which may be used to contain both Assembler language statements to be inserted into programs by means of COPY statements, and macro instruction definitions for use by the macro processor.

The Assembler uses the System/370 Standard Instruction Set, and requires for execution a minimum partition size of 20K; it may be executed either in virtual or in real mode.

The Assembler reads source program input from SYSIPT and directs its output to SYSLST, SYSPCH, and SYSLNK, dependent on the user options in force. Library input may also be read from SYSSLB. All of these logical units may be assigned to any of the physical devices already indicated for the control and service programs. The Assembler further requires direct access storage space for three work files; any of the following physical devices may be used for this purpose:

- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2319 Disk Storage
- 3330-1,-2,-11/3333-1,-11 Disk Storage
- 3340 Disk Storage
- 3344 Disk Storage
- 3350 Disk Storage

Data Management

The data management facilities of DOS/VS are divided into two parts: the physical input/output control system (physical IOCS); and the logical input/output control system (logical IOCS). The user invokes the services of the IOCS routines by use of macro instructions.

The EXCP (execute channel program) and WAIT macro instructions of physical IOCS allow the user to handle input and output devices in a direct way by writing his own channel programs; it is usually more convenient for him however to use the macro instructions of logical IOCS, either using GET and PUT macro instructions to handle logical data records or using READ and WRITE macro instructions to handle physical data blocks. OPEN and CLOSE macro instructions perform the functions of creating, checking, and updating file labels for input and output files; the CNTRL macro instruction performs specific

device-dependent control functions such as stacker selection, printer carriage movement, and magnetic tape positioning.

The individual component routines of logical IOCS are classified under four headings: the Sequential Access Method (SAM), the Direct Access Method (DAM), the Indexed Sequential Access Method (ISAM), and the Virtual Storage Access Method (VSAM).

When RPS is specified during System generation

- SAM, DAM and VSAM will automatically include Rotational Position Sensing for 3330-1,-2,-11, 3333-1,-11, 3340, 3344 and 3350 Disk Storage.
- ISAM will automatically include Rotational Position Sensing for 3330-1, 2, 3333-1, 3340, 3344, and 3350 (in 3330-1 Compatibility Mode) Disk Storage.

Sequential Access Method - SAM

The Sequential Access Method (SAM) enables files to be defined and accessed in a sequential manner beginning with the first logical record of the file and continuing in sequence till the last logical record of the file is reached. The components of the Sequential Access Method are described in the following paragraphs.

Basic Sequential IOCS provides support for definition, creation, and processing of files associated with unit record devices and the system console. The DTFCD macro instruction is used to define a punched card file; the DTFPR macro instruction is used to define a printer file; the DTFCN macro instruction is used to define a system console file.

By means of GET or PUT macro instructions, records are obtained or created starting with the first record of the logical file and continuing to the last record. Logical records are considered to be unblocked and may be of either fixed or variable length within the limits of the unit record medium to which they relate. Input and output operations may be overlapped with instruction processing by specification of two data areas for use by IOCS. Either the CNTRL macro instruction or first data character control may be used to effect any stacker selection or printer forms carriage movement required.

Basic Sequential IOCS supports the following devices:

- 1442 Card Read Punch
- 2501 Card Reader
- 2520 Card Read Punch
- 2540 Card Read Punch
- 2560 Multifunction Card Machine
- 2596 Card Read Punch
- 3504/3505 Card Reader
- 3525 Card Punch
- 5425 Multifunction Card Unit
- 1403 Printer
- 1443 Printer
- 3211 Printer
- 3800 Printing Subsystem
- 3881 Optical Mark Reader
- 3210 Console Printer-Keyboard
- 3215 Console Printer-Keyboard

The display operator console for the Model 115 or 125 with or without the 5213 Model 1 Console Printer.

The display console for the Models 138 or 148 with or without the 3286 Model 2 printer.

The display console for the Model 158 together with the 3213 Console Printer (supported only in 3215 compatibility mode).

Device-independent IOCS provides support for definition, creation, and processing of files associated with the system input and output logical units. The IOCS is used with the card readers, card punches, and printers that act as system input and output units, and enables magnetic tape or direct access storage to be substituted for such devices at execution time without the need for program modification. The DTFDI macro instruction is used to define a device-independent file.

By means of GET or PUT macro instructions records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are unblocked and of fixed length within the constraints of the unit record medium to which they may relate. First data character control must be used to specify any stacker selection or printer forms carriage movement required.

Device-Independent IOCS supports the following physical devices:

- 1442 Card Read Punch
- 2501 Card Reader
- 2520 Card Read Punch
- 2540 Card Read Punch
- 2560 Multifunction Card Machine
- 3504/3505 Card Reader
- 3525 Card Punch
- 5425 Multifunction Card Unit
- 1403 Printer
- 1443 Printer
- 3203 Printer
- 3211 Printer
- 3800 Printing Subsystem

3540 Diskette I/O Unit
 5203 Printer

Any of the following physical devices may be substituted for these devices at execution time:

2400-series Magnetic Tape Units
 3400-series Magnetic Tape Units
 2311 Disk Storage Drive
 2314 Direct Access Storage Facility
 2319 Disk Storage
 3330-1,-2,-11/3333-1,-11 Disk Storage
 3340 Disk Storage
 3344 Disk Storage
 3350 Disk Storage

Sequential Tape IOCS provides support for definition, creation, and processing of input and output files recorded on magnetic tape. The DTFMT macro instruction is used to define a magnetic tape file.

By means of GET or PUT macro instructions magnetic tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. The data within a file may be encoded either in EBCDIC or in ASCII. The CNTRL macro instruction enables the user to specify such control operations as forward space, backspace, rewind, and unload; the user may position magnetic tapes in accordance with the needs of the program.

Sequential Tape IOCS also provides support for definition creation and processing of magnetic tape work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. He may also issue the NOTE and the various POINT macro instructions to reposition magnetic tapes in accordance with the needs of his program.

Sequential Tape IOCS supports the following physical devices:

2400-series Magnetic Tape Units
 3400-series Magnetic Tape Units

Sequential Disk IOCS provides support for definition, creation, and processing of input and output files recorded on direct access storage devices. The DTFSD macro instruction is used to define a direct access storage file.

By means of GET or PUT macro instructions direct access records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either blocked or unblocked and may be of either fixed or variable length. Necessary blocking and deblocking of logical records is performed by the IOCS. Logical records, blocked or unblocked, may span multiple physical records. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS.

Sequential Disk IOCS also provides support for definition, creation, and processing of direct access storage work files; that is, files which serve as output and as input within the same program. In this case READ or WRITE macro instructions are used to obtain or create physical blocks; any necessary blocking or deblocking of logical records within physical blocks is the responsibility of the user. Users may also issue the NOTE and the various POINT macro instructions to logically reposition the file in accordance with the needs of their program.

Sequential Disk IOCS supports the following physical devices:

2311 Disk Storage Drive
 2314 Direct Access Storage Facility
 2319 Disk Storage
 2321 Data Cell Drive
 3330-1,-2,-11/3333-1,-11 Disk Storage
 3340 Disk Storage
 3344 Disk Storage
 3350 Disk Storage

Sequential Diskette IOCS provides support for definition, creation and processing of input and output files recorded on IBM diskettes. The DTFDU macro instruction is used to define a diskette file.

By means of GET or PUT macro instructions, diskette records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records are fixed length and unblocked, but may be grouped together in the user's I/O AREA(s) for performance reasons through IOCS use of command chaining.

Sequential Diskette IOCS supports the following physical device:

3540 Diskette Input/Output Unit

Sequential Paper Tape IOCS provides support for definition, creation, and processing of input and output files recorded in punched paper tape. The DTFPT macro instruction is used to define a paper tape file.

By means of GET or PUT macro instructions paper tape records are obtained or created starting with the first logical record of the file and continuing to the last record. Logical records may be either of undefined format, in which case they must be terminated by the end-of-record character, or of fixed length and unblocked, in which case the end-of-record character must not be present. Input and output operations may be overlapped with instruction processing by the specification of two data areas for use by IOCS. Any necessary translation of codes may be performed under the control of user-specified translation tables.

Sequential Paper Tape IOCS supports the following physical devices:

1017 Paper Tape Reader
 1018 Paper Tape Punch
 2671 Paper Tape Reader

Magnetic Character Recognition IOCS provides support for definition and processing of the input files associated with the IBM magnetic character recognition readers and certain optical character readers. The DTFMR macro instruction is used to define such a file.

The external interrupt feature is used to provide automatic entry to a user-written stacker selection routine on a first priority basis regardless of the priority of the partition in which the routine resides. Following stacker selection, the IOCS enables the user to access documents sequentially, process the data, and exercise control of non-MCR and non-OCR input and output devices. This normal processing (as opposed to stacker selection processing) takes the dispatching priority of the partition in which the problem program is executed.

Engage, disengage, stacker selection, and document reading functions are invoked by the use of macro instructions. A buffer is maintained for each MCR device to provide the problem program with continuous input data. GET macro instructions are used when a single reader is attached to the system; READ CHECK, and WAIT F macro instructions are used when the system is servicing a number of readers.

The supervisor and logical IOCS can support a maximum of six character readers which may operate in any combination in any or all partitions. The maximum number that may be effectively operated is application and configuration dependent. Pertinent timing information is provided in the *Supervisor and I/O Macros* manual.

Magnetic Character Recognition IOCS supports the following physical devices:

1255 Magnetic Character Reader
 1259 Magnetic Character Reader
 1419 Magnetic Character Reader

Note: Programs utilizing the Magnetic Character Recognition IOCS are highly time-dependent and should be executed in real mode only.

Optical Character Recognition IOCS provides support for definition and processing of input files associated with certain IBM optical character readers. The DTFOR macro instruction is used to define such a file for the 1287, 1288, and the 3886.

The 3886 is supported with special document definition macros used in a separate assembly to create a format record. Format records are stored in the Core Image Library for access by user 3886 processing programs.

The IOCS is used to read printed paper tapes or journal rolls such as those produced on cash registers and accounting machines. The IOCS is also used to read printed and hand-printed data and optical mark-read data from cut-form documents such as sales checks, utility stubs, and customer orders.

Optical Character Recognition support can be used in a multiprogramming environment. Factors affecting performance include the following:

CPU model
 Number of readers (a maximum of eight are supported)
 Characteristics of tapes and documents
 Batch or multiprogramming environment
 Blocking of input data on printed paper tapes
 User programming

In addition throughput is dependent on operator loading and unloading time. This handling time is significant when processing short printed paper tape rolls.

Optical Character Recognition IOCS supports operations on the following physical devices:

1287 Optical Reader
 1288 Optical Page Reader
 3886 Optical Character Reader (Model 1)

Direct Access Method - DAM

The Direct Access Method (DAM) enables files to be defined on direct access storage volumes with any form of organization and access that

the user may require. The records making up the file may be of fixed or variable length and may or may not contain key fields. All records are regarded as being unblocked; any necessary blocking or deblocking of logical records within physical records is the responsibility of the user. The DTFDA macro instruction is used to define a direct access file.

READ and WRITE macro instructions are used to retrieve and store physical records on the basis of information supplied by the user; such information may be either actual disk addresses or relative addresses within the file. Furthermore the address may be that of the actual record required or may indicate the point within the file at which a search for the required record is to begin.

The Direct Access Method allows the use of spanned records such that each record retrieved or stored spans multiple physical records. When this is the case, the physical segments making up the record are stored contiguously within the file.

The Direct Access Method supports the following physical devices:

- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2319 Disk Storage
- 2321 Data Cell Drive
- 3330-1,-2,-11/3333-1,-11 Disk Storage
- 3340 Disk Storage
- 3344 Disk Storage
- 3350 Disk Storage

Indexed Sequential Access Method - ISAM

The Indexed Sequential Access Method (ISAM) enables files to be defined on direct access storage volumes in such a way that records making up the file may be processed either in sequential order or in random order according to the needs of the accessing program. Logical records must be of fixed length, but may be blocked or unblocked; necessary blocking and deblocking of logical records is performed by the IOCS. Records can be added within the file without the necessity for sorting, recopying, or merging. Records may also be updated as required. The DTFIS macro instruction is used to define an indexed sequential file.

GET and PUT macro instructions are used to process the file in sequential order, the user supplying control information for the first record to be processed. READ and WRITE macro instructions are used to process the file in random order, the user supplying control information for each record to be processed.

Optional features of the Indexed Sequential Access Method allow the user to speed up program execution in exchange for increased main storage requirements.

The Indexed Sequential Access Method supports the following physical devices:

- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2319 Disk Storage
- 2321 Data Cell Drive
- 3330-1,-2/3333-1 Disk Storage
- 3340 Disk Storage
- 3344 Disk Storage
- 3350 Disk Storage in 3330 Model 1 Compatibility Mode.

Note: 3330-11, 3333-11 and 3350 in native mode are not supported.

Virtual Storage Access Method - VSAM

VSAM is an access method designed to operate with direct access devices and to support both direct and sequential processing by means of either an index key (keyed accessing) or by means of relative byte address (addressed accessing). (Relative byte address refers to the displacement of a stored record, or control interval, from the beginning of the storage space allocated to the file to which it belongs.)

Three types of data sets are provided: key-sequenced data sets, which are ordered by a key field in the data record, entry-sequenced data sets, which are ordered by the sequence in which the records were loaded, and relative record data sets which are ordered by record number. Keyed accessing is used to access key-sequenced or relative record data sets, and addressed accessing is used to access both key-sequenced and entry-sequenced data sets. Key-sequenced and entry-sequenced data sets may be either fixed or variable length records, relative record data sets are fixed length records only.

VSAM is composed of two major elements: a data organization which minimizes data movement and which is suitable for data base applications; and routines for creating files in the VSAM organization, adding and deleting records and performing other data management functions. See also *Access Method Services* under System Utility Programs. Because the VSAM data organization and the access method routines are supported for both OS/VS and DOS/VS, VSAM provides full file portability.

VSAM Highlights

- Access to data via VSAM is controlled by macro instructions written under the conventions of the Assembler language. Access to files may be either direct or sequential, and may either be keyed (controlled by index key) or addressed (controlled by relative byte address).
- With VSAM, certain device-dependent calculations such as the optimum block size for a given device type will be carried out automatically. All data accessing is by relative byte within the storage space allocated to the file. These features minimize programmer effort when he wants to change device types.
- VSAM offers the DOS/VS user the facility of a catalog (which will simplify JCL preparation), variable-length record support, and password protection.
- Most existing COBOL, PL/I, RPG II and Assembler language programs written for use with ISAM data sets may be used with VSAM data sets by means of the VSAM ISAM Interface Program. The ISAM Interface Program maps ISAM macro instructions into the corresponding VSAM requests. Refer to the Program Product section of the sales manual for details regarding COBOL and PL/I support of VSAM.
- VSAM offers a multifunction service program to facilitate overall management of data. Such services as defining files initially, deleting VSAM files from the VSAM catalog, printing and copying data, listing the VSAM catalog, and providing backup and portability features are controlled by this multifunction program. Converting files from the ISAM and SAM format to the VSAM format is another important function of this program.
- The VSAM user can expect to see performance improvements relative to DOS/VS ISAM. Performance gains with VSAM become increasingly significant as the number of insertions to the file rises. This is due to the elimination of the "chained record overflow" concept employed by ISAM. VSAM will effectively maintain its sequential, non-inserted file performance as records are added to the file. While maintaining equivalent or better performance on direct retrieve and update, VSAM requires significantly less time to perform a record insert than does ISAM. These factors, coupled with the efficient VSAM index structure and with the VSAM performance options offer the potential of significant performance improvements relative to ISAM.

The functional enhancements inherent to DOS/VS VSAM (e.g., variable length records, device independence, etc.), and the relative performance improvements over ISAM may require additional pages of main storage.

Some of VSAM's performance improvements over DOS/VS ISAM are due to adaptations made to provide DOS/VS relocate support. These adaptations include dynamically allocating input/output areas and modules, having the index in main storage, and reducing the usage of transient areas.

- A significant feature of VSAM is that of file and volume portability. Because the VSAM file organization and the access method routines are supported for both DOS/VS and OS/VS, VSAM provides full file portability.
- VSAM offers multiple levels of password protection to enhance file security.

Additional features are available to VSAM users. The primary objective of these features is to provide functions which will reduce the need to schedule redundant work, and improve compatibility with OS/VS by providing the following options:

Alternate Indexes: This feature permits application programs to access the records of a VSAM entry or key sequenced data set on the basis of keys other than the prime key. These alternate keys may be non-unique and must be contained in the base data record. Once an Alternate Index has been constructed by using Access Method Services, it may optionally be automatically updated whenever a data record is changed in the base data set to which it relates.

Relative Record Data Set: With this feature the data set is viewed as a numbered sequence of fixed length slots. Records may be inserted, updated, read, or erased in these slots using VSAM keyed processing, with the slot (i.e., record) number as the key. No index is used since each record's physical location is calculated directly by VSAM from its record number and the characteristics of the data set.

Get Previous: This feature permits retrieval and update processing on the basis of descending key values, relative record numbers, or relative byte addresses. Processing may begin either within or at the end of the data set.

Reusable Data Set: This capability allows a data set to be reused (i.e., reset to empty when opened and reloaded) many times without being deleted and redefined. A reusable data set may be any key sequenced, entry sequenced, or relative record data set that does not have an alternate index associated with it and that

does not reside on unique space. However, an alternate index may be a reusable data set.

Spanned Record: Originally VSAM did not permit a record to exceed a control interval in size. The Spanned Record feature removes the restriction, allowing a record to occupy multiple control intervals within a control area. If indexed, the keys must be in the first control interval.

Recovery: Extensions to the facilities within VSAM Catalog Management and Access Method Services permits limited access, via Access Method Services, to data that is not addressable by the catalog (due to the loss of, or damage to the catalog). Further, the user can restore addressability of the data and reconstruct the associated catalog entries.

User Catalogs: This facility is compatible with the one provided to OS/VS users in the original release of VSAM. It can increase volume portability by allowing user catalogs to control VSAM data sets. A user catalog and its associated data can be moved from one system to another without reading or writing data sets.

Automatic Close at End of Job: This facility is similar to one provided to OS/VS users in the original release of VSAM. It is designed to update the catalog entry and closes all open VSAM data sets within a partition. This helps to ensure that the data sets have been closed properly, whether the end of job was normal or abnormal.

VSAM Supported Input/Output Devices:

Direct access devices supported by VSAM under DOS/VS are the 2314, 2319, and 3330-1,-2,-11,/3333-1,-11,/3340, 3344, and 3350. VSAM under DOS/VS does not support the 2301, 2303, 2305, 2311, or 2321.

Device Support: The Device Support Chart shows all devices that are supported by DOS/VS. (For other telecommunications devices see VTAM, QTAM and BTAM Terminals Supported). See also *The POWER/VS Program*. The chart shows for each device the relevant models of System/370 to which it may be attached and the type of channel or control unit necessary to perform the attachment.

Devices which are not shown in this table have no specific programming support under DOS/VS and their existence is not recognized by the control program.

DEVICE SUPPORT CHART

Device	System/370 Model		135, 135-3, 138	145, 145-3, 148	155II 158	3031
	115	125				
1017 Paper Tape Reader Models 1, 2	2826	2826	2826	2826	2826	2826
1018 Paper Tape Punch	2826	2826	2826	2826	2826	2826
1255 Magnetic Character Reader Models 1, 2, 3	m	m	X	X	X	X
1259 Magnetic Character Reader Model 2	m	m	X	X	-	-
1270 Optical Character Reader Models 1, 2, 3, 4	m	m	m	m	m	m
1275 Optical Character Reader Models 2, 4	m	m	m	m	m	m
1287 Optical Reader Models 1, 2, 3, 4	-	-	X	X	X	X
1287 Optical Reader Model 5	m	m	X	X	X	X
1288 Optical Page Reader	-	-	X	X	X	X
1403 Printer Models 2, 7, N1	n	n	2821	2821	2821	2821
Model 3	-	-	2821	2821	2821	2821
1419 Magnetic Character Reader Models 1,	m	m	X	X	X	X
1442 Card Read Punch Model N1	m	m	X	X	X	X
1442 Card Punch Model N2	m	m	X	X	X	X
1443 Printer Model N1	m	m	X	X	X	X
2311 Disk Storage Drive Model 1	-	-	2841	2841	2841	2841
2314 Disk Storage - A Series	-	-	-	-	-	-
2312 Disk Storage Model A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1
2313 Disk Storage Model A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1
2314 Storage Control Model A1	-	-	X	X	X	X
2318 Disk Storage Model A1	-	-	2314-A1	2314-A1	2314-A1	2314-A1
2314 Disk Storage - B Series	-	-	-	-	-	-
2314 Storage Control Model B1	-	-	X	X	X	X
2319 Disk Storage Model B1	-	-	2314-B1	2314-B1	2314-B1	2314-B1
2319 Disk Storage Model B2	-	-	2319-B1	2319-B1	2319-B1	2319-B1
2319 Disk Storage - A Series	-	-	-	-	-	-
2319 Disk Storage Model A1	-	-	IFA	IFA	-	-
2319 Disk Storage Model A2	-	-	-	2319-A1	-	-
2319 Disk Storage Model A3	-	-	2319-A1	-	-	-
2321 Data Cell Drive	-	-	2841	2841	-	-
2401 Magnetic Tape Unit Models 1 to 6, 8	-	-	2803/4	2803/4	2803/4	2803/4
2415 Magnetic Tape Unit and Control Models 1 to 2	-	-	X	X	X	X
2420 Magnetic Tape Unit Models 5, 7	-	-	2803	2803	2803	2803
2501 Card Reader Models B1, B2	m	m	X	X	X	X
2520 Card Read Punch Model B1	m	m	X	X	X	X
2520 Card Punch Models B2, B3	m	m	X	X	X	X
2540 Card Read Punch	2821	2821	2821	2821	2821	2821
2560 Multifunction Card Machine	n	n	-	-	-	-
2596 Card Read Punch	m	m	X	X	X	X
2671 Paper Tape Reader	2822	2822	2822	2822	2822	2822
2803 Tape Control Models 1, 2, 3	-	-	X	X	X	X
2804 Tape Control Models 1, 2, 3	-	-	X	X	X	X
2816 Switching Unit	-	-	X	X	X	X
2821 Control Unit Models 1, 2, 3, 5, 6	m	m	X	X	X	X
2822 Paper Tape Reader Control	m	m	X	X	X	X
2826 Paper Tape Control	m	m	m	m	m	m
2841 Storage Control	-	-	X	X	X	X
3203 Printer Models 1, 2	n	n	-	-	-	-
3203 Printer Model 4	-	-	n***	n***	-	-
3210 Console Printer-Keyboard Model 1****	-	-	n	n	n**	n**
3210 Console Printer-Keyboard Model 2****	-	-	n	n**	n**	n**
3211 Printer	-	-	3811	3811	3811	3811
3213 Console Printer Model 1	-	-	-	-	n*	n*
3215 Console Printer-Keyboard	-	-	n	n	n**	n**
3330 Disk Storage Models 1, 2 and 11	-	3333	3333, 3830-1	3333, 3830-1	3333, 3830-1	3333, 3830-1
3333 Disk Storage and Control Model 1 and 11	-	n	3830-2, IFA	3830-2, 3345-3, -4,-5, ISC	3830-2, ISC	3830-2, ISC
3340 Direct Access Storage Facility Model A2	n	n	3830-2# IFA	3830-2 3345-3, -4,-5, ISC	3830-2 ISC*	3830-2 ISC*
3340 Direct Access Storage Facility Models B1, B2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2	3340-A2
3344 Disk Storage	3340-A2†	3340-A2†	3340-A2	3340-A2	3340-A2	3340-A2
3345 Storage and Control Frame Models 3, 4, 5	-	-	-	n	-	-
3350 Disk Storage and Control Models A2, A2F	-	-	3830-2	3830-2, ISC	3830-2, ISC*	3830-2, ISC*
3350 Disk Storage Models B2, B2F (in 3330 Model 1 Compatibility Mode only)	-	-	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F	3350-A2, -A2F
3410 Magnetic Tape Unit Models 1, 2, 3	3411	3411	3411	3411	3411	3411
3411 Magnetic Tape Unit and Control Models 1, 2, 3	n	n	X	X	X	X
3420 Magnetic Tape Unit Models 3, 5	3803-3	3803-3	-	-	-	-
3420 Magnetic Tape Unit Model 3, 5, 7	-	-	3803-1	3803-1	3803-1	3803-1
3420 Magnetic Tape Unit Models 4, 6, 8	-	-	3803-2	3803-2	3803-2	3803-2
3504 Card Reader Models A1, A2	-	n	-	-	-	-
3505 Card Reader Models B1, B2	m	m	X	X	X	X
3525 Card Punch Models P1, P2, P3	3505-B1, -B2	n or 3505 -B1,-B2	3505-B1, -B2	3505-B1 -B2	3505-B1, -B2	3505-B1, -B2
3540 Diskette I/O Unit Models B1, B2	m	m	X	X	X	X
3800 Printing Subsystem	-	-	-	X	X	X
3803 Tape Control Model 1	-	-	X	X	X	X
3803 Tape Control Model 2	-	-	S	S	S	S
3803 Tape Control Model 3	n	n	-	-	-	-
3811 Printer Control Unit	-	-	X	X	X	X
3830 Storage Control Model 2	-	-	X	X	X	X
3881 Optical Mark Reader	m	m	m	m	m	m
3886 Optical Character Reader Model 1	m	m	X	X	X	X
5203 Printer Model 3	n	-	-	-	-	-
5213 Printer Model 1	n	-	-	-	-	-
5425 Multifunction Card Unit Models A1, A2	n	n	-	-	-	-

Notes:

-	not attachable
X	attachable to any available channel
m	attachable to a multiplexer channel only
n	natively attachable
*	attachable to Model 158 only
**	attachable to Model 155II only
***	Model 138 and 148 only
****	Does not attach to the S/370 Models 138 or 148
#	not attachable if string contains 3344
†	on 3115-2/3125-2 only
S	attachable to selector channel only
IFA	Integrated File Adapter
ISC	Integrated Storage Control

Telecommunications Support

Support for telecommunications devices is provided under the IBM Disk Operating System/Virtual Storage by three access methods: the Virtual Telecommunications Access Method (VTAM), the Basic Telecommunications Access Method (BTAM), and the Queued Telecommunications Access Method (QTAM).

Virtual Telecommunications Access Method - VTAM (Also refer to the Program Products section for licensed options provided for VTAM).

The **Virtual Telecommunications Access Method (VTAM)** is a functionally superior alternative to BTAM and provides telecommunications support for the 3704/3705 in network control mode and for locally attached 3270s, 3730s, and 3790s. In addition, VTAM controls the sharing of telecommunication resources between application programs and supports the concurrent execution of multiple teleprocessing applications.

VTAM provides for the direct transmission of messages between application programs and terminals. Using the network control mode, it makes the lines and communications controllers transparent to the application program; thus, the application program need only be responsible for device control characters in data streams.

The expanded interface for application programs allows the user to control connections between application programs and terminals, as well as to request data transfer. A single request for connection or input can be directed simultaneously to more than one terminal.

For SS and BSC terminals, VTAM supports switched networks as point-to-point, manual dial, automatic dial and automatic answer. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device.

For SDLC terminals, VTAM supports switched and nonswitched lines. Nonswitched networks are supported as point-to-point or multipoint, as appropriate for the device. Switched networks are supported as point-to-point, manual dial, automatic dial, and automatic answer. Each station has a unique transmission identification within the network, as defined by the installation.

The VTAM application program interface is upwards compatible for the three virtual storage operating systems (DOS/VS, OS/VS1, and OS/VS2). It is designed for long-term stability and to aid user teleprocessing growth.

VTAM and VSAM are companion access methods on which to build customer data base/data communications systems.

Network operator-control facilities are provided, enabling the user to monitor and reconfigure his network to meet fluctuating requirements.

The program operator facility allows an authorized user-written application program to enter VTAM Network operator commands and receive VTAM Network operator messages.

Configuration Restart Facilities allow the VTAM Network to be reinstated after a failure or a normal deactivation occurs. Manual switching support to a backup Processor or 3704/3705 is provided.

VTAM's modular design and use of tailored DOS/VS RAS facilities provide a reliable telecommunications system and assist in maintenance.

A 3790-SNA System Installation Package, consisting of a 3790 Sample Installation test program with appropriate supporting code and control statements, and a 3790 Installation Guide, is provided to facilitate installation of VTAM2-3790 Communication Systems and the host communications subsystem. The 3790 - SNA System Installation Package supports the 8100/DPCX Information System.

To aid in installing the 8100 Information System with DPPX, the Host Command Facility Program Product, with a 3270 display station running under VTAM, can be used to:

- Remotely operate an 8100/DPPX System from a 3270 display station.
- Run 8100/DPPX checkout routines remotely.
- Verify the operation of a connection between S/370 and 8100/DPPX.
- Modify DPPX network profiles.

Maintaining Telecommunications Integrity: VTAM provides the capability for an installation to establish and maintain the integrity of the telecommunications system. These capabilities involve the control of connections between application programs and terminals and of the access and use of data within the system.

Specifically, VTAM enables the installation (via macro instructions and user-coded exit routines):

- To control which terminals can logon to which application programs.
- To specify and check authorization for a terminal user's connection to a specified application program.
- To request that VTAM buffers and NCP/VS buffers be cleared before being returned to the buffer pool.

In addition, VTAM validates requests from application programs when the request is received and before the response is returned.

Teleprocessing Online Test Executive Program (TOLTEP) is a component of VTAM and is designed to control the selection, loading, and execution of teleprocessing online terminal tests (OLTTS) for all control units and terminals in a VTAM network. It uses VTAM capabilities for line sharing, remote reporting, and remote test requests. TOLTEP performs control services, device accessing, and configuration-update functions for teleprocessing OLTTS of devices supported by VTAM.

TOLTEP allows the operator or IBM representative to run teleprocessing OLTTS concurrently with other processing programs, with VTAM, and with the operating system. TOLTEP is automatically included in a system when VTAM is generated. It is initiated when VTAM is initiated and stopped when VTAM is stopped.

TOLTEP does not support the dedicated testing of a locally attached 3704/3705 Communications Controller. Dedicated testing of the local 3704/3705 is handled by OLTEP.

Although TOLTEP provides testing facilities for the VTAM network, OLTEP is still required for testing appropriate non-VTAM networks.

TOLTEP requires the configuration data set (CDS) and the OLTT data set.

VTAM System Requirements: VTAM operates in DOS/VS and requires the Compare and Swap and the Compare Double and Swap instructions. These instructions are provided via the Conditional Swapping Feature (#1051) for the Model 135, and via the Advanced Control Program Support Feature (#1001) or the Conditional Swapping Feature (#1051) for the Model 145. The minimum DOS/VS system under which VTAM operates is 128K of real storage.

Note: Conditional Swapping is standard on the Models 135-3 and 138. Advanced Control Program Support is standard on the Models 145-3 and 148. Insert PSW Key and Set PSW Key from Address, which are part of Advanced Control Program Support, are standard on the S/370 Models 135-3 and 138, but are called PSW Key Handling.

See VTAM, QTAM and BTAM Terminals Supported for a list of the devices supported by VTAM with DOS/VS.

Basic Telecommunications Access Method (BTAM) provides basic support for telecommunications systems. The BTAM facilities of DOS/VS may be used in all or any of the system partitions in either virtual or real mode, or may be used to design a dedicated telecommunications system in a system with a single partition.

BTAM provides facilities for performing the following operations: Initiating and answering calls to and from terminals on switched networks ... Polling and addressing terminals on nonswitched multipoint lines ... Changing the status of terminal lists ... Transmitting and receiving messages ... Posting completion status of messages ... Managing buffer pools ... Code translation ... Retransmitting messages received with detected errors ... Providing online terminal test facilities ... Keeping error statistics.

In a multiple partition environment the teleprocessing program will normally operate in a high priority foreground partition that will include the BTAM module combined with the user's message processing routines. The user may employ any of the IOCS macro instructions provided by the system in the design of his telecommunications application.

BTAM provides a multiple WAIT macro instruction for use by telecommunications line operations *only*. This macro instruction enables the telecommunications program to release control of the central processing unit until one or more of a series of events has occurred (such as the completion of a BTAM READ or WRITE operation). Thus it provides for the efficient concurrent operation of lower priority programs. The support of Binary Synchronous Communications and a variety of start-stop devices gives BTAM considerable flexibility and a wide range of applications. This support covers both low and high speed devices in a single access method.

Queued Telecommunications Access Method (QTAM) provides a generalized IOCS that extends the techniques of logical IOCS to the telecommunications environment. QTAM provides a macro definition language to generate a high-level and flexible message control program in addition to the standard GET and PUT macro instruction

support for message processing programs. Functions provided by QTAM macro instructions include: automatic control of switched networks ... polling of terminals ... receiving and editing messages from terminals ... addressing terminals ... sending and editing messages to terminals ... dynamic buffer management ... queuing of messages on a direct access storage device ... dequeuing messages and passing them to separate processing programs ... collecting output messages passed from processing programs onto a queue.

Telecommunications systems built from QTAM facilities consist of:

- a message control program which resides in real storage allocated to a high priority partition and controls the flow of message traffic from one remote terminal to another (message switching applications) and between remote terminals and any message processing programs (message processing applications).
- one or more message processing programs which reside in real storage allocated to partitions of lower priority and perform the message processing functions required by the user's application.

QTAM allows asynchronous operation of all processing programs.

QTAM requires direct access storage for intermediate storage of message queues. The following physical devices may be used for this purpose: 2311 Disk Storage Drive ... 2314 Direct Access Storage Facility ... 2319 Disk Storage ... 3330-1,-2/3333-1 Disk Storage ... 3344 Disk Storage ... 3350 Disk Storage in 3330 Model 1 Compatibility Mode.

Note: Programs built from QTAM facilities may be executed in real mode only.

Communication Serviceability Facilities

Communication Serviceability Facilities are provided by VTAM, QTAM and, on an optional basis, by BTAM. The user is strongly advised to include these facilities with BTAM since they increase system availability by providing statistics and diagnostic aids for system repair and preventive maintenance. The devices supported by each facility are shown in *VTAM, QTAM and BTAM Terminals Supported* at the end of this section.

The following facilities are provided for VTAM:

Error Recovery Procedures are provided for the 3704, 3705-I and 3705-II Communications Controllers as well as the local 3270 Information Display System. The 3704 and 3705 in network control mode provides error recovery on a line basis. If the ERP fails, VTAM is informed of the error and the error is recorded.

Error Counts are maintained on a line basis by the 3704 and 3705 Communications Controllers. Error counts are maintained for the 3704, 3705, and local 3270 by VTAM.

Online Terminal Tests, are available via the Teleprocessing Online Test Executive Program (TOLTEP) concurrently with user programs and do not impact user operations apart from the time required to perform their functions. Online tests requested from a terminal supported by VTAM can be returned to that terminal or to any other terminal on the same system supported by VTAM. Normal operation is maintained for terminals in the system not under test.

The following facilities are provided by both BTAM and QTAM:

Error Recovery Procedures are provided on a line basis. The operation in error is retried, twice on non-BSC devices. If the error persists a descriptive message is output to the system console. Certain non-recoverable errors result in termination of the job and a storage dump. Diagnostic Write and Read commands (2701 only) are performed to isolate non-recoverable errors to either the control unit or an external source.

Error Counts are maintained on a line basis and output to the system console if the error rate becomes excessive. The user program can request error statistics from the cumulative counters to be output to the system console.

Online Terminal Test Procedures operate concurrently with user programs and do not impact user operations apart from the time taken to perform their functions. (When tests use the IBM 2760, the film should be reloaded before continuing the job.) Tests requested from a terminal can be returned to that terminal or to any other terminal on the same system. Normal operation is maintained for unaffected terminals within the system.

The following facilities are provided by QTAM only:

Operator Control is an option to allow the operator to examine and modify QTAM control information and to respond to errors and other unusual conditions. A 1050 System or a 2740 Communication Terminal with station control and checking is required for use as an operator control terminal. When the facility is used operator awareness messages may be routed to this terminal instead of the system console.

Checkpoint/Restart of the QTAM message control program is optional. The terminal table queue control blocks and the polling lists are checkpointed on disk at user-specified intervals. Two checkpoint records are maintained, with a pointer to the most current record. Restart is accomplished by reloading the message control program and using the latest checkpoint record to overlay the initial queue control blocks and polling lists.

Telecommunications Design Considerations

The following configuration and design considerations apply to the DOS/VS telecommunications environment:

All telecommunications devices with the exception of the 2701 SDA-II, the Integrated Communications Adapters of System/370 Model 135/138, the 2848-2260 (local), the 3270 (local), and the 3704/3705-I/3705-II must be attached to the multiplexer channel, and no burst mode device may co-exist on the channel with telecommunications devices. Support for the 2701 SDA-II attached to a selector channel is limited to nonswitched (leased or private line connection) networks.

All start/stop terminals on a multipoint nonswitched line must be of the same type. Different types of terminals may be mixed within the same problem program.

BSC terminals and remote Processors are supported by BTAM and VTAM.

Different types of BSC terminals may be mixed on the same multipoint line in a nonswitched network or on the same computer phone number in a switched network. The BSC terminal mix capability is shown in the *Terminal Support Chart 2* at the end of this section.

SDLC terminals are supported by VTAM and NCP/VS. The data transmission link may be nonswitched or switched facilities, connected in half-duplex or full-duplex configuration. *Terminal Support Chart 2*, later on in this section, shows the support available for dialing and answering, as well as the terminal mix capability.

For application programs using BTAM or QTAM, storage requirements depend on the BTAM or QTAM modules themselves and also on the extent of the following user-specified areas and functions: I/O buffer areas ... terminal lists ... message processing routines ... number of macro instructions issued ... number of lines supported ... number of terminals per line ... line procedure specifications.

For application programs using VTAM, storage requirements are largely dependent upon how efficiently the application programs manage their VTAM control blocks. In addition, storage requirements depend upon the following user-specified areas and functions: I/O buffer areas ... number and organization of terminals ... number and type of macro instructions used.

VTAM, QTAM and BTAM Terminals Supported

VTAM, QTAM and BTAM telecommunications access methods support the following terminals, programmable features, transmission control units, and communications controllers. Programmable features which change the control or transmission characteristics and which are not shown are not supported. Attempts to use VTAM, QTAM or BTAM with unsupported features can cause unpredictable results. If the terminal/feature is not supported by all three access methods, the access method(s) which does(do) support the terminal/feature is(are) shown in parenthesis.

The user should be aware that many terminal and control unit special features are transparent to programming, and are therefore readily usable even though not specifically identified. Note that the appropriate line adapters and hardware attachment features must be included in the system configuration.

Terminals that are functionally equivalent to those specifically supported by VTAM, QTAM or BTAM may also function satisfactorily with VTAM, QTAM or BTAM; the customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

REMOTE ATTACHMENT

Terminals and Terminal Features

SS Lines:

IBM Terminals

- 1030 Data Collection System on nonswitched lines: (QTAM,BTAM)
- 1031 Input Station (Models A1, A2, A3, A4, A5, A6, A7):
Supported: Attachment of 1031, 1033, 1034, 1035
- 1031 Input Station (Models B1, B2, B3, B4, B5, B6, B7):
Supported: Attachment of 1035
- 1033 Printer
- 1034 Card Punch
- 1035 Badge Reader

- 1050 Data Communication System on switched or nonswitched lines:
1051 Control Unit (Models 1,2):
Supported: Attachment of 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1092, 1093
#1313 - Automatic EOB
#4795 - Line Correction
#4796 - Line Correction Release
#5465 - Open Line Detection
#6100 - Receive Interrupt
#9698 - Text Time-Out Suppression
#9700 - Transmit Interrupt
- 1052 Printer-Keyboard (Models 1, 2):
Supported: #1313 - Automatic EOB
#9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code
- 1053 Printer (Model 1):
Supported: #9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code
- 1054 Paper Tape Reader (Model 1)
1055 Paper Tape Punch (Model 1)
1056 Card Reader (Models 1, 3)
1057 Card Punch (Model 1)
1058 Printing Card Punch (Models 1, 2)
1092 Programmed Keyboard (Models 1, 2)
1093 Programmed Keyboard (Models 1, 2)
- 2848 Display Control (Models 1,2,3) on nonswitched lines: (QTAM,BTAM)
Supported: Attachment of 2260,1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053 (QTAM)
- 2260 Display Station (Models 1, 2):
Supported: #3606 - Extended Cursor Control, Alpha-meric Keyboard
#4766 - Alphameric Keyboard
Not Supported: Tab feature of #3606
- 1053 Printer (Model 4): (BTAM)
Supported: #9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code
- 2845 Display Control (Model 1) on nonswitched lines: (QTAM,BTAM)
Supported: Attachment of 2265,1053
#3301 - Destructive Cursor
#4801 - Line Addressing
Not Supported: Attachment of 1053 (QTAM)
#7801 - Tab
- 2265 Display Station (Model 1):
Supported: #4766 - Alphameric Keyboard
- 1053 Printer (Model 4): (BTAM)
Supported: #9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code
- 2740 Communication Terminal (Model 1) on switched or nonswitched lines:
Supported: #3255 - Dial Up (Switched only)
#6114 - Record Checking
#7479 - Station Control (non switched only)
#8028 - Transmit Control (Switched only)
#8301 - 2760 Attachment (QTAM,BTAM)
#9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code
Correspondence Code
- 2740 Communication Terminal (Model 2) on nonswitched lines:
Supported: #1495, #1496 - Buffer Expansion
#1499 - Buffer Receive
#6114 - Record Checking
#9571, #9591 - PTTC/EBCD Code
- 2741 Communication Terminal (Model 1) on switched or nonswitched lines: (VTAM)
Supported: #3255 - Dial Up
#4708 - Receive Interrupt
#7900 - Transmit Interrupt
#9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code
Correspondence Code
- 2760 Optical Image Unit (Model 1) on switched or nonswitched lines: (QTAM,BTAM)
- 3767 Communication Terminal (Models 1,2) (supported as a 2740-1) on switched or nonswitched lines:
Required: #7111 - 2740-1 Start/Stop
Supported: #9560 - Station Control
- 3767 Communication Terminal (Models 1,2,3) (supported as a 2740-2) on nonswitched lines:
Required: #7112 - 2740-2 Start/Stop
- 3767 Communication Terminal (Models 1,2) (supported as a 2741) on switched or nonswitched lines: (VTAM)
- Required: #7113 - 2741 Start/Stop
- 5100/5110 Portable Computer (supported as a 2741) on switched or nonswitched lines:
Required: #1525 - Communications Adapter
- CMCST (Communicating Magnetic Card Selectric® Typewriter) (supported as a 2741 with Correspondence Code) on switched lines:
Supported: The CMCST is functionally equivalent to a 2741 with Dial Up, Receive Interrupt and Transmit Interrupt
- IBM Processors As Terminals**
(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)
- System/7 (supported as a 2740-1 with checking) on switched or nonswitched lines:
Required: #1610 - Asynchronous Communication Control
- Non-IBM Terminals**
AT&T 83B3 Line Control Type on nonswitched lines
CPT-TWX (Model 33/35) Line Control Type on switched lines
World Trade Telegraph on nonswitched lines
WU 115A Line Control Type on nonswitched lines
- BSC LINES:**
IBM Terminals
2790 Data Communication System on switched or nonswitched lines: (BTAM)
2715 Transmission Control Unit (Model 1, 2):
Required: 2740
Supported: Attachment of 2798,1035,1053
#3801 - Expanded Capability
#4850 - Local 2740 Adapter
#9401 - Point-to-Point Non-Switched
#9402 - Point-to-point Switched
#9403 - Multipoint Non-Switched
- 2740 Communication Terminal (Model 1)
2798 Guidance Unit (Model 1)
1035 Badge Reader (Model 1)
1053 Printer (Model 1)
- 2770 Data Communication System on switched or nonswitched lines: (VTAM,BTAM)
2772 Multipurpose Control Unit:
Required: #5010 - Multipoint Data Link Control (VTAM)
Supported: Attachment of 0050,0545,1017,1018,1053, 1255,2203,2213,2265,2502,5496
#1340 - Automatic Answering
#1490 - Buffer Expansion (256 bytes)
#1491 - Buffer Expansion Additional (512 bytes)
#1910 - Conversational Mode
#3250 - Display Format Control
#3650 - EBCDIC Transparency
#3860 - 144 Character Print Line
#4610 - Identification
#4690 - Keyboard Correction
#5010 - Multipoint Data Link Control (BTAM)
#5890 - Horizontal Format Control
#6555 - Space Compression/Expansion
#7705 - Synchronous Clock
#7950 - Transmit-Receive-Monitor-Print
#9140 - Extended Re-Entry
#9402 - Line Termination - 2-wire
#9761 - Transmission Code EBCDIC
#9762 - Transmission Code ASCII
#9936 - Immediate WACK
- 0050 Magnetic Data Inscrber
0545 Output Punch (Models 3,4)
1017 Paper Tape Reader (Models 1,2)
1018 Paper Tape Punch (Model 1)
1053 Printer (Model 1)
1255 Magnetic Character Reader
2203 Printer (Models A1,A2):
Supported: #5558 - Print Positions, 24 Additional
2213 Printer (Models 1,2)
2265 Display Station (Model 2)
2502 Card Reader (Models A1,A2)
5496 Data Recorder
- 2780 Data Transmission Terminal on switched or nonswitched lines: (VTAM,BTAM)
Supported: #1340 - Automatic Answering
#1350 - Automatic Turnaround

- #3401 - Dual Communication Interface
 - #5010 - Multiple Record Transmission
 - #5020 - Multipoint Line Control
 - #5820 - 120 Character Print Line
 - #5821 - 144 Character Print Line
 - #6400 - Selective Character Set
 - #7850 - Terminal Identification
 - #8030 - EBCDIC Transparency
 - #9150 - Extended Retry Transmission
 - #9761 - ASCII Transmission Code
 - #9762 - EBCDIC Transmission Code
- 2980 General Banking System on nonswitched lines: (VTAM,BTAM)
2972 Station Control Unit (Model 8 - RPQ 858160, Model 11 - RPQ 858231):
Supported: Attachment of 2980,2971
RPQ 835503 - Buffer Expansion
RPQ 858165,858182 - 96-Character Buffer
- 2980 Teller Station (Model 1 - RPQ 835504, Model 4 - RPQ 858147)
2980 Administrative Station (Model 2 - RPQ 835505)
2971 Remote Control Unit (Model 3 - RPQ 858144)
- 3270 Information Display System on nonswitched lines: (VTAM,BTAM)
3271 Control Unit (Models 1,2):
Supported: Attachment of 3277,3284,3286,3287,3288
#1550 - Copy
#9761 - EBCDIC Code
- 3274 Control Unit (Model 1C) [supported as a 3271]:
Supported: Attachment of 3277,3278,3284,3286,3287,3288,3289
- 3276 Control Unit Display Station (Models 1,2,3,4) [supported as a 3271]:
Supported: Attachment of 3278,3287
#6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
- 3277 Display Station (Models 1,2):
Supported: #6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4) [supported as a 3277]:
Supported: #6350 Selector Light-Pen
#9082 - EBCDIC Character Set
- 3284 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286]:
Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) [supported as a 3286-2]:
Supported: #9089 - EBCDIC Character Set
- 3289 Printer (Models 1,2) [supported as a 3286-2]
- 3270 Information Display System on switched lines (BTAM) or nonswitched lines: (VTAM,BTAM)
3275 Display Station (Models 1,2):
Supported: Attachment of 3284
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code
- 3284 Printer (Model 3):
Supported: #9089 - EBCDIC Character Set
- 3650 Programmable Store System (Supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (Models A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3653, 3663, 3657, 3275, 3659, 3669, 3784
- 3653 Point of Sale Terminal (Model 1 and 1P)
3663 Supermarket Terminal (Model 1P, 2 and 3P)
3657 Ticket Unit (not available on 3651 Models A25 and B25)
3275 Display Station (Model 3)
Supported: Attachment of 3284
- 3284 Printer (Model 3)
3659 Remote Communication Unit (Model 1)
Required: 2400 BPS non-switched line
- 3784 Printer (Model 1) not available on 3651 models A25 and B25
3669 Remote Communications Unit (not available on 3651 Model A25 and B25)
- 3660 Supermarket Scanning System (supported as a S/3) on switched lines: (BTAM)
3651 Store Controller (Models A60,B60):
Supported: Attachment of 3663,3669
- 3663 Supermarket Terminal (Models 1,2):
Supported: Attachment of 3666
- 3666 Checkout Scanner (Model 1)
3669 Store Communications Unit (Model 1)
- 3660 Supermarket Key-Entry System (supported as a S/3) on switched lines: (BTAM)
3661 Store Controller:
Supported: Attachment of 3663
- 3663 Supermarket Terminal (Models 1,2)
- 3735 Programmable Buffered Terminal (Model 1) on switched or nonswitched lines: (VTAM,BTAM)
Supported: Attachment of 5496,3286
#5010 - Multipoint Data Link Control
#9761 - EBCDIC Code
#9762 - ASCII Code
- 5496 Data Recorder (Model 1)
3286 Printer (Model 3)
- 3741 Data Station (Model 2) on switched or nonswitched lines: (VTAM,BTAM)
Supported: Attachment of 0129,3713,3715,3717
#1680 - Expanded Communications
#1685 - Expanded Communications/
Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
3713 Printer (Model 1)
3715 Printer (Models 1,2)
3717 Printer (Model 1)
- 3741 Programmable Workstation (Model 4) on switched or non-switched lines: (VTAM,BTAM)
Supported: Attachment of 0129,3713,3715
#1680 - Expanded Communications
#1685 - Expanded Communications/
Multipoint Data Link Control
#5450 - Operator Identification Card Reader
#7850 - Terminal Identification
- 0129 Card Data Recorder (Model 2)
3713 Printer (Model 1)
3715 Printer (Models 1,2)
- 3747 Data Converter (Model 1) on switched or nonswitched lines: (VTAM,BTAM)
Supported: #1660 - Communications Adapter
- 3770 Data Communication System (supported as a 2770) on switched or nonswitched lines: (VTAM,BTAM)
3771 Communication Terminal (Models 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3773 Communication Terminal (Models 1,2,3,P1,P2,P3):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3774 Communication Terminal (Models 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3775 Communication Terminal (Models 1,P1):
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: 1201 - ASCII Code
- 3776 Communication Terminal (Models 1,2) [supported as a 2772/3780]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3777 Communication Terminal (Model 1) [supported as a 2772/3780]:
Required: #1460 - SDLC/BSC, Switch Control, or
#1461 - BSC Point-to-Point, or
#1462 - BSC Multipoint
Supported: #1201 - ASCII Code
- 3780 Data Communications Terminal (Model 1) [supported as a 2772 without component select] on switched or nonswitched lines: (VTAM,BTAM)
Supported: #3601 - EBCDIC Transparency
#5010 - Multipoint Data Link Control
#5701 - Print Positions, Additional
#9761 - EBCDIC Code
#9762 - ASCII Code
- 5110 Computer (supported as a 2772) on switched and nonswitched lines:
Required: #2074 BSCA
Supported: Attachment of a 5103 Printer, 5106 Tape Cartridge and 5114 Diskette Unit
- The 5110 emulates the following 2772 features:
Auto Answer
Buffer Expansion Additional
144 Character Print Line
Identification
Multipoint Data Link Control (TCAM, BTAM)
Horizontal Format Control

- Space Compression/Expansion
Synchronous Clock
Transmission Code EBCDIC
- 5230 Data Collection System (supported as a 3741-2,-4) on switched or nonswitched point-to-point lines: (BTAM)
5231 Controller (Model 2):
Required: #2074 - BSCA
- 5275 Direct Numerical Control Station (Model 1) (supported as a 3275 with EBCDIC Code and EBCDIC Character Set) on switched lines (BTAM) or nonswitched lines (VTAM,BTAM)
- IBM Processors As Terminals**
(For details of programming support provided within the Processor when acting as a terminal, see appropriate programming sales manual pages)
- 1130 Computing System on switched or nonswitched lines: (BTAM)
1131 Central Processing Unit:
Required: #7690 - Synchronous Communications Adapter
- 1800 Data Acquisition and Control System on switched or nonswitched lines: (BTAM)
1826 Data Adapter Unit:
Required: #7550 - Communication Adapter
- Series/1 (supported as a System/3) on switched or nonswitched lines: (BTAM)
4953 or 4955 Processor
Required: 2074, 2075, 2094 Binary Synchronous Communications Adapter
- System/3 on switched or nonswitched lines: (VTAM,BTAM)
5406 or 5410 or 5415 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter
- System/7 (supported as a S/3) on switched or nonswitched lines: (VTAM,BTAM)
5010 Processor Module:
Required: #2074 - Binary Synchronous Communications Adapter
- System/32 (supported as a S/3) on switched or nonswitched lines: (VTAM,BTAM)
5320 System Unit:
Required: #2074 - Binary Synchronous Communications Adapter
- System/34 (supported as a S/3) on switched or nonswitched lines: (VTAM, BTAM):
5340 System Unit:
Required: #2500 or 3500 Communications Adapter Feature
- System/360 Model 20 on switched or nonswitched lines: (BTAM)
2020 Processing Unit:
Required: #2074 - Binary Synchronous Communications Adapter
- System/360 Models 25,30,40,50,65,65MP,67(65mode),75,85,91,195 on switched or nonswitched lines: (BTAM)
Processing Unit:
Required: #4580 - Integrated Communications Attachment
2701 Data Adapter Unit, or
2703 Transmission Control, or
3704 Communications Controller in emulation mode, or
3705-I Communications Controller in emulation mode, or
3705-II Communications Controller in emulation mode
- All virtual storage S/370 Processors on switched or nonswitched lines: (VTAM,BTAM)
Processing Unit:
Required: #4640 - Integrated Communications Adapter
2701 Data Adapter Unit (BTAM), or
2703 Transmission Control (BTAM), or
3704 Communications Controller in network control (VTAM) or emulation mode (BTAM), or
3705-I Communications Controller in network control (VTAM) or emulation mode (BTAM), or
3705-II Communications Controller in network control (VTAM) or emulation mode (BTAM)
- S/8100 with DPPX on nonswitched lines: (Supported as a 3271) (VTAM, BTAM)
Required: Refer to S/8100 sales pages for required features.
- SDLC Lines:**
- Communications Controllers**
- 3704 Communications Controller in network control mode (VTAM)
- 3705-I Communications Controller in network control mode (VTAM)
- IBM Terminals**
- 3270 Information Display System on nonswitched lines: (VTAM)
3271 Control Unit (Models 11,12):
Supported: Attachment of 3277,3284,3286,3287,3288
#1200 - ASCII Code
#1550 - Copy
#9761 - EBCDIC Code
- 3277 Display Station (Models 1,2):
Supported: #6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
- 3284 Printer (Models 1,2,3):
Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or a 3286]:
Supported: #9089 - EBCDIC Character Set
- 3288 Printer (Model 2) (supported as a 3286-2):
Supported: #9089 - EBCDIC Character Set
- 3275 Display Station (Models 11,12):
Supported: Attachment of 3284
#1200 - ASCII Code
#6350 - Selector Light-Pen
#9089 - EBCDIC Character Set
#9761 - EBCDIC Code
- 3270 Information Display System on switched and nonswitched lines: (VTAM) [supported as a 3790 with Configuration Support 9165]
3276 Control Unit Display Station (Models 11,12,13,14)
Supported: Attachment of 3278, 3287
#6350 - Selector Light-Pen
#9082 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4) [supported as a 3277]
Supported: 6350 - Selector Light-Pen
#9082 EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286]
Supported: #9082 - EBCDIC Character Set
- 3600 Finance Communication System on switched or nonswitched lines: (VTAM)
3601 Controller (Models 1,2A,2B,3A,3B):
Supported: Attachment of 3603, 3604, 3606, 3608, 3610, 3611, 3612, 3615, 3618, 3614, 3624
- 3602 Controller (Models 1A,1B):
Supported: Attachment of 3603, 3604, 3606, 3608, 3610 3611, 3612, 3615,3618, 3614, 3624
- 3603 Terminal Attachment Unit (Model 1,2):
3604 Keyboard Display (Models 1,2,3,4,5,6)
3606 Financial Services Terminal (Models 1,2)
3608 Printing Financial Services Terminal (Models 1,2)
3610 Document Printer (Models 1,2,3,4,5)
3611 Passbook Printer (Models 1,2)
3612 Passbook and Document Printer Models (1,2,3)
3614 Consumer Transaction Facility (Models 1,2,11,12)
Required: When attached to a 3601 or 3602, 3602 or 3602 application programs
- 3615 Administrative Terminal Printer Models (1,2)
3618 Administrative Line Printer (Model 1)
3624 Consumer Transaction Facility (Models 12,11,12):
Required: When attached to a 3601 or 3602, 3601 or 3602 application programs
Supported: Attachment to a 3704/3705 (via non-switched lines only) or 3601, 3602.
- 3630 Plant Communication System on switched or nonswitched lines (VTAM, TCAM)
3631 Controller (Models 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646, 3842, 7430 (RPQ)
- 3632 Controller (Models 1A, 1B)
Supported: Attachment of 3604, 3641, 3642, 3643, 3644, 3646, 3842, 7430 (RPQ)
- 3604 Keyboard Display (Model 6)
3641 Reporting Terminal (Models 1, 2)
3642 Encoder Printer (Models 1, 2)
3643 Keyboard Display Models 2, 3, 4
3644 Automatic Data Unit (Model 1)
3646 Scanner Control Unit (Model 1)
3842 Loop Control Unit (Model 1)
7430 Document Printer (RPQ)

3650 Programmable Store System on switched or non-switched lines: (VTAM, TCAM via VTAM)

3651 Store Controller (Models A25, B25, A75, B75, C75, D75)
Supported: Attachment of 3653, 3663, 3657, 3275, 3659, 3669, 3784

3653 Point of Sale Terminal (Model 1 and 1P)
3663 Supermarket Terminal (Model 1P, 2 and 3P)
3657 Ticket Unit (not available on 3651 Models A25 and B25)
3275 Display Station (Model 3)
Supported: Attachment of 3284

3284 Printer (Model 3)
3659 Remote Communications Unit (Model 1)
Required: 2400 BPS non-switched line
3784 Printer (Model 1) not available on 3651 Model A25 and B25
3669 Remote Communications Unit (Model 1) not available on 3651 Model A25 and B25

3650 Retail Store System on switched or nonswitched lines: (VTAM)

3651 Store Controller (Models A50,B50):
Supported: Attachment of 3653,3657,3275,3659,3784

3653 Point of Sale Terminal
3657 Ticket Unit
3275 Display Station (Model 3):
Supported: Attachment of 3284

3284 Printer (Model 3)
3659 Remote Communications Unit (Model 1):
3784 Printer (Model 1)

3660 Supermarket Scanning System on switched lines: (VTAM)

3651 Store Controller (Models A60,B60):
Supported: Attachment of 3663,3669

3663 Supermarket Terminal (Models 1,2):
Supported: Attachment of 3666
3666 Checkout Scanner
3669 Store Communication Unit (Model 1)

3660 Supermarket Key-Entry System on switched lines: (VTAM)

3661 Store Controller:
Supported: Attachment of 3663
3663 Supermarket Terminal (Models 1,2)

3730 Distributed Office Communication System on switched or nonswitched lines: (VTAM)

3791 Controller (Model 11C, 12A, or 12 B with: SDLC with Clock (#6301) or SDLC without Clock (#6302 or 6303) and required modem
3732 Text Display Station
3736 Printer

3767 Communication Terminal (Models 1,2,3) on switched or nonswitched lines: (VTAM)

Supported: SDLC adapter provided unless one of the Start/Stop features are specified
#1201 - ASCII Code

3770 Data Communication System on switched or nonswitched lines: (VTAM)

3771 Communication Terminal (Models 1,2,3):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3773 Communication Terminal (Models 1,2,3,P1,P2,P3):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3774 Communication Terminal (Models 1,2,P1,P2):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3775 Communication Terminal (Models 1,P1):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3776 Communication Terminal (Models 1,2):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC
Supported: #1201 - ASCII Code

3776 Communication Terminal (Models 3,4):
Supported: 1201 ASCII Code
3777 Communication Terminal (Model 1):
Required: #1460 - SDLC/BSC, Switch Control, or #1470 - SDLC

Supported: #1201 - ASCII Code
3777 Communication Terminal (Model 3):
Supported: #1201 ASCII Code

3790 Communication System on switched or nonswitched lines (VTAM)

8100/DPCCX Information System on switched or nonswitched lines: (VTAM)

IBM Processors As Terminals

System/32 (supported as a 3770) on switched or nonswitched lines: (VTAM)

5320 System Unit:
Required: #1005 - Additional Storage (minimum of one)
#6301 - Synchronous Data Link Control

System/34 (supported as a 3770) on switched or nonswitched lines: (VTAM) 5340 System Unit:

Required: #2500 or 3500 Communications Adapter Feature

S/8100 with DPPX on switched or nonswitched lines: (VTAM)

Required: Refer to S/8100 sales pages for required features.

Local Attachment

Transmission Control Units and Communications Controllers

Integrated Communications Adapter of S/370 Model 115: (QTAM,BTAM)

Required: #4640 - Integrated Communications Adapter
Supported: #1291-#1296 - Autocall

Integrated Communications Adapter of S/370 Model 125: (QTAM,BTAM)

Required: #4640 - Integrated Communications Adapter
Supported: #1291-#1296 - Autocall

Integrated Communications Adapter of S/370 Model 135, 135-3, 138: (QTAM,BTAM)

Required: #4640 - Integrated Communications Adapter
Supported: EBCDIC Code is a standard feature
#9673-#9680 - Transparency (BTAM)
#9681-#9688 - ASCII Code (BTAM)
#9689-#9696 - 6-bit Transcode (BTAM)

2701 Data Adapter Unit on local channel: (QTAM,BTAM)

Supported: #1302, #1303, #1314 - Autocall
#3455 - Dual Code
#3463-#3465 - Dual Communication Interface (BTAM)
#8029 - Transparency (BTAM)
#9060 - EBCDIC Code (BTAM)
#9061 - ASCII Code (BTAM)
#9062 - 6-bit Transcode (BTAM)

2702 Transmission Control Unit on local channel: (QTAM,BTAM)

Supported: #1290 - Autocall
#1319 - Autopoll
#8055 - 2741 Break

2703 Transmission Control Unit on local channel: (QTAM,BTAM)

Supported: #1340, #1341 - Autocall
#7715 - EBCDIC Code (BTAM)
#7716 - ASCII Code (BTAM)
#7717 - 6-bit Transcode (BTAM)
#8055 - 2741 Break (BTAM)
#9100 - Transparency for ASCII (BTAM)

2715 Transmission Control Unit (Model 1) on local channel: (BTAM)

Supported: See "2790" under *Local Terminals*

3704/3705-I/3705-II Communications Controller on local channel:

Supported: EBCDIC Code, ASCII Code, Autopoll and EBCDIC Transparency do not have special feature codes in the 3704/3705
EP/VS (QTAM,BTAM)
NCP/VS (VTAM)
PEP
#8002 - Two-Channel Switch (VTAM)

Local Terminals

2848 Display Control (Models 1,2,3) on local channel: (QTAM,BTAM)

Supported: Attachment of 2260,1053
#3901 - Extended Cursor Control
#4787 - Line Addressing
#5340 - Non-Destructive Cursor
#5341 - Non-Destructive Cursor Adapter
Not Supported: Attachment of 1053 (QTAM)

2260 Display Station (Models 1,2):

Supported: #3606 - Extended Cursor Control, Alpha-numeric Keyboard

Not Supported: Tab feature of #3606
1053 Printer (Model 4): (BTAM)

Supported: #9567, #9597 - PTTC/BCD Code
#9571, #9591 - PTTC/EBCD Code

2790 Data Communication System on local channel: (BTAM)

- 2715 Transmission Control Unit (Model 1):
Supported: Attachment of 2740,2791,2793
 #3801 - Expanded Capability
 #4850 - Local 2740 Adapter
Not Supported: #8110 - Two Processor Switch
- 2740 Communication Terminal (Model 1)
- 2791 Area Station (Models 1,2):
Supported: Attachment of 1035,2795,2796,2797,2798,
 1053
1035 Badge Reader (Model 1)
2795 Data Entry Unit (Model 1)
2796 Data Entry Unit (Model 1)
2797 Data Entry Unit (Model 1)
2798 Guidance Display Unit (Model 1)
1053 Printer (Model 1)
- 2793 Area Station (Model 1):
Supported: Attachment of 2795,2796,2797,2798,1053
2795 Data Entry Unit (Model 1)
2796 Data Entry Unit (Model 1)
2797 Data Entry Unit (Model 1)
2798 Guidance Display Unit (Model 1)
1053 Printer (Model 1)
- 3270 Information Display System on local channel: (VTAM,BTAM)
- 3272 Control Unit (Models 1,2):
Supported: Attachment of 3277,3284,3286,3287,3288
- 3277 Display Station (Models 1,2):
Supported: #6350 - Selector Light-Pen
 #9089 - EBCDIC Character Set
- 3284 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286 attached
to a 3272-1 or -2]:
Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) (supported as a 3286-2):
Supported: #9089 - EBCDIC Character Set
- 3270 Information Display System on local channel: (supported as a
3272)
- 3274 Control Unit (Model 1B):
Supported: Attachment of 3277,3278,3284,
 3286,3287,3288,3289
- 3277 Display Station (Models 1,2):
Supported: #6350 - Selector Light-Pen
 #9082 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4) [supported as a 3277]:
Supported: #6350 - Selector Light-Pen
 #9082 - EBCDIC Character Set
- 3284 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286]:
Supported: #9082 EBCDIC Character Set
- 3288 Printer (Model 2) [supported as a 3286-2]:
Supported: #9089 EBCDIC Character Set
- 3289 Printer (Models 1,2) [supported as a 3286-2]
- 3270 Information Display System on local channel: (VTAM, TCAM thru
VTAM) [supported as 3790 with Configuration Support 9165]
- 3274 Control Unit Model 1A):
Supported: Attachment of 3277,3278,3284,
 3286,3287,3288,3289
- 3277 Display Station (Models 1,2):
Supported: #6350 - Selector Light-Pen
 #9082 - EBCDIC Character Set
- 3278 Display Station (Models 1,2,3,4):
Supported: #6350 - Selector Light-Pen
 #9082 - EBCDIC Character Set
- 3284 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3286 Printer (Models 1,2):
Supported: #9089 - EBCDIC Character Set
- 3287 Printer (Models 1,2) [supported as a 3284 or 3286]:
Supported: #9082 - EBCDIC Character Set
- 3288 Printer (Model 2) [supported as a 3286-2]:
Supported: #9089 - EBCDIC Character Set
- 3289 Printer (Models 1,2) [supported as a 3286-2]
- 3730 Distributed Office Communication System on local channel
(VTAM)
- 3791 Controller (Models 11C, 12A, or 12B with: Local Channel
Attachment (#1515)
- 3732 Text Display Station
- 3736 Printer
- 3790 Communication System on local channel (VTAM): See
appropriate sales pages for description of Configurations and Access
Methods supported.
- 7770 Audio Response Unit (Model 3) on local channel (QTAM,BTAM)

Legend:

SS = Start/Stop
BSC = Binary Synchronous Communication
SDLC = Synchronous Data Link Control
Local = Local Channel Attachment

X = supported now
(date) = date when support will be available

Notes:

- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1".
- (b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS, BPS, DOS, or OS. Any virtual storage S/370 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1, or OS/VS2.
- (c) Nonswitched support only.
- (d) 3704/3705 EP/VS, or the Partitioned Emulation Programming (PEP) extension to 3704/3705 NCP/VS, can be used to emulate the 270X.
- (e) 270X = 2701, 2702, 2703; column shows last digit of 270X support. ICA = M115 ICA, M125 ICA, M135 ICA. All support without a date is available now.
- (f) Support is for console printer and for data formatted as cards from diskette or keyboard (Logon).
- (g) Supported for BTAM only.

Terminal Support Chart 2

Terminal (a)	Communications Code				Communications Network		
	EBCDIC		ASCII		PTP	PTP	MP
	norm	trans	norm	trans			
SS Terminals:							
1031	-	-	-	-	-	-	X
1051	-	-	-	-	X	-	X
2260	-	-	-	-	-	-	X
2265	-	-	-	-	-	-	X
2740-1	-	-	-	-	X	X	X
2740-2	-	-	-	-	-	-	X
2741	-	-	-	-	X	X	-
2760	-	-	-	-	X	X	-
3767-1,-2 (2740-1)	-	-	-	-	X	X	X
3767-1,-2,-3(2740-2)	-	-	-	-	-	-	X
3767-1,-2 (2741)	-	-	-	-	X	X	-
5100 (2741)	-	-	-	-	X	X	-
5110 (2741)	-	-	-	-	X	X	-
CMCST (2741)	-	-	-	-	X	-	-
S/7 (2740-1)	-	-	-	-	X (e)	X	X
AT&T 83B3, WU 115A	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	X	-
BSC Terminals:							
2715-2	-	X	-	-	S	X	M
2772	X	X	X	-	S	X	M
2780	X	X	X	-	S	X	M
2972-8,-11	X	-	-	-	-	-	M
3271-1,-2	X	-	X	-	-	-	M
3274-1C (3271-1,-2)	X	-	X	-	-	-	M
3275-1,-2	X	-	X	-	S (f)	-	M
3276 (3271-1,-2)	X	-	X	-	-	-	M
3651-A25,-B25,-A75 B75,C75,D75 (S/3)	-	X	-	-	D(h)	X	N
3651-A60,-B60 (S/3)	-	X	-	-	X	-	-
3661 (S/3)	-	X	-	-	X	-	-
3735	X	-	X	-	S	-	M
3741-2,-4	X	X	X	-	S (g)	X	-
3747	X	X	-	-	S (g)	X	-
3771,3773,3774, 3775 (2772)	X	X	X	-	S	X	M
3776,3777-1 (2772/3780)	X	X	X	-	S	X	M
3780 (2772)	X	X	X	-	S	X	M
5110 (2772)	X	X	-	-	S	X	M
5231-2 (3741-2,-4)	X	-	-	-	X	X	M
5275 (3275-1,-2)	X	-	-	-	S (f)	-	M
1131	X	X	-	-	S	X	M
1826	X	X	X	-	S	X	M
Series/1 (as S/3)	X	X	X	-	X	X	-
S/3	X	X	X	-	S	X	M
S/7 (S/3)	X	X	X	-	X	X (h)	M
S/32 (S/3)	X	X	X	-	S	X	M
S/34 (S/3)	X	X	X	-	S	X	M
S/360-20	X	X	X	X	S	X	M
S/360 (b)	X	X	X	X	S	X	-
S/370 (b)	X	X	X	X	S	X	-
S/8100/DPPX DPPX/DSC	X	-	X	-	-	X	X

SDLC Terminals:

3704 Remote	SDLC is insensitive	-	X	-
3705 Remote		-	X	-
3271-11,-12	to data interchange	-	-	N
3274-1C (3791)		-	X	N
3275-11,-12		-	-	N
3276 (3791)	codes.	D	X	N
3601		X	X	N
3602		X	X	N
3614		-	X	N
3624		-	X	N
3631		X	X	N
3632		X	X	N
3651-A25,B25,A75 B75,C75,D75 (S/3)		D	X	N
3651-A50,-B50		D	X	N
3651-A60,-B60		D	-	-
3661		D	-	-
3767-1,-2,-3		D	X	N
3771,3773,3774, 3775,3776,3777-1 3791 (c)		D	X	N
		D	X	N
8130/DPCX-A21,-A23		D	X	N
8140/DPCX-A31, -A33,-A51,-A53 S/32 (3770)		D	X	N
		D	X	N
S/34 (3770, 3791) S/8100/DPPX		D	X	N

Terminal (a)

Local Terminals:

2260	-	-	-	-
2715-1 (d)	-	X	-	-
3272-1,-2	X	-	-	-
3274-1A (3791)				
3274-1B (3272-2)	X	-	-	-
3791 (c)	3791 local attachment is code insensitive.			
7770-3	-	-	-	-

Communications Code
EBCDIC ASCII
norm trans norm trans

Communications Network
sw nonsw
PTP PTP MP

Legend:

- SS = Start/Stop
- BSC = Binary Synchronous Communication
- SDLC = Synchronous Data Link Control
- Local = Local Channel Attachment

- X = supported
- = not supported

- D = Group of terminals which can communicate over the public switched telephone network to the same SDLC line appearance on a 3704 or 3705 attached to a S/370. All DTEs so communicating must be operating with the same clocking source (either modem or business machine) and at the same transmission speed.
- M = Group of terminals which can operate on same BSC MP line and same line speed.
- N = Group of terminals which can operate on same SDLC MP line and same line speed.
- S = Group of terminals which can share the same phone number(s).

Notes:

- (a) If shown, the terminal type in parenthesis designates the programming support provided by SCPs. E.g., "S/7 (2740-1)" means "the S/7 is supported as a 2740-1".
- (b) S/360 Models 25, 30, 40, 50, 65, 65MP, 67 (65 mode), 75, 85, 91, 195 with either BOS BPS, DOS or OS. Any virtual storage S/370 Processor with either BOS, BPS, DOS, OS, DOS/VS, OS/VS1 or OS/VS2.
- (c) The 3791 Controller as part of the 3790 Communication System/Data Entry Configuration does not support ASCII code.
- (d) Terminal operates on local channel using nonswitched BTAM programming support.
- (e) Supported at 134.5 bps only.
- (f) Switched network supported by BTAM only.
- (g) The 3741/3747 can use the same switched network hardware at the 3704/3705 as other BSC terminals. However, the Network Control Program requires that the port be configured for 3741/3747 when the port is to be used for 3741/3747. Two separate versions of the NCP/VS must be maintained for the two separate configurations of the port, and the proper version loaded into the 3704/3705 for the way the port is to be used at the time.
- (h) IPL of S/7 is not supported in this network configuration.

System Utility Programs

The system utility programs maintain system control data at a system or organizational level. Except where specifically noted, support is provided for utility functions concerning the following physical devices:

- 2400-series Magnetic Tape Units
- 3400-series Magnetic Tape Units
- 2311 Disk Storage Drive
- 2314 Direct Access Storage Facility
- 2319 Disk Storage
- 2321 Data Cell Drive
- 3330/3333 Disk Storage
- 3340 Disk Storage
- 3344 Disk Storage
- 3350 Disk Storage
- 3540 Diskette I/O Unit.

Additional system devices may be required for program execution; these may be assigned to any of the appropriate physical devices already listed under the heading *Control and Service Programs*.

The following are the utility functions provided:

Initialize Magnetic Tape - The program initializes up to sixteen tape volumes. For each volume the program creates from one to eight volume labels as required, one dummy header label, and a tape mark. The program may be used to initialize either EBCDIC tapes with IBM Standard Volume Labels or ASCII tapes with ANSI Standard Volume Labels.

Initialize Disk The program initializes disk packs for further use by DOS/VS. The initialization procedure consists of VTOC label checking, home address generation, volume label creation, track descriptor (RO) record generation, and IPL and VTOC creation. 2311, 2314 and 2319 disk packs may be initialized with or without a test for defective tracks (surface analysis); however surface analysis should be included when a volume is initialized for the first time. For 3330 and 3333 disk packs and 3340 data modules, the initialization procedure does not include surface analysis or home address generation.

For 3330 compatibility volumes, home address and RO will be rewritten on all tracks, including alternate tracks, surface analysis will be performed on tracks flagged as defective with such tracks being reclaimed if no errors are found, and IPL and VTOC records will be written. For 3340 and 3344 volumes, tracks flagged as defective will be analyzed to determine if they can be reclaimed via turning off the defective track bit. Defective HA/RO areas will be rewritten with appropriate Skip Displacement (SD) values to allow the assignment of alternate tracks to them.

Initialize Data Cell - The program initializes from one to five data cells for use on a 2321 Data Cell Drive. The initialization procedure is identical to the initialization of a 2311 disk pack.

Assign Alternate Track - Disk - The program assigns an alternate track to a defective track on a disk and, if update records are supplied as input, replaces bad records on a track. The alternate tracks may be assigned either unconditionally or conditionally based upon the result of a surface analysis of the track. (For 3330 and 3333 disk packs and 3340 data modules only unconditional alternate track assignment is possible.)

Assign Alternate Track - Data Cell - The program performs for a 2321 Data Cell the functions of the Assign Alternate Track - Disk program just described.

Clear Disk - The program clears one or more areas of disk and preformats tracks containing an indicated base value throughout the area cleared.

Clear Data Cell - The program performs for a 2321 data cell the functions of the Clear Disk program just described.

VTOC Display - The program displays the labels contained in the Volume Table of Contents of a disk volume. The labels are identified by their location within the Volume Table of Contents and their format, type, and major fields are indicated by appropriate heading lines in the printed output.

Copy Disk to Disk - The program copies a volume or a file of data from one disk pack to another disk pack of the same type. The output records occupy areas of the disk identical to those of the original volume or file. Sequential, Indexed Sequential, and Direct Access files are all supported.

Copy and Restore Diskette - Support is provided to: Recovery data from a diskette on which the label information (on track zero) cannot be read ... Copy one 3540 diskette to another 3540 diskette. During this copy, error sectors and deleted records are eliminated. The utility can be used in a single or multiple 3540 configuration.

Copy and Restore Disk to Card - The programs allow the user to copy a volume or file of data from disk to punched cards, and to restore the data to a disk pack of the same type at a later date. The restored records occupy areas of the disk identical to those of the original volume or file. Sequential, Indexed Sequential, and Direct Access files are all supported.

The punched card output created by the copy program is designed for use by the restore program only.

Both copy and restore programs provide checkpoint and restart facilities. The checkpoint file may be assigned to either tape or disk.

Copy and Restore Disk or Data Cell to Magnetic Tape - The programs allow the user to copy a volume or file of data from disk or data cell to magnetic tape, and to restore the data to a disk pack or data cell of the same type at a later date. The functions of the programs are equivalent to those of the Copy and Restore Disk to Card programs just described.

Backup and Restore System Utility Programs

The programs allow fast backup of system and/or private libraries to tape with subsequent restore to disk. When the libraries are restored to disk, they are automatically condensed and may be reallocated to different sizes or to different DASD types. The restore program will accept the PID tape as input and allocate the libraries within a DOS/VS partition.

Copy File and Maintain Object Modules (OBJMAINT) Utility: This program is a multipurpose utility providing the following functions:

- File-to-file copy with blocking and deblocking of data sets on tape, card, disk or diskette
- update and expansion of object modules
- Maintenance of PTF data sets
- Comprehensive data set listing capability

Fast Copy Disk Volume - The program copies the complete contents of a 3336 disk pack or a 3348 data module onto another 3336 or 3348, respectively. It copies either directly from disk to disk or uses magnetic tape as intermediate output. The program copies a complete 3336 or 3348 only, rather than specific files or extents. The pack may contain any combination of DOS/VS files and components.

Block/Deblock Function - The program blocks an 80/81 byte record file to a 3440-byte record file, and deblocks a 3440-byte file to create an 80-byte SYSIN file. The program is only meant to support IBM distribution files, that is, only 3440-byte blocked records, 80-byte deblocked records as output and 80 and/or 81-byte records as input will be processed. Other functions provided: deblocking of selected Program Temporary Fixes (PTFs) from a blocked PTF file, card to card copy function including 80cc to 96cc conversion and listing of a file with 3440-byte blocked records. Devices supported are the 2501, 3504 and 3505 Card Readers, 2540 Card Read Punch, 2560 MFCM, 3525 Card Punch, 2400/3400 series Magnetic Tape Units, 2311 Disk Storage Drive, 2314 DASF and 2319, 3330 and 3333 Disk Storages.

Access Method Services - An extensive service program package which can be used to:

- define (create), print, copy, reorganize or delete a VSAM file
- convert an ISAM file or SAM file to a VSAM file
- add, alter, delete or print entries in the VSAM catalog
- create backup copies of VSAM files
- copy a VSAM file and catalog entries in a format which makes it easily portable to another DOS/VS system or to an OS/VS system.

Other Utility Programs

Analysis Program-1: The program provides a testing capability which assists the user in effective management of 3350/3344 DASDs.

AP-1 reports the operational status of the 3350/3344 hardware and media upon request by the operator. Brief messages (e.g., NO DRIVE PROBLEMS FOUND) appear on the console giving the user guidance for initiating further analysis. More detailed error analysis data, useful to the system programmer and system engineer, is directed to SYSLST.

AP-1 analyzes the operational status of the drive and the data and control paths for reading, writing, and arm movement. It further, at the direction of the operator, scans the volume to verify that all data is machine readable. With these aids, the user can determine whether an error situation is drive or media related and thus initiate the appropriate recovery procedures.

Maintain System History Utility: This program provides for a simplified and controlled installation of PTFs. It provides backup records and updates a PTF history. If severe problems occur after the application of a PTF, the system can be quickly restored using the copy saved previously.

COPYSERV: The program allows for automated merge of existing system and private libraries into newly created libraries, eliminating the manual effort of comparing directory listings and preparing the required copy cards thus reducing significantly the time required to prepare the new release for production status.

Recovery Management Support and Recording

Recovery Management Support (RMS) and Recovery Management Support Recording (RMSR) are standard functions under DOS/VS with the following exceptions:

- For models 115 and 125, recovery management support is a supervisor assembly option for all environments.

- Models 115 and 125 configurations which have no tapes, channel attached devices, or the integrated communications adapter, do not need Recovery Management Support Recording; the Models 115 and 125 processors perform RMSR functions for processor errors and for natively attached input and output device errors.

The functions of RMS and RMSR are described below:

Recovery Management Support - The Recovery Management Routines attempt to recover from or otherwise reduce the impact of machine malfunctions indicated by machine check and channel check interruptions. They feature:

- Transparent recovery after successful retry including error statistics collection.
- Continuation if the error is unrecoverable but the affected job or task can be terminated.
- Comprehensive error recording to support deferred maintenance.

Recovery Management Support Recording - RMSR collects and records on direct access storage (SYSREC) statistical and event data on matching errors. This recorded data facilitates early warning, rapid diagnosis, and repair of failing components, providing greater system availability due to improved preventive maintenance and shorter duration of planned and unplanned maintenance.

The error recording file on direct access storage can be totally or selectively edited and printed or transferred to magnetic tape for later editing and printing by the Environmental Recording, Editing and Printing (EREP) Program. A number of functional enhancements have been made to this program including integration of the recording, editing, and printing of ESTV records.

Tape and Disk Error Recovery Procedures - Routines that analyze error type and type of device in error and pass control to the proper ERP in an attempt to recover or to the ERP message writer in case of hard errors.

Diagnostic Aids

DOS/VS provides a number of system tools and facilities to help to allocate responsibility for program repair. These include:

- The Online Test Executive Program (OLTEP) which allows execution of machine diagnostic programs in the real storage allocated to the background partition of a multiprogramming environment at the same time as other system and user programs are executed in foreground partitions. OLTEP can be executed in real mode only.
- The Teleprocessing Online Test Executive Program (TOLTEP) is provided for telecommunications networks under VTAM. See description of *Virtual Telecommunications Access Method - VTAM* for information on TOLTEP.
- Problem Determination and Serviceability Aids (PDAIDS) which allow the tracing of the following events as they occur during program execution: Fetching and loading of program phases (Fetch/Load Trace) ... Input and output activity (I/O Trace) ... Supervisor Calls (SVC Trace) ... Certain QTAM events (QTAM Trace) ... Program checks in transient areas (Transient Dump) ... Certain VTAM events ... VTAM Buffer Pool Trace.
- System Debugging Aids (SDAIDS) which use the Program Event Recording Facility and Monitor Calling Facility of System/370 to provide additional stop and dump facilities and the following additional trace facilities: Page Trace ... Instruction Trace ... Alter Main Storage Trace ... Alter General Register Trace ... Successful Branch Trace.
- The Dump Generation Program (DUMPGEN) which generates a stand-alone storage dump program tailored to the requirements of the individual installation.
- The PDZAP program which allows quick applying of ZAP fixes to phases and transients in the Core Image Libraries without requiring a reassembly and recataloging of the changed phase or transient.
- The High Speed Standalone Dump facility allows the user to dump all of main storage on a DASD device or magnetic tape in a minimal amount of time and to immediately re-IPL the system and to return to normal operation.
- The Page Data Set Dump (SYSVIS) program provides a complete or selective dump of the Page Data Set.
- The Label Cylinder Display Program (LSERV) which produces a formatted listing of the file label information contained on the tracks of the label cylinder of the system residence extent.
- The Main Storage Alter Command (ALTER) which allows the system operator to change the contents of up to 16 bytes of virtual or real storage from the system console starting from a specified address.

- The Main Storage Dump Command (DUMP) which allows the system operator to obtain a dump of the contents of main storage on the System List Device (SYSLST).
- Analysis Program-1 (AP-1) aids the operator in analyzing 3350 or 3344 DAS error situations and in isolating such errors into hardware or media related areas.

AP-1 may be directed to test for hardware errors only or hardware and media errors. Simple result messages appear on the operator console. Detailed error related data are directed to SYSLST.

AP-1 will only analyze errors associated with 3350 or 3344 devices and requires that one of these devices be on the system.

Emulator Programs

Three emulator programs are provided to allow the emulation under DOS/VS of the following IBM systems:

- IBM System/360 Model 20 (emulated on Models 115, 125, 135, 135-3, and 138 only)
- IBM 1401, 1440, and 1460 Data Processing Systems (emulated on all System/370 models supported by DOS/VS except Model 115).
- IBM 1410 and 7010 Data Processing Systems (emulated on Model 145, 145-3, 148, 155II and 158).

Note: The 1401/1440/1460 Emulator Program and the 1410/7010 Emulator Program are no longer supplied as components of DOS/VS, but are available as an independent release. (Program No. 5747-CC3).

Execution of any emulator program requires the presence of the appropriate machine compatibility feature shown in the following table:

		125	135	145	155II
		135-3	145-3	148	158
Emulation of Model:	115	138	148		
System/360 Model 20	#7520	#7520	----	----	----
1401/1440/1460	----	#4457	#4457 or	#3950	
		#4458			
1410/7010	----	----	#4458	#3950	

The combination of emulator program and compatibility feature enables programs written for the emulated system to be executed on System/370. Most programs require no change for execution under the emulator, though certain special and custom features of the original system may not be emulated. (Those features not emulated are listed below under the headings of the individual emulator programs.)

Both emulator jobs and System/370 native jobs may be placed in a single input job stream for execution. The emulator programs may be executed in a multiprogramming environment concurrently with user-written or IBM-supplied programs including other emulator programs, except that on Model 125 only one 1401/1440/1460 emulator program can be executed at any given time and Model 20 emulated jobs cannot be multiprogrammed with 1401/1440/1460 emulated jobs.

Card, tape, and disk programs are emulated. Cards and tapes used and created by the emulated system can be used by the emulator programs without change (except that 7-track tapes in mixed parity are not accepted by the Model 20 emulator program and that tapes in mixed density are not accepted by any emulator program). Disk files created by the emulated system must first be copied to tape on the original system by means of a suitable utility program, and then restored to disk on System/370 by emulating the restore function of the utility program.

The following paragraphs contain information relevant to specific emulator programs.

The System/360 Model 20 Emulator Program - The System/360 Model 20 Emulator Program enables programs written for the System/360 Model 20 to be executed under DOS/VS on System/370 Models 115, 125, 135, 135-3, and 138 with the use of the machine compatibility features already listed.

Emulation is provided for Model 20 systems with main storage sizes from 4K to 32K bytes. All basic features are emulated.

The following features and operations are *not* emulated:

- Selective Tape Listing (on 1403)
- Dual Feed Carriage (on 2203)
- Merging cards from primary and secondary feeds of 2560 (when the device is emulated by the combination of 3504/3505 and 3525)
- Punch files from either 2560 hopper (when the device is emulated by the combination of 3404/3505 and 3525)
- 2560 Sort/Merge
- Punch stacker selection when 2560 is emulated by the combination of 3504/3505 and 3525

- 1401/1440 Compatibility (on System/360 Model 20 submodel 5)

The following types of Model 20 program *cannot* be emulated:

- Time-dependent programs
- Programs using mixed parity or mixed density on 7-track tape
- Programs using ASCII code
- Programs using the two commands associated with the 1403 Universal Character Set feature

The emulated Model 20 error conditions are always those of the Model 20 submodel 5.

For full details on emulator restrictions, see *Model 20 DOS/VS Emulator on S/370*(GC33-5388).

The following input/output devices are emulated: 2152 Printer-Keyboard ... 2501 Card Reader ... 2520 Card Read Punch ... 1442 Card Punch ... 2560 Multifunction Card Machine ... 1403 Printer ... 2203 Printer ... 2415 Printer ... 2401 Magnetic Tape Unit ... 2311 Disk Storage Drive.

Input and output devices *not* emulated are: 1255 Magnetic Character Reader ... 1259 Magnetic Character Reader ... 1270 Optical Character Reader ... 1419 Magnetic Character Reader ... Telecommunications Devices.

Full details on input and output device correspondence can be found in the manual: *Model 20 DOS/VS Emulator on System/370*(GC33-5388).

The emulator program provides the optional ability to emulate Model 20 unit record input and output operations on System/370 tape or disk devices. This option is called 'device independence' and provides better job throughput than when Model 20 unit record devices are emulated by equivalent System/370 unit record devices, particularly when Model 20 programs use intermediate card files. Furthermore in the multiprogramming environment the user does not need to dedicate unit record devices to the partition in which the emulator is being executed.

Model 20 features and instructions *not* emulated when using the device independence option are: Stacker selection for input files ... Optional Card Print Feature on 2560 Model A1 ... Punch Feed Read instructions ... Read Column Binary on 2501, 2520, and 2560 ... The 2560 Sort/Merge program ... Selection of two stackers only is emulated for 2520 and 2560 ... Primary and secondary feeds of 2560 cannot interact.

When using the device independence option all tape and disk devices supported by the emulator program may be used to emulate Model 20 unit record devices.

A Model 20/DOS/VS disk Data Interchange program is provided with the emulator program to enable disk files organized in Model 20 format (accessible by Model 20 emulated programs) to be converted to disk files organized in System/370 format (accessible by DOS/VS programs). The reverse conversion from DOS/VS format to Model 20 DPS format is also provided. Sequential, Indexed Sequential, and Direct Access data organization are all supported.

When converting a file from Model 20 format to DOS/VS format using the Data Interchange program the user may specify a new blocking factor; the blocksize specified must not exceed the capacity of a single track of the System/370 device. Files created under DOS/VS may be converted to Model 20 format provided the necessary Model 20 extents are initialized by a Model 20 DPS job executed under the emulator program.

The Data Interchange program does not require the presence of the Model 20 machine compatibility feature and may be executed in any partition of a DOS/VS system.

The 1401/1440/1460 Emulator Program - The 1401/1440/1460 Emulator Program enables programs written for the 1401, 1440, or 1460 Data Processing Systems to be executed under DOS/VS on System/370 Models 115, 125, 135, 135-3, 138, 145, 145-3, 148, 155II and 158 with the use of the machine compatibility features already listed.

Emulation is provided for 1401, 1440, and 1460 systems with core storage sizes of from 1,400 to 16,000 positions of core storage. All basic features of these systems are emulated, together with the following optional features: Expanded Print Edit ... Inverted Print Edit ... High-Low-Equal Compare ... Multiply/Divide ... Processing Overlap ... Sense Switches ... Advanced Programming/Indexing ... Bit Test ... Print Storage ... Additional Print Control ... Space Suppression ... Column Binary ... Binary Transfer ... 51-column Card ... Punch-Feed Read ... Card Image (on 1442) ... Selective Stacker ... Scan Disk.

Features and operations *not* emulated are: Selective Tape Listing (on 1403) ... Compressed Tapes ... Mixed Density Tapes ... Read Compare Feature (on 1404).

The following input and output devices are emulated (full details of input and output device correspondence are to be found in the manual *1401/1440/1460 DOS/VS Emulator on S/370*): 1402 Card Read Punch ... 1442 Card Read Punch ... 1442 Card Reader ... 1444 Card

Punch ... 1407 Console Inquiry Station ... 1447 Console ... 1403 Printer ... 1404 Printer (continuous forms only) ... 1443 Printer ... 729 Magnetic Tape Units ... 7330 Magnetic Tape Units ... 7335 Magnetic Tape Units ... 1301 Disk Storage ... 1311 Disk Storage ... 1405 Disk Storage.

Input and output devices *not* emulated are: 1445 Printer ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Optical Readers ... Magnetic Character Readers ... Teleprocessing Devices ... Audio Response Units.

Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so that they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so that they can then be used on the original system.

The 1410/7010 Emulator Program - The 1410/7010 Emulator Program enables programs written for the 1410 or 7010 Data Processing Systems to be executed under DOS/VS on System/370 Models 145, 145-3, 148, 155II and 158 with the use of the machine compatibility features already listed.

Emulation is provided for 1410 and 7010 systems with core storage sizes of from 10,000 to 100,000 positions. All basic features are emulated, together with the following optional features: Processing Overlap ... Priority Processing ... Two Channels on 1410 ... Inverted Print Edit ... 7010 Second, Third and Fourth Data Channels ... 7010 Store and Restore Status ... 7010 Floating Point Arithmetic.

Features and operations *not* emulated are: 1410/1401 Compatibility Mode ... Column Binary ... 51-column Cards ... 1410/7010 Diagnostic Instruction Branch on C-bit ... 7010 Program Relocation and Storage Protection ... 7010 Interval Timer ... Stacker Select ... Mixed Density Tapes.

Input and output devices emulated are (full details of input and output device correspondence are to be found in the manual *1410/7010 DOS/VS Emulator on System/370*(GC33-5385)): 1402 Card Read Punch ... 1442 Card Reader ... 1415 Console ... 1403 Printer ... 729 Magnetic Tape Units ... 7330 Magnetic Tape Units ... 1301 Disk Storage ... 2302 Disk Storage.

Input and output devices *not* emulated are: 1311 Disk Storage Drive ... 1405 Disk Storage ... 7340 Hypertape Drive ... 1011 Paper Tape Reader ... 1012 Paper Tape Punch ... Magnetic Character Readers ... Optical Readers ... Teleprocessing Devices ... Audio Response Units.

Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so that they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so that they can then be used on the original system.

Other Program Support

The *Program Product* section describes the Program Products supported under DOS/VS, including language processors, sort/merge processors, utility programs and application programs. These Program Products, in addition to providing extended functional capabilities over any predecessor Type I or Type II programs, also provide support for new input and output devices. The specific devices supported are shown in the description of each program.

Type I and Type II processors that run under DOS/VS are listed in those sections. In determining the applicability of these programs to a customer's needs particular attention must be given to the availability of appropriate device support within the programs.

DOS/VS FD Macros and Utility for the 3735 (5747-AZ1)

Form Description Macros and Utility Support for the 3735 is available as a separate program operable under DOS/VS.

This SCP provides support for 3735 Programmable Buffered Terminal Users on DOS/VS systems with BTAM. It assembles user-written Form Description Programs and prepares them for subsequent transmission to the 3735.

General Documentation (available only from Mechanicsburg)

IBM3735 Programmable Buffered Terminal Concepts and Application (GA27-3043), *IBM 3735 Programmable Buffered Terminal Form Description Macro Instructions and Form Description Utility PLM* (GY30-3000), and *IBM 3735 Operator's Guide*(GA27-3061).

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VIRTUAL MACHINE FACILITY-VM/370
5749-010

IBM Virtual Machine Facility/370 (VM/370), a multiple-access timesharing system for System/370 Models 135, 135-3, 138, 145, 145-3, 148, 155II, 158, 158AP, 165II, 168, 168AP, and 3031, 3031 AP, 3032, and 3033 Processors contains four major elements:

1. A control program, CP, which controls the resources of the real computer to provide multiple virtual machines. Each virtual machine can run a different operating system such as OS (/VS), DOS (/VS), CMS, and RSCS and can provide virtual storage support for operating systems that do not offer such support.
2. The Conversational Monitor System, CMS, a component that gives users a wide range of conversational facilities including creation and management of files and compilation, testing, and execution of problem programs.
3. The Remote Spooling Communications Subsystem, RSCS, a component that enables users to transmit files to and receive files from remote stations in the RSCS teleprocessing network.
4. The Interactive Problem Control System, IPCS, a component that enhances the support of VM/370 by providing interactive online facilities for problem management, problem determination, and problem isolation.

System/370 Models 158MP and 168MP are also supported but only when running in uniprocessor mode or with an asymmetric I/O configuration. In an asymmetric I/O configuration, all I/O attached to the system must be attached to one processor.

THE VIRTUAL MACHINE

The control program (CP) of VM/370 manages the resources of a System/370 to provide virtual storage support through the implementation of virtual machines.

Each virtual machine user appears to have the functional capabilities of a dedicated System/370 available. The remote terminal acts as the virtual systems console for the virtual machine. Other users may be running batch, teleprocessing, testing or timesharing jobs at the same time.

Each user can specify the configuration required: the number, type, and I/O addresses of all devices to be used, and from 8192 bytes to 16 million bytes of storage, provided sufficient resources are available with the real machine's configuration.

Virtual devices, excepting virtual channel-to-channel adapters, must have real counterparts. For example, many users' virtual readers, punches, and printers can be "mapped" or redirected onto common spool disks. VM/370 allows a physical disk pack to be logically subdivided into many separate minidisks, or virtual disks, each with its own virtual I/O address and each encompassing a user-determined number of contiguous cylinders. The use of virtual disks significantly expands the number of different users or operating systems that can have concurrent access to direct access storage devices, and may improve the utilization of available disk space without compromising the integrity of any user's data stored on the disk.

Each user's virtual computer comprises a processor operator's console (the user's remote terminal), a virtual Processor with or without Dynamic Address Translation, a virtual storage size ranging from 8192 bytes to 16 million bytes, and virtual I/O channels and I/O devices. Virtual machine configurations may also include transmission control units and channel-to-channel adapters. Virtual I/O devices are logically controlled by the virtual machine's operating system and not by VM/370, with the exception of those virtual unit-record devices that are spooled by VM/370 to/from disk. The basic device support for the proper number and type of I/O devices must be generated into the operating system's supervisor or nucleus.

The following operating systems can execute in VM/370 virtual machines: DOS, DOS/VS, OS/PCP, OS/MFT, OS/MVT, OS/VS1, OS/VS2, OS-TSO, OS-ASP, PS44, RSCS, APL/DOS-360 (with CP option), VM/370, and CMS. The control program intercepts, translates, and schedules all real I/O operations of the virtual machine. All virtual machines execute in problem state, and the control program intercepts and processes all interrupts and privileged instructions. Only the control program executes in the supervisor state.

The user can select various versions and levels of IBM operating systems, including OS/VS, DOS/VS, OS, and DOS, to run in the virtual machine, subject to the following major restrictions:

- Machine or program timing dependencies may not exist. (That is, there is no reliance on a certain action or activity being completed within a fixed interval of time.)
- The **DIAGNOSE** instruction may not be used for machine control by an operating system running in a VM/370 virtual machine. Use of the **DIAGNOSE** instruction for communication with VM/370 is permitted and recommended. See *VM/370: System Programmer's Guide* (GC20-1807).
- The **READ DIRECT** and **WRITE DIRECT** instructions may not be used in a VM/370 virtual machine.
- No dynamic modification of channel programs is permitted except within a virtual = real machine or when performed by either the OS

Indexed Sequential Access Method (ISAM), OS/VS1 BTAM Autopoll, or the OS/VS Telecommunications Access Method (TCAM) Level 5 and above. (A dynamically modified channel program is one that is changed by the processor or the channel during the interval between the execution of the **START I/O** instruction and the channel end interrupt.)

- VM/370 supports OS/VS TCAM Level 5 and above in a virtual environment. This support is intended for use by TCAM applications in a testing environment and is not recommended for production systems. When attempting to identify problems which are encountered when using TCAM under VM/370, it may be advantageous to recreate the problem in a standalone OS/VS1 or OS/VS2 environment.
- DOS Emulation under OS in a virtual machine is not supported. VM/370 provides its own method of running DOS and OS systems concurrently.
- OS/VS2 must run in uniprocessor mode.

For a comprehensive list of restrictions, see the *IBM Virtual Machine Facility/370: Planning and System Generation Guide* (GC20-1801).

THE CONTROL PROGRAM

The control program (CP) of VM/370 creates and controls virtual machines, multiprogramming the resources of the real computer to offer concurrent execution of multiple virtual machines. Local and remote terminals on the real computing system are controlled either by CP as virtual system consoles or by a multiple-access operating system executing in a virtual machine (e.g., RSCS).

All virtual machines execute in problem state, providing the basic mechanism for control by permitting either CP or the Virtual Machine Assist hardware feature to trap and process all interrupts and privileged instructions. Extended Control-Program Support for VM/370 is an expansion of Virtual Machine Assist to further reduce the real supervisor state time used by VM/370 while performing its control functions. The reduction in VM/370 supervisor state time is accomplished in three ways. 1) Certain privileged instructions are emulated by the hardware rather than simulated by the software. 2) A hardware assist has been implemented for VM/370 that is designed to be executed only by VM/370. 3) Extended Control-Program Support for VM/370 also includes support of an interval timer in a virtual machine. The heavily used portions of CP are kept in main storage. All portions of CP execute in supervisor state with Dynamic Address Translation off.

Execution under VM/370 does not require communication between CP and the virtual machine operating system since, subject to the restrictions listed above, the virtual machine interface is that of the real machine. Communication is available however through use of the Diagnose interface: CMS utilizes the **DIAGNOSE** instruction for many operations including I/O operations; and VS1 Release 4 and above utilizes it to support VM/VS Handshaking.

Time Management: CP periodically gives each virtual machine access to the real processor for a small amount of time, called a "time slice". To determine how frequently and for how much time a virtual machine should gain access to the real processor, CP examines the number of console requests or terminal interrupts the virtual machine has issued during its past time slices. If these were many, CP defines the virtual machine as a conversational user and assigns it the smaller of two possible time slices. If they were few, the virtual machine is considered a nonconversational user and is assigned the larger time slice. CP gives conversational users more frequent access to the processor, and the major objective of its algorithms is to provide interactive users the best possible response times.

Storage Management: Each virtual machine's storage is created and controlled by CP as virtual storage and is organized into 4K blocks called pages and 64K blocks called segments. For each virtual machine, CP creates and maintains a set of segment and page tables to describe the virtual storage and to reflect the allocation in real storage. In addition CP creates a set of shadow page tables for each virtual machine that creates and controls virtual storage of its own.

The active pages from all logged-on virtual machines and from the pageable routines of CP compete for available page frames. When the number of page frames available for allocation falls below a threshold value, CP determines which virtual storage pages currently allocated to real storage are relatively inactive and initiates suitable page-out operations to disk for them. Paging is done on demand, thus a page-in operation does not occur until a page is referenced during virtual machine execution.

One or more virtual storage segments can be read-shared among virtual machines. The information to be shared must be part of an operating system (e.g., CMS) that does not create or control virtual storage and that has been recorded ("saved") in page-format on a VM/370 system disk. These segments can be outside the address spaces of the virtual machines.

Virtual I/O Management: Because virtual machines execute in problem state, CP gains control whenever a **START I/O** instruction is issued by a virtual machine operating system. CP copies into its own

VM/370 (cont'd)

work area the channel command list and pages into real storage all virtual storage locations required for data transfer. If a virtual device is a minidisk, any cylinder numbers specified are modified to reflect the true location of the data; the virtual device address is mapped to the real device address. The virtual machine is given a suitable condition code to indicate the status of the START I/O operation, and CP reflects the interrupts caused by the I/O operation to the virtual machine enabling it to initiate any required error recovery operations.

Since a virtual disk device (full disk or minidisk) may be shared among multiple virtual machines and a particular virtual machine may have read-only or read/write access to a shared disk, CP verifies each virtual machine I/O operation against parameters in the virtual machine's configuration to ensure device integrity.

Spooling: CP spooling facilities allow multiple virtual machines to share unit record devices by intercepting and modifying the Start I/O operations to those virtual unit record devices designated as spooled in the virtual machine configuration. CP uses its paging I/O mechanism to create the disk records which act as intermediate storage between the real unit record devices and the virtual machines.

The spooling facilities allow data files to be transferred between virtual machines or between different operating systems executing at different times in the same virtual machine. In addition, virtual machine console input/output data may be spooled to disk for later printing.

CP Commands: CP commands allow control of the real computing system and VM/370 and provide user control of virtual machines and associated CP facilities. CP commands can be used at any time without regard to which operating system is executing in the virtual machine. A user's privilege class(es), defined as part of his virtual machine configuration, defines his allowable subset of CP commands.

THE CONVERSATIONAL MONITOR SYSTEM

A generalized conversational facility for interactive program development, problem solving, and end-user applications is offered by the Conversational Monitor System (CMS) component of VM/370.

The CMS command language provides each user with a wide range of capabilities at his remote terminal, such as:

- Creating source programs, data, and text files directly on disk.
- Adding, deleting, modifying, rearranging, extracting, or merging files and/or portions of files.
- Compiling, testing, and debugging some types of OS, DOS problem programs under CMS. These tasks can also be performed for CMS problem programs as well. Languages supported under CMS include the latest levels of COBOL, PL/I, FORTRAN, BASIC, APL, and Assembler.
- Creating complete job streams to be passed to batch operating systems such as DOS or OS for compilation and/or execution. The resultant output can be printed on a high-speed printer or directed back to CMS for analysis and correction by the user.
- Submitting high-resource jobs to a background CMS Batch Facility for serial execution.
- Extending CMS facilities to suit his own requirements, e.g., creating additional commands from his own programs or developing command procedures as CMS EXEC files.

CMS allows a programmer to increase his productivity by reducing or eliminating requirements for JCL preparation and by permitting the user to assemble and test whenever he wants, as often as he desires, and for as long as he needs, provided that sufficient I/O devices are available. A programmer can concentrate his efforts on one project at a time, completing projects faster, and putting applications into productive use sooner. The VM/370 data security and user-isolation features protect other users from his errors, and, likewise, protect his data, programs, and disk files from access or destruction by others.

CMS is a single task system designed specifically for the virtual machine environment of VM/370. Each CMS user executes in his own virtual machine. User programs and CMS commands executing under CMS communicate with the user via I/O to the virtual operator's console. Programs coded using CMS macros or certain OS or DOS macros will execute under CMS with restrictions in the following major areas:

- ISAM
- Multitasking
- TP access methods
- Overlay program structures
- Other I/O-related restrictions

For more detailed information about the execution-time restrictions of assembler language programs under CMS, refer to the publication *IBM VM/370: System Programmer's Guide* (GC20-1807). Refer to the PP-Systems section of the sales manual for additional information on the Compiler Program Products supported under CMS; these are listed in the section entitled *IBM Program Product Support for VM/370*.

The CMS file system utilizes chained, fixed-length blocks that are allocated and deallocated automatically as required by the logical file size. Programs executing under CMS can read and write these CMS files via CMS I/O macros, OS BSAM, QSAM, or BDAM macros, or

DOS sequential I/O macros. CMS files are identified by a three part designator consisting of filename, filetype, and filemode; filename and filetype are self-explanatory, and filemode describes the location and access mode of the file. CMS files may be read and written only by programs executing under CMS.

CMS offers the capability of reading, but not writing or updating, OS sequential and partitioned data sets using the CMS **MOVEFILE** command and OS QSAM, BPAM, and BSAM macros. Under CMS, users can also read DOS SAM data files using the same commands and macros used for reading OS data sets as well as the DOS sequential I/O macros. To provide data portability and compatibility between CMS, OS, and DOS, CMS supports read, update and write access to VSAM data sets from COBOL, PL/I, and VS BASIC programs.

VM/370 ASSEMBLER

The language of the VM/370 Assembler is the same as the language of the OS/VS Assembler. Four system macro libraries are distributed and contain CMS macros as well as OS Release 20.6 macros. The language of the DOS/VS Assembler is a subset of the language supported by the VM/370 Assembler. Assembler language programs written using DOS/VS macro instructions may be processed by the VM/370 Assembler if the user-installation has created a CMS library containing a copy of the DOS/VS macros found in the DOS/VS source statement library. However, no option is available to flag uses of the extended features of the language which are supported by the VM/370 Assembler but not by the DOS/VS Assembler.

REMOTE SPOOLING COMMUNICATIONS SUBSYSTEM - RSCS

VM/370 remote spooling support is provided for the general user in the form of the Remote Spooling Communications Subsystem (RSCS) component. RSCS, using the existing VM/370 spool file system, allows spooling of data between any virtual machine and 2770, 2780, 3770 (except 3777-2) as a 2770; 3776 and 3777-1 also as a 3780, and 3780 terminals as well as 8100/DPPX running DPPX/RJE (BSC) and HASP supported workstations and main processors running HASP, ASP, RES, JES2 and JES3.

RSCS is a multitasking supervisor supporting multiple, concurrent remote spooling operations while running in a single VM/370 virtual machine. It is designed so that a separate task supports the specific device characteristics of each remote terminal or workstation attached to the virtual machine via a teleprocessing line. The RSCS supervisor provides each task with a common access method to the VM/370 spool file system and an Execute Channel Program (EXCP) level interface for I/O to the teleprocessing line.

Printer or punch files that the VM/370 virtual machine user wants to have transmitted to a supported remote device need only be spooled to the RSCS virtual machine with the destination designated via the CP **TAG** command. The proper task for the remote device will be initiated and the files will be sent. For files being transmitted from the remote device to a virtual machine, RSCS will read data from the remote device, produce VM/370 spool files from the data, and spool the files to the virtual machine designated by the user; these files will remain in the virtual machine's card reader until disposed of by the user.

RSCS supported remote stations are of two general types; *nonprogrammable* and *programmable*. Support is provided for both types of stations.

Non-Programmable Terminal Support

This task under RSCS provides support for the 2770, 2780, 3770 (except 3773-2 and 3773P Models) as a 2770; (3776/3777-1 also as a 3780), and 3780 terminals via the 3704/3705 Communications Controller in emulation mode only, via the 2701 Transmission Control Units, via the Integrated Communications Adapter available on the 135, 135-3, 138, or, for the 2770, 2780 and 3780 terminals, via the 2703 Transmission Control unit.

Programmable Terminal Support

Any processor now supported as a HASP workstation when programmed to run as a HASP workstation is supported as a workstation by the Spool MULTI-LEAVING (SML) support under RSCS. The DOS/VS Remote Job Entry Workstation Program (PRPQ WF0358) is also supported. Any processor running HASP, ASP, RES, JES2, and JES3 is supported as a main processor by RSCS when it itself assumes the role of a HASP programmable workstation. For specific configurations supported, refer to the HASP pages in the sales manual.

RSCS offers these advantages:

- A multitasking supervisor designed to facilitate transmission of data to and from VM/370 systems.
- Common support for the 2770, 2780, 3770 (except 3777-2) as a 2770; 3776/3777-1 also as a 3780, and 3780.
- Access to main processors running HASP, ASP, RES, JES2, and JES3.
- Access to HASP Programmable Workstations.
- Access to 8100/DPPX with DPPX/RJE (BSC)

VM/370 (cont'd)

- Multiple telecommunications workstation lines supported by one RSCS virtual machine for remote data transmission.
- Common command language for all data control functions.
- Command language compatible with the VM/370 system operator's spool file control commands.
- Entry of a subset of the control commands from the remote station.
- RSCS access security provided by password validation by the tasks of remote stations before data transmission begins.

INTERACTIVE PROBLEM CONTROL SYSTEM - IPCS

VM/370 IPCS support is intended for use by systems programmers

IPCS is intended to reduce the time expended in managing and resolving programming problems and to reduce the necessity of doing problem management, problem determination, and problem isolation using hardcopy documentation.

The problem management facilities provide individual disk resident problem reports and includes commands that allow viewing and updating of a disk resident problem status file. These facilities allow both the system programmer and the PSR to manage problems from their occurrence through their resolution.

Problem determination facilities standardize the problem reporting process, identify previous occurrences of the same problem on that system and allow faster and more specific identification with similar problems previously experienced by the entire VM/370 customer base. Duplicate problem recognition: 1) reduces the amount of unnecessary hardcopy documentation and 2) allows faster identification of available fixes that can be applied to the system.

Online problem isolation facilities provide the capability to view and diagnose disk resident problem related data; e.g., CP abend dumps without the use of hardcopy documentation. This allows the system programmer or PSR to interactively diagnose a CP abend dump from a VM/370 supported terminal to determine the need to output the dump in hardcopy.

VM/370 teleprocessing support allows the use of IPCS by support personnel located remotely from the customer's location. There is the dependency upon the availability of the necessary teleprocessing facilities on the customer's system and at the remote location.

VM/370 architecture provides the facilities necessary to restrict data access to any given user of the system including a PSR using IPCS facilities. It is the customer's responsibility to determine what data the system needs for protection. In allowing the PSR to work in an online environment, the system programmer using standard VM/370 facilities can control the PSR's access to only the necessary and pertinent data files associated with the problem being diagnosed.

VM/370 HIGHLIGHTS

- Provides virtual machine and virtual storage capabilities for System/370.
- Offers a general-purpose, conversational timesharing system suitable for problem solving, program development, and end-user applications.
- Allows many types of batch problem-solving applications to be run from a remote terminal with no change to the batch program.
- Allows DOS/VS, OS/VS1 and OS/VS2 virtual machines, as well as those running DOS or OS, to run concurrently on the same System/370. Where your customer has specific throughput or terminal response requirements, you should plan to benchmark VM/370 to ensure that any proposed configuration will meet the customer's performance needs.
- Allows multiple copies of the same operating system to run concurrently in different virtual machines, eliminating the need for DOS customers for example, to multitask unrelated jobs together in the same partition and permitting the use of specialized virtual machine systems.
- Allows system generation, system update, and system testing, as well as operating system conversion and testing activities concurrent with other work.
- Provides a high degree of security, isolation, and integrity for each user's operating system, programs, and data. Restricts a user's capability to access or alter any portion(s) of other users' virtual machines.
- Provides disk "password" protection to limit authorized access to users' disks; and "read only" disk protection to minimize the possibility of destruction of information or to allow shared reading of disk files.
- Provides device address independence for all operating systems that run under the control of VM/370.
- Provides facilities which supplement the reliability, availability and serviceability (RAS) characteristics of the System/370 architecture.

- Allows operating systems which do not themselves support the Dynamic Address Translation facility to use virtual storage as though it were real storage.
- Provides the ability to subdivide physical disk packs into virtual disks, each with its own virtual I/O device address, disk label, Volume Table of Contents (VTOC), and a user-specified number of contiguous cylinders starting with virtual cylinder zero.
- Allows one or more users to test privileged code in their own virtual machines.
- Allows new computer operators to get "hands on" experience using a remote terminal and their own virtual machines.
- Permits shared use by all virtual machines of the 2770, 2780, 3770 (except 3777-2) (as a 2770; 3776/3777 also as a 3780), and 3780 terminals for remote printing, punching and card reading.
- Supports communication with other Processors running HASP, ASP, JES2, JES3, RES, the DOS/VS RJE PRPQ, DPPX/RJE, and VM/370.
- Provides the full capabilities of the 3270 to users of VS APL through support of the 3270 Data analysis APL Feature. VS APL support of the Feature aids in the interchange of APL terminal procedures and applications among APL and 3270 users by providing a consistent terminal protocol across these applications.
- Provides options to improve the performance of selected virtual machines.
- Provides support for a virtual and/or real channel to channel adapter. VM/370 can run on either or both of two processors coupled by a real channel-to-channel adapter. Support of the virtual channel to channel adapter allows the user to run control programs designed to operate on directly coupled systems under VM/370.
- Allows the use of virtual machines for backup of programs currently being run on other System/360 or System/370 computers having equivalent devices but differing I/O addresses and storage size.
- Provides the potential for programmers to increase productivity through use of the Conversational Monitor System.
- Eliminates the need for JCL (Job Control Language) preparation in most cases when compiling, assembling and/or testing in CMS.
- Simplifies the creation and manipulation of source programs on disk, and allows the user to examine selected portions of program listings and storage dumps at his remote terminal.
- Allows any user to set up frequently used sequences of commands into special procedures to eliminate the repetitious re-keying of those command sequences.
- Allows the spooling of virtual machine console input and output, including CP commands and responses.
- Allows the use of one or more dedicated channels by any number of virtual machines depending on the total number of real channels available on the system. VM/370 must have at least one selector or block multiplexer channel for use by paging, spooling and VM/370 system residence devices. I/O devices attached to a dedicated channel can be accessed only by the virtual machine to which the channel is dedicated.

RELEASE 5 HIGHLIGHTS
Support of the 303X Processors

VM/370 now supports the 3033 Processor. This support includes the following:

- Use of the channel attached consoles as primary system console and alternate console.
- Use of the new processor numbers to determine the duration of the time slice.
- Integrated channels
- CPEREK changes to recognize and process logout formats of the new processor. EREP processing has been enhanced to allow EREP processing to be independent of the content and EC level of the extended logout areas of the 3033 Processor. This is accomplished by reading frames stored on the 7443 Service Recording File and using them to format and interpret error records.
- The CP error recording logic has been changed to allow recording on from two to nine cylinders, as specified by the user during system generation. Error record types are intermixed in the error recording area.

Release 5 does not contain virtual support for the System/370 Extended Facility on the 303X Processors or the System/370 Extended Feature on the 158/168 Processors.

Support of Channel Check Reflection

VM/370 (cont'd)

Support for the reflection of channel checks has been added in Release 5. This support includes reflection of channel control checks, interface control checks, and channel data checks to virtual machines.

The support includes integrated channels on the 135, 135-3, 138, 145, 145-3, 148, 155-II, 158, 158-3, 3031, 3032 and 3033.

It also includes support for the standalone 2860, 2870, and 2880 channels on the 165-II, 168, and 168-3 processors.

CMS Support of DOS/34

Release 5 contains support in CMS/DOS and CMS VSAM for new devices and new function introduced in DOS/VS Release 34.

- Support of 3330-11 native.
- Support of 3350 native.
- Increase page length flexibility when producing printed output from Access Method Services.
- Support of the 3203-4 Printer as a 3211 compatible printer.

This support removes the restriction on use of the 3330-11 and 3350 with VSAM under CMS.

IPCS as a Basic Component

IPCS has been made a basic component of VM/370.

- Separate installation of IPCS is no longer required.
- As of Release 5, VM/370 will no longer include the VMFDUMP module DMKEDM. IPCS VMFDUMP is the improved functional replacement.

IPCS was announced for VM/370 on January 12, 1976

Monitor to Disk

This support provides the user with the option of recording output from the VM/370 Measurement Facility on disk. The previous support required the user to dedicate a tape drive to the Measurement Facility for those periods of time that the user wished to record performance data. The new support makes it more practical for the user to make frequent measurements. By doing so and by using the VM/370 Performance/Monitor Analysis Program FDP, the user can gain a better understanding of the operation of the system and its performance.

AP HIGHLIGHTS

The VM/370 AP support provides for concurrent execution of work on the two processors of an Attached Processor System in the following states:

- Both processors can execute in the problem state concurrently.
- Either processor can execute in the supervisor state while the other processor executes in the problem state.
- In some instances both processors can execute in the supervisor state concurrently.
- Because of the system design, all I/O requests must be issued by the host processor and all I/O interrupts will be received on the host processor.
- The VM/370 AP support makes use of the Virtual Machine Assist feature (if present) on either or both instruction processors in an AP system.
- The VM/370 AP support will include automatic processor recovery. If the Attached Processor is unable to function because of hardware malfunctions, VM/370 will attempt to execute in uniprocessor mode on the host processor. Should the host processor experience hardware malfunction, VM/370 will terminate operation since no I/O capabilities exist on the Attached Processor.
- The VM/370 AP support makes use of AP hardware features including:
 - Shared Main Storage
 - Prefixing
 - Processor Signaling
 - Processor Address

HIGHLIGHTS OF RELEASE 4

VM/370 Support for the 3850 Mass Storage System (MSS)

The Mass Storage System (MSS) is a hierarchical storage system that makes up to 472 billion bytes available online via 3330 devices. Access and storage are controlled by the IBM 3850 Mass Storage System. The Mass Storage Control (MSC) accepts requests for data from up to four System/370 processors. When data is no longer needed, it is moved to slower, less expensive storage medium, freeing the fast-access DASD space for current use.

VM/370 supports up to four dedicated paths for each 3850 MSS. VM/370 dedicated MSS support allows up to four virtual machines concurrently running VS1, SVS, or MVS operating systems generated with 3850 MSS support to each control an interface to a common 3850 MSS. Each of the Mass Storage Control (MSC) connections can

be attached to a different VM/370 virtual machine or a different processor. Each virtual machine using an MSC port reduces by one the number of other real processors that may be connected to the 3850 Mass Storage System. Other virtual machine not using the MSS can be run concurrently.

Alternate Path Support

VM/370 Alternate Path Support will provide for up to four channels on one control unit to be attached to VM/370 through the use of the Two Channel Switch and Two Channel Switch, Additional Features. Since one device may be attached to two real control units by use of the String Switch feature, eight paths to a given device are available to the control program when the maximum number of alternate channels and alternate control units are specified.

If the primary path to a device is busy when a I/O request is received for that device, VM/370 can select a free path, allowing for immediate I/O initiation on the available alternate path. When no available path exists for a device, the I/O request is queued off multiple busy/scheduled paths. When a path becomes available, the waiting I/O request is initiated on that path.

Virtual Reserve/Release Support

VM/370 will support Reserve/Release operation codes for shared DASD as though each virtual machine has a separate channel path to a shared device. The Reserve/Release operation codes will be simulated on a virtual basis for minidisks, including full extent minidisks.

Removal of Free Storage Abend when Adding Virtual Devices

VM/370 will no longer abend if a request for free storage cannot be obtained when virtual devices are being added to a user's configuration. Instead, an appropriate message will be issued.

Interactive Problem Control System (IPCS) Enhancements

Contained in Release 4 are enhancements to the IPCS VMFDUMP command and DUMPSCAN command.

Support of System/370 Models 158 and 168 Attached Processors

The VM/370 AP support will provide for concurrent execution of work on the two processors of an Attached Processor System in the following states:

- Both processors can execute in the problem state concurrently.
- Either processor can execute in the supervisor state while the other processor executes in the problem state.
- In some instances both processors can execute in the supervisor state concurrently.

Because of the system design, all I/O requests must be issued by the host processor and all I/O interrupts will be received on the host processor.

The VM/370 AP support makes use of the Virtual Machine Assist feature (if present) on either or both instruction processors in an AP system.

The VM/370 AP support will include automatic processor recovery. If the Attached Processor is unable to function because of hardware malfunctions, VM/370 will attempt to execute in uniprocessor mode on the host processor. Should the host processor experience hardware malfunction, VM/370 will terminate operation since no I/O capabilities exist on the Attached Processor.

The VM/370 AP support makes use of AP hardware features including:

- Shared Main Storage
- Prefixing
- Processor Signaling
- Processor Address

RELEASE 3 PLC 8 HIGHLIGHTS

VM/370 support for the System/370 Models 135-3, 138, 145-3 and 148 includes the standard feature of Extended Control-Program Support (ECPs) which is available only on these models. This feature is an expansion of the current virtual machine assist. Extended Control-Program Support is a hardware assist that reduces Processor time needed to execute certain frequently used VM/370 supervisor functions by as much as 55%. The performance improvement is in addition to that resulting from the improved internal instruction rate of the hardware and the current virtual machine assist. Extended Control-Program Support will be used if a test performed during IPL shows it to be present and compatible, thus allowing a particular VM/370 system to be run on the newly supported models as well as on other models. Console support for the Models 138 and 148 is provided in both display and printer/keyboard modes. The 3286 Printer Model 2 support is provided in the printer/keyboard mode. The 3203 Model 4 printer, which is natively attached for the System/370 Models 138 and 148, is also supported as a real or virtual device.

VM/370 (cont'd)

'SET AUTOPOLL ON' substantially reduces the overhead required by CP to service BTAM autopoll channel programs by bypassing the testing of the channel program and allowing notification to CP via a DIAGNOSE interface whenever an autopoll CCW has been modified. (Supported by OS/VS1 Release 6 only.)

VM/370 support of the 3270 Data Analysis/Text Keyboard includes:

- Extensions to the CP commands 'TERMINAL' and 'QUERY'
- Access to 151 characters. Included is the 120 character TN, T11 character set plus 32 graphics, code and control characters, allowing new approaches to text applications
- The COPY function to copy text characters from a screen to a 3284-2 or 3286-2 matrix printer (equipped with feature 1066 for hard copy printouts).

Support of many of the OS/VS2 EREP parameters allows the installation more flexible definition of the contents of the EREP output. Data from the error recording area can now be concatenated to data previously recorded on an output tape. Most of the original VM/370 operands have been replaced with their OS/VS2 equivalents due to conflict in meaning and usage between the original VM/370 operands and the OS/VS2 parameters. The HELP operand has been deleted.

The Virtual Machine Communication Facility allows virtual machines to communicate via a CP DIAGNOSE protocol. The support provides a number of functions that can be invoked by DIAGNOSE instructions to establish and control communications. These include authorization to establish communications, data transfer and signaling, and control functions. The interface is provided for use by user written programs executing in virtual machines.

HIGHLIGHTS OF RELEASE 3

CMS support of VSAM provides indexed file capability to high level language programs executing under CMS, data compatibility with OS and DOS, enlarged file capacity for CMS end user applications, and record I/O for users of VS BASIC. CMS will support VSAM via integration of the DOS/VS VSAM component and simulation of DOS/VS supervisor and I/O functions. CMS support of VSAM will permit user programs written in COBOL, PL/I, or VS BASIC to utilize VSAM function under CMS and will include a new command to invoke VSAM Access Method Services. Assembler program usage of VSAM function and the ISAM Interface Program (IIP) are not supported.

CMS support of DOS/VS program execution adds a new option to the SET command of CMS to enable the terminal user to specify the DOS environment in CMS and invoke a new set of CMS commands. In the DOS environment CMS simulates DOS/VS supervisor and I/O functions thereby allowing execution of many DOS programs. Execution of DOS programs is initiated via commands entered at the CMS terminal or via entry to the CMS Batch Facility. Assembler program execution is supported only insofar as the program utilizes DOS/VS services required in CMS for COBOL and PL/I compiler and execution library support.

Support of the 3270 Data Analysis-APL Feature brings increased productivity to the CMS user of VS APL through improved interactive data processing. The new Feature added to the efficiencies of the 3270 Information Display is designed to increase System/370 use by data processing professionals and to attract new applications of new users. The Feature:

- Provides a US EBCDIC extension set for APL characters, as well as dual case, and characters of the "TN" print train (which are displayable and printable only).
- Retains full editing (substitute, delete, insert) and formatting capabilities of the 3270, on current and planned applications.
- Requires minimal retraining either for keyboard/printer users of APL or for 3270 users.
- Operates with Featured and non-Featured devices on the same Featured control unit.
- Is orderable from the factory or installable in the field.

Support of the new program product VS APL provides a shared variable facility that allows APL users to communicate with non-APL programs called "auxiliary processors" operating outside the APL environment. This provides the APL user selected data management services and selected CP and CMS command service, offering enhanced facilities for problem solving and end-user applications in CMS.

Support of the DOS/VS COBOL and DOS PL/I Optimizing Compiler and library program products provides additional program development and end-user application facilities in CMS to DOS-based installations.

Support of the new 3350 and 3344 Direct Access Storage provides VM/370 support as well as support in DOS/VS, OS/VS1, and OS/VS2 running in a VM/370 virtual machine.

Extended shared segment usage by CMS provides sharing of VSAM and DOS/VS supervisor and I/O functions among CMS users. In addition, the CMS editor, the EXEC command processor, and the OS simulation routines are now reentrant and can be placed in a discontinuous shared segment by the installation. CMS is utilizing CP

extensions to the current support of named and saved systems to share segments which are outside the address space of a virtual machine.

Extended CP protection of shared segments allows the Virtual Machine Assist feature to be activated for shared, named systems, thus allowing shared CMS systems to take advantage of the performance improvements of this feature.

Improved spool file recovery adds a new checkpoint start procedure to the recovery options available to the VM/370 operator at IPL. Another RAS improvement includes enhancements to the procedure for generating the CPEREPR program. Extended local 3270 support provides a COPY function for the 3284, 3286, 3287 (as a 3284/3286), and 3288 printers.

Support of the dial feature (3440) for the 3275 Display Station (Model 2) allows the 3275 to be used over switched lines as a virtual machine operator's console.

The VM/370 publications library now includes: *VM/370: CMS User's Guide*, *VM/370: System Logic and Problem Determination Guide*, *VM/370: Operating Systems in a Virtual Machine*, and *VM/370: Data Areas and Control Blocks Logic*. Additional information on the 3270 Data Analysis-APL Feature is in the new publication *An Introduction to the IBM 3270 Data Analysis-APL Feature* (GA27-2788).

OPTIMIZING VIRTUAL MACHINE PERFORMANCE

An operating system executing in a VM/370 virtual machine is normally slower compared to standalone execution on the same System/370. The operating system executes concurrently with other virtual machines and executes in problem state to allow the CP component to control the resources of the real machine. VM/370 allows an installation to improve the performance of selected virtual machines by specifying one or more of the following options:

- Virtual Machine Assist, a hardware assist available on System/370 Models 135, 135-3, 138, 145, 145-3, 148, 158, 158AP, 168, 168AP and the 3031, 3031AP, 3032 and 3033 Processors makes possible throughput improvements for virtual machine users. See Desirable Features under *System Configuration* for a description of the Virtual Machine Assist. VMA on the 168, 168AP and 3033 is an RPQ.
- The IBM System/370 135-3, 138, 145-3, and 148 includes Extended Control-Program Support. Extended Control-Program Support for VM/370 is a hardware assist that is an expansion to the current Virtual Machine Assist. This support includes an operator command to disable the new assist, allowing the user to run with the previous support, if he desires.
- APL Assist feature, (1005) on the System/370 Model 135 and on the System/370 Model 145, which may be used with the VS APL Program Product (5748-AP1) to enhance performance of VS APL under CMS on the Models 135 and 145. APL Assist is standard on S/370 135-3, 138, 145-3, and 148. The APL Assist feature (1005) is mutually exclusive with the APL Assist RPQ (S00256) on the System/370 Model 145.
- APL Assist, an RPQ (S00256) on the System/370 Model 145 which may be used with the VS APL (5748-AP1) to enhance performance of APL under CMS on the Model 145.
- Favored Execution, an option which attempts to provide a specified percentage of real processor time to a particular virtual machine.
- Reserving "n" number of page "frames" (i.e., 4096 byte blocks) of real main storage for the exclusive use of one virtual machine to minimize paging in that virtual machine.
- Designating the virtual machine as "Virtual=Real", to eliminate paging in that virtual machine and to reduce the normal control program overhead. This is accomplished by giving that virtual machine a contiguous block of real main storage equal in size to its virtual storage and at real storage addresses which correspond to its virtual addresses, with the exception of page zero (i.e., the first 4096 bytes of storage). Page zero is relocated, but locked into real storage.
- Locked page frames.
- Assigning higher priorities to one or more virtual machines.

The options of favored execution, with a percentage specified, reserved page frames and virtual = real, listed above, can be specified for only one virtual machine at a time. Three different virtual machines may each have one of these three options, or several options may be specified for the same virtual machine.

There is no VM/370 restriction on the number of virtual machines that may simultaneously use the Extended Control-Program Support for VM/370, Virtual Machine Assist, the APL Assist, and the locked page frame or priority options. Locked page frames are restricted by the amount of real storage available. Use of any or all of these options, except for the Extended Control-Program Support for VM/370, Virtual Machine Assist and the APL Assist, will reduce the performance of other virtual machines.

VM/370 (cont'd)

For a more detailed description of these performance options, see the *IBM Virtual Machine Facility/370: Introduction (GC20-1800)*, or the *IBM Virtual Machine Facility/370: System Programmer's Guide (GC20-1807)*.

OS/VS1 improvements under VM/370, VM/VS Handshaking, will enable VS1 when running under VM/370 to enhance its operational characteristics and to avoid many instructions and procedures which are redundant in a virtual machine environment. With this support, handshaking will be initiated automatically during nucleus initialization of VS1 when running under VM/370 if the VS1 system has been generated with a new VS1 option call VM. In handshaking mode, VS1 will:

- Close CP spool files at job end to permit VM/370 to begin final output processing earlier.
- Provide a unique mode of execution which will eliminate paging by VS1 and reduce the number of privileged instructions executed whenever the virtual machine size is equal to the VS1 virtual address space. This mode makes possible performance improvements for VS1 where address space is less than or equal to 16 MB under VM/370 by reducing the real supervisor state time necessary to control the operation of the VS1 virtual machine.
- Optionally process a new virtual interrupt that allows VM/370 to return control to the VS1 virtual machine prior to resolution of a real page fault. The VS1 supervisor may then perform a task switch to allow other tasks access to the system.

Final evaluation of the performance of each operating system under VM/370 must be made in terms of each installation's throughput requirements and of the function provided by concurrently executing virtual machines.

INTEGRATED EMULATORS UNDER VM/370

Emulator-dependent programs which run on a particular System/370 equipped with the appropriate compatibility feature(s) listed below can be run on that System/370 in DOS or OS virtual machines under VM/370.

The following chart shows by System/370 Model number which integrated emulators can run under VM/370 and the compatibility feature numbers that are required:

System	1401	1440	7070	7080	7090	7094	7094II	S/360 MODEL
135,135-3,138	1401	1440			7090			7520
145,145-3,148	1440	1460			7090			
155II,158,158AP	1440	1410	7070		7094			
165II	1460	7010	7074		7094II		20	
168,168AP				7080				

No changes are required to these emulators, DOS, OS, or to VM/370 itself to allow emulator-dependent programs to run in virtual machines.

- (1) For the Model 158 only, this feature is not available if the Virtual Machine Assist feature (8740) is loaded. See *System Configuration* section.
- (2) For the Model 158 only, this feature is not available if the OS/VS1 ECPS (Extended Control-Program Support) Feature (8750) is loaded.

Integrated emulators will not be supported on the 3033 processor.

SIMULATED HANDS-ON PROCESSOR CONSOLE DEBUGGING

To aid programmers in solving obscure or complex problems that are difficult to isolate in any other way except by hands-on debugging at the processor console, VM/370 offers the following console debugging facilities from the user's remote terminal:

- Examining or altering the contents of the following: real or virtual storage, general registers, floating-point registers, the instruction counter, and other fixed-location fields such as Program Status Words (PSWs) and the Channel Status Word (CSW).
- Dumping on the high-speed printer the contents of all registers plus any part of storage, and selected blocks of disk records.
- Setting an Instruction Address Stop to stop execution of the user's program at a predetermined point in the program.
- Simulating external or I/O interrupts to the user's virtual machine (e.g., pressing the external interrupt key or readying the card reader).
- Dynamically tracing any or all of the following:
 - I/O events
 - Successful branches
 - Supervisor Call Interrupts (SVCs)
 - User program check interrupts
 - Channel command sequences
 - Total instruction trace.

SERVICE CLASSIFICATION

VM/370 is System Control Programming (SCP). Refer to sales manual GI section for a detailed description of SCP support. VM/370 does not alter or affect in any way the current service classification of any IBM operating system, language, program product, or any other type of IBM program supported by VM/370 while under the control of VM/370.

PROGRAMS SUPPORTED IN VM/370 VIRTUAL MACHINES

For information on those programs and program products supported to run under an operating system such as OS or DOS in a virtual machine environment under VM/370, see the appropriate sales manual pages.

IBM PROGRAM PRODUCT SUPPORT FOR VM/370-CMS

The IBM program products supported under CMS are as follows:

OS Full American National Standard COBOL Version 4 Compiler and Library	5734-CB2
OS Full American National Standard COBOL Version 4 Library	5734-LM2
OS/VS COBOL Compiler and Library	5746-CB1 (1)
OS/VS COBOL Library Only	5746-LM1 (1)
COBOL Interactive Debug	5734-CB4 (1)
DOS/VS COBOL Compiler and Library	5746-CB1 (5)
OS FORTRAN IV (G1)	5734-FO2
OS FORTRAN IV Library (Mod I)	5734-LM1
OS Code and Go FORTRAN	5734-FO1
OS FORTRAN IV (H Extended)	5734-FO3
OS FORTRAN IV Library (Mod II)	5734-LM3
FORTRAN Interactive Debug	5734-FO5
OS PL/I Optimizing Compiler	5734-PL1
OS PL/I Resident Library	5734-LM4
OS PL/I Transient Library	5734-LM5
OS PL/I Optimizing Compiler and Libraries	5734-PL3
OS PL/I Checkout Compiler	5734-PL2 (2)
DOS PL/I Optimizing Compiler	5736-PL1 (5)
DOS PL/I Resident Library	5736-LM4 (5)
DOS PL/I Transient Library	5736-LM5 (5)
DOS PL/I Optimizing Compiler and Libraries	5736-PL3 (5)
VS BASIC	5748-XX1 (3)
MATH/BASIC	5734-XM8
STAT/BASIC	5734-XA3
Business Analysis/BASIC	5734-XMB
Planning System Generator/CMS (PSG/CMS)	5748-XT1
APL/CMS	5799-ALK (4)
VS APL	5748-AP1

Notes:

- (1) COBOL Interactive Debug operates as a command processor under CMS on programs produced by the following compilers using the TEST option:
 - OS Full American National Standard COBOL Compiler Version 4 Release 1 Modification Level 2 (5734-CB2)
 - OS/VS COBOL (5740-CB1)
- (2) CMS supports the OS PL/I Checkout Compiler Release 2, Modification Level 1 and above.
- (3) VS BASIC is the recommended BASIC product for use with VM/370 CMS. CALL-OS BASIC Release 1.2 under CMS is withdrawn and no longer orderable in any form.

All correct BASIC programs that run under CMS with CALL-OS BASIC, 360A-CX-44X, will run under CMS with VS BASIC after adjustment of file input/output statements. CMS editing commands can be used to change these statements to conform to VS BASIC syntax.

Additionally, under CALL-OS BASIC, if an OPEN statement is issued for a file already open, the file is repositioned to its beginning. Under VS BASIC, an OPEN statement for a file already open is ignored. CALL-OS BASIC programs containing such OPEN statements should be converted by adding a CLOSE statement before the OPEN statement.

Files created under CALL-OS BASIC which run under CMS can be read by VS BASIC after being converted to VS BASIC format using the VS BASIC service program VSBUTIL.

A new VS BASIC release was available on 4/26/76. This new release, in conjunction with Release 3 of VM/370 CMS, removes the restriction on the use of record input/output for users of VS BASIC under CMS.

- (4) VS APL Program Product (5748-AP1) makes the APL language available to CMS users under VM/370 on any virtual storage S/370 Processor and 3031, 3031AP, 3032, and 3033 Processor except 3115 and 3125. This system provides language, function, and performance enhancements over the APL/360 systems.

In addition, a no charge RPQ for the System/370 Model 145 is available to enhance the performance of VS APL PP(5748-AP1) on the Model 145. The APL Assist (1005) for the Model 145 can be

VM/370 (cont'd)

ordered Note: APL Assist is standard on the System/370 Models 135-3, 138, 145-3, and 148.

(5) CMS support is as of VM/370 Release 3.

For program product ordering information, see the respective program product sales manual pages. Further details on the languages supported appear in the publication *IBM Virtual Machine Facility/370: Introduction* (GC20-1800), and in the Program Product section of the sales manual.

Installed User Programs SCRIPT/370 Version 3 (5796-PHL), an Installed User Program (IUP), is available to provide text-processing capabilities directly under CMS. See Availability Notice G320-1520.

The Statistics Generating Package for VM/370, or VM/SGP (5796-PDD), an IUP, is available and consists of a data selection and reporting language, a translator, and a library of reduction programs to handle most classes of VM Monitor output from the VM/370 Measurement Facility.

VM/370 Performance Monitor Analysis FDP (5798-CPX) is available for reduction of VM Monitor output from the VM/370 Measurement Facility.

MUSIC III, the McGill University System for Interactive Computing (5796-AJC), an IUP, is available and can complement CMS when run under VM/370 by providing a high-performance limited-function timesharing subsystem. See Availability Notice G320-1408-3.

VS/REPACK (5796-PDZ), an IUP, allows the user to collect and graphically display the pattern of activity of the program or system, analyze this data to predict how rearranging will increase efficiency and verify that the program is operating correctly.

Field Developed Programs: The VM/370 Control and Accounting System (5798-AYP), a Field Developed Program (FDP), is available for use under CMS (see Announcement GB21-1110 for details).

The CMS Sort for VM/370, an FDP, is available for use under CMS. See Announcement GB21-1376 for details.

Programming RPQs - The VM/370 Resource Management PRPQ is designed to improve real resource management for the larger VM/370 user (Model 155II and above with one megabyte or more of storage).

CUSTOMER RESPONSIBILITIES

- Ordering and installing all the required communications facilities.
- Generating the appropriate 3704/3705 Communications Controller programs.
- Allocating and formatting direct access storage space for the VM/370 control program, the CMS system residence area, and user work areas.
- Generating and updating user directory and virtual machine descriptions.
- Making the final evaluation as to which programs should be run under VM/370 in his environment.
- Training personnel to operate the VM/370 system.
- Teaching users VM/370 commands and how to operate the remote terminals.
- For existing CP-67/CMS customers, planning for the conversion from the System/360 Model 67 to the System/370.

It is recommended that a customer system programmer become familiar with the internal operation of the VM/370 system in order to obtain maximum benefit from the virtual machine environment.

COMPATIBILITY STATEMENT FOR CP-67/CMS USERS

VM/370 is based on the CP-67/CMS system and is designed specifically for the System/370. The Dynamic Address Translation facility on the System/370 is conceptually similar to the same feature on the System/360 Model 67, but differs in hardware implementation. Consequently, CP-67/CMS is not supported on the System/370, and, likewise, VM/370 is not supported on the System/360 Model 67.

The internal structure of VM/370 differs from that used in CP-67/CMS. User modifications to CP-67/CMS are not compatible with VM/370.

The Conversational Monitor System of VM/370 is based on the Cambridge Monitor System of CP-67/CMS. Some commands are unchanged, but most have additional parameters or options which offer enhanced function and more precise control. Some command names have been changed or dropped with functions moved to other commands in the Conversational Monitor System.

PROGRAMMING SYSTEMS: VM/370 is written in System/370 Assembler Language and uses System/370 instructions not available on the System/360. All program releases and SCP programming support will use CMS as an installing and updating vehicle.

SYSTEM CONFIGURATION: The following systems and devices are supported by VM/370 except as otherwise noted below:

Processors

System/370 Model 135
 System/370 Model 135-3
 System/370 Model 138
 System/370 Model 145
 System/370 Model 145-3
 System/370 Model 148
 System/370 Model 155II
 System/370 Model 158
 System/370 Model 158-3
 System/370 Model 158 Attached Processor
 System/370 Model 158MP (See note)
 System/370 Model 165II
 System/370 Model 168
 System/370 Model 168 Attached Processor
 System/370 Model 168MP (See note)
 The 3031 Processor
 The 3031 Attached Processor Complex
 The 3032 Processor
 The 3033 Processor

Note: System/370 models 158 MP and 168 MP are supported when running in uniprocessor mode, or with an asymmetric I/O configuration. In an asymmetric I/O configuration, all I/O attached to the system must be attached to one processor.

As of Release 5, the 303X processors will be supported. All System/370 Processors must have at least 393,216 (384K) bytes of real main storage.

Required Processor and Channel Features and Facilities

- The System Timing facility (2001) (which includes the Clock Comparator and the CPU Timer) on Models 135 and 145. (Clock Comparator and CPU Timer are standard on S/370 Models 135-3, 138, and 148. They are a pre-requisite on the Model 145-3.)
- The Floating Point feature
 - For the 135, feature 3900 (Note)
 - For the 145, feature 3910 (Note)

Note: Floating Point Arithmetic is standard on S/370 Models 135-3, 138, 145-3, and 148. Extended Precision Floating Point is standard on S/370 Models 138, 145-3, and 148.

- The Channel Indirect Data Addressing features on each of the following standalone I/O channels on the Models 165II, 168, and 168AP: 2860 (1861, 1862, 1863), 2870 (1861), 2880 (1861, 1862).
- The Word Buffer feature (8810), available with the System/370 Model 145, is required for selector channels if a 2305 Model 2 Fixed Head Storage Device or any model of the 3340 DASD is attached.

Note: Word Buffer is a prerequisite on S/370 Model 145-3 and is standard on S/370 Model 148.

VM/370 (cont'd)
Desirable Processor Features

- Virtual Machine Assist. Throughput improvements for VS systems running under VM/370 are possible with a hardware assist available on the System/370 processors 3135, 3135-3, 3138, 3145, 3145-3, 3148, 3158, 3158AP and 3168 and the 3031, 3031AP, 3032, and 3033 processors. VMA on the 3168, 3032, and 3033 is an RPQ. The Virtual Machine Assist makes performance improvements possible by allowing a significant reduction in the real supervisor state time used by VM/370 to control the operation of virtual machines running under VM/370.

This reduction in VM/370 supervisor state time is accomplished by using emulation, rather than software simulation, for certain privileged operation codes used by the VS system supervisors. Emulation is also used to update the shadow page table and to handle SVC interrupts.

The Virtual Machine Assist is available on the System/370 Models 135, 145, and 158 as a hardware feature (8740) and on the Model 168 as an RPQ (S20573) on the 3032 as an RPQ (8P0723) and on the 3033 as an RPQ (EJ1156 and S20587). It is standard on the S/370 Models 135-3, 138, 145-3, 148, 3031, and 3031AP. On the System/370 Model 158AP Virtual Machine Assist function is also included in and enabled by OS/VS1 ECPS (Extended Control Program Support) Feature (8750). Contact your Product Marketing Group for further information on availability of the RPQ. See the *Machines* section of the Sales Manual for details on the availability of the hardware feature. On the System/370 Model 158 VMA Function is also included in and enabled by OS/VS1 ECPS (Extended Control-Program Support) Feature (8750).

- The IBM System/370 135-3, 138, 145-3, and 148 include Extended Control-Program Support. A hardware assist has been added as an expansion to the current Virtual Machine Assist. This support will include an operator command to disable the new assist, if desired. Extended Control-Program Support for VM/370 is an expansion of Virtual Machine Assist to further reduce the real supervisor state time used by VM/370 while performing its control functions. The reduction in VM/370 supervisor state time is accomplished in three ways. 1) Certain privileged instructions are emulated by the hardware rather than simulated by the software. 2) A hardware assist has been implemented for VM/370 that is designed to be executed only by VM/370. 3) Extended Control-Program Support for VM/370 also includes support of an interval timer in a virtual machine.
- The Extended Precision Floating Point feature, although not required, will improve the execution of programs which use Extended Precision Floating Point instructions under VM/370 on Models 135, 155II, and 158.
 - For the 135, feature 3840
 - For the 155II, feature 3700
 - For the 158, feature 3700

The Extended Floating Point Function is also included in and enabled by OS/VS1 ECPS (Extended Control-Program Support) Feature (8750).

The OS/VS1 ECPS (Extended Control-Program Support) (8750) cannot be used when VM/370 is running in the Attached Processor mode.

Note: Floating Point Arithmetic is standard on S/370 Models 135-3, 138, 145-3, 148, 3031, and 3031AP. Extended Precision Floating Point is standard on S/370 Model 138, 145-3, and 148.

- The Word Buffer feature (8810), on the System/370 Model 145, is recommended for selector channels if 2314 Storage Units are attached and required if 3330 (with the Integrated File Adapter), 3340, 3344, or 3350 Disk Storage units are attached.

Note: Word Buffer is a prerequisite on S/370 Model 145-3 and is standard on S/370 Model 148.

VM/370 I/O SUPPORT
Direct Access Storage Devices

2314 Direct Access Storage Facility
 2319 Disk Storage
 3330 Disk Storage Models 1, 2, and 11
 3333 Disk Storage and Control Models 1 and 11
 3340 Direct Access Storage Facility, Models A2, B1 and B2; and the 3348 Data Module, Models 35, 70, and 70F
 3344 Disk Storage Models B2 and B2F
 3350 Disk Storage Models A2, A2F, B2, B2F, C2 and C2F
 2305 Fixed Head Storage Model 1 (Processors 3165II, 3168, 3168AP, and 3033 only)
 2305 Fixed Head Storage Model 2
 3850 Mass Storage System.

All of the above direct access devices with the exception of the 3850 Mass Storage System are supported as VM/370 system residence, paging and spooling devices and/or virtual devices for use by virtual

machines. All are supported as dedicated devices. The 3850 Mass Storage System is supported as a dedicated device only. All except the 2305 and the 3850 are supported by CMS and RSCS.

Direct Access Control Units

3345 Integrated Storage Control Models 3, 4, and 5 on the Model 145 for 3330 Disk Storage Models 1 and 2; 3333 Disk Storage and Control Models 1 and 11 and 3340 Model A2
 2835 Storage Control Model 1 for 2305 Model 1 (Processors 3165II, 3168, 3168AP, 3031, 3032, 3033 only)
 2835 Storage Control Model 2 for 2305 Model 2
 2844 Auxiliary Storage Control for 2314 and 2319
 3830 Storage Control Model 1 for 3330 Models 1 and 2 only
 3830 Storage Control Model 2 for 3333 Models 1 and 11 and 3340 Model A2
 3830 Storage Control Model 3
 3851 Mass Storage Facility
 IFA (Integrated File Adapter) (4650) on System/370 Models 135, 135-3, and 145 for 2319
 IFA (Integrated File Adapter) (4655) on the Model 135, 135-3, 138, for 3330 Models 1, 2 and 11, 3333 Models 1 and 11, 3340 Models A2, B1 and B2, and 3344 Models B2 and B2F
 ISC (Integrated Storage Control) (4460) on the Models 145, 145-3, 148, 155II and 168 for 3330 Models 1, 2 and 11, 3333 Models 1 and 11, 3340 Models A2, B1 and B2, 3344 Models B2 and B2F, and 3350 Models A2, A2F, B2, B2F, C2 and C2F.

Magnetic Tapes

2401, 2402, and 2403 Magnetic Tape Units
 2415 Magnetic Tape Unit, Models 1, 2, 3, 4, 5 and 6
 2420 Magnetic Tape Unit, Models 5 and 7
 3420 Magnetic Tape Unit, Models 3, 4, 5, 6, 7 and 8
 3410 Magnetic Tape Unit, Models 1, 2, and 3, 9-track only
 3411 Magnetic Tape Unit and Control, Models 1, 2 and 3, 9-track only.

Tape Control Units

2804 Tape Control
 2803 Tape Control
 3803 Tape Control
 3411 Magnetic Tape Unit and Control.

Printers

1403 Printers Models 2, 3, 7, and N1 (with minimum of 132 print positions)
 1443 Printer Model N1 (with 144 print positions)
 3203 Printer Model 4
 3211 Printer (Right Indexing only)
 3213 Printer (in 3215 Emulator Mode)
 3284 Printer Models 2 and 3
 3286 Printer Models 2 and 3
 3287 Printer Models 1 and 2 (as a 3284/3286)
 3288 Printer Model 2.

Readers/Punches

2501 Card Reader Models B1 and B2
 2540 Card Read Punch Model 1
 3505 Card Reader Models B1 and B2
 3525 Card Punch Models P1, P2 and P3
 2520 Card Punch Models B2 and B3.

Unit Record Control Units

2821 Control Unit
 3811 Printer Control Unit
 IPA (Integrated Printer Adapter) (4670, 4672, or 4677) on the 3135 Processor.
 IPA (4670, 4672, 4677, 8075 or 8076) on the 3138 processor
 IPA (8075 or 8076) on the 3148 processor

TELECOMMUNICATIONS SUPPORT SUMMARY
Terminals

The following devices are supported as virtual machine operator consoles (and consequently as CMS user terminals):

2741 Communication Terminal
 1050 Data Communication System
 CPT-TWX (Model 33/35) Line Control Type Terminals
 3275 Display Station (Model 2)
 3277 Display Station (Model 2) via a 3271 Control Unit (Model 2) or a 3272 Control Unit (Model 2)
 3767 Communication Terminal (as a 2741)
 5100/5110 Computer System (as a 2741).
 IBM S/370 Model 138 Display Console printer-keyboard is supported in printer-keyboard mode (3286-2 required) or display mode.
 IBM S/370 Model 148 Display Console printer-keyboard is supported in printer-keyboard mode (3286-2 required) or display mode.
 3066 System Console Models 1 and 2 for S/370 Models 165II and 168.
 3036 Console for 3031, 3032, and 3033 Processors.

VM/370 (cont'd)

Supported by VM/370 Remote Spooling Communications Subsystem (RSCS):

2770 Data Communication System
 2780 Data Transmission Terminal
 3770 Data Communication System, (except 3777-2) non-programmable models as a 2772;3776/3777-1 also as a 3780; 3777-2 as a S/360-20)
 3780 Data Communications Terminal
 HASP supported programmable workstations.
 8100/DPPX with DPPX/RJE (BSC)

Terminal Control Units

3271 Control Unit (Model 2)
 3272 Control Unit (Model 2).
 8100/DPPX with DPPX/DSC (as a 3271)

Transmission Control Units

ICA (Integrated Communications Adapter) (4640) available on the Models 135, 135-3, 138
 2701 Data Adapter Unit
 2702 Transmission Control
 2703 Transmission Control
 3704 Communications Controller
 3705-I Communications Controller
 3705-II Communications Controller.

VM/370 supports the 3704 and 3705 Communications Controllers in network control mode, emulation mode, or in network control or emulation mode of the Partitioned Emulation Programming (PEP) extension of NCP/VS. CMS supports the generation of 3704/3705 programs for these modes of operation and CP provides commands to load, dump, trace and control the operation of the 3704/3705.

The 3704 or 3705 in network control mode or in the network control mode of PEP may be used by VM/370 for the control of virtual machine operator's consoles. Concurrent with the use of the network control mode of PEP by VM/370, the emulation mode of PEP may be used by multi-access virtual machine operating systems.

Use of network control mode by a virtual machine operating system requires that the 3704 or 3705 be dedicated to the virtual machine. The 3704 or 3705 may be attached to a virtual machine running DOS/VS, OS/VS1, or OS/VS2 with either VTAM or TCAM to support the network control mode of operation. In this case, communications between the 3704/3705 and the terminals attached to it are completely under the control of the virtual machine operating system, not VM/370.

Note: Customers using VM/370 support for the 3704/3705 must order one of the two OS/VS 3704/3705 Network Control Program Support Packages listed below. These are the only 3704/3705 support packages that contain the CMS files required for generating and loading 3704/3705 control programs.

ORDER NUMBER

5744-BA1 (Supported by VM/370 in network control mode, emulation mode, or in network control or emulation mode of PEP.)

5744-BA2 (Supported by VM/370 in emulation mode only.)

RPQ Availability: Prior availability of an RPQ does not guarantee or imply current or future availability.

TERMINALS SUPPORTED AS VIRTUAL MACHINE OPERATOR'S CONSOLES

Terminals which are equivalent to those explicitly supported may also function satisfactorily. The customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied programs or products may have on such terminals.

- The following **system consoles** and the remote terminals listed below in items 2, 3, 4, 5 (excepting those terminals attached via binary synchronous lines), and 6 are supported by VM/370 as real as well as virtual Processor operator's consoles:
 - 3210 Console Printer-Keyboard Models 1 and 2
 - 3215 Console Printer-Keyboard Model 1
 - 2150 Console with 1052 Printer-Keyboard Model 7
 - IBM S/370 Model 138, 148, and 158 Display Console printer-keyboard is supported in printer-keyboard mode (3286-2 required) or in display mode.
 - 7412 Console (via RPQ AA2846) with 3215 Console Printer-Keyboard Model 1
 - 3066 System Console Models 1 and 2 for System/370 Models 165II and 168.
 - 3066 System Console Model 3 for System/370 Model 168AP.
 - 3036 Console for the 3031, 3032 and 3033 Processors.
- 2741 Communication Terminal** on either switched or point-to-point nonswitched lines with these features:

PTTC/EBCD (9571, Part 1167963) or standard Correspondence (9812, Part 1167043) print elements
 Transmit Interrupt (7900) or Transmit Interrupt Control RPQ (E40681)
 Receive Interrupt (4708).

Required with switched lines:

Data Set Attachment (9114)
 Dial Up (3255).

One of the following is required for point-to-point nonswitched lines:

Data Set Attachment (9115 for facility D1), or
 Data Set Attachment (9116 for facility B2), or
 Data Set Attachment (9120 for facility B1 or D1), or
 IBM Line Adapter (4635 for 4-wire limited distance line), or
 IBM Line Adapter (4691-4694 for 4-wire shared nonswitched line), or
 IBM Line Adapter (4647 for 4-wire nonswitched line).

The following features, although not required, will enhance the convenience and usability of the terminal:

Print Inhibit (5501)
 Red Ribbon Control RPQ (868019)
 Typamatic Keys (8341)
 Pin Feed Platen (9509).

- 1050 Data Communication System** on either switched or point-to-point nonswitched lines with these components:

1051 Control Unit (Model 1 or 2) with these features:

Transmit Interrupt (7900) or
 Transmit Interrupt Control RPQ (E26903)
 Receive Interrupt (6100) or
 Receive Interrupt Control RPQ (E27428)
 Text Time-Out Suppression (9698)
 First Printer Attachment (4408).

Required with switched lines:

Data Set Attachment (9114).

One of the following is required for point-to-point nonswitched lines:

Data Set Attachment (9115 for facility D1), or
 Data Set Attachment (9116 for facility B2), or
 Data Set Attachment (9120 for facility B1 or D1), or
 IBM Line Adapter (4691-4694 for 4-wire shared nonswitched line), or
 IBM Line Adapter (4647 for 4-wire nonswitched line).

1052 Printer-Keyboard (Model 1 or 2) with the following feature:
 PTTC/EBCD print element (9571, Part 1167963).

The following features, although not required, will enhance the convenience and usability of the terminal:

Automatic Ribbon Shift and Line Feed Select (1295)
 EOB on Carrier Return RPQ (E28235).

- Terminals on switched lines compatible with the line control used by the IBM Telegraph Control Type II Adapter** (8-level ASCII code at 110 bps).
- 3270 Information Display System** with these components, including the Data Analysis-APL Feature (1066) if APL or text characters are to be displayed or printed via copy.

3271 Control Unit (Model 2) on nonswitched, point-to-point, binary synchronous transmission lines. (Note 3)

3272 Control Unit (Model 2) on a multiplexer, block multiplexer, or selector channel.

3277 Display Station (Model 2) with one of the following features required by VM/370:

66 Key EBCDIC Typewriter Keyboard (4630) (Note 2)
 66 Key EBCDIC Data Entry Keyboard (4631)
 78 Key Operator Console - Keyboard (4632)
 78 Key EBCDIC Typewriter Keyboard (4633)
 66 Key EBCDIC/APL Typewriter Keyboard (4637) (Note 2)
 78 Key EBCDIC/APL Typewriter Keyboard (4638)
 78 Key Text Keyboard (4639)

The following features, while not required, will enhance the convenience and usability of the terminal:

Audible Alarm (1090)
 Operator Identification Card Reader (4600)
 Lower Case Character Display RPQ (8K0366).

The following feature recommended for use with either Keyboard 4637 or 4638 only, provides APL, dual case US EBCDIC, and (output only) TN print train capability; used with keyboard 4639, it provides access to the 120 TN, T11 character set:

Data Analysis-APL (1066).

3275 Display Station (Model 2) with the same features required as the 3277 (Model 2). The Data Analysis-APL Feature (1066) and

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the EBCDIC/APL Typewriter Keyboards do not apply to the 3275. 3275 includes its own control unit function and is supported when attached via nonswitched, point-to-point, binary synchronous transmission lines or via switched connection if the 3275 is equipped with feature 3440. (Note 3)

3284 Printer (Models 2 and 3) (Note 1)

3286 Printer (Model 2) (Note 1)

3287 Printer (Models 1 and 2) (as a 3284/3286)

3288 Printer (Model 2) (Note 1)

Note 1: The 3284, 3286, 3287 (as a 3284/3286), and 3288 Printers are supported by VM/370 only to the extent of the COPY function which allows transferring display screens of data from local and remote 3270 system terminals to hard copy printers. The COPY function is invoked by depression of a program function key. The remote support is effective only when both the printers and the terminals are attached via the same 3271 Control Unit (Model 2) or 3275 Display Station (Model 2).

Note 2: These display terminals are not supported for use with the 3284, 3286, 3287 (as a 3284/3286), or 3288 printers.

Note 3: The maximum number of binary synchronous transmission lines supported by the CP component of VM/370 for its own use is sixteen minus the number of 3704/3705 Communications Controllers operating in network control mode.

Note 4: The APL Feature is not available for the 3288 printer.

6. 3767 Communication Terminal (as a 2741) on switched or point-to-point nonswitched lines with these features:

- 2741 Start/Stop (7113)
- Correspondence Keyboard (9381), or
- EBCDIC Keyboard (9391)
- EIA Interface with Clock (3719), or
- 1200 bps Integrated Modem (5500 or 5505).

7. 5100 Portable Computer (as a 2741) on switched or point-to-point nonswitched lines with the Communications Adapter (1525).

TERMINALS SUPPORTED FOR REMOTE SPOOLING

The VM/370 Remote Spooling Communications Subsystem (RSCS) supports the following terminals and workstations.

1. 2770 Data Communication System

The IBM 2770 Data Communication System with the 2772 Multipurpose Control Unit (hereafter called 2770) can be connected to the central System/370 via a switched or nonswitched point-to-point communication line.

The following devices and features are required for operating a 2770 as an RSCS non-programmable terminal:

- One IBM 2213 Printer, Model 2, or one IBM 2203 Printer, or one IBM 1053 Printer
- One IBM 2502 Card Reader, Model A1 or A2
- EBCDIC Transmission Code.

Other supported equipment and features are as follows:

- One IBM 545 Output Punch, Model 3 or 4, with or without 3950 attachment
- EBCDIC Transparency (3650)
- Additional Buffer Expansion (1491)
- Space Compression/Expansion (6555)
- Synchronous Clock (7705).

2. 2780 Data Transmission Terminal

The IBM 2780 Data Transmission Terminal, Model 1 and 2, can be connected to the central System/370 via a switched or non-switched point-to-point line. EBCDIC Transmission Code is required.

The following features are optional:

- EBCDIC Transparency (8030)
- 120/144-Character Print Line (5820 or 5821)
- Multiple Record Transmission (5010)
- Synchronous Clock (7705).

3. 3770 Data Communication System

The IBM 3770 Data Communications System (except 3777-2) with the non-programmable models of the 3771, 3773, 3774, 3775, 3776, and 3777-1 Communication Terminals (hereafter called 3770) can be connected to the central System/370 via a switched or nonswitched point-to-point communication line. The following features are required for operating a 3770 as an RSCS non-programmable terminal:

- EBCDIC Transmission Code (9761)
- SDLC/BSC, Switch Control (1460), or
- BSC Point-to-Point (1461).

4. 3780 Data Communications Terminal

The IBM 3780 Data Communications Terminal can be connected to the central System/370 via a switched or nonswitched point-to-point communication line. EBCDIC Transmission Code is required.

The following devices and features are optional:

- One IBM 3781 Card Punch
- Component Selection (1601, required for the 3781)
- EBCDIC Transparency (3601)
- Additional Print Positions (5701)
- Synchronous Clock (7705).

5. Programmable Terminals

Any processor now supported as a HASP workstation when programmed to run as a HASP workstation is supported as a workstation by the Spool MULTI-LEAVING (SML) support under RSCS. The DOS/VS Remote Job Entry Workstation Program (PRPQ WF0358) is also supported. Any processor running HASP, ASP, RES, JES2, and JES3 is supported as a main processor by RSCS when it itself assumes the role of a HASP programmable workstation. For specific configurations supported, refer to the HASP pages in the Sales Manual.

TRANSMISSION CONTROL UNITS SUPPORTED BY VM/370

1. 2701 Data Adapter Unit

For CPT-TWX (Model 33/35) Line Control Type Terminals

Telegraph Adapter Type II (7885).

For 2770, 2780, 3270, 3770 (except 3777-2) as a 2770; 3776/3777-1 also as a 3780; 3777-2 as a S/360-20 MULTI-LEAVING Workstation) and 3780 Terminals

Synchronous Data Adapter Type II (7698)

- EBCDIC Code (9060)
- EBCDIC Transparency (8029).

For 1050 and 2741 Terminals

IBM Terminal Adapter Type I, Model II (4640)

- Selective Speed (134.5 bps) (9581)
- 2741 Break Feature RPQ (M53193), and Break Command RPQ (858492).

As Needed

Expanded Capability (3815) - required if more than two low speed adapters (either IBM Type I Model II, or Telegraph Type II), or more than one high-speed adapter (Synchronous Data Adapter Type II), or one high-speed and at least one low-speed adapter are to be attached to the same 2701.

Expansion Feature (3855) - required for each line adapter after the first.

2. 2702 Transmission Terminal

For 1050 and 2741 Terminals

Terminal Control Base for IBM Terminal Control (9696).

IBM Terminal Control Type I (4615)

- Selective Speed (134.5 bps) (9684)
- Type I Terminal Interrupt (8200)
- Data Set Line Adapter (3233) and/or IBM Line Adapter (4635) (4-wire).

For CPT-TWX (Model 33/35) Line Control Type Terminals

Terminal Control Base for Telegraph Terminal Control (9697).

Telegraph Terminal Control Type II (7912)

- Pluggable End Characters† (return key generates an interrupt) RPQ (E62920)
- Data Set Line Adapter (3233).

Terminal Control Expansion (7935) - required if both of the above terminal control bases are to be attached to the same 2702.

As Needed

31 Line Expansion (7955).

3. 2703 Transmission Control Unit

For 1050 and 2741 Terminals

Start-Stop Base Type I (7505) or Type II (7506).

IBM Terminal Control Base (4619).

IBM Terminal Control Type I (4696)

- Line Speed Option (134.5 bps) (4878)
- Type I Terminal Interrupt (8200)
- Data Line Set (3205), and/or IBM Line Set 1B (4687).

For CPT-TWX (Model 33/35) Line Control Type Terminals

VM/370 (cont'd)

Telegraph Terminal Control Base (7905).

Telegraph Terminal Control Type II (7912)

Line Speed Option (110 bps) (4877)

Data Line Set (3205)

Pluggable End Characters† (return key generates an interrupt) RPQ (E66707).

For 2770, 2780, 3270; 3777-2 (as a S/360-20 MULTI-LEAVING Workstation), and 3780 Terminals

Synchronous Base (7703, 7704, or 7706).

Synchronous Terminal Control for EBCDIC (7715)

Transparency (9100)

Synchronous Line Set (7710).

As Needed

Base Expansion (1440) - required if more than one base type is to be attached to the same 2703.

4. Integrated Communications Adapter (ICA) (4640) (available on the System/370 Model 135, 135-3, 138)

Additional Lines (4722-4728).

For 1050, 2741, 3767 (as a 2741) and 5100 (as a 2741) Terminals

Terminal Adapter Type I Model II (9721-9728)

Switched Network Facility (9625-9632)[optional]

Write Interrupt (9745-9752)

Read Interrupt (9737-9744)

Unit Exception Suppression (9729-9730)[optional]

For the 3767 only (as a 2741)

200 bps (2711-2718), or
 300 bps (9593-9600).

For the 5100 only (as a 2741)

300 bps (9593-9600).

For 2770, 2780, 3270, 3770 (except 3777-2) as a 2770; 3776/3777-1 also as a 3780; 3777-2 as a S/360-20) and 3780 Terminals

Synchronous Data Adapter Type II (9649-9656)

Half-Duplex Facility (9617-9624)

EBCDIC Transparency (9673-9680).

For CPT-TWX (Model 33/35) Line Control Type Terminals

Telegraph Adapter Type II (9785-9792)

Switched Network Facility (9625-9632).

5. 3704/3705-I/3705-II Communications Controller

See the 3704/3705-I/3705-II machine pages for required feature codes.

Note: CPT-TWX (Model 33/35) terminals or equivalent devices are supported only at 110 bps by the 3704/3705 Network Control Program under VM/370.

† Although not required, these features enhance the usability of these terminals.

TWO-CHANNEL SWITCHES

VM/370 has Alternate Path Support and does not take advantage of the Two Channel Switch, and Two Channel Switch, additional features.

DEDICATED DEVICES

With VM/370 Release 2 and 3, any input/output device not supported by VM/370 but which is attachable to an IBM System/370 and conforms to System/370 architecture may be eligible for dedicated use by a virtual machine under VM/370. The subclass of the device should be specified during VM/370 system generation so that virtual CCW strings directed to the unsupported device will be translated correctly; refer to the VM/370: Planning and System Generation Guide, GC20-1801, for details. The standard device and program restrictions also contained in that publication must be observed. The device must be tested in this environment to ensure proper operation.

CONFIGURATIONS SUPPORTED BY CMS

- Virtual storage size: Recommended minimum of 320K bytes up to 16 million bytes in multiples of 4096 bytes.
- Virtual console - any terminal supported by VM/370 as a virtual machine operator's console.
- Any virtual card readers, card punches (except the 2520), and printers supported by VM/370 as spooling devices.
- Up to ten virtual 2314, 2319, 3330, 3333, 3340, 3344, or 3350 direct access storage devices. Each virtual disk is at minimum one cylinder. The CMS file system constrains virtual disk sizes as follows: a maximum of 115 cylinders on each virtual 3350 in native

mode, a maximum of 246 cylinders on each virtual 3330 or 3333, a maximum of 349 cylinders on each virtual 35MB 3340, and a maximum of 682 cylinders on each virtual 70MB 3340. Note that OS and DOS virtual disks read by CMS are not constrained by these limits. The CMS system disk is required and reduces the number of user disks online at any given time to nine.

- Up to four 2400, 2415, 2420, or 3420 (7- or 9-track), or 3410 (9-track only) Magnetic Tape Units.

MINIMUM VM/370 CONFIGURATION

Processors One of the System/370 Processors previously designated with at least 393,216 bytes of real main storage

One Console

One Printer

One Card Reader

One Card Punch

Two Spindles of Direct Access Storage

One 9-track Magnetic Tape Unit

One Transmission Control Unit (or the Integrated Communications Adapter on the System/370 Model 135, 135-3, 138). If only local 3277 Display Stations are used as terminals, then only a 3272 Control Unit is required.

One Multiplexer Channel

One Selector or Block Multiplexer Channel

One Communication Terminal

The requirement for at least one transmission control unit, line, and remote terminal can be eliminated if the customer plans to run only two virtual machines using the primary and alternate system consoles. The requirement is also eliminated if the only terminals to be used are 3277 Display Stations attached to a 3272 Control Unit. These conditions permit a customer to install VM/370 earlier and gain experience with multiple concurrent virtual machine operation and/or CMS timesharing before the installation of his teleprocessing terminals, control units, and lines.

VM/370 requires a minimum main storage of 384K. This constitutes a change from previous releases of VM/370. This minimum main storage requirement will support a VM/370 mixed-mode environment, that is, CMS running concurrently with other virtual machines. Installation of VM/370 for mixed-mode environments on an installed System/370 should consider at least a main storage upgrade.

REPRESENTATIVE VM/370 CONFIGURATION

3145 512K storage

3215 Console Printer-KeyBoard

1403 Printer Model N1 (two)

3330 or 3340 DASD drives as needed to meet the requirements of VM/370, the virtual machine operating systems and the users.

3420 Magnetic Tape Units (two)

2540 Card Read Punch

3704 Communications Controller

3277 Display Stations, as needed with the 3271 or 3272 Control Unit

2741 or Communication Terminals (as needed)

3767 Communication Terminals (as 2741s) (as needed)

Two Block multiplexer channels (1421-1422) with Word Buffer feature (8810)

One Multiplexer channel

FIELD ENGINEERING CONSIDERATIONS
Engineering Change Levels

For a listing of engineering change (EC) levels at which the operation of VM/370 has been verified, refer to VM/370: Release 2 Guide (GC20-1815).

UCW CONSIDERATIONS

It is essential to the operation of VM/370 that sufficient Unit Control Words (UCWs) are installed for the System/370 Model 135, 135-3, 138, 145, 145-3, 148, 155II or 158 multiplexer channel. Before ordering, contact your local FE Installation Planning Representative for assistance in determining the necessary quantity of UCWs for your configuration. Installation options controlling the use of UCWs should be carefully reviewed with Field Engineering prior to installing VM/370 on any System/370.

RELIABILITY, AVAILABILITY AND SERVICEABILITY

The VM/370 system is based on the proven concepts of the CP-67/CMS system which has been in use by customers since 1968. VM/370 utilizes System/370 architecture, including RMS, to enhance its own reliability, availability, and serviceability (RAS). The environment of multiple concurrent virtual machines may result in improved RAS for many System/360 operating systems that are run under VM/370.

The VM/370 features that improve reliability are:

- User isolation, each in his own virtual machine.
- Read-only protection of "shared" or critical disks.
- Restricting access to other users' disks via password protection.

VM/370 (cont'd)

- Screening of all interrupts by the control program to prevent abnormal termination of OS due to receiving I/O interrupts from devices not included in the OS nucleus.
- Nucleus protection in CMS.

Availability is enhanced for the following reasons:

- VM/370 allows users to run concurrently as many versions, levels, types, and copies of operating systems as they require.
- Customers can generate, update, and test operating systems without the need for a dedicated machine. Premature conversion of a customer's production work to an insufficiently-tested new environment can be avoided.
- When the control program detects a permanent storage error in a main storage page frame that is being used by a virtual machine, the frame will be marked unusable. If the page frame has not been altered by the virtual machine, a new page frame is assigned to the virtual machine and a fresh copy of the page is brought in the next time the page is referenced.

The storage error is transparent to the virtual machine user. If the frame has been altered, VM/370 resets the virtual machine, clears its virtual storage to zeroes, and sends an appropriate message to the user. Normal system operation continues for all other users.

- If, in writing out a page on the paging device, the control program encounters a defective area on the disk, that area is marked as unusable and the page is written elsewhere on the paging device.
- Upon abnormal termination, the control program will automatically dump and reload itself without system operator intervention. Completed spool files will be saved, and communication lines will be re-initialized following the reload. Each user can then re-initialize his virtual machine.
- When a terminal or line error is detected for a virtual machine operator's console, VM/370 breaks connection with that user. However, that user is not logged off by VM/370 for fifteen more minutes, giving him that period of time to attempt to re-establish connection with the system for that virtual machine.

Serviceability is improved by:

- Providing various commands to trace, examine, and alter the operation of a virtual machine.
- Providing IPCS commands and facilities which analyze CP abend dumps, generate user-detected problem reports, allow viewing of disk-resident CP abend dumps, and allow management of problems and their status.
- Recording on the VM/370 system residence disk machine checks, channel checks, and I/O errors for Field Engineering use. The above data can be printed by running the appropriate VM/370 service programs in a virtual machine.
- Allowing a Field Engineer to run, concurrently with customer production, any of his system-supported and stand-alone diagnostics that avoid the VM/370 restrictions stated in the *IBM Virtual Machine Facility/370: Planning and System Generation Guide*(GC20-1801).

Serviceability of the 3704/3705 Under VM/370

VM/370 provides a concurrent problem determination capability for use with the 3704/3705 as a function of the **NETWORK TRACE** command. Options to this command allow tracing each basic transmission unit sent to and received from the 3704/3705 and also activating the network control program line trace for a particular 3704/3705 resource. For details on the **NETWORK TRACE** command, refer to *VM/370: Operator's Guide*(GC20-1806).

VM/370 utilizes the Online Test Stand-Alone Executive Program (OLTSEP) as the primary interface for diagnostic online tests (OLTs) for all devices attached to the system. This means of support restricts the function of diagnostic tests that are provided for the 3704/3705 in network control mode when used by VM/370 for control of virtual machine operators' consoles. The following defines the serviceability aids that are or are not available for the 3704/3705 when used in this manner:

3704/3705 Internal Function Tests (IFTs): - IFTs run under OLTSEP and provide the full level of device serviceability in this mode of operation that is available for the 3704/3705. An IFT requires the entire 3704/3705 for its use. The 3704/3705 is therefore not available for normal system use.

Down-line Tests:

Terminal Tests - the 3700 series Online Terminal Test (OLTT) programs that are required to maintain the terminals supported by VM/370 through the Network Control Program will function under OLTSEP. This mode of operation will require the dedication of the 3704/3705 to the OLTSEP virtual machine, and therefore, the 3704/3705 cannot be used for normal system operations for the duration of the test.

Line/Modem Tests - The 3700 series Online Terminal Test (OLTT) programs do not function under OLTSEP. The 2700 series OLT

programs can be executed under OLTSEP if the line or lines to be tested are partitioned emulation lines, and are set to emulation mode. The 2700 series OLTs are terminal tests that are also able to aid in line error detection.

Additional terminal serviceability aids and line problem determination aids are provided for the Network Control Program by the 3704/3705 Control Panel Tests, as outlined in the *IBM 3704 and 3705 Communications Controller Operator's Guide* (GA27-3055) and the *VM/370 ECHO* command as defined in the *VM/370: Command Language Guide for General Users*(GC20-1804).

Security and Auditability Highlights

Since the virtual machines created by VM/370 are essentially equivalent to standalone System/370 machines, the isolation between virtual machine programs approaches the isolation between physically separate systems. This same isolation protects the VM/370 Control Program (CP) from inadvertent or malicious modification, thus protecting the protection mechanisms. Some of the security features provided are as follows:

- Main storage isolation - virtual machine is restricted to its own address space; shared storage (if any) is enforced read-only.
- CP privilege classes restrict usage of the sensitive CP facilities to installation-authorized virtual machines.
- Password protection is provided both for access to the CP system and for access to user DASD files.
- Installation exits are provided to allow for extension of the access restrictions or for implementation of access journaling.
- Built-in traps prevent password penetration through repetition of access attempts.
- All virtual machine I/O is monitored and checked against extent authorization controls in the virtual configuration.

An additional security-related feature of VM/370 is that explicit installation action is required to permit the VM Measurement Facility to monitor potentially sensitive data transmitted to/from each user terminal.

PERFORMANCE

VM/370 has been designed to handle a diverse set of requirements with virtual machines.

The performance of systems and programs running in virtual machines, as compared to real machines, will be reduced by varying degrees. Thus, performance will be influenced by such factors as: the total amount of real storage available; the speed, capacity, and number of paging devices; CCW translation, privileged instruction and I/O interrupt handling for virtual machines; and the use of CP performance options.

Because of the dynamic nature of the virtual machine environment, no specific statement can be made concerning general performance. However, it can be said that VM/370 gives highest priority to the interactive users for short periods of time, while the heavy computing user will be given less frequent but longer periods of use.

VM/370 system performance data is obtainable by users both at the console and, in an extended form, through a general-purpose data collection and recording facility with the VM/370 Measurement Facility, as follows:

Data obtainable at the console will show current load conditions on the system. Information on utilization and contention for major system resources (Processor, real storage, and devices) will allow the system analyst to identify possible bottleneck conditions.

The data collection and recording facility can record a wide range of performance related statistical data for more detailed information. Several classes of data collection are provided which may be activated either separately or together. The accumulated data is recorded on tape for later examination and reduction by the user.

The 3270 remote and binary-synchronous line configurations affect response times observed at the 3270 remote display devices. On the basis of the speed of the communication line, users of the CMS Editor may choose between multiple line transmission to the 3270 device (similar to CMS editor support for local 3270s) and a single line at a time mode (as though the display screen were a 2741).

To assist you in evaluating your customer's environment while running under VM/370, a performance guideline, *Introduction to Systems Performance Evaluation, Virtual Storage Systems* (ZZ20-2349) is available from Mechanicsburg. Considerations regarding performance can also be found in the *IBM VM/370: Introduction* (GC20-1800), *Virtual Machine Operating System* section, and in the *VM/370: System Programmer's Guide* (GC20-1807). Detailed VM/370 performance information concerning machine configurations and varying combinations of CMS users, batch, and/or multiple batch virtual machines are available at your local Market Support Center.

VM/370 (cont'd)
INSTALLATION PLANNING

Generating and installing the initial release of VM/370 requires coordinated planning between the customer, DP marketing representative, systems engineers (providing marketing support services), FE programming and service representatives, and the communications common carrier. The *IBM Virtual Machine Facility/370: Planning and System Generation Guide* (GC20-1801) should be reviewed thoroughly before ordering or generating the VM/370 system. See also the publication *IBM VM/370: Planning for Release 3* (GC20-1817) for a description of the facilities new to Release 3.

PROGRAMMING UPDATE SERVICE: Programming update service for VM/370 is provided using the VM/370 Program Level Change (PLC) service.

GENERAL DOCUMENTATION

Title	Number
VM/370 Planning and System Generation Guide	GC20-1801
VM/370 Operator's Guide	GC20-1806
VM/370 System Programmer's Guide	GC20-1807
VM/370 System Messages	GC20-1808
VM/370 Terminal User's Guide	GC20-1810
VM/370 RSCS User's Guide	GC20-1816
VM/370 CMS Command and Macro Reference	GC20-1818
VM/370 CMS User's Guide	GC20-1819
VM/370 CP Command Reference for General Users	GC20-1820
VM/370 Release 3 Guide	GC20-1822
VM/370 Interactive Problem Control System User's Guide	GC20-1823
OS/VS and VM/370 Assembler Programmer's Guide	GC33-4021
VM/370 Introduction	GC20-1800
VM/370 OLTSEP and Error Recording Guide	GC20-1809
VM/370 Glossary and Master Index	GC20-1813
VM/370 Planning for Release 3	GC20-1817
VM/370 Operating Systems in a Virtual Machine	GC20-1821
VM/370 Quick Guide for Users (Reference Summary)	GX20-1826
VM/370 Summary of VM/370 CP and CMS Commands reference card)	GX20-1961
VM/370 Service Routines Program Logic	SY20-0882
VM/370 Data Areas and Control Block Logic	SY20-0884
VM/370 System Logic and Problem Determination Guide	SY20-0885
VM/370 Control Program Listings Microfiche	SYB0-0900
VM/370 Conversational Monitor System Listings Microfiche	SYB0-0901
VM/370 Remote Spooling Communications Subsystem Microfiche	SYC0-9000
VM/370 Interactive Problem Control System Microfiche	SYC0-9001
VS2 EREP Microfiche	SJD2-4350
VM/370 Environmental Recording, Editing and Printing (EREP) Program	GC29-8300
VM/370 Environmental Recording, Editing and Printing (EREP) Program Logic	SY25-7701
OS/VS, DOS/VS and VM/370 Assembler Language	GC33-4010
OS/VS and VM/370 Assembler Logic	SY33-8041

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1401/1440/1460 Emulator Program for the System/370 Under OS/VS (5744-AH1):

Operating System, Virtual Storage, using the IBM Compatibility feature (4457 or 4458). The combination of the program and the compatibility feature enables programs written for the 1401, 1440, or 1460 Data Processing Systems to be executed on the Models 135, 145 or 158. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiple-Divide Processing Overlap, Sense Switches, Advanced Programming/Indexing, Bit Test, Print Storage, Additional Print Control, Space Suppression, Selective Stacker.

The following features and operations are not emulated: Column Binary, Binary Transfer, 51-Column Card, Punch-Feed Read, Read-Punch Release, Card Image (on 1442), Selective Tape Listing (on 1403), Compressed Tapes.

The following input/output devices are not emulated: 1404 Printer, 1444 Card Punch, 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices.

Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher priority regions and paging rates. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the CPU and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator takes advantage of the multiprogramming facilities of OS/VS compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator programs jobs and System/370 jobs can be placed in a single input job stream for processing.

The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1401/1440/1460 system or a stand-alone emulator program must be dumped onto tape using a 1401/1440/1460 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires the Models 135, 145 or 158, the Compatibility Feature (4457 or 4458), enough real storage for the operating system, the emulator functions required for the system being emulated (emulator program and buffers), the 1401/1440/1460 program, and enough Models 135, 145 or 158 devices to correspond to the emulated 1401/1440/1460 devices, in addition to the devices required for the operating system.

Input/output device correspondence is as follows:

1401/1440/1460 I/O Device +

1401 Card Read Punch
1442 Card Read Punch

1403 Printer
1443 Printer
729 II, IV, V, VI Tape Unit or
7330 Magnetic Tape Unit, or
7335 Magnetic Tape Unit

1407 Console Inquiry Station or
1447 Console

1301 Disk Storage, or 1311
Disk Storage Drive, or 1405
Disk Storage, Model 1 or 2

The 1401/1440/1460 Emulator Program executes as a problem program under the

IBM Compatibility feature (4457 or 4458). The combination of the program and the compatibility feature enables programs written for the 1401, 1440, or 1460 Data Processing Systems to be executed on the Models 135, 145 or 158. Most 1401/1440/1460 programs require no changes for execution under the emulator, although certain special and custom features are not emulated. Programs written for the 1401 Model G are not emulated. Emulation is provided for 1401/1440/1460 systems with main storage sizes from 2,000 to 16,000 positions of core storage.

All basic features are emulated, along with the following optional features: Expanded Print Edit, Inverted Print Edit, High-Low-Equal Compare, Multiple-Divide Processing Overlap, Sense Switches, Advanced Programming/Indexing, Bit Test, Print Storage, Additional Print Control, Space Suppression, Selective Stacker.

The following features and operations are not emulated: Column Binary, Binary Transfer, 51-Column Card, Punch-Feed Read, Read-Punch Release, Card Image (on 1442), Selective Tape Listing (on 1403), Compressed Tapes.

The following input/output devices are not emulated: 1404 Printer, 1444 Card Punch, 1445 Printer, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Optical Readers, Magnetic Character Readers, Teleprocessing Devices.

Throughput under emulation is not determined as much by the emulator as it is by the 1400 program being executed. Throughput of 1400 jobs is affected by the mix of CPU operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher priority regions and paging rates. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the CPU and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator takes advantage of the multiprogramming facilities of OS/VS compilers, and more than one "integrated" emulator program can be executed concurrently. The emulator program uses the data management services of the operating system, and takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator programs jobs and System/370 jobs can be placed in a single input job stream for processing.

The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes, used and produced by the 1401/1440/1460 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1401/1440/1460 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1401/1440/1460 system or a stand-alone emulator program must be dumped onto tape using a 1401/1440/1460 utility program, and then restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires the Models 135, 145 or 158, the Compatibility Feature (4457 or 4458), enough real storage for the operating system, the emulator functions required for the system being emulated (emulator program and buffers), the 1401/1440/1460 program, and enough Models 135, 145 or 158 devices to correspond to the emulated 1401/1440/1460 devices, in addition to the devices required for the operating system.

Input/output device correspondence is as follows:

System/370 I/O Device

Any card reader or card read punch supported by the queued sequential access method of the Operating System Virtual Storage.

Any printer supported by the queued sequential access method of OS/VS.
Any tape unit or direct access storage device supported by the basic sequential access method of OS/VS.

Any operator's console supported by OS/VS.

Any direct access storage device supported by the basic direct access method of OS/VS ++.

Publication: IBM Operating System: 1401/1440/1460 OS Emulator on Models 135/145/155, Reference GC33-2008.

+ Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

++ If more than one System/370 direct access storage device is required to correspond to the emulated 1401/1440/1460 disk storage device, all corresponding System/370 devices must be the same type of direct access storage device.

Additional Documentation

PLM GY33-7011
Microfiche GJ01-2100

1410/7010 Emulator Program for the System/370 Models 145, 155II, and 158 Under OS/VS (5744-AG1):

The 1410/7010 Emulator Program executes as a problem program

under the Operating System Virtual Storage, using the IBM 1401/1440/1460, 1410/7010 Compatibility Feature (4458). The combination of the program and the compatibility feature enables programs written for the 1410 or 7010 Data Processing System to be executed on the Model 145. Most 1410/7010 programs require no changes for executing under the emulator, although certain special and custom features are not emulated. Emulation is provided for 1410/7010 systems with main storage sizes from 10,000 to 100,000 positions of core storage.

All basic features are emulated, along with the following optional features: Processing Overlap, Priority Processing, Two Channels on 1410, Inverted Print Edit, 7010 Second, Third, and Fourth Data Channels, 7010 Storage and Restore Status, 7010 Floating Point Arithmetic feature.

The following features and operations are not emulated: 1401/1410 Compatibility Mode, Column Binary, Stacker Select, 51-Column Card, 1410/7010 Diagnostic Instruction Branch of Tape Indicate J (I) K, 7010 Diagnostic Instruction Branch on C Bit, 7010 Program Relocation and Storage Protection, 7010 Interval Timer, Disk CE Track Operations (i.e., Operation with CE Switch On).

The following input/output devices are not emulated: 1311 Disk Storage Drive, 1405 Disk Storage, 7340 Hypertape Drive, 1011 Paper Tape Reader, 1012 Paper Tape Punch, Magnetic Character Readers, Teleprocessing Devices, Optical Readers, 1442 Card Reader*, Model 3.

Throughput under emulation is not determined as much by the emulator as it is by the 1410/7010 program being executed. Throughput of 1410/7010 jobs is affected by the mix of CPU operations (executed by the compatibility feature), input/output operations (executed by the emulator program), and the amount of interference from higher priority regions and paging rates. A precise performance estimate cannot be given.

Unlike stand-alone emulators, integrated emulators must share the CPU and input/output devices with the operating system. In a system with multiprogramming capability, however, the time lost waiting for a shared resource is much less on the average than the time lost by a stand-alone emulator waiting for its input/output operations to complete. This reduction in system wait time should increase total system throughput.

The emulator program takes advantage of the multiprogramming facilities of OS/VS. Other problem programs, such as utility programs, user jobs, compilers, and more than one "integrated" emulator program can be executed concurrently.

The emulator program uses the data management services of the operating system, and it takes advantage of the automatic allocation of resources and the device independence achieved by these services. The operating system error recovery procedures are also used. Both emulator program jobs, and System/370 jobs can be placed in a single input job stream for processing. The emulator program allows the user to apply most of his programming resources toward developing new applications and redesigning existing applications to take full advantage of available Model 145 facilities.

Card, tape, and disk programs are emulated. Cards and tapes used and produced by the 1410/7010 system or by other emulator programs, and mixed parity tapes, are emulated. Disk files must be converted before they can be used by the emulator program. Two tape formatting programs are provided with the emulator program: (1) to assist the user in converting his tape files before emulation so they can be used more efficiently by the emulator program, and (2) to convert tape files produced during emulation back to the 1410/7010 format so they can be used on the original system. In addition, a disk formatting program is provided to assist the user in converting his disk files.

Disk files created by the 1410/7010 system or a stand-alone emulator program must be dumped onto tape using a 1410/7010 utility program, and they restored to disks that have been formatted by the disk formatting program. Both the disk formatting program and the tape formatting programs run as problem programs under the operating system.

System Requirements: The emulator program requires a Model 145, the Compatibility feature (4458), enough real storage for the operating system, the emulator functions required for the system being emulated (emulator program and buffers), and the 1410/7010 program; and enough Model 145 devices to correspond to the emulated 1410/7010 devices, in addition to the devices required for the operating system.

Input/output device correspondence is as follows:

1410/7010 I/O Device **

1402 Card Read Punch

System/370 I/O Device

Any card reader or card read punch supported by the queued sequential access method of the operating system.

1403 Printer

Any printer supported by the queued sequential access method of the operating system.

729 II, IV, V, VI Tape Unit
or 7330 Magnetic Tape Unit

Any tape unit or direct access storage device supported by the basic sequential access method of the operating system.

1415 Console Printer

Any operator's console supported by the operating system.

1301 Disk Storage, Model 1 or 2,
1302 Disk Storage, Model 1 or 2,
2302 Disk Storage, Model 1 or 2

Any direct access storage device supported by the basic direct access method of the operating system***.

* Can be emulated if running on 1402 mode.

** Programmed reading on more than one reader, printing on more than one printer, or punching on more than one punch is not supported.

*** If more than one System/370 direct access storage device is required to correspond to the 1410/7010 disk storage device being emulated, all corresponding System/370 devices must be the same type of direct access storage device.

Additional Documentation

PLM	GY33-7012
Microfiche	GJDI-2150

DOS Emulator Under OS/VS (5744-AS1):
Version 3

The DOS Emulator eases the transition for DOS (Releases 25, 26, 27, 28, 29, 30, 31, 32 and 33) user migration to OS/VS and the System/370 Model 135 (OS/VS1), 145, 155 II, or 158.

The Emulator program integrates the facilities of the DOS system into the operating environment of OS/VS. It receives DOS jobs as input and produces output in the same format as format as found in DOS.

Throughput under emulation is not determined as much by the emulator as it is by the DOS program being executed. Throughput of DOS jobs is affected by the amount of interference from higher priority virtual or real regions/address spaces, and the paging rate of the system.

Highlights Version 3 Modification 3:

- DOS programs can be processed under OS/VS without conversion.
- No re-linkage edit, re-compile, or re-assembly is required for DOS programs.
- Other OS/VS programs can run concurrently.
- DOS/VS functions supported are:
 - Extended Control Mode
 - Virtual Storage Support
 - Relocating Loader
 - Five partitions
 - Shared Virtual Area
 - Generic assignment
 - Block Multiplexer Channel and Rotational Position Sensing
- OS/VS Sysin/Sysout facilities are available to the DOS user.
- DOS BTAM is supported; includes 2260 local and 3270 local and remote.
- DASD Device Sharing support allows both OS/VS and DOS programs to concurrently share DASD volumes.
- 3340 in restricted, non restricted (sharable) and substituted modes.
- 3330 Model 11 in non restricted (sharable) and substituted modes.
- Device substitution allows programs written for a given type of DASD to run on another type of DASD.
- Volume sharing and device substitution facilities are extended to the 3850 Mass Storage System, using the virtual 3330 device.
- The 3540 Diskette is supported via the OS/VS Reader and Writer facilities.
- The 3344 and 3350 Direct Access Storage devices are accepted by the Emulator in Compatibility Mode only. This support allows the user to operate a 3344 as if it were four 70MB 3340s, or a 3350 as if it were two Model 1 3330s.
- ISAM mapping function allows unmodified DOS programs to access OS/VS formatted ISAM data sets. This function, together with a degree of existing SAM and DAM compatibility, allows individual program conversion where a group of programs access common data sets.
- An automatic DOS IPL procedure eliminates the need for ADD, DEL, SET, CAT and DPD commands.
- Operator communications substantially improved compared with Version 2.

Restrictions: The following IBM units and features supported by DOS are not supported by the emulator:

Virtual Storage Support: DOS/VS programs should not rely on the DOS/VS paging mechanism.

Other DOS/VS functions: Emulator does not support SDAID, OLTEP, Machine Emulators, QTAM, VTAM.

Programs using VSAM run only on restricted DOS volumes.

2260 and 3270: 2260 local and 3270 local and remote are supported only if accessed through DOS BTAM.

Device substitution: supported for non restricted DASD volumes only. Emulated DOS programs must not contain any device dependent coding other than DTFs. Emulated DOS system and OS/VS system must support explicitly the substituted (new) device.

1270, 1275 optical reader, sorter.

1259, 1412, and 1419 magnetic character readers.

1287, 1288 optical character reader in document mode, when: response times are required for pocket selection, (1287 only); PIC bit in the CCW is used, or the CCW string is modified between the READ and WAITF macros.

Model-dependent functions such as CS30, CS40, and the DIAGNOSE instruction.

7770 and 7772 Audio Response Units under DOS BTAM.

Use of data chaining for staged devices.

Device Sharing.

DOS files accessed on a device shared volume cannot:

- have more than 16 extents.
- be a DOS ISAM file.
- be a multivolume file.
- have both split and unsplit cylinder.

DOS programs accessing files on a device shared volume must:

- issue a DOS OPEN or OPENR for each file accessed.
- not and cannot rely on the information in the DBDL and EXTENT cards other than the logical unit (SYSXXX, file name, and file-ID fields).
- not use embedded SEEKS in the channel program accessing the files on the shared volume.
- use absolute track specifications on the DD when accessing files using absolute track address.

ISAM Mapping.

The use of the ISAM Mapping Feature is subject to the following limitations:

- DOS program may read and write only fixed-length records.
- The use of incore indexes or prime data will be ignored.
- The ISAM DTF may not be modified.
- Fields other than filename C, P, O, I, A, R, T, and H are not supported any may be invalid.
- The Emulator does not take any steps to provide or prevent concurrent use of an ISAM file with other jobs.

3540 Diskette.

DOS/VS programs using the 3540 Diskette will not run under the Emulator if they:

- attempt to use a file without issuing an OPENR Macro
- use EXCPs or non-standard access method
- attempt to use a file created in the same Emulator job

The following programming items, permissible in the DOS environment, cannot be handled by the emulator:

The emulator program for 1401/40/60, 1410/7010 and Model 20 under DOS. Modification, use, or storing of information in user CCWs between EXCP and WAIT. Storage protection under DOS may be specified but is not effective.

QTAM, AUTOTEST and VTAM.

HIO is not a restriction for DOS BTAM.

Programs that:

- Depend upon the HIO, RDD, WDD, and DIAGNOSE instructions for their operation.
- Rely on known timing relationships of DOS.
- Use PCI bit.

Minimum System Requirements: The Emulator requires the OS/DOS Compatibility Feature. The basic Emulator program requires 48K bytes of Virtual Storage. Additional virtual storage is required for the DOS System being emulated including allowances for its associated partitions.

- 48K bytes: Emulator program
- 6K bytes: Control blocks for up to 10 I/O devices in job step
- Add 300 bytes for each additional device
- Add 20K bytes for the emulator's service aids

Systems Support - Version 3 Modification 3 of the DOS/OS Emulator supports DOS Releases 25 - 27 plus DOS/VS Releases 28, 29, 30, 31, 32 and 33 on all releases of OS/VS1 and OS/VS2 current at the time of availability of Version 3.

DOS Emulator support in no way changes the currency of a DOS or DOS/VS release.

Device Requirements: There must be enough devices available to support both DOS and OS/VS. When using staged I/O, and device sharing facilities the need for devices dedicated to DOS can be minimized.

Generally, the Emulator supports devices which are concurrently supported by the System/370, OS/VS system and DOS system being utilized. The Emul f devices may not be concurrent with the various releases of OS/VS or DO!

In addition, allowable mapping of command code compatible devices between OS/VS and DOS are as follows:

DOS	OS/VS
1403	3211
2400	3420
2540 (Reader)	3505 (Reader)
2540 (Punch)	3525 (Punch)

Note that OS/VS does not support 2311 Disk Units and 2311 Data Cells.

The System/370 Model 155 requires logic EC level 260-448 and DOS Compatibility Feature (5450) EC level 260-715.

General Documentation
7015.

Program Logic Manual (SY33-

System/370 Models 165 II and 168
Emulator Program for the 7080 Under OS/VS
(5744-AL1):

165 II or 168 equipped with the 7080 Compatibility Feature(7118 or 7128). The 7080 Integrated Emulator Program and the Compatibility Feature enable the Model 165 to execute, under the Operating System, programs written for an IBM 7080 Data Processing System. Most 7080 programs that are debugged and are not time-dependent can be executed without modification. Certain devices and features of the 7080 system are not emulated, however.

The 7080 Emulator takes advantage of the multiprogramming facilities of OS/VS. Other problem programs, such as user jobs, utility programs, compilers, or additional 7080 Integrated Emulator Programs, can be executed concurrently in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System Virtual Storage, thereby achieving device independence and the automatic allocation of system resources.

Throughput depends upon the 7080 program being emulated, as determined by the following factors: mix of 7080 CPU operations executed by the compatibility feature, the 7080 CPU and I/O operations simulated by the emulator program, the amount of interruption from higher priority tasks of the Operating System, and the paging rate.

Tape formatting programs are provided with the Emulator to assist user in converting 7080 tape files before emulation, so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation, so that they can be used on the original system.

Specifically excluded from support are the following items:

- The IBM 7622 Signal Control, associated units and related instructions.
- The IBM 7908 Data Channel, associated devices and features (including control storage bank 4) and related instructions, specifically ENABLE COMPARE BACKWARD.
- All 7080 RPK (Request for Price Quotation) features and related instructions.

System Requirements: The 7080 Emulator Program requires a System/370 Model 165 II or 168 equipped with the 7080 Compatibility Feature (7118 or 7128); it requires enough Model 165 II or 168 devices to correspond to the 7080 devices (in addition to devices required by the Operating System Virtual Storage) it requires enough storage for the Operating System Virtual Storage, and for the 7080 program being executed.

Input/output device correspondence is as follows:

7080 Device	System/370 Device
7153 Console	3066 Systems Console
7502 Console Card Reader	Any card reader or SYSIN device supported by the Operating System Queued Sequential Access Method.
729 II, IV, V, VI Magnetic Tape Unit	2400 Series Magnetic Tape Units Models 1 - 6 and 8 (7-track) or 2420 Magnetic Tape Unit Models 5 or 7 or 3420 Magnetic Tape Unit Model 3, 5 or 7 or any other tape unit supported by the Basic Sequential Access Method of the Operating System* Virtual Storage or direct access devices**.

* All seven-track tape drives used for 7080 compatible tapes must have the Seven-Track Compatibility Feature.

** A 7080 tape in spanned variable-length format may be kept on any Model 165 II or 168 direct access device supported by BSAM. The file will appear to be a tape to the 7080 program, which can access it only through tape commands.

7080 devices not listed are not supported.

Additional Documentation

PLM	GY27-7229
Microfiche	GJD1-1642

The 7080 Integrated Emulator
Program executes as a problem
program under OS/VS on a Model

165 II or 168 equipped with the 7080 Compatibility Feature(7118 or 7128). The 7080 Integrated Emulator Program and the Compatibility Feature enable the Model 165 to execute, under the Operating System, programs written for an IBM 7080 Data Processing System. Most 7080 programs that are debugged and are not time-dependent can be executed without modification. Certain devices and features of the 7080 system are not emulated, however.

The 7080 Emulator takes advantage of the multiprogramming facilities of OS/VS. Other problem programs, such as user jobs, utility programs, compilers, or additional 7080 Integrated Emulator Programs, can be executed concurrently in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System Virtual Storage, thereby achieving device independence and the automatic allocation of system resources.

Throughput depends upon the 7080 program being emulated, as determined by the following factors: mix of 7080 CPU operations executed by the compatibility feature, the 7080 CPU and I/O operations simulated by the emulator program, the amount of interruption from higher priority tasks of the Operating System, and the paging rate.

Tape formatting programs are provided with the Emulator to assist user in converting 7080 tape files before emulation, so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation, so that they can be used on the original system.

Specifically excluded from support are the following items:

- The IBM 7622 Signal Control, associated units and related instructions.
- The IBM 7908 Data Channel, associated devices and features (including control storage bank 4) and related instructions, specifically ENABLE COMPARE BACKWARD.
- All 7080 RPK (Request for Price Quotation) features and related instructions.

System Requirements: The 7080 Emulator Program requires a System/370 Model 165 II or 168 equipped with the 7080 Compatibility Feature (7118 or 7128); it requires enough Model 165 II or 168 devices to correspond to the 7080 devices (in addition to devices required by the Operating System Virtual Storage) it requires enough storage for the Operating System Virtual Storage, and for the 7080 program being executed.

Input/output device correspondence is as follows:

7080 Device	System/370 Device
7153 Console	3066 Systems Console
7502 Console Card Reader	Any card reader or SYSIN device supported by the Operating System Queued Sequential Access Method.
729 II, IV, V, VI Magnetic Tape Unit	2400 Series Magnetic Tape Units Models 1 - 6 and 8 (7-track) or 2420 Magnetic Tape Unit Models 5 or 7 or 3420 Magnetic Tape Unit Model 3, 5 or 7 or any other tape unit supported by the Basic Sequential Access Method of the Operating System* Virtual Storage or direct access devices**.

* All seven-track tape drives used for 7080 compatible tapes must have the Seven-Track Compatibility Feature.

** A 7080 tape in spanned variable-length format may be kept on any Model 165 II or 168 direct access device supported by BSAM. The file will appear to be a tape to the 7080 program, which can access it only through tape commands.

7080 devices not listed are not supported.

Additional Documentation

PLM	GY27-7229
Microfiche	GJD1-1642

7094 Integrated Emulator System/370 Model
165 II or 168 - OS (5744-AM1):

165 II or 168 equipped with the 709/7090/7094/7094 II Compatibility Feature(7119 or 7129). The 7094 Integrated Emulator Program and the Compatibility Feature enable the Model 165 II or 168 to execute, under the Operating System/VS programs written for a 709/7090/7094/7094 II Data Processing System. Most 7090/7094 programs that are debugged are not time-dependent can be executed without modification. Certain devices and features of the 7090/7094 system are not emulated, however.

The 7094 Emulator takes advantage of the multiprogramming facilities of OS/VS. Other problem programs, such as user jobs, utility programs, compilers, or additional 7090/7094 Integrated Emulator Programs, can be executed concurrently in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System Virtual Storage, thereby achieving device independence and the automatic allocation of system resources.

Throughput depends upon the 7090/7094 program being emulated, as determined by the following factors: mix of 7090/7094 CPU operations executed by the compatibility feature, the 7090/7094 CPU and I/O operations simulated by the emulator program, and the amount of interruption from higher priority tasks of the Operating System Virtual Storage.

System Requirements: The 7094 Integrated Emulator Program requires a System/370 Model 165 II or 168, the 709/7090/7094/7094 II Compatibility Feature (7119 or 7129) devices required for the operating system, and one device or direct access data set for each emulated 7094 device. All card read punch units used to read or punch binary data must be equipped with the Card Image Feature, and all tape drives used for 7094 compatible tapes must be equipped with the Seven-Track Compatibility Feature.

Input/output device Correspondence is as follows:

709/7090/7094 II	Model	System/370
7108 Processing Unit (7090)	1	Model 165 II or 165 (with RPK S20471) Processing Unit with 709/7090/7094/7094 II Compatibility
7110 Processing Unit (7094)	1	Functions provided by Model 165 II or 168
7111 Processing Unit (7094 II)	1	Functions provided by Model 165 II or 168
7109 Arithmetic Sequence Unit	1	2860 Selector Channel(s) 2870 Multiplexer Channel(s) 2880 Block Multiplexer Channel(s)
7302 Core Storage	1	Any tape unit supported by the operating system sequential access method or sufficient space on a direct access device supported by the Basic Sequential Access Method.
7607 Data Channel(s) (Channels A through H supported)	1, 2, 3, 4, 5	Any card reader with Card Image feature or SYSIN device supported by the operating system Queued Sequential Access Method.
729 Tape Unit	2, 4, 5 6	Any card punch with Card Image feature or SYSOUT device supported by the operating system Queued Sequential Access Method.
711 Card Reader	2	If SYOUT is used the user must write his own SYOUT writer to punch binary dates.
721 Card Punch	1	Any printer or SYSOUT device supported by the operating System Queued Sequential Access Method.
716 Printer	1	

Any 7094 features or devices not listed are not emulated. 704 Mode is not emulated.

Additional Documentation

PLM	GY27-7187
Microfiche	GJD1-1640

System/370 Models 165 II and 168 Integrated Emulator Program for the 7070/7074 Under OS/VS (5744-AK1): The 7070/7074 Emulator Program executes as a problem program under OS/VS on a Model 165 II and 168 equipped with the 7070/7074 Compatibility Feature (7117 or 7127). The Model 165 II and 168 to execute, under the Operating System Virtual Storage programs written for an 7070/7074 Data Processing System with the Floating Point feature and 10,000 words of storage. Most 7070/7074 programs that are debugged and are not time-dependent can be executed without modification. Certain devices and features of the 7070/7074 system are not emulated, however.

The Integrated Emulator Program takes advantage of the multiprogramming facilities of OS/370. Other problem programs such as: user jobs, utility programs, compilers, or additional 7070/7074 Integrated Emulator Programs can be executed concurrently in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System Virtual Storage, thereby achieving device independence and the automatic allocation of system resources.

Throughput depends upon the 7070/7074 program being emulated, as determined by the following factors: the mix of 7070/7074 CPU operations executed by the compatibility feature, the 7070/7074 CPU and input/output operations simulated by the emulator program, the amount of interruption from higher priority tasks of the Operating System, and the paging rate.

Tape formatting programs are provided with the Emulator to assist the user in converting 7070/7074 tape files before emulation, so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation, so that they can be used on the original system. Native mode tape files must be preprocessed using the tape formatting program if record lengths exceed 32,755 bytes or if the complete range of data management facilities of the operating system are to be used.

The following CPU features are not emulated: Additional Storage and associated instructions ... Interval Time Instructions ... Customer Engineering Diagnostic Instructions ... Optional Feature Instructions (except Floating Point).

The following input/output devices are not emulated: 7907 Data Channel ... 7900 Inquiry Station ... 7300 Disk Storage ... 7500 Card Reader ... 7550 Card Punch ... 7400 Printer ... 7603 Input/Output Synchronizer.

The following input/output features are not emulated: Tape Read All Alpha (treated as tape read) ... Read Binary Tape ... Tape Read/Write from 7074 locations 9990-9999 ... 729 Tape Switching Feature ... Unit Record Priority Interrupts ... Unit Record Signal.

System Requirements: The 7070/7074 Emulator Program requires a System/370 Model 165 II or 168 equipped with the 7070/7074 Compatibility Feature; it requires enough Model 165 II or 168 devices (in addition to devices required by the Operating System Virtual Storage) it requires enough storage for the Operating System, for the emulator functions needed for the 7070/7074 system being emulated, and for the 7070/7074 program being executed.

Input/Output device correspondence is as follows:

7070/7074 Device	System/370 Device
7150 Console	3066 Systems Console
7501 Console Card Reader	Any card reader or SYSIN device supported by the Operating System Queued Sequential Access Method.
729 II, IV, V, VI Magnetic Tape Unit	2400 Series Magnetic Tape Units Models 1 - 6 and 8 (7-track) or 2420 Magnetic Tape Unit Models 5 or 7 or 3420 Magnetic Tape Unit Model 3, 5, or 7 or any other tape unit supported by the Basic Sequential Access Method of the Operating System* or direct access devices**.

* All seven-track tape drives used for 7070/7074 compatible tapes must have the Seven-Track Compatibility Feature.

** A 7074 tape in spanned variable-length format may be kept on any Model 165 II or 168 direct access device supported by BSAM. The file will appear to be a tape to the 7070/7074 program, which can access it only through tape commands.

Additional Documentation

PLM	GY27-7228
Microfiche	GJD1-1641

OS/VS 7070/7074 Integrated Emulator for System/370 Model 155 II, or 158 (5744-AJ1): The 707X Emulator executes as a problem program under OS/VS on a System/370 Model 155 II, or 158 equipped with the 7070/7074 Compatibility Feature (7117). The 707X Emulator enables the Model 155 II or 158 to execute, under the Operating System, programs written for an IBM 707X Data Processing System with 10,000 words of storage. Most 707X programs that are not time-dependent can be executed without modification. Certain devices and features of the 707X system are not emulated.

Problem programs such as user jobs, utility programs, compilers, or teleprocessing can be executed concurrent with the 707X Emulator in main storage. The Emulator allows the user to direct his programming resources toward developing new applications and redesigning existing applications to take advantage of System/370 facilities. The Emulator uses the data management services of the Operating System Virtual Storage, thereby achieving device independence and the automatic allocation of system resources.

Performance: Throughput depends upon the following factors: the mix of 707X CPU operations part of those being CPU operations executed by the compatibility feature, the 707X CPU and input/output operations simulated by the Emulator Program, and the amount of interruption from higher priority partitions or regions and from the Operating System.

Two tape formatting programs are provided with the Emulator to assist the user in converting 707X tape files before emulation so that they can be processed more efficiently by the Emulator, and in converting tape files produced during emulation so that they can be used on the original system.

The following CPU features are not emulated: Additional Storage and associated instructions ... Interval Timer Instructions ... Customer Engineer Diagnostic Instructions ... Optional Feature Instructions (except Floating Point which is emulated).

The following input/output devices are not emulated: 7907 Data Channel ... 7900 Inquiry Station ... 7300 Disk Storage ... 7500 Card Reader ... 7550 Card Punch ... 7400 Printer ... 7603 Input/Output Synchronizer.

The following input/output features are not emulated: Tape Read All Alpha ... Read Binary Tape ... Tape Read/Write from 707X locations 9990-9999 ... 720 Tape Switching Feature ... Unit Record Priority Interrupts ... Unit Record Signal.

System Requirements: The 707X Emulator requires a System/370 Model 155 II, or 158 equipped with the 7070/74 Compatibility Feature (7117); it requires enough System/370 devices to correspond to the 707X devices in addition to devices required by the operating system; it requires enough main storage for the operating system, the emulator functions needed for the 707X system being emulated, and the 707X program being executed.

Input/output device correspondence is as follows:

707X Device	System/370 Device
7150 Console	Model 155 II or 158 Console
7501 Console Card Reader	1442 Card Read Punch, 2501 Card Reader, 2520 Card Read Punch, 2540 Card Read Punch, with 2821 Control Unit, or any other SYSIN devices supported by the Queued Sequential Access Method of the Operating System
729 II, IV, V, VI Magnetic Tape Unit	2400 Series Magnetic Tape Units (Models 1, 2, 3, 4, 5 or 6) or 2420 Magnetic Tape Units (Models 5 or 7) or any other tape unit supported by the Basic Sequential Access Method of the Operating System* or direct access devices**.

* All seven-track tape drives used for 707X-compatible tapes must have the Seven-Track Compatibility Feature.

** A 707X tape in spanned variable-length format may be kept on any System/370 direct access device supported by BSAM. The file will appear to be a tape to the 707X program which can access it only through tape commands.

Additional Documentation

PLM	GY27-7238
Microfiche	GJD1-1643

3704/3705 Emulation Support and System Support for OS/VS (5747-AG1) or OS/VS (5744-AN1): Emulation Program Support is a set of program modules provided to the customer to generate, using the EP Generation Procedure, a customized 3704/3705 Emulation Program. The EP, when generated and loaded, executes in the 3704/3705 and provides the functional capabilities of the 2701 Data Adapter Unit and/or 2702/2703 Transmission Control Units through the physical medium of the 3704/3705.

System Support Programs consists of the Emulation Program (EP) Generation Procedure, Load Program, Dump Program, and Assembler.

3704/3705 SYSTEM SUPPORT PROGRAMS for OS/VS and DOS/VS

3704/3705 System Support Programs for OS/VS and DOS/VS consist of a Generation Procedure which allows generation of the Network Control Program/Virtual Storage (NCP/VS), and its Partitioned Emulation Programming (PEP) Extension, the Emulation Program/Virtual Storage (EP/VS), the Load Program, the Dump Program, and the 3704/3705 Assembler for use in conjunction with OS/VS and DOS/VS systems.

See the PP section for the System Support Programs (SSP) for Advanced Communications Function NCP/VS, 5735-XX3

NCP/VS Generation Procedure

In OS/VS, the 3704/3705 NCP/VS Generation Procedure is a two-stage process using the 3704/3705 Assembler and the Linkage Editor to generate a 3704/3705 NCP/VS.

Stage 1 is an assembly of system generation macros. The output from Stage 1 is a job stream containing the JCL and the control information necessary to generate and link edit an NCP/VS. Stage 2 is the execution of the job stream.

In DOS/VS, the 3704/3705 NCP/VS Generation Procedure is a three-stage process using the 3704/3705 Assembler and the Linkage Editor to generate a 3704/3705 NCP/VS.

Stage 1 is an assembly of System Generation macros. Stage 2 processes the conditionally assembled NCP/VS modules and builds a job stream containing the JCL necessary to catalog the conditionally assembled modules and link edit an NCP/VS. Stage 3 is the execution of the job stream.

System generation macros are divided into three groups: System Macros ... Configuration Definition Macros ... Block Handling Macros.

The System Macros provide information pertaining to the entire communications controller. The macros specify facilities such as:

Storage Size ... Channel Type ... Buffer size and number ... Recommended serviceability aids (online terminal test; address interrupt trace) ... Dynamic network alteration and interrogation facilities.

The Configuration Definition Macros describe the characteristics of:

Line Group ... Terminals ... Terminal Components ... Service Order Tables for nonswitched lines ... Terminal ID sequence for BSC devices.

Block Handling Macros define processing to be done on data blocks and when the processing is to be performed. Processing functions include: Editing out backspaced text ... Date/Time stamping.

Processing may be performed: After receipt from a terminal ... After receipt from CPU, but before the line is available ... After receipt from CPU, but after the line is available.

The Partitioned Emulation Programming (PEP) Extension may be generated in a similar manner. In addition, NCP/VS-only or EP/VS-only systems may be generated by use of the Generation Procedure.

Load Program

The 3704/3705 Load Program retrieves a specified load module from direct access on the host system. This load module is then transferred across the channel to the Communications Controller. Upon successful completion of this transfer, control is passed to the program just loaded.

Dump Program

The Dump Program dumps the storage and register contents of the Communications Controller to a host system data set and provides for the printing of the contents. Formatting of critical control blocks of the NCP/VS is provided as an option. The dump may be a full or partial dump.

3704/3705 Assembler

The 3704/3705 Assembler assembles programs written in 3704/3705 Assembler language. The instructions are similar to those processed by the OS/VS and DOS/VS assemblers. The assembler operates on three kinds of instructions: 3704/3705 machine instructions (written in 3704/3705 Assembler language notation) ... Macro instructions ... Assembler instructions.

The machine instructions are represented to the 3704/3705 Assembler by mnemonic operation codes, usually followed by one or more operands.

The macro language provides a convenient method of generating a desired sequence of assembler language statements many times in one or more programs. Macro definitions can be coded inline in assembler language programs or stored in a host library and called in when needed by means of a macro instruction coded in the program.

The assembler instructions direct the assembler to perform certain operations during the assembly process, but are not converted into executable code.

EP/VS Generation Procedure

The EP/VS Generation Procedure is a two-stage process which uses the 3704/3705 Assembler and the OS/VS or DOS/VS Linkage Editor to generate a 3704/3705 EP/VS.

Stage 1 is an assembly of the System Generation Macros. The output of Stage 1 is a job stream containing the JCL and control information necessary to generate and link edit an EP/VS. Stage 2 is the execution of the job stream.

SSP System Requirements

The OS/VS SSP operates in a minimum 192K virtual region. The DOS/VS SSP operates in a minimum 64K virtual partition.

3704/3705 EP/VS

A set of program modules provided to the customer to generate (by use of the EP/VS Generation Procedure) his customized 3704/3705 EP/VS. The EP/VS, when generated and loaded, executes in the 3704/3705 and provides the functional capabilities of the 2701 Data Adapter Unit and/or 2702/2703 Transmission Control Units through the physical medium of the 3704/3705-I/3705-II.

Programs which operate with an IBM 2701, 2702, or 2703 will operate with a 3704/3705-I/3705-II in emulation mode, provided the programs: use only the 2701, 2702 or 2703 features supported by EP/VS ... use only terminals and CPU attachments supported by EP/VS ... require only RPQs supported by EP/VS ... are not time-dependent.

2701, 2702, and 2703 features not supported by EP/VS are: Synchronous Data Adapter Type I ... Parallel Data Adapter ... Programmable Two-Processor Switch ... 6-Bit Transcode ... Attachment to other than a byte multiplexer channel ... 230, 400 bps Synchronous Speed ... 1032 Digital Time Unit Attachment. ASCII Transparency is only supported by the emulation mode of operation when the 3705 has a Communication Scanner, Type 3 (FC 1643). A second channel is only supported when two Channel Adapters, Type 4 (FC 1544) are installed in the 3705.

Intermixing of 2701, 2702, and 2703 line and function is permitted; however, subchannel address assignment must be contiguous. Replacement of multiple 2701s, 2702s, or 2703s with a 3704/3705-I/3705-II may require device address reassignment.

The following RPQs for 2701s, 2702s, and 2703s will be provided as standard features with EP/VS:

2701	M44307	Attach 2711
	F26072	Autopoll IBM III
	M53193	Break Command IBM I
	858492	Break Command IBM I
	E60987	IBM Type III at 4800 bps
	E56160	Dataphone 50 on SDA II
2702	F13308	50 bps Speed
	E46765	Break Command IBM I
	E54838	Immediate End
	E62920	Carriage Return on TTY
	EA3120	TTY X Off
2703	E53715	Break Command IBM I
	F17897	50 bps Speed
	Z71949	1200 bps Speed
	Z16087	Immediate End
	E49633	28 Second Timeout - no data
	E62376	TTY II Character Recognition
	858126	Timeout Change
	E61947	TTY II with Telegraph Line Set
	W21061	Timeout Change
	W23396	IBM I - no LRC
	Y24344	EOT or EOB Four Character Sequence

Although operation of EP/VS is mutually exclusive with operation of NCP/VS, EP/VS and NCP/VS operation may be alternated provided the customer has sufficient storage to support NCP/VS operation. This procedure will necessitate a re-IPL of the 3704/3705-I/3705-II. EP/VS and NCP/VS may co-reside using PEP as described in *Network Control Program/Virtual Storage - NCP/VS*.

Thruput rates of the 3705-I with EP/VS are, in most cases, comparable to those attained with a similarly configured 2701, 2702, or 2703.

The following terminals and CPU remote attachments are supported by EP/VS:

EP/VS TERMINAL SUPPORT CHART

SS Terminals	BSC Terminals
1031	2715-2
1051	2772

**3704/3705 System Support Programs
for OS/VS and DOS/VS (cont'd)**

2848/2260	2780
2845/2265	2972-8,-11
	3271-1,-2
	3274-1C (3271-1,2)
2740-1 (a)	3275-1,-2
	3276 (3271-1,2)
2740-2	3651-A25,-B25,-A75,-B75
	C75,-D75 (S/3)
2741	3651-A60,-B60 (as a S/3)
3767-1,-2 (as a 2740-1,-2, 2741)	3661 (as a S/3)
3767-3 (as a 2740-2)	3670
5100 (as a 2741)	3735
5110 (as a 2741)	3741-2,-4
CMCST	3747
S/7 (as a 2740-1)	3771-1,-2,-3 (as a 2772)
AT&T 83B2/B3 Line Control Type	3773-1,-2,-3,-P1,-P2,-P3 (as a 2772)
CPT-TWX (M33/35) Line Control Type	3774-1,-2,-P1,-P2 (as a 2772)
WU 115A Line Control Type	3775-1,-P1 (as a 2772)
WT Telegraph	3776-1,-2 (as a 2772/3780)
	3777-1 (as a 2772/3780)
	3777-2 (as a S/360-20)
	3780
	5110 (as a 2772)
	1131 w/ SCA
	1826 w/ CA
	S/3
	S/7 (as a S/3)
	S/32 (as a S/3)
	S/34 (as a S/3)
	S/360-20 w/BSCA
	S/360-25 w/ICA
	S/370-115,-125,-135, -135-3,-138 w/ICA
	S/360, S/370 w/2701,2703
	S/360, S/370 w/Local
	3704/3705-I/3705-II

(a) 2760 attached to a
2740-1 is supported.

EP/VS Minimum Machine Requirements: The minimum 3704/3705-II configuration for program execution is a Model A1 with Channel Adapter Type 1, Communications Scanner Type 1 or Type 2, and appropriate line attachment features. The minimum 3705-II configuration is a Model E1 with a Channel Adapter Type 1, Communication Scanner Type 2, and the appropriate line attachment features.

Programming Service Classification: See SCP Index.

**NETWORK CONTROL PROGRAM/VIRTUAL STORAGE
NCP/VS**

(Also refer to the Program Products section for licensed options provided for NCP/VS).

NCP/VS is a set of program modules provided to the customer to generate (by use of the NCP/VS Generation Procedure) his customized NCP/VS. NCP/VS, when generated and loaded, executes in the 3704/3705-I/3705-II and is supported by OS/VS VTAM, OS/VS TCAM, DOS/VS VTAM and by DOS/VS EXTM (a Program Product).

NCP/VS performs such transmission control unit functions as line control, character recognition, line timeout, character assembly/disassembly and checking. In addition, some functions typically performed by a telecommunications access method are provided by NCP/VS. Polling, addressing, code translation, data link control and first level error recovery procedures are performed by NCP/VS.

The basic element of communication between the host access method and the 3704/3705 is the block. A transfer between the Processor and 3704/3705 may consist of one or more blocks. A block consists of control information and any text that may accompany it. The text is generally a transmission block destined to or received from a terminal.

A block is sent by the host to the Communications Controller to request that an operation be performed. When the operation is complete, NCP/VS may send a block to the host indicating the results of the requested operation. NCP/VS will also send unsolicited blocks to the host to provide it with such information as error statistics.

Within the Controller, the installation can optionally select functions to make certain changes in transmission block data. These functions are essentially data editing functions which can be performed on a transmission block before transmission to a terminal on output or before transmission to the Processor on input.

At any time, the NCP/VS may have several transactions in process at various points in the subsystem. The supervisory functions provide the capability for scheduling NCP/VS activity optimally by resolving contention for processing time within NCP/VS.

In addition, there are functions in NCP/VS to accomplish the logical and physical elements of input/output on the communication lines and the channel to the host Processor. These functions are dependent upon the network configuration, specifically line and terminal types.

SDLC/BSC Path: The SDLC/BSC Path is an enhancement to NCP/VS. It provides an SNA application-driven two-way path for data flow between the Host Positive Credit Session of a 3651 Retail Store Controller and a specific BSC device via a 3705-I/3705-II Communications Controller.

The 3651 and the BSC device must be attached to the same 3705-I/3705-II: the 3651 via a nonswitched SDLC line and the BSC device via a point-to-point nonswitched BSC line operating in EBCDIC transparent mode. The 3705-I may be local or remote, the 3705-II must be local.

When using the SDLC/BSC Path, the following are supported as terminals on the BSC line: S/360 and S/370, and the 1130, 1800, S/3, and S/7 when specified as a S/3. Any device or application code required is the user's responsibility.

Definition of the path is accomplished at NCP system generation time. Data flowing over the SDLC/BSC Path does not enter the host CPU. First level error recovery is performed by NCP/VS. Other errors must be handled by the user-written application program interacting with VTAM in the host. Application dependent logic can be added by way of the BSC User Block Handling Routines (UBHRs) in NCP/VS.

Partitioned Emulation Programming - PEP is an extension of NCP/VS which allows NCP/VS and EP/VS to co-reside within a single 3704/3705-I/3705-II. Through PEP, a contiguous range of subchannel addresses may be assigned to emulation mode operation for the execution through the 3704/3705 of programs written for the IBM 2701 Data Adapter Unit, the IBM 2702 Transmission Control Unit and the IBM 2703 Transmission Control Unit, concurrently with network control mode operation. A line may be assigned to either network control mode or emulation mode operation at one time. Assignments may be changed between network control mode and emulation mode through use of a Control Command issued to the NCP/VS by the host Processor Operator Control Facility.

Support of features, attachment of remote terminals and Processor attachments for the NCP/VS partition when PEP is generated is the same as described for NCP/VS, and for the EP/VS partition is the same as described for EP/VS, except that: (1) Two channel NCP/VS support for MP systems is available when PEP is used provided both a Type 1 and a Type 3 channel adapter are employed; (2) NCP/VS support is for virtual storage operating systems only.

The 3704 and 3705-I with the Remote Program Loader Feature are supported by OS/VS VTAM and OS/VS TCAM through VTAM, and by DOS/VS VTAM.

PEP is available for System/370 Processors using OS/VS with VTAM or TCAM or using DOS/VS with VTAM. The EP/VS partition does not operate with VTAM.

NCP/VS (cont'd)

Problem determination aids such as machine and program check recording, permanent line error recording, 3704/3705 panel display, online terminal test,abend condition check and debugging aids are provided by NCP/VS.

Remote attachment via the NCP/VS is shown in the following chart:

NCP/VS TERMINAL SUPPORT CHART

	Communications Code				Communications Network			
	BCD	EBCD	Correspondence	EBCDIC norm	ASCII norm	PTP	sw	nonsw
SS Terminals:								
1051	X	X	-	-	-	X	X	X
2740-1	X	X	X	-	-	X	X	X
2740-2	X	X	-	-	-	-	-	X
2741	X	X	X	-	-	X	X	-
3767-1,-2 (2740-1)	-	X	X	-	-	X	X	X
3767-1,-2,-3 (2740-2)	-	X	-	-	-	-	-	X
3767-1,-2 (2741)	-	X	X	-	-	X	X	-
5100 (2741)	-	X	X	-	-	X	X	-
5110 (2741)	-	X	X	-	-	X	X	-
CMCST (2741)	-	-	X	-	-	X	-	-
S/7 (2740-1)	-	X	-	-	-	X	X	X
AT&T 83B3 (b)	-	-	-	-	-	-	-	X
CPT-TWX (M33/35)	-	-	-	-	-	X	-	-
WT Telegraph	-	-	-	-	-	-	X	-
WU 115A (b)	-	-	-	-	-	-	-	X
BSC Terminals:								
2715-2	-	-	-	X	-	X	X	X
2772	-	-	-	X	X	X	X	X
2780	-	-	-	X	X	X	X	X
2972-8,-11	-	-	-	X	-	-	-	X
3271-1,-2	-	-	-	X	-	X	-	X
3274-1C (3271-1,-2)	-	-	-	X	-	X	-	X
3275-1,2	-	-	-	X	-	X	-	X
3276 (3271-1,2)	-	-	-	X	-	X	-	X
3735	-	-	-	X	-	X	X	X
3741-2,-4	-	-	-	X	X	X	X	-
3747	-	-	-	X	X	X	X	-
3771-1,-2,-3 (2772)	-	-	-	X	X	X	X	X
3773-1,-2,-3,-P1,-P2,-P3(2772)	-	-	-	X	X	X	X	X
3774-1,-2,-P1,-P2 (2772)	-	-	-	X	X	X	X	X
3775-1,-P1 (2772)	-	-	-	X	X	X	X	X
3776-1,-2 (2772/3780)	-	-	-	X	X	X	X	X
3777-1 (2772/3780)	-	-	-	X	X	X	X	X
3777-2 (S/360-20)	-	-	-	X	X	X	X	X
3780 (2772)	-	-	-	X	X	X	X	X
5110 (as a 2772)-5275 (3275-1,-2)	-	-	-	X	-	-	-	X
1131	-	-	-	X	X	-	X	X
1826	-	-	-	X	X	X	X	X
S/3	-	-	-	X	X	X	X	X
S/7 (S/3)	-	-	-	X	X	X	X(c)	X
S/32 (S/3)	-	-	-	X	X	X	X	X
S/34 (S/3)	-	-	-	X	X	X	X	X
S/360-20	-	-	-	X	X	X	X	X
S/360	-	-	-	X	X	X	X	-
S/370	-	-	-	X	X	X	X	-

SDLC Terminals:

Terminal	SDLC is communication		
3704 Remote	-	X	-
3705-I Remote	-	X	-
3271-11,-12 code insensitive	-	-	X
3274-1C (3791)	-	X	X
3275-11,-12	-	-	X
3276 (3791)	X	X	X
3601	X	X	X
3602	X	X	X
3614	-	X	X
3624	-	X	X
3651-A50,-B50	X	X	X
3651-A60,-B60	X	-	-
3661	X	-	-
3767-1,-2,-3	X	X	X
3771-1,-2,-3	X	X	X
3773-1,-2,-3,-P1,-P2,-P3	X	X	X
3774-1,-2,-P1,-P2	X	X	X
3775-1,-P1	X	X	X
3776-1,-2	X	X	X
3777-1	X	X	X
3791	X	X	X
S/32 (3770)	X	X	X
S/34 (3770)	X	X	X

Legend:

X = supported now or will be supported. See *Terminal Support Chart 1* for specifics.

- = not supported.

Notes:

- (a) All terminals shown, except the 3704/3705-I Remote, are supported by a Local 3704/3705-I/3705-II or Remote 3704/3705-I. The Remote 3704/3705-I does not support another Remote 3704/3705-I. Consult the 3705 Configurator for storage sizing and performance capabilities of the 3704 and 3705 in terms of the number of lines and terminal mix. If shown, the terminal type in parenthesis designates the programming support provided. E.g., "S/7 (2740-1)" means "that S/7 is supported as a 2740-1".
- (b) Attachment of non-IBM terminals is under the provisions of the IBM Multiple Supplier System Policy.
- (c) IPL of S/7 is not supported in this network configuration.

NCP/VS Support with IBM 3872, 3874, 3875 Modems of BSC, SDLC Lines

Attachment	IBM Modem			Multiplexer's Modem Configuration	Remote Modem Configuration
	BSC	SDLC	3872 3874 3875		
X		X	X X	Nonswitched	Nonswitched
	X		X X X	Nonswitched	Nonswitched
X		X	X X X	Nonswitched with SNBU*	Nonswitched with SNBU
					Nonswitched with SNBU & fan out only when NCP/VS originates the call to the remote modem
X	X	X		Switched Network	Switched Network

* Switched Network Back Up

NCP/VS Minimum Machine Configuration: For program execution -- a 3705-I Model A2 with Channel Adapter Type 1 or Type 2, Communication Scanner Type 1 or Type 2, and appropriate line attachment features ... a 3704 Model A3 with Channel Adapter Type 1, Communication Scanner Type 1 or Type 2, and appropriate line attachment features ... a 3705-II Model A3 with Channel Adapter Type 1, Communication Scanner Type 2, and appropriate line attachment features.

General Documentation

Title	Form Number
IBM 3704 and 3705 Communications Controllers Assembler Language	GC30-3003
IBM 3704 and 3705 Communications Controllers Principles of Operations	GC30-3004
Introduction to the 3704/3705 Communications Controllers	GA27-3051
IBM 3704/3705 Communications	

NCP/VS (cont'd)

Controllers Network Control Program/VS Program Logic Manual	SY30-3007
IBM 3704/3705 Communications Controllers Network Control Program Storage Estimates for OS/TCAM and OS/VS TCAM Users	GC30-3006
IBM 3704/3705 Program Reference Handbook	GY30-3012
Network Control Program/TCAM Network User's Guide	GC30-3009
EP Storage and Performance Guide	GC30-3005
EP Program Logic Manual	SY30-3001

Programming Service Classification: See SCP Index



SYSTEM CONTROL PROGRAMMING
SCP SUPPORT FOR ADVANCED FUNCTION SYSTEMS
AND TERMINALS

3600 FINANCE COMMUNICATION SYSTEM

Programming support in the central processor for the 3600 Finance Communication System consists of an OS/VS or DOS/VS assembler, support programs used exclusively with 3600 systems (i.e., the 3600 Host Support Independent Release-IR), and the Subsystem Support Services used in common by 3600 systems and other subsystems. This programming support enables the user to: Define the configuration for each 3601/3602 controller ... Customize each 3614 or 3624 Consumer Transaction Facility ... Write 3601/3602 application programs ... Create and maintain a library for the 3600 system at the central computing system ... Transmit 3601/3602 configuration images, 3614 or 3624 customization images, and 3601/3602 application program images to 3601s/3602s and 3614s ... Test these images, using special debugging commands, from a 3270 display/printer ... Print dumps of 3601/3602 application program storage and diskette files ... Convert assembly listings of 3601/3602 application programs into a more meaningful format ... Generate personal codes for 3614 and 3624 users ... Encipher and decipher messages transmitted to or from 3614s or 3624s.

3600 Host Support (Independent Release)

The assembler creates configuration data from 3601/3602 configuration macro instructions, creates customization data from 3614 and 3624 customization macro instructions, and creates 3601/3602 application program object modules from programs written in 3600 Assembler Language.

3601/3602 Configuration Definition macro Instructions: These are used to specify the physical and logical configuration of each 3601/3602 and its associated user workstations. The macro instructions are assembled into configuration data by the macro facility of the OS/VS or DOS/VS Assembler. The configuration macro instructions describe: User-defined parts of 3601/3602 storage (called segments) ... Files to be created on the 3601/3602 diskette ... Loops by which terminals are attached to the 3601/3602 controller ... The link between the 3601/3602 and the telecommunication network ... Translation tables for the keyboards, printers and displays of terminals attached to the 3601/3602 ... Terminals, storage, application programs, and operators associated with the workstations for the 3601/3602.

3614 and 3624 Customization Image Definition macro Instructions: These specify the physical and logical configuration for each 3614 or 3624. The macro instructions are assembled into customization data by the macro facility of the OS/VS or DOS/VS Assembler.

3600 Assembler Language: This is the set of macro instructions used to write application programs for execution in a 3601 or 3602 controller. Programs written in this language are assembled into object modules by the OS/VS or DOS/VS Assembler.

3600 Post-List Processor: This program can be used after a 3601/3602 application program has been assembled to delete unnecessary assembler statements and make the assembly listing more readable.

3600 Host Support Program (HSP): Beginning with IR4, this program is used to link edit (1) any subsections of the 3601/3602 application programs into a single application program module and (2) the application program modules, controller configuration module and controller data into a single 3601/3602 diskette image. The 3601/3602 images are then put into the Subsystem Library. In addition, HSP will ADD/REPLACE image subsections and provide a facility for patching these images. These functions also apply to 3614 or 3624 customization images.

3600 Host Diskette Image Create (HDIC): This program can be used as an alternative to transmitting the diskette image to the 3601/3602 by SSS (see below) during the diskette create process. HDIC takes the diskette image from the Subsystem Library, processes it and writes it to a sequential host data set. Further processing could include (1) transmitting the complete image, via user application, to a 3601/3602 to complete diskette creation, or (2) spooling the complete image to a removable medium for further processing at another host.

3600 Program Validation Services (PVS): After the 3601/3602 configuration data and 3601/3602 application program have been assembled and Link Edited, the user can test them with 3600 Program Validation Services. These services use VTAM and a local or remote 3277 Model 2 and, optionally, a 3284 Model 2 or 3286 Model 2 printer attached to a System/370 Processor, and provide special debugging commands for the testing. See the appropriate SCP section on terminal support for compatible devices supported.

The following two programs are not available in releases later than IR3.

3600 Format Service Program: This program must be used to transform the assembler output into the format required for the 3600 library and to place the formatted 3601/3602 application program, configuration data, or customization data on a VSAM data set.

3600 Finance Image Processor: The finance image processor is a part of Subsystem Support Services specifically for the 3600 Finance Communication System. It is used to create or modify the load images for the 3601/3602 controller, 3614 terminal, and 3601/3602 application programs.

3614 Hard Error Recovery Modules: These can be used to indicate the recovery action that should be taken after a hard error status occurs in a 3614 causing it to close. The user furnishes the recovery analysis program with the maintenance data from the 3614 and a risk acceptance level associated with reopening the 3614. The hard error routine performs a rather complex analysis of the maintenance data to recommend a recovery action. The recovery action recommended is based on severity of errors, previous error history, and the acceptable risk level. Based on this analysis three possible actions may be taken by the user's program:

- Attempt to reopen the 3614.
- Inform the operator that manual service is required by a representative of the operating institution.
- Inform the operator that service is required by a hardware service representative (IBM CE or equivalent).

This facility is available in both the 3600 sub-host and the S/370 host support code.

3614 Control Data Format Service Routine: Beginning with the availability of the 3600 Host Support Independent Release 3, 3614 control data tapes for Version 4 and earlier 3614's must be re-formatted by this service routine before further processing by 3600 Host Support programs.

3614 and 3624 Host Support: The following two sets of programs provide host Processor data encryption support for the 3614 and 3624 Consumer Transaction Facility. Source listings are not orderable for, nor supplied with, these modules. Customers should be informed of this fact before the 3614 or 3624 is ordered.

Personal Identification Number (PIN) Generation Program: The 3614 and 3624 user is identified by an account number encoded on a magnetic stripe on his identification card and by a PIN entered at the 3614 or 3624. The PIN is issued to the user by the financial institution and can be freely selected if the financial institution chooses to write its own host application programs to generate and check the PINs. As an alternative, PINs can be generated using the PIN Generation Program and the codes entered at the 3614 or 3624 can be checked automatically by the 3614 or 3624. When this option is chosen, the PINs have a special, complex relationship to the account number on the identification card. The two versions of this program (BQKPEERS and BQKDPERS) allow the financial institution to generate PINs under either the 3614 Alternate Encryption Technique (AET) or the U.S. Federal Information Processing Data Encryption Standard (DES) respectively. In addition, the DES version allows greater flexibility in PIN and offset number generation.

Cipher Program: The cipher program is used by the host application program to encipher and decipher messages and by Subsystem Support Services to encipher the 3614 or 3624 customization image before transmitting it. The integrity of the enciphering and deciphering process depends upon adequate safeguarding of the user-supplied cryptographic key used by the cipher program. The two versions of this program (BQKCIPIH and BQKDES) allow the financial institution to encipher the 3614 customization image and other data under either AET or DES, respectively.

Subsystem Support Services - SSS

SSS provides support for the creation and maintenance of the 3600 library and for transmitting load images to the 3601, 3602, and 3614 or 3624. The host processor creates the load images which are then transmitted by SSS to the 3601, 3602, 3614 or 3624. SSS also supports a dump of an application program storage segment from the 3601 or 3602 controller and of the user's 3601/3602 diskette files. SSS uses a special dump-formatting program. It can also receive data specified by the system monitor's 888 command.

Note: Subsystem Support Services (SSS) are no longer supplied as components of DOS/VS, but are available as an independent release (Program No. 5747-CC6).

General Documentation:

Title	Number
SSS User's Guide	GC30-3022
3600 System Summary	GC27-0001
Instructions and Macro Reference	GC27-0003
Programmer's Guide and Component Description	GC27-0004
Host Service Programs Reference	GC27-0005
DOS/VS 3600 Host Support IR	
Release 5	5747-BR1
OS/VS 3600 Host Support IR	
Release 5	5744-CA3



3600 Finance Communication System (cont'd)

Programming Service Classification: See SCP Index.

3650 PROGRAMMABLE STORE SYSTEM

3650 Programmable Store System

3650 PSS Programming Support consists of SPPS and Host Support.

Programmable Store System Host Support

In support of the 3650 Programmable Store System and residing in a Host S/370 is the PSS Host Support which consists of the following basic components: Controller Configuration Facility, Terminal Configuration Facility, Data Base Facility and Data Communication Facility. They supply the support to maintain system libraries, tailor and transmit controller and terminal programs from a Host S/370 to a 3651, generate tables for use in a 3651, create format controls and space allocation for files, and provide problem determination aids. Either BTAM or VTAM is used to provide BSC or SNA transmission to and from the store controller.

The 3650 PSS supports the 3653 Model 1 functions. PSS also provides the capability for user written programs executing in the 3651 controller to interact with user written programs executing in the Host, another 3651 mdl 75, and 3663 Model 1P or 3P.

Subsystem Program Preparation Support

The Subsystem Programming Preparation Support (SPPS) provides the capability of writing programs for execution in the 3651 Models A25, B25, A75, C75 and D75 Store Controller. Devices supported by the Subsystem Programming Preparation Support are the 3651, host communications, 3275-3 Display Station and 3284 in Screen image mode, and 3653 Model 1 for basic input and output operations only.

Refer to the *PP-Systems* section of the sales manual for information on Subsystem Programming Preparation Support II (SPPS II). SPPS II provides additional capability.

A minimum 3650 Programmable Store System requires support from:

(1) One System/370 with the following minimum storage entry:

	BTAM	VTAM
DOS/VS	128K	160K
OS/VS1	240K	256K
OS/VS2	768K	768K

Additional storage will be required based on application requirements and performance considerations.

- (2) An IBM 3704 or 3705 Communications Controller in emulation mode using BTAM or network control mode using VTAM.
- (3) A telecommunications access method (BTAM for BSC*, VTAM for SDLC).
- (4) The Virtual Storage Access Method (VSAM).
- (5) The IBM 3651 Model A25, B25, A75, B75, C75 or D75 Store Controller.
- (6) An IBM 3653 Model 1 or an IBM 3663 Model 1P or 3P, or an IBM 3275 Model 3 display station.

Additional terminal devices may be added. (See appropriate "machines" pages.)

*Note: BSC switched line communications only.

Programming Service Classification/Charge: See SCP Index.



3650 RETAIL STORE SYSTEM

3650 RSS Programming Support consists of SPPS and Host Support, both of which operate in conjunction with SSS Global support provided by the operating systems.

3650 SSS Logic (Release 2)
 3650 SPPS Programmer's Guide

SY30-3017
 GC30-3024

Subsystem Programming Preparation Support - SPPS

Programming Service Classification: See SCP Index

The Subsystem Programming Preparation Support (SPPS) provides the capability of writing programs for execution in the 3651 Models A50 and B50 Store Controller.

The customer program may have two parts: a procedural part, and a data format and transformation part.

The procedural part provides the programmer with the capability to perform: Arithmetic ... Logic ... Program Control ... Input/Output operations.

The data format and transformation part provides the programmer with the capability of specifying data formats on 3275 Model 3 Display Stations, and transformations to be applied to such data (including checks and edits) during Input/Output operations which were specified in the procedural part of a program.

Devices supported by SPPS are the 3651, host communication, 3275 Model 3 Display Station and 3284 in Screen Image mode.

3650 Release I (OS/VS1 and DOS/VS only) supports the 3651 and the capability to write the procedural part. 3650 Release II (OS/VS1, OS/VS2 MVS, DOS/VS) supports the capability to write the data format and transformation part for the 3275 Model 3.

Subsystem Support Services and Retail Store System Support

In support of the 3650 Retail Store System and residing in a host S/370 is RSS Host Support, which operates in conjunction with SSS Global support to maintain system libraries, tailor and transmit controller data from a host S/370 to a 3651, generate tables for use in the 3651, create all format controls and space allocation for files, and provide problem determination aids.

Note: Subsystem Support Services (SSS) are no longer supplied as components of DOS/VS, but are available as an independent release (Program No. 5747-CC6).

3650 Release I (OS/VS1 and DOS/VS only) uses BTAM and supports the initial functions available on the 3651 which include basic sales and logging support, negative in-store credit, support of all terminals and the interface for user program execution. 3650 Release II (OS/VS1, OS/VS2, DOS/VS) uses VTAM and supports the functions available on the 3651 Model 50 which include basic sales and logging support, negative in-store credit, support of all terminals, and interface for user program execution, as well as the expanded functions available on the 3651 files, and additional interfaces for user program execution. It also supports 3653 functions associated with the functional expansion feature, the 3651 9.3 megabyte disk storage, direct attachment for 3651 to 3704/3705 and the 9600 bps loop transmission speed.

A minimum 3650 Retail Store System requires support from one System/370 with the following minimum configuration:

	BTAM	VTAM
DOS/VS	128K	160K
OS/VS1	240K	256K
OS/VS2 MVS	N/A	768K

Additional storage will be required based on application requirements and performance considerations.

- An IBM 3704 or 3705-I or 3705-II Communications Controller in emulation mode using BTAM (OS/VS1 and DOS/VS only) or network control mode using VTAM.
- A telecommunications access method (BTAM for BSC, VTAM for SDLC).
- The Virtual Storage Access Method (VSAM).
- The IBM Subsystem Support Services (SSS).
- The IBM 3651 Model A50 Store Controller.
- An IBM 3653 Point of Sale Terminal or an IBM 3275 Model 3 Display Station.

Additional terminal devices may be added (see appropriate "Machines" pages.)

General Documentation:

Title	Number
3650 Introduction	GA27-3075
3650 Administrative Operations Guide	GA27-3088
3650 Sales Operations Guide	GA27-3089
3650 PDP's and Operator Messages	GA27-3089
3650 Host Logic (Release 2)	SY30-3025
SPPS Logic	SY30-3024
3650 SSS User's Guide	GC30-3022



3660 SUPERMARKET SCANNING SYSTEM

IBM programming support for the 3660 Supermarket Scanning System consists of the Subsystem Support Services (SSS). The SSS program is required in configuring and supporting individual 3651 Models A60 and B60 Store Controllers - Supermarket. For configuring, the user creates Input Statements which select the options and create certain tables that are necessary to the operation of the 3660 system. These statements are edited and translated into "System Definition Records" (SDR) by SSS. Using the appropriate telecommunications access method, the SDRs are transmitted to the selected 3651 to complete the tailoring of the 3660 system. For support, any IBM-supplied changes or subsequent changes required to the SDR are applied through SSS.

Note: Subsystem Support Services (SSS) are no longer supplied as components of DOS/VS, but are available as an independent release (Program No. 5747-CC6).

A minimum 3660 Supermarket Scanning System requires the support from one System/370 with the following minimum configuration:

	BTAM	VTAM
DOS/VS	128K	160K
OS/VS1	240K	256K
OS/VS2 MVS	768K	768K

Additional storage will be required based on the application requirements and performance considerations, particularly in a VTAM environment.

- An IBM 3704 or 3705-I or 3705-II in emulation mode using BTAM or network control mode using VTAM or a S/370 ICA using BTAM.
- BTAM telecommunications access method (using BSC) or VTAM telecommunications access method (using SDLC).
- The Virtual Storage Access Method (VSAM).
- The IBM Subsystem Support Services (SSS).
- An IBM 3872 modem or equivalent, or an IBM 2400 bps Integrated Modem feature in the 3704 or 3705.
- BSC compatibility (if using BTAM) or SDLC compatibility (if using VTAM).
- An IBM 3651 Model A60 Store Controller - Supermarket.
- An IBM 3669 Store Communications Unit.
- Customer supplied Store Loop.
- At least one IBM 3663 Supermarket Terminal.

Additional terminals and devices may be added (see appropriate sales manual "machines" pages).

To further support the 3660 System, it will be necessary for the user to create host S/370 programs. This user-written code is necessary to organize, preformat, and transmit data records to be used in the 3651 Model A60/B60 Supermarket Controller. This includes any changes to these data records. These records are for price/description, check authorization, and operator authorization data. The user will also need to instruct the 3651 to execute certain tasks, accept miscellaneous messages, or transmit data held within the controller back to the host S/370 for application processing. The user is responsible for interfacing directly with the telecommunications access method.

The *IBM 3660 Supermarket Systems Programmers User's Guide* contains the programming information necessary for the user to establish his 3660 system including those functions described immediately above, required to be built into user-written code.

General Documentation: (Order for Mechanicsburg.)

Title	Number
IBM System/370 Subsystem Support Services Logic Manual	SY30-3017
IBM 3660 Supermarket Systems Sales Operations Guide	GA27-3090
IBM 3660 Supermarket Host Program Logic Manual	SY30-3019

Programming Service Classification: See SCP Index.

3660 SUPERMARKET KEY-ENTRY SYSTEM

The 3660 Supermarket Key-Entry System does not require the support of the Subsystem Support Services (SSS). It does require support from user-created host S/370 programs. This user-written code is necessary to organize, preformat and transmit data records to be used in the 3661 Store Controller. This includes any changes to these data records. These records are for price/description, check authorization, operator authorization and system parameter records (SPR). The user will also need to instruct the 3661 Store Controller to execute certain tasks, accept miscellaneous messages, or transmit data held within the controller back to the host S/370 for application processing.

The *IBM 3660 Supermarket Systems Programmers User's Guide; Key-Entry System* contains the information necessary for the user to establish his 3660 Supermarket Key-Entry System, including those functions described immediately above, required to be built into user-written code.

A minimum 3660 Supermarket Key-Entry System requires the support from one System/370 and:

- A virtual storage operating system (OS/VS1 or OS/VS2 MVS or DOS/VS)
- An IBM 3704 or 3705-I or 3705-II in emulation mode using BTAM or in network control mode using VTAM or a S/370 ICA using BTAM
- BTAM telecommunications access method with RFT option (using BSC) or VTAM telecommunications access method (using SDLC)
- 1200 bps Integrated Modem feature in the 3704 or 3705-I or 3705-II, or ICA
- BSC compatibility (if using BTAM) or SDLC compatibility (if using VTAM)
- An IBM 3661 Store Controller
- An IBM 3663 Model 2 Supermarket Terminal locally attached to the 3661
- A customer supplied Store Loop for the attachment of additional Supermarket Terminals, if required

Additional terminals may be added. See appropriate sales manual "Machines" pages.



3770 DATA COMMUNICATION SYSTEM

The 3770 Data Communication System is a family of terminals. Teleprocessing support for SDLC line control is provided by RES or JES2 (MVS) or POWER/VS (non-programmable 3770 models only, except 3777-2), VTAM, TCAM nonswitched (OS/VS1 and OS/VS2 MVS only), and 3704.3705 NCP/VS. An appropriately configured 3770 system (except 3777-2) operates on nonswitched point-to-point lines, switched point-to-point lines and nonswitched multipoint lines, using SDLC or BSC or either under manual switch control. An appropriately configured 3777-2 operates on nonswitched point-to-point lines and switched point-to-point lines using RES BSC or JES2/360-20 MULTI-LEAVING Workstation support for the System/360 Model 20 Submodel 5.

The RES-JES2-POWER/VS support provides for remote entry from the non-programmable models of the 3770 SDLC terminals in a terminal-sharing environment, where multiple applications may establish logical connections with the terminal on a per-session basis.

The 3770 system consists of the 3771, 3773, 3774, 3775, 3776 and 3777-1 Communication Terminals. All except 3773P models can operate under RES-JES2-POWER/VS support for the 2772 Multipurpose Control Unit. In addition, the 3776/3777-1 can operate under RES-JES2-POWER/VS support for the 3780 Data Communications Terminal. Additional 3770 products include the 3784 Line Printer, the 3521 Card Punch, the 3501 Card Reader, the 2502 Card Reader and the 3203 Printer.

Users may develop, test and run terminal programs for programmable models of the 3773, 3774 and 3775 Communication Terminals. 3770 programs are prepared at the host using a System/370 assembler, 3790 programming statements, and an IBM-supplied macro instruction library. Program Validation Services (PVS) validate and format 3770 terminal programs for storage at the host and for later transmission to the 3773, 3774 or 3775 under control of user-written host application programs.

The macros and PVS support for programmable models of the 3773, 3774 and 3775 Communication Terminal (3773P/3774P/3775P) is packaged as a Host Support SCP component. The component called 3790 Host Support - OS/VS (or DOS/VS) carries the program number 5744-BZ3 (or 5747-BQ1).

3790 COMMUNICATION SYSTEM

Support for the 3790 system is provided by VTAM and TCAM through VTAM using the System/370 Local Channel Attachment, or VTAM, TCAM through VTAM and TCAM/NCP Direct over nonswitched communication lines using SDLC. VTAM and TCAM through VTAM are supported using switched communications facilities with SDLC. Nonswitched lines can be either point-to-point or multipoint. Batch and/or inquiry sessions may use the physical line concurrently. Program-controlled or manual procedures can be used at the host to establish physical connections over switched lines for batch sessions, with auto or manual answer at the 3791. Manual procedures are used at the 3791 to establish physical connections over switched lines for inquiry sessions with auto or manual answer at the host. The initial release of 3790 support requires a special, system operator-assisted procedure to use switched communication lines.

The JES2 support when used with the 3790 RJE Function provides the user with a Remote Job Entry capability.

User-Developed 3790 Programs

Users may develop, test and run programs for the 3790 which do not use the 3760.

3790 programs are prepared at the host using a System/370 assembler, 3790 statements, and an IBM-supplied macro instruction library.

Program Validation Services (PVS) allows validation of the 3790 program statements at the host to assist in 3790 program development. PVS also formats 3790 programs for storage at the host and later transmission to the 3791. The macros and PVS, along with a 3790 Industry Unique function applicable to SSS and appropriate inner macros necessary for the independent link-editing of these functions to the Operating System, are packaged as a Host Support SCP component.

Subsystem Support Services (SSS) controls 3790 program libraries at the host and controls the transmission of 3790 programs and data set specifications from the host to the 3791 via VTAM and NCP/VS.

Batch Transfer Program

The Batch Transfer Program is a program which supports, using VTAM, the extraction of data sets from a 3790 Communication System/Data Entry Configuration to a System/370 virtual storage system.

This program allows the customer to specify jobs of data to be transferred from the 3791 to the host. A request for a specific job will result in the transmission of all batches flagged as available for transmission within that job. When Key Entry Data Jobs are received at the host, they are written to disk or tape into user-named sequential data sets for subsequent processing by an application program. Route jobs (messages to the host operator) are sent to either the operator's console or the printer. List format jobs, print jobs and report jobs are sent to a host printer.

The Batch Transfer Program, through a user exit, provides for the inclusion of a user-written routine for data jobs. This facility allows a user to modify or delete records that are received at the host, or provide additional records himself for inclusion within the output data set.

Multiple batches from more than one 3791 may be combined at the host to produce a single job data set during one execution of the Batch Transfer Program.

With the availability of the Reverse Extract function, the Batch Transfer Program will also provide the capability to transfer a host-created data set via the System/370 Local Channel Attachment or SDLC to the 3791 for updating by a 3760 operator. The data sets will be transferred in a similar manner by specifying the job name and the 3791 address to the Batch Transfer Program.

Reverse Extract is not supported under *Special Programming Support (SPS/KE)*(OS/VS1 and OS/VS2 only).

Programming Service Classification: See SCP Index.



SYSTEM/32

The System/32 is a low-cost general purpose computer system. Teleprocessing support for SDLC line control is provided by RES-JES2-POWER/VS, VTAM, and the 3704/3705 NCP/VS when the System/32 is specified as a 3770. Teleprocessing support for BSC line control is provided by RES-JES2-JES3-POWER/VS, VTAM, BTAM, TCAM (OS/VS1 and OS/VS2 only), and EP/VS with PEP when the System/32 is specified as a System/3. An appropriately configured System/32 operates on a nonswitched point-to-point line, a switched point-to-point line, or as a tributary station on a nonswitched multipoint line, using SDLC or BSC. Operation of System/32 is under control of an SCP-supplied utility or user-written program.

The System/32 consists of a processing unit, keyboard, display, disk storage, line or serial printing facility, diskette drive, and optionally a data communications adapter (SDLC or BSC).

Note: The diskette drive is not supported by BSC or SDLC communications programs.

SYSTEM/34

The System/34 is a low-cost general purpose computer system, with attached display stations. Teleprocessing support for SDLC line control is provided by JES2, VTAM and the 3704/3705 NCP/VS when the System/34 is specified as a 3770.

Teleprocessing support for BSC line control is provided by HASP, ASP, RES, JES2, JES3, VTAM, BTAM, TCAM (OS/VS1 and OS/VS2 only), and the 3704/3705 EP/VS with PEP when the System/34 is specified as a System/3. An appropriately configured System/34 operates on a nonswitched point-to-point line, a switched point-to-point line, or as a tributary station on a nonswitched multipoint line, using SDLC or BSC. Operation of System/34 is under control of an SSP supplied utility or user-written program.

The System/34 consists of a processing unit, keyboard display workstations, disk storage, line or serial printing facility, diskette drive, and optionally a data communications adapter (SDLC or BSC).

Note: The diskette drive is not supported by BSC or SDLC communications programs.

Programming Service Classification: See SCP Index.

SUBSYSTEM INFORMATION RETRIEVAL FACILITY
RELEASES 1, 2 and 3 for the
IBM 3790 (Configuration Support #9169)
and the IBM 8100 Information System
5747-BQ1 (DOS/VS) - 5744-BZ3 (OS/VS)

The Subsystem Information Retrieval Facility is a part of the Host Support Independent Release (IR) for the 3790 (Configuration Support #9169) and 8100/DPCX systems. The subsystem Information Retrieval Facility provides the host location with the ability to retrieve incident and status information, the ability to execute problem determination tools and to modify with appropriate control, distributed system control code. It establishes in one product a broad range of functions required to help isolate and act on problems in a distributed system network.

Highlights

- Host Initiated Data Link Data Trace
- Host Retrieval of 3276 Error Log
- Host Retrieval of:
 - Program Abend Dumps
 - Condition Incident Log
 - Control Code Configuration for 3791
 - Selected Data Set Records
- Host Initiated Wrap Test
- Host PTF Distribution and Control
- Host Initiated Data Link Protocol Trace
- Interactive Control
- Host Retrieval of Formatted 8100/DPCX System Dump

Subsystem Information Retrieval Facility Highlights in Detail

- **Host Distribution and Control of Requests for Engineering Action** - REA files can be built in the host or can be retrieved from a 3791. The 3791 REA status can be queried, one or multiple REAs sent to any or all network 3791s and indicators set for automatic or manual application of selected REAs.
- **Host Initiated Data Link Data Trace** - A data link message trace can be initiated or terminated by the host. The trace data will be spooled to a 3791 data set for printing at the 3791 or for transmission to the host for printing.
- **Host Retrieval of 3276 Error Log** - Status and statistical information contained in the Error Log of the 3276 Display Units connected to a distributed system may be retrieved by the host.
- **Host Retrieval of Program Abend Dumps** - Available Program Abend Dumps may be retrieved by the Host for central site analysis.
- **Host Retrieval of Condition Incident Log** - Available Condition Incident Log records are retrieved from the distributed systems for analysis at the host.
- **Control Code Configuration** - The Control Code feature, configuration and quantity are retrieved at the host. The configuration data is extracted from a system file that was loaded during the system installation. In addition to the configuration, the file contains the serial number of the machine and the EC level of the code.
- **Selected Data Set Records** - Selected records from the Transaction, Print and Message Data Sets can be retrieved at the Host.
- **Host Initiated Wrap Test** - Test data is transmitted to the distributed system and then queried by the host to test the communication path. The duration of the wrap test can be modified to support physical testing of the line.
- **Host Initiated Data Link Protocol Trace** - A trace facility can be initiated or terminated from the host that will provide all pertinent incoming and outgoing SDLC command and address bytes and SNA headers between the 3791 and 3276.
- **Host PTF Distribution and Control** - PTF files can be built in the host or can be retrieved from an 8100/DPCX. The PTF status of 8100/DPCXs can be queried, one or multiple PTFs sent to any or all network 8100/DPCXs and indicators set for automatic or manual application of selected PTFs.
- **Interactive Control** - 3270 Display (1720 character screen) support is provided for input and editing of control statements and the presentation of retrieved information.
- **Host Retrieval and Formatting of 8100/DPCX System Dumps** - System dumps can be retrieved from 8100/DPCX systems and presented for display and/or printing in a formatted manner at the host.

Customer Responsibilities - For the REA and PTF files, customers must acquire the necessary information from Field Engineering and load the required data. Communication between the customer and Field Engineering must be sustained to ensure that the REA and PTF information is kept current and accurate.

Operating System Support

System Configuration: The Subsystem Information Retrieval Facility may be used on any System/370 Model 125 or larger capable of operating with OS/VS - VTAM, OS/VS - ACF/VTAM, OS/VS - TCAM Level 10, OS/VS - ACF/TCAM, DOS/VS - VTAM, DOS/VS - ACF/VTAM, and DOS/VS - EXTM.

Programming Services/Charge: See PP Index.

Documentation:

Subsystem Information Retrieval Facility Guide and Reference Manual SC27-0497.

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PRICE LIST

General Systems Division

Column Heading	Explanation
MACH Type	— Machine type number
MDL/FEAT	— Machine model number or feature number — Acc. means accessory
Description	— Description of machine, model, feature or accessory — Preceding numbers are part numbers for accessories
Purchase Price	— Purchase Price of base machine, exclusive of features — NC = No Charge
Monthly Rental	— Monthly rental charge (MRC) under LRA — Monthly availability charge (MAC) under Agreement for IBM Machine Service if the machine and customer are eligible — NC = No Charge
Monthly Lease	— Monthly lease charge (MLC), under LRA, for base term indicated — ETP, FTP, TAP or ATP monthly charge for machines and customer's still eligible for withdrawn lease plans. See ACB section to verify customer eligibility under the old lease plan. — Note: If a Plan A base machine is on LRA/lease, any LRA/rental features or models will be billed an additional amount in lieu of additional use charges. This amount will be equal to a percentage of the LRA/rental charge based upon the type of base machine—CPU = 5%, I/O = 10%.
Base Term	— Base term, in months, for LRA leases — Former FTP machines are indicated 12 and 24 months — Former ETP machines are indicated 24 months — Former TAP machines are indicated 36 months — Former ATP machines are indicated 60 months — Verify eligibility for the withdrawn plans by machine and customer.
U/L%	— Upper limit percentage under LRA leases
Term CHG	— Termination charge under LRA leases (%/months)
MMMC	— Minimum monthly maintenance charge for purchased machines — NC = No charge — TM = Time and material maintenance only

Column Heading	Explanation
FIC	– The service charge for field installation of the special feature on purchased machine. PO under this heading means plant installation only (cannot be field installed).
PUR OPT	– Applicable purchase option percent. SLGLP machines accrue at this rate plus 15 percent.
M.G.	– Maintenance Group—indicates the machine group used when calculating the additional maintenance charge for optional periods of Maintenance Agreement service availability.
P.C.	– Per Call—the class of rates applicable to purchased machines subject to hourly service charges (e.g., where no maintenance agreement exists, or when service is requested outside the hours covered in the Maintenance Agreement, etc.).
W.C.	– Warranty Category—indicates the months of warranty following initial installation on a purchased machine.
R.P.	– Rental Plan—the rental plan under which the machine is offered. See "Rental Plans" in ACB Section. (For Rental Plan "A" machines, the entry indicates that additional billable time is charged at an hourly rate of 1/176th of 10% of the MAC. The extra shift rate is usually 10% except that it is 30% for the following machines: 1231, 1255, 1403, 1419, 1442, and 1443.
L.C.	– Useful Life Category—see "Investment Tax Credit"

DATE : 11/01/78

MACH MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L % CHG	TERM	MMMC	FIC	PUP OPT	M G	P C	W C	R C	L P
0026	001 PRINTING CARD PUNCH ALPHA	2125.00	76.00				39.00		55	C	1	B	B	2
	002 PRINTING CARD PUNCH NUMERIC	2005.00	70.00				35.00		55	C	1	B	B	2
	005 PRINTING CARD PUNCH ALPHA	3625.00	147.00				59.00		55	C	1	B	B	2
	006 PRINTING CARD PUNCH NUMERIC	3510.00	141.00				49.00		55	C	1	B	B	2
	007 PRINTING CARD PUNCH	2770.00	108.00				40.50		55	C	1	B	B	2
	008 PRINTING CARD PUNCH	2645.00	103.00				40.50		55	C	1	B	B	2
	021 INTERPRETING CARD PUNCH	2755.00	119.00				48.50		55	C	1	B	B	2
	1210 ALPHABETIC FIELD LIMIT	259.00	8.00				2.00	58.00	55	C	1	B	B	2
	1221 ALPHABETIC RECEIVE	489.00	24.00				2.00	36.00	55	C	1	B	B	2
	1255 ALTERNATE PROGRAM	95.00	3.00				1.00	58.00	55	C	1	B	B	2
	1350 AUXILIARY DUPLICATION	259.00	8.00				5.50	73.00	55	C	1	B	B	2
	1509 CARD CORRECTION	221.00	7.00				1.50	75.00	55	C	1	B	B	2
	1535 CARD INSERTION	158.00	5.00				3.50	90.00	55	C	1	B	B	2
	1945 CLOCK READ-IN	252.00	10.00				2.00	PO	55	C	1	B	B	2
	4360 FEED,VARIABLE LENGTH	619.00	24.00				4.00	PO	55	C	1	B	B	2
	4595 HIGH SPEED SKIP	686.00	24.00				2.50	241.00	55	C	1	B	B	2
	4702 INTERMIX	145.00	6.00				NC	19.00	55	C	1	B	B	2
	4711 INTERSPERSED GANG PUNCH UP	126.00	10.00				7.00	102.00	55	C	1	B	B	2
	4712 INTERSPERSED GANG PUNCH UL	126.00	10.00				7.00	102.00	55	C	1	B	B	2
	4714 INTERSPERSED GP SW CTRL CC	32.00	5.00				3.50	24.00	55	C	1	B	B	2
	5930 PUNCH SWITCH CONTROL	NC	NC				NC							
	6070 READING BOARD , LARGE	20.00					NC	NC						
	7061 SELF-CHECKING NUMBER	780.00	33.00				22.00	PO	55	C	1	B	B	2
	7062 SELF-CHECKING NUMBER-MOD 11	1090.00	35.00				8.00	PO	55	C	1	B	B	2
	7063 SELF-CHECK GENERATOR-MOD 11	189.00	5.00				NC	13.00	55	C	1	B	B	2
	7064 SELF-CHECKING NUM PUNCH ELIM	322.00	10.00				7.00	90.00	55	C	1	B	B	2
	7244 SPACE CODE GENERATION	NC	NC				NC							
0029	A11 CARD PUNCH NUM NON-PRINTING	1300.00	67.00				33.50		55	C	1	B	B	2
	A12 CARD PUNCH EXP NON-PRINTING	1415.00	74.00				37.00		55	C	1	B	B	2
	A21 CARD PUNCH NUM PRINTING	1965.00	92.00				45.00		55	C	1	B	B	2
	A22 CARD PUNCH EXP PRINTING	2075.00	98.00				47.50		55	C	1	B	B	2
	B11 CARD PUNCH NUM NON-PR L ZERO	1675.00	80.00				40.00		55	C	1	B	B	2
	B12 CARD PUNCH EXP NON-PR L ZERO	1790.00	86.00				42.00		55	C	1	B	B	2
	B21 CARD PUNCH NUM PRINT L ZERO	2340.00	106.00				48.50		55	C	1	B	B	2
	B22 CARD PUNCH EXP PRINT L ZERO	2455.00	112.00				48.50		55	C	1	B	B	2
	C22 CARD PUNCH EXP PRINT INTERP	3310.00	142.00				51.00		55	C	1	B	B	2
	1350 AUXILIARY DUPLICATION	179.00	6.00				2.50	136.00	55	C	1	B	B	2
	1535 CARD INSERTION	53.00	2.00				0.75	136.00	55	C	1	B	B	2
	1540 CHARACTER INHIBIT	71.00	3.00				NC	34.00	55	C	1	B	B	2
	1570 COLUMN LOCATE	149.00	7.00				1.50	90.00	55	C	1	B	B	2
	4360 FEED,VARIABLE LENGTH	608.00	24.00				11.00	PO	55	C	1	B	B	2
	4595 HIGH SPEED SKIP	477.00	24.00				8.00	241.00	55	C	1	B	B	2
	4720 INTERSPERSED GANGPUNCH	239.00	10.00				1.50	153.00	55	C	1	B	B	2
	6065 READING BOARD EXTENSION	16.00	PURCHASE ONLY				NC	NC						
	7061 SELF-CHECKING NUMBER-MOD 10	577.00	31.00				12.50	136.00	55	C	1	B	B	2
	7062 SELF-CHECKING NUMBER-MOD 11	689.00	35.00				13.00	143.00	55	C	1	B	B	2
	7063 SELF-CHECK NUMBER GENERATOR	59.00	3.00				NC	13.00	55	C	1	B	B	2
0047	001 TAPE TO CARD PRINTING PUNCH	3985.00	207.00				84.50		50	C	1	B	B	2
	1350 AUXILIARY DUPLICATION	259.00	8.00				5.50	73.00	50	C	1	B	B	2
	3390 DISTRIBUTORS GP 5 2-POS	79.00	3.00				2.00	26.00	50	C	1	B	B	2

NOTE: SOME PRICES HAVE CHANGED EFFECTIVE JANUARY 1, 1979. REFER TO NOTICE TO CUSTOMER DATED SEPTEMBER 26, 1978.

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUP	M	P	W	P	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C
0047	4375	FIELD DEF EXITS 5-8	76.00	2.00					1.00	90.00	50	C	1	B	B	2
	6780	SELECTORS GP 5 2-POS	126.00	5.00					2.50	49.00	50	C	1	B	B	2
	6795	SELECTOR GP 10 1-POS MDL 2	158.00	10.00					2.50	66.00	50	C	1	B	B	2
0059	001	VERIFIER NUMERIC	2065.00	101.00					52.00		55	C	1	B	B	2
	002	CARD VERIFIER-ALPHAMERIC	2185.00	107.00					52.00		55	C	1	B	B	2
	1380	AUXILIARY VERIFICATION	179.00	6.00					2.50	62.00	55	C	1	B	B	2
	4360	FEED,VARIABLE LENGTH	608.00	24.00					12.00	PO	55	C	1	B	B	2
	4595	HIGH SPEED SKIP	477.00	24.00					8.50	221.00	55	C	1	B	B	2
	6065	READING BOARD EXTENSION	16.00						NC	NC						
0082	001	SORTER	2830.00	67.00					34.00		45	C	2	B	B	2
	1520	CARD COUNTING UNIT	2170.00	35.00					14.50	119.00	45	C	2	B	B	2
	1545	CARD MATCH FRONT RAIL BRUSH	618.00	10.00					1.25	73.00	45	C	2	B	B	2
	1546	CARD MATCH REAR RAIL BRUSH	618.00	10.00					1.25	73.00	45	C	2	B	B	2
	1547	CARD MATCH OFFSET RAIL BRUSH	NC	NC					NC							
	2370	COUNTER,AUXILIARY CARD	252.00	5.00					2.00	66.00	45	C	2	B	B	2
	4091	FEED,INTERCH, 51 COL	696.00	10.00					7.00	PO	45	C	2	B	B	2
	4092	FEED,INTERCH, 60 COL	696.00	10.00					7.00	PO	45	C	2	B	B	2
	4093	FEED,INTERCH,66 COL	696.00	10.00					7.00	PO	45	C	2	B	B	2
	4501	GROUP SORTING-LCC MASTER CDS	1345.00	24.00					3.50		45	C	2	B	B	2
	4502	GROUP SORTING-RCC MASTER CDS	1345.00	24.00					3.50	PO	45	C	2	B	B	2
	5230	MULTIPLE COLUMN SELECTOR	1385.00	31.00					4.00	180.00	45	C	2	B	B	2
	7240	SORTING SUPPRESSION	61.00	2.00					1.25	26.00	45	C	2	B	B	2
0083	001	SORTER	8175.00	141.00					59.00		45	C	2	B	B	2
	1225	ALPHABETIC SORTING	1130.00	16.00					3.50	PO	45	C	2	B	B	2
	1520	CARD COUNTING UNIT	2170.00	35.00					14.50	PO	45	C	2	B	B	2
	1545	CARD MATCH FRONT RAIL BRUSH	747.00	16.00					4.00	176.00	45	C	2	B	B	2
	1546	CARD MATCH REAR RAIL BRUSH	747.00	16.00					4.00	176.00	45	C	2	B	B	2
	1547	CARD MATCH OFFSET RAIL BRUSH	NC	NC					NC							
	2370	COUNTER,AUXILIARY CARD	392.00	7.00					3.50	66.00	45	C	2	B	B	2
	4015	FEED,FILE	915.00	24.00					2.50	PO	45	C	2	B	B	2
	4501	GROUP SORTING-LCC MASTER CDS	1345.00	24.00					4.00	176.00	45	C	2	B	B	2
	4502	GROUP SORTING-RCC MASTER CDS	1345.00	24.00					4.00	176.00	45	C	2	B	B	2
	4503	GROUP SORTING-LCC DETAIL CDS	NC	NC					NC							
	4504	GROUP SORTING-RCC DETAIL CDS	NC	NC					NC							
	5230	MULTIPLE COLUMN SELECTOR	2240.00	54.00					14.50	PO	45	C	2	B	B	2
	7240	SORTING SUPPRESSION	61.00	2.00					1.25	58.00	45	C	2	B	B	2
0084	001	SORTER	10890.00	316.00					105.00		55	C	2	B	B	2
	1225	ALPHABETIC SORTING	1760.00	31.00					1.25	PO	55	C	2	B	B	2
	2370	COUNTER,AUXILIARY CARD	448.00	10.00					3.50	42.00	55	C	2	B	B	2
	7240	SORTING SUPPRESSION	179.00	5.00					NC	47.00	55	C	2	B	B	2
0085	001	COLLATOR	7350.00	168.00					69.50		50	C	2	B	B	2
	050	COLLATOR	7220.00	128.00					59.00		50	C	2	B	B	2
	1130	ALPHABETIC COLLATING	1630.00	40.00					9.50	PO	50	C	2	B	B	2
	1960	COLLATOR COUNTING	955.00	16.00					8.00	304.00	50	C	2	B	B	2
	2370	COUNTER,AUXILIARY CARD	252.00	5.00					2.00	66.00	50	C	2	B	B	2
	3195	CYCLE DELAY UNIT ADDN	145.00	2.00					1.75	73.00	50	C	2	B	B	2
	4101	FEED,INTERCH PRIMARY, 51 COL	336.00	10.00					7.00	PO	50	C	2	B	B	2
	4102	FEED,INTERCH PRIMARY, 60 COL	336.00	10.00					7.00	PO	50	C	2	B	B	2
	4103	FEED,INTERCH PRIMARY, 66 COL	336.00	10.00					7.00	PO	50	C	2	B	B	2
	4107	FEED,INTERCH SEC, 51 COL	336.00	10.00					7.00	PO	50	C	2	B	B	2

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MACH MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L % CHG	TERM	MMMC	FIC	PUP	M	P	W	R	L
									OPT	C	C	C	C	P
0085 4108	FEED, INTERCH SEC, 60 COL	336.00	10.00				7.00	PO	50	C	2	B	B	2
4109	FEED, INTERCH SEC, 66 COL	336.00	10.00				7.00	PO	50	C	2	B	B	2
6681	SELECTOR, PRIMARY/SECONDARY X	112.00	2.50				1.50	14.00	50	C	2	B	B	2
7465	SPLIT SELECTOR AND SEQ UNITS	168.00	5.00				2.50	119.00	50	C	2	B	B	2
7630	SWITCH, TOGGLE	6.00	8.00	SUC			NC	22.00	50	C	2	B	B	2
0087 001	COLLATOR	12890.00	324.00				94.00		55	C	2	B	B	2
002	COLLATOR	12330.00	283.00				82.00		55	C	2	B	B	2
1960	COLLATOR COUNTING	955.00	16.00				7.00	304.00	55	C	2	B	B	2
3195	CYCLE DELAY UNIT ADDN	145.00	2.00				1.75	73.00	55	C	2	B	B	2
4101	FEED, INTERCH PRIMARY, 51 COL	336.00	10.00				6.50	PO	55	C	2	B	B	2
4102	FEED, INTERCH PRIMARY, 60 COL	336.00	10.00				6.50	PO	55	C	2	B	B	2
4103	FEED, INTERCH PRIMARY, 66 COL	336.00	10.00				6.50	PO	55	C	2	B	B	2
4107	FEED, INTERCH SEC, 51 COL	336.00	10.00				6.50	PO	55	C	2	B	B	2
4108	FEED, INTERCH SEC, 60 COL	336.00	10.00				6.50	PO	55	C	2	B	B	2
4109	FEED, INTERCH SEC, 66 COL	336.00	10.00				6.50	PO	55	C	2	B	B	2
6681	SELECTOR, PRIMARY/SECONDARY X	112.00	2.50				1.50	14.00	55	C	2	B	B	2
0088 001	COLLATOR	20270.00	525.00				175.00		45	C	2	B	B	2
002	COLLATOR	18070.00	467.00				163.00		45	C	2	B	B	2
003	COLLATOR	15970.00	407.00				154.00		45	C	2	B	B	2
1090	ALPH COLLATE 4 POS MDL 1,2,3	1295.00	35.00				5.50	PO	45	C	2	B	B	2
1091	ALPH COLLATE 8 POS MDL 1,2	2170.00	60.00				7.00	PO	45	C	2	B	B	2
1092	ALPH COLLATE 10 POS MDL 1	2605.00	74.00				8.00	PO	45	C	2	B	B	2
1960	COLLATOR COUNTING	899.00	31.00				13.00	158.00	45	C	2	B	B	2
2370	COUNTER, AUXILIARY CARD	252.00	5.00				2.00	66.00	45	C	2	B	B	2
4015	FEED, FILE-SECONDARY	915.00	24.00				2.50	119.00	45	C	2	B	B	2
4030	FD, 51-COL INT SEC, & FILE FD	4275.00	85.00				55.00	PO	45	C	2	B	B	2
6555	SELECTOR, DIGIT	224.00	10.00				2.50	42.00	45	C	2	B	B	2
6765	SELECTORS, RECODE GP 5 ADDN	224.00	5.00				2.50	85.00	45	C	2	B	B	2
7421	SPLIT CTRL UNITS MDL 1,2,3	168.00	5.00				2.50	119.00	45	C	2	B	B	2
7422	SPLIT CTRL UNITS MDL 1,2	168.00	5.00				2.50	119.00	45	C	2	B	B	2
7423	SPLIT CTRL UNITS MDL 1 ONLY	168.00	5.00				2.50	119.00	45	C	2	B	B	2
7630	SWITCH TOGGLE	6.00	8.00	SUC			NC	22.00						
0129 001	PUNCH VERIFIER NON-PRINT	3650.00	161.00				50.50		40	C	1	B	B	2
002	PUNCH NON-VERIFIER PRINTING	4090.00	179.00				55.00		40	C	1	B	B	2
003	PUNCH VERIFIER PRINTING	4380.00	193.00				56.50		40	C	1	B	B	2
1020	ACCUMULATE	583.00	24.00				3.00		40	C	1	B	B	2
1025	ADDL ACCUMULATE PRGRM LEVELS	146.00	5.00				1.50		40	C	1	B	B	2
1201	AUXILIARY STORAGE	233.00	8.00				1.50		40	C	1	B	B	2
3215	DIRECT PUNCH CONTROL	176.00	6.00				1.50		40	C	1	B	B	2
3610	EXPANSION FEATURE	292.00	10.00				NC		40	C	1	B	B	2
3950	VARIABLE LENGTH CARD DEVICE	723.00	31.00				7.50		40	C	1	B	B	2
4601	INTERPRET	328.00	16.00				2.00		40	C	1	B	B	2
5570	PRODUCTION STATISTICS	292.00	10.00				1.50		40	C	1	B	B	2
6065	READING BOARD EXTENSION	16.00					NC	NC						
7061	SLF CHK NUMBER MODULUS 10	438.00	16.00				1.50		40	C	1	B	B	2
7062	SLF CHK NUMBER MODULUS 11	583.00	24.00				1.50		40	C	1	B	B	2
7503	CARD INPUT/OUTPUT ATTACH	1560.00	96.00				13.50		40	C	1	B	B	2
8201	3741/5320 ATTACHMENT	1330.00	76.00				9.50		40	C	1	B	B	2
8705	VERIFY READ CONTROL	176.00	6.00				1.50		40	C	1	B	B	2
0357 004	INPUT STATION	884.00	39.00				4.00		50	C	1	B	B	2

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	QPT	G	C	C	P	C
0357	005	INPUT STATION	1155.00	46.00					13.00		50	C	1	B	B	2
	006	INPUT STATION	1505.00	63.00					18.00		50	C	1	B	B	2
	1450	BADGE READ-OUT MDL 6 ONLY	238.00	5.00					2.00	PO	50	C	1	B	B	2
	2287	CONTROLLED RESET	95.00	2.00					NC	32.00	50	C	1	B	B	2
0358	001	INPUT CONTROL UNIT	2450.00	86.00					25.00		50	C	1	B	B	2
0360	001	CLOCK READ-OUT CONTROL	1675.00	54.00					3.50		60	C	1	B	B	2
0361	001	READ-OUT CLOCK	1345.00	41.00					3.00		60	C	1	B	B	2
0372	001	MANUAL ENTRY	520.00	15.00					1.00		60	C	1	B	B	2
	002	MANUAL ENTRY	607.00	18.00					1.50		60	C	1	B	B	2
	003	MANUAL ENTRY	694.00	21.00					1.50		60	C	1	B	B	2
	7578	SUPERVISOR KEY	NC	NC					NC	PO						
0373	001	PUNCH SWITCH	859.00	30.00					0.75		65	C	1		B	2
0374	001	CARTRIDGE READER	637.00	21.00					1.50		60	C	1	B	B	2
0402	A01	ALPHABETICAL ACCOUNTING MACH	21790.00	538.00					150.00		60	C	2	B	B	2
	R50	ALPHABETICAL ACCOUNTING MACH	21630.00	430.00					111.00		60	C	2	B	B	2
	S50	ALPHABETICAL ACCOUNTING MACH	21510.00	330.00					104.00		60	C	2	B	B	2
	S52	ALPHABETICAL ACCOUNTING MACH	19280.00	252.00					92.50		60	C	2	B	B	2
	S53	ALPHABETICAL ACCOUNTING MACH	20270.00	296.00					96.00		60	C	2	B	B	2
	XA1	COMPUTING ACCOUNTING MACHINE	28990.00	700.00					217.00		60	C	2	B	B	2
	XRC	COMPUTING ACCOUNTING MACHINE		560.00							60	C	2	B	B	2
	XS0	COMPUTING ACCOUNTING MACHINE	28650.00	464.00					169.00		60	C	2	B	B	2
	XS3	COMPUTING ACCOUNTING MACHINE	27440.00	428.00					162.00		60	C	2	B	B	2
	1240	ALPH. SUMMARY PUNCHING 8 POS	392.00	10.00					2.50	172.00	60	C	2	B	B	2
	1270	ASTERISK LIST ELIM 6 POS	112.00	140.00SUC					0.75	85.00						
	1271	ASTERISK PROT 6 POS ALPH	112.00	140.00SUC					0.75	85.00						
	1272	ASTERISK PROT 6 POS NUM	112.00	140.00SUC					0.75	85.00						
	1273	ASTERISK PROT 6 POS TOTAL	112.00	140.00SUC					0.75	85.00						
	2165	COMPARING POS 5 ADDN	224.00	5.00					1.50	85.00	60	C	2	B	B	2
	2195	COMPL RECON 4 CTR GP OR LESS	224.00	3.00					1.00	78.00	60	C	2	B	B	2
	2225	CONSECUTIVE NUMBER CONTROL	313.00	7.00					2.00	172.00	60	C	2	B	B	2
	2565	CTR RESET PREDETERM SIG DIG	252.00	5.00					1.25	85.00	60	C	2	B	B	2
	3241	DEMOUNTABLE TYPE BAR NUM	13.00	16.00SUC					NC	3.50	60	C	2	B	B	2
	3243	DEMOUNTABLE TYPE BAR ALPH	21.00	28.00SUC					NC	3.50	60	C	2	B	B	2
	4091	FEED, INTERCH, 66 COL	112.00	5.00					2.50	172.00	60	C	2	B	B	2
	4092	FEED, INTERCH, 66 COL	112.00	5.00					2.50	172.00	60	C	2	B	B	2
	4093	FEED, INTERCH, 66 COL	112.00	5.00					2.50	172.00	60	C	2	B	B	2
	4550	HAMMER-SPRING TENSION ADJUST	38.00	43.00SUC					NC	23.00						
	4845	LIST TAB CONTROL 1 CTR BASIS	752.00	10.00					2.50	43.00	60	C	2	B	B	2
	4846	LIST TAB CONTROL 2 CTR BASIS	375.00	5.00					2.50	180.00	60	C	2	B	B	2
	5265	MULTIPLICATION, SINGLE PROD	1090.00	35.00					4.00	87.00	60	C	2	B	B	2
	5266	MULTIPLICATION, DOUBLE PROD	640.00	16.00					1.00	7.00	60	C	2	B	B	2
	5815	PROGRAM FEATURE-SPECIAL	112.00	3.00					1.50	85.00	60	C	2	B	B	2
	6525	SELECTOR, CO GP 4 5-POS	224.00	5.00					2.00	58.00	60	C	2	B	B	2
	6555	SELECTOR, DIGIT	112.00	5.00					2.00	24.00	60	C	2	B	B	2
	6660	SELECTOR, PILOT GP 5 2-POS	280.00	10.00					3.50	75.00	60	C	2	B	B	2
	7191	SKIP STOPS ADDN	168.00	5.00					1.25	85.00	60	C	2	B	B	2
	7390	SPLIT COLUMN CONTROL-ADDN	8.00	10.00SUC					0.75	23.00	60	C	2	B	B	2
	7615	SWITCHES SET-UP CHANGE-ADDN	13.00	16.00SUC					NC	22.00	60	C	2	B	B	2
	7630	SWITCH, TOGGLE	6.00	8.00SUC					NC	22.00	60	C	2	B	B	2
	8480	TYPE CHARACTER - SPECIAL	NC	NC					NC							

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MACH MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUR	M	P	W	R	L
									OPT	C	C	C	C	P C
0402 8481	TYPE CHAP SPEC-ADD TB CHANGE	NC	NC				NC							
0514 001	REPRODUCING PUNCH	6530.00	163.00				72.00		50	C	2	B	B	2
003	REPRODUCING PUNCH	6090.00	132.00				66.00		50	C	2	B	B	2
1500	CABLE,SP-ADDN EA FT OVER STD	6.00	6.00	SUC			NC	PO						
2050	COL SPLIT FOR SUM PNCH OF XS	17.00	21.00	SUC			0.75	41.00						
2240	CONSEC NUMBER G P & CHECKING	420.00	10.00				4.00	199.00	50	C	2	B	B	2
2370	COUNTER,AUXILIARY CARD	325.00	5.00				2.00	75.00	50	C	2	B	B	2
3435	DP BC DETECTION 10 POS	415.00	8.00				2.50	85.00	50	C	2	B	B	2
3745	EMITTER,PUNCH	56.00	3.00				2.00	24.00	50	C	2	B	B	2
4075	FEED,FOLDED STUB CARD PUNCH	562.00	16.00				3.50	260.00	50	C	2	B	B	2
4141	FEED, INTERCHANGEABLE PUNCH	562.00	16.00				7.00	PO	50	C	2	B	B	2
4142	FEED, INTERCHANGEABLE READ	562.00	16.00				7.00	PO	50	C	2	B	B	2
4143	22 COL FEATURE	562.00	10.00				6.00	PO	50	C	2	B	B	2
5011	MARK SENSE PCH FD POS 1-10	1630.00	35.00				13.00	PO	50	C	2	B	B	2
5012	MARK SENSE PCH FD POS 11-20	1090.00	24.00				7.00	66.00	50	C	2	B	B	2
5013	MARK SENSE PCH FD POS 21-27	1090.00	24.00				7.00	66.00	50	C	2	B	B	2
5021	MARK SENSE READ FD POS 1-10	1630.00	35.00				13.00	PO	50	C	2	B	B	2
5022	MARK SENSE READ FD POS 11-20	1090.00	24.00				7.00	66.00	50	C	2	B	B	2
5023	MARK SENSE READ FD POS 21-26	1090.00	24.00				7.00	66.00	50	C	2	B	B	2
5031	MARK SENSE CONV 2 FDS 10 POS	730.00	16.00				5.50	66.00	50	C	2	B	B	2
5032	MARK SENSE CONV 2 FDS 20 POS	1355.00	31.00				8.00	66.00	50	C	2	B	B	2
5033	MARK SENSE CONV 2 FDS 27 POS	1895.00	40.00				11.00	66.00	50	C	2	B	B	2
5411	OFFSET STACKING PUNCH FEED	252.00	10.00				4.00	102.00	50	C	2	B	B	2
5412	OFFSET STACKING READ FEED	252.00	10.00				4.00	102.00	50	C	2	B	B	2
5445	OFFSET STACK,CMPG REST CHG	43.00	56.00	SUC			0.75	43.00						
6510	SELECTOR,CLASS 10 POS	224.00	4.00				1.50	85.00	50	C	2	B	B	2
6841	SELECTOR,SPLIT COL 1 DIF POS	43.00	56.00	SUC			0.75	33.00						
6842	SELECTOR,SPLIT COL ADDN IDEN	4.00	5.00	SUC			0.75	19.00						
7630	SWITCH,TOGGLE	6.00	8.00	SUC			NC	25.00						
8801	X CTRL G P ADDN GP PCH COL	134.00	2.00				1.00	118.00	50	C	2	B	B	2
8811	X CTRL G P ADDN GP COMP	134.00	2.00				1.00	118.00	50	C	2	B	B	2
0510 001	DOCUMENT ORIGINATING MACH	7140.00	185.00				94.00		50	C	2	B	B	2
003	DOCUMENT ORIGINATING MACH	6700.00	149.00				78.00		50	C	2	B	B	2
1500	CABLE,SP-ADDN EA FT OVER STD	6.00	6.00	SUC			0.00	PO						
2050	COL SPLIT FOR SUM PNCH OF XS	17.00	21.00	SUC			0.25	39.00						
2240	CONSEC NUMBER G P & CHECKING	420.00	10.00				3.50	181.00	50	C	2	B	B	2
2331	CNT-CTRLD PCH,SER PR,DESC	1295.00	35.00				6.00	PO	50	C	2	B	B	2
2332	CNT-CTRLD PCH,SEP PR,ASC	1295.00	35.00				6.00	PO	50	C	2	B	B	2
2370	COUNTER,AUXILIARY CARD	325.00	5.00				1.50	68.00	50	C	2	B	B	2
3435	DP BC DETECTION 10 POS	415.00	8.00				2.00	77.00	50	C	2	B	B	2
3745	EMITTER,PUNCH	56.00	3.00				1.50	22.00	50	C	2	B	B	2
3761	END PRINTING RT HAND	43.00	43.00	SUC			NC	PO	50	C	2	B	B	2
3762	END PRINTING-SPEC INVERTED	43.00	56.00	SUC			NC	37.00	50	C	2	B	B	2
4075	FEED,FOLDED STUB CARD PCH	562.00	16.00				3.00	236.00	50	C	2	B	B	2
4141	FEED, INTERCHANGEABLE PUNCH	562.00	16.00				6.00	PO	50	C	2	B	B	2
4142	FEED, INTERCHANGEABLE READ	562.00	16.00				6.00	PO	50	C	2	B	B	2
4143	22 COL FEATURE	562.00	10.00				5.00	PO	50	C	2	B	B	2
5011	MARK SENSE PCH FD POS 1-10	1630.00	35.00				11.00	PO	50	C	2	B	B	2
5012	MARK SENSE PCH FD POS 11-20	1090.00	24.00				6.00	60.00	50	C	2	B	B	2
5013	MARK SENSE PCH FD POS 21-27	1090.00	24.00				6.00	60.00	50	C	2	B	B	2

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	P	L	
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P
0519	5021	MARK SENSE READ FD POS 1-10	1630.00	35.00					11.00	PD	50	C	2	B	B 2
	5022	MARK SENSE READ FD POS 11-20	1090.00	24.00					6.00	60.00	50	C	2	B	B 2
	5023	MARK SENSE READ FD POS 21-26	1090.00	24.00					6.00	60.00	50	C	2	B	B 2
	5031	MARK SENSE CONV 2 FDS 10 POS	730.00	16.00					4.50	60.00	50	C	2	B	B 2
	5032	MARK SENSE CONV 2 FDS 20 POS	1355.00	31.00					6.50	60.00	50	C	2	B	B 2
	5033	MARK SENSE CONV 2 FDS 27 POS	1895.00	40.00					9.00	60.00	50	C	2	B	B 2
	5411	OFFSET STACKING PUNCH FEED	252.00	10.00					3.50	93.00	50	C	2	B	B 2
	5412	OFFSET STACKING READ FEED	252.00	10.00					3.50	93.00	50	C	2	B	B 2
	5445	OFFSET STACK,CMPG REST CHG	43.00	56.00SUC					0.25	39.00					
	6510	SELECTOR,CLASS 10 POS	224.00	4.00					1.00	77.00	50	C	2	B	B 2
	6841	SELECTOR,SPLIT COL 1 DIF POS	43.00	56.00SUC					0.25	30.00					
	6842	SELECTOR,SPLIT COL ADDN IDEN	4.00	5.00SUC					0.25	18.00					
	7630	SWITCH,TOGGLE	6.00	8.00SUC					NC	23.00					
	8801	X CTRL G P ADDN GP PCH COL	134.00	2.00					0.50	107.00	50	C	2	B	B 2
	8811	X CTRL G P ADDN GP COMP	134.00	2.00					0.50	107.00	50	C	2	B	B 2
0534	003	CARD PUNCH	2110.00	92.00					32.00		55	C	1	B	B 2
0545	003	NON PRINTING PUNCH	2980.00	143.00					65.00		55	C	1	B	B 2
	004	PRINTING PUNCH	3645.00	168.00					65.00		55	C	1	B	B 2
	5550	PUNCH 81 INDICATION	149.00	4.00					NC	28.00	55	C	1	B	B 2
0548	001	INTERPRETER	5770.00	132.00					51.50		45	C	1	B	B 2
	2370	COUNTER,AUXILIARY CARD	325.00	5.00					2.00	75.00	45	C	1	B	B 2
	3715	EMITTER,INTERPRETER	348.00	5.00					2.00	76.00	45	C	1	B	B 2
	6841	SELECTOR,SPLIT COL 1 DIF POS	43.00	56.00SUC					0.75	33.00					
	6842	SELECTOR,SPLIT COL-ADDN IDEN	4.00	5.00SUC					0.75	19.00					
	7405	SPLIT COLUMN RELAY-ADDN	112.00	5.00					1.25	32.00	45	C	1	B	B 2
	7630	SWITCH,TOGGLE	6.00	8.00SUC					NC	25.00					
	8905	ZERO ELIMINATION	67.00	84.00SUC					0.75	103.00					
0552	6510	SELECTOR,CLASS	224.00	4.00					2.00	85.00	45	C	2	B	B 2
0557	001	ALPHABETIC INTERPRETER	7270.00	223.00					111.00		45	C	2	B	B 2
	1659	CD TO CD CMP NUM 5 POS MDL 1	899.00	24.00					12.00	382.00	45	C	2	B	B 2
	1660	CD TO CD CMP NUM ADDN	448.00	10.00					2.50	119.00	45	C	2	B	B 2
	1674	CD TO CD CMP ALPH 5 POS	134.00	3.00					2.00	58.00	45	C	2	B	B 2
	1675	CD TO CD CMP ALPH ADDN	134.00	3.00					1.00	49.00	45	C	2	B	B 2
	1690	CD TO CD CMP SPL CHAR 5 POS	224.00	5.00					2.00	58.00	45	C	2	B	B 2
	1705	CD TO CD CMP SPL CHAR ADDN	224.00	5.00					1.00	49.00	45	C	2	B	B 2
	1905	CHECK PROTECTION	506.00	5.00					1.50	172.00	45	C	2	B	B 2
	2370	COUNTER,AUXILIARY CARD	280.00	3.00					2.00	66.00	45	C	2	B	B 2
	3715	EMITTER,INTERPRETER	190.00	3.00					2.00	118.00	45	C	2	B	B 2
	5525	PRE-SENSING MDL 1 ONLY	640.00	10.00					7.00	150.00	45	C	2	B	B 2
	5555	PRINT ENTRY CONTROL	319.00	5.00					2.00	132.00	45	C	2	B	B 2
	5860	PROOF FEATURE	1855.00	35.00					13.00	PD	45	C	2	B	B 2
	6130	REPETITIVE PRINTING MDL 1	640.00	10.00					2.50	PD	45	C	2	B	B 2
	6421	SELECT STACK 2ND STK MDL 1	448.00	10.00					5.50	102.00	45	C	2	B	B 2
	6422	SELECTIVE STACKING 3RD STK	359.00	8.00					5.50	102.00	45	C	2	B	B 2
	6423	SELECTIVE STACKING 4TH STK	313.00	7.00					5.00	102.00	45	C	2	B	B 2
	6825	SELECTOR,GP 4 5-POS	224.00	5.00					2.00	49.00	45	C	2	B	B 2
	6841	SELECTOR,SPLIT COL 1 POS	43.00	56.00SUC					0.75	33.00					
	6842	SELECTOR, SPLIT COL ADDN	4.00	5.00SUC					0.75	19.00					
	7360	SPECIAL CHAR PRINTING	640.00	10.00					3.50	90.00	45	C	2	B	B 2
	8391	TYPE WHEEL SPEC,1 CHAR	40.00	50.00SUC						22.00					

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MACH MDL/ TYPE FEAT	DESCRIPTION	PUPCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUP OPT	M G	P C	W C	R C	L C
C557 8392	TYPE WHEEL SPEC, 1 ADDN CHAR	12.00	12.00	SUC			NC							
8393	TYPE WHEEL SPEC, ADDN WHEEL	3.00	4.00	SUC			NC							
8465	TYPE WHEEL SPEC, 8 LARGE WHS	364.00	10.00				7.00	PO	45	C	2	B	B	2
0802 001	PROOF MACHINE	7785.00	120.00				73.50			C	1		B	2
002	PROOF MACHINE	7215.00	110.00				66.00			C	1		B	2
3792	ENDORSER PLATE NO ART WORK	42.00	NC				NC	11.00						
4610	ILLUMINATING LAMP-NO BULB	42.00	NC				0.00	PO						
5245	MULTIPLE CREDIT	272.00	4.00				2.00	19.00		C	1		B	2
0803 001	PROOF MACHINE	9000.00	205.00				108.00		35	C	1	B	B	2
002	PROOF MACHINE	8480.00	193.00				99.50		35	C	1	B	B	2
003	PROOF MACHINE	7345.00	167.00				89.50		35	C	1	B	B	2
004	PROOF MACHINE	6805.00	156.00				80.50		35	C	1	B	B	2
3792	ENDORSER PLATE NO ARTWRK	42.00	NC				NC	11.00						
3796	ART WORK	30.00	NC				NC							
4610	ILLUMINATING LAMP	42.00	NC				NC	PO						
5245	MULTIPLE CREDIT	257.00	4.00				2.50	19.00	35	C	1	B	B	2
1001 001	DATA TRANSMISSION UNIT	455.00	16.00				4.00		45	C	1	B	B	1
1222	ALPHABETIC TRANSMIT	281.00	8.00				0.75	PO	45	C	1	B	B	1
1035 001	BADGE READER	944.00	32.00				4.00		45	C	1	B	B	2
1051 001	CONTROL UNIT-ON LNE & HME LP	2710.00	65.00				11.50		50	B	1	B	B	2
001	CTL UNIT ON LINE	3130.00	81.00				11.00		50	B	1	B	B	2
002	CTL UNIT ON LINE	2270.00	54.00				11.00		50	B	1	B	B	2
1287	AUTO-FILL CHARACTER GEN	92.00	2.00				0.50	21.00	50	B	1	B	B	2
1295	AUTO RIB SHIFT & LINE FD SEL	96.00	3.00				0.50	16.00	50	B	1	B	B	2
1307	AUDIBLE ALARM-MODEL 1,2 ONLY	211.00	5.00				0.50	54.00	50	B	1	B	B	2
1313	AUTOMATIC ECB	211.00	5.00				0.50	47.00	50	B	1	B	B	2
1635	CARD PUNCH ATTACHMENT	NC	NC				NC							
3130	ATTACHMENT, CPU	460.00	10.00				1.00	PO	50	B	1	B	B	2
4408	FIRST PRINTER ATTACH-MDL 1,2	460.00	10.00				0.50	25.00	50	B	1	B	B	2
4409	FIRST PRINTER ATTACH-MDL N1	NC	NC				NC							
4410	FIRST PUNCH ATTACHMENT	252.00	5.00				0.50	15.00	50	B	1	B	B	2
4411	FIRST READER ATTACHMENT	506.00	10.00				0.50	37.00	50	B	1	B	B	2
4450	FORMS STAND STACKER	62.00	NC				NC							
4605	HOME COMPONENT RECOGNITION	123.00	3.00				0.50	18.00	50	B	1	B	B	2
4606	HOME LOOP INPUT COMP INTPLCK	105.00	2.50				0.50	15.00	50	B	1	B	B	2
4607	HOME CORRECTION	514.00	10.00				0.50	18.00	50	B	1	B	B	2
4632	INPUT/OUTPUT COMPONENT TABLE	54.00	67.00	SUC			TM	13.00						
4647	IBM LINE ADAPTER 4W VOICE GR	367.00	10.00				1.00	59.00	50	R	1	B	B	2
4691	IBM LINE ADAPTER 4W SUBCH 1	735.00	21.00				1.50	42.00	50	R	1	B	B	2
4692	IBM LINE ADAPTER 4W SUBCH 2	735.00	21.00				1.50	42.00	50	R	1	B	B	2
4693	IBM LINE ADAPTER 4W SUBCH 3	735.00	21.00				1.50	42.00	50	R	1	B	B	2
4694	IBM LINE ADAPTER 4W SUBCH 4	735.00	21.00				1.50	42.00	50	R	1	B	B	2
4770	KEYBOARD REQUEST	230.00	5.00				1.00	43.00	50	B	1	B	B	2
4790	LINE ADAPTER	414.00	10.00				0.50	29.00	50	B	1	B	B	2
4795	LINE CORRECTION	514.00	10.00				1.00	21.00	50	B	1	B	B	2
4796	LINE CORRECTION RELEASE	105.00	2.50				0.50	21.00	50	B	1	B	B	2
5050	MASTER STATION	753.00	16.00				0.50	29.00	50	B	1	B	B	2
5465	OPEN LINE DETECTION	230.00	5.00				NC	17.00	50	B	1	B	B	2
6060	READER STOP-PREFIX J	211.00	5.00				0.50	25.00	50	B	1	B	B	2
6100	RECEIVE INTERRUPT	358.00	10.00				NC	33.00	50	B	1	B	B	2

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MACH	MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUR	M	P	W	R	L
										OPT	G	C	C	C	P
1051	6381	SECOND PRINTER ATTACHMENT	460.00	10.00				0.50	25.00	50	B	1	B	B	2
	6383	SECOND PUNCH ATTACHMENT	252.00	5.00				0.50	15.00	50	B	1	B	B	2
	6384	SECOND READER ATTACHMENT	252.00	5.00				0.50	15.00	50	B	1	B	B	2
	7660	SWITCH UNIT FOR MODEL 1	138.00	3.00				0.50	8.00	50	B	1	B	B	2
	7661	SWITCH UNIT FOR MODEL 2	138.00	3.00				0.50	6.00	50	B	1	B	B	2
	7662	SWITCH UNIT FOR MODEL N1	138.00	3.00				0.50	11.00	50	B	1	B	B	2
	7873	TELEGRAPH LINE ATTACHMENT	230.00	5.00				0.50	88.00	50	B	1	B	B	2
	7900	TRANSMIT INTERRUPT	358.00	10.00				NC	33.00	50	B	1	B	B	2
	8715	VERTICAL FORMS CONTROL	367.00	9.00				2.00	9.00	50	B	1	B	B	2
1052	001	PRINTER KEYBOARD	2425.00	88.00				30.00		55	C	1	B	B	2
	007	PRINTER KEYBOARD	2425.00	88.00				30.00		55	C	1	B	B	2
	008	PRINTER KEYBOARD	2425.00	88.00				30.00		55	C	1	B	B	2
	1006	ACCELERATED CARRIER RETURN	123.00	3.00				NC	PO	55	C	1	B	B	2
	1313	AUTOMATIC EOB	NC	NC				NC							
	4452	FORMS FEED CONTROL	NC	NC				NC							
	4606	HOME LOOP INPUT COMP INTRLCK	NC	NC				NC							
	5465	OPEN LINE DETECTION	NC	NC				NC							
	9509	PIN FEED PLATEN,REGULAR	61.75	PURCHASE ONLY				NC							
	9510	PIN FEED WITH FORMS CTRL	134.00	PURCHASE ONLY				NC							
1053	001	PRINTER	1675.00	67.00				15.00		50	C	1	B	B	2
	002	PRINTER	1675.00	67.00				15.00		50	C	1	B	B	2
	003	PRINTER	1675.00	67.00				15.00		50	C	1	B	B	2
	004	PRINTER	1675.00	67.00				15.00		50	C	1	B	B	2
	1006	ACCELERATED CARRIER RETURN	116.00	3.00				NC	PO	50	C	1	B	B	2
	4452	FORMS FEED CONTROL	NC	NC				NC	PO						
	4462	FORMS STAND STACKER	62.00					NC	NC						
	7850	2772 ATTACHMENT	520.00	19.00				NC		50	C	1	B	B	2
	9509	PIN FEED PLATEN,REGULAR	61.75	PURCHASE ONLY				NC							
	9510	PIN FEED WITH FORMS CTRL	134.00	PURCHASE ONLY				NC							
	ACC.	5213821 BULK CABLE	RPQ	PURCHASE ONLY				NC							
	ACC.	5728298 CABLE ASSEMBLY	RPQ	PURCHASE ONLY				NC							
1054	001	PAPER TAPE READER	1300.00	32.00				5.50		45	C	1	B	B	2
	002	PAPER TAPE READER	1300.00	32.00				5.50		45	C	1	B	B	2
	3570	EDGE PUNCH READ	168.00	5.00				0.50	14.00	45	C	1	B	B	2
	6120	REELS,CENTER ROLL FD,TAKE-UP	168.00	5.00				0.50	6.00	45	C	1	B	B	2
	7910	TELEGRAPH SPEED	NC	NC				NC							
1055	001	PAPER TAPE PUNCH	1700.00	52.00				10.00		45	C	1	B	B	2
	002	PAPER TAPE PUNCH	1700.00	52.00				10.00		45	C	1	B	B	2
	003	PAPER TAPE PUNCH	1800.00	59.00				10.00		45	C	1	B	B	2
	3571	EDGE-PUNCHING	212.00	5.00				1.00	14.00	45	C	1	B	B	2
	6121	REEL,TAKE-UP	104.00	3.00				1.00	4.00	45	C	1	B	B	2
1056	001	CARD READER	3045.00	94.00				12.50		50	C	1	B	B	2
	1640	CARD READER PROGRAM	841.00	26.00				1.50	PO	50	C	1	B	B	2
	3861	EXTENDED CHARACTER READING	841.00	26.00				2.50	PO	50	C	1	B	B	2
	4006	FEED, SHORT CARD PACK	160.00	5.00				1.00	6.00	50	C	1	B	B	2
	4595	HIGH SPEED SKIP	273.00	8.00				2.00	96.00	50	C	1	B	B	2
	7910	TELEGRAPH SPEED	NC	NC				NC							
1058	001	PRINTING CARD PUNCH	1930.00	117.00				36.00		45	C	1	B	B	2
	5478	OPERATOR PANEL	196.00	10.00				1.00	209.00	45	C	1	B	B	2
1092	001	PROGRAMMED KEYBOARD	1505.00	48.00				2.50		60	C	1	B	B	2

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L	
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P
1092	002	PROGRAMMED KEYBOARD	1675.00	54.00					5.50		60	C	1	B	B 2
	5247	MULTIPLE KEY DEPRESSION	242.00	7.00					0.50	PD	60	C	1	B	B 2
	7795	TANDEM OPERATION	NC	NC					NC						
	7910	TELEGRAPH SPEED	NC	NC					NC						
	7915	1051 ATTACHMENT	242.00	7.00					1.00	PD	60	C	1	B	B 2
1131	01A	CENTRAL PROCESSING UNIT	12030.00	709.00					131.00		55	B	2	B	A 2
	01B	CENTRAL PROCESSING UNIT	15790.00	955.00					140.00		55	B	2	B	A 2
	01C	CENTRAL PROCESSING UNIT	26130.00	1545.00					283.00		55	B	2	B	A 2
	01D	CENTRAL PROCESSING UNIT	46080.00	2715.00					312.00		55	B	2	B	A 2
	02A	CENTRAL PROCESSING UNIT	16080.00	955.00					178.00		55	B	2	B	A 2
	02B	CENTRAL PROCESSING UNIT	19840.00	1190.00					187.00		55	B	2	B	A 2
	02C	CENTRAL PROCESSING UNIT	30160.00	1785.00					283.00		55	B	2	B	A 2
	02D	CENTRAL PROCESSING UNIT	49800.00	2975.00					312.00		55	B	2	B	A 2
	03B	CENTRAL PROCESSING UNIT	26976.00	1590.00					274.00		55	B	2	B	A 2
	03C	CENTRAL PROCESSING UNIT	38950.00	2295.00					294.00		55	B	2	B	A 2
	03D	CENTRAL PROCESSING UNIT	62560.00	3730.00					322.00		55	B	2	B	A 2
	04A	CENTRAL PROCESSING UNIT	8630.00	549.00					178.00		55	B	2	B	A 2
	04B	CENTRAL PROCESSING UNIT	13020.00	768.00					187.00		55	B	2	B	A 2
	05B	CENTRAL PROCESSING UNIT	22930.00	1345.00					274.00		55	B	2	B	A 2
	05C	CENTRAL PROCESSING UNIT	34910.00	2055.00					294.00		55	B	2	B	A 2
	05D	CENTRAL PROCESSING UNIT	58710.00	3490.00					322.00		55	B	2	B	A 2
	3616	1132 ATTACHMENT	216.00	10.00					2.50	321.00	55	B	2	B	A 2
	3617	MODEL 2 ATTACHMENT	216.00	10.00					2.50	321.00	55	B	2	B	A 2
	3623	ATTACHMENT-1134	216.00	10.00					2.50	172.00	55	B	2	B	A 2
	3624	LOADER-1134	216.00	10.00					NC	153.00	55	B	2	B	A 2
	3625	1134 ATTACH MDL 4A & 4B ONLY	720.00	58.00					2.50	328.00	55	B	2	B	A 2
	3854	EXPANSION ADAPTER	109.00	5.00					NC	32.00	55	B	2	B	A 2
	4449	1442 MDL 5 ATTACHMENT	706.00	39.00					4.00	452.00	55	B	2	B	A 2
	4454	1442 MODEL 6,7 ATTACHMENT	706.00	39.00					4.00	217.00	55	B	2	B	A 2
	4455	1442 MDL 6 OR 7 ATT 4A OR 4B	706.00	28.00					4.00	217.00	55	B	2	B	A 2
	7187	1627 ATTACHMENT-MODEL 1	324.00	15.00					1.00	119.00	55	B	2	B	A 2
	7189	1627 ATTACHMENT-MODEL 2	324.00	15.00					1.00	119.00	55	B	2	B	A 2
	7490	STORAGE ACCESS CHANNEL	523.00	28.00					1.00	879.00	55	B	2	B	A 2
	7690	SYNCH COMMUNICATIONS ADAPTER	4570.00	273.00					20.00	3660.00	55	B	2	B	A 2
	7923	1055 ATTACHMENT	432.00	23.00					2.00	172.00	55	B	2	B	A 2
	7924	1055 ATTACH MDL 4A & 4B ONLY	432.00	23.00					2.00	172.00	55	B	2	B	A 2
	8034	1231 ATTACHMENT	1260.00	70.00					4.00	626.00	55	B	2	B	A 2
	8042	2501 ATTACHMENT	1780.00	98.00					8.00	626.00	55	B	2	B	A 2
1132	001	PRINTER	5270.00	317.00					46.00		50	C	2	B	A 2
	002	PRINTER	2875.00	205.00					46.00		50	C	2	B	A 2
	8391	TYPE WHEEL SPEC 1 CHAR	40.00	50.00SUC						22.00					
	8392	TYPE WHEEL SPEC 1 ADDIT CHAR	12.00	12.00SUC					NC						
	8393	TYPE WHEEL SPEC ADDIT WHEEL	3.00	4.00SUC					NC						
1133	001	MULTIPLEX CONTROL ENCLOSURE	836.00	46.00							55	B	2	B	A 2
	1865	CHANNEL MULTIPLEXER	2640.00	133.00					12.50	270.00	55	B	2	B	A 2
	3201	DISK CONTROL 1	944.00	51.00					2.50	470.00	55	B	2	B	A 2
	3202	DISK CONTROL 2	833.00	46.00					3.50	199.00	55	B	2	B	A 2
	3203	DISK CONTROL 3	944.00	51.00					2.50	470.00	55	B	2	B	A 2
	3204	DISK CONTROL 4	833.00	46.00					3.50	199.00	55	B	2	B	A 2
	3301	2311-11 1ST DRV	4170.00	353.00					34.00	652.00	55	B	2	B	A 2

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C
1133	3302	2311-11 2ND DRV	4170.00	353.00					34.00	652.00	55	B	2	B	A	2
	3303	2311-12 1ST DRV	3025.00	256.00					34.00	652.00	55	B	2	B	A	2
	3304	2311-12 2ND DRV	3025.00	256.00					34.00	652.00	55	B	2	B	A	2
	4423	1403 MDL 6 ATTACHMENT	4795.00	243.00					41.00	1910.00	55	B	2	B	A	2
	4424	1403 ATTACHMENT-MODEL 6	9405.00	532.00					41.00	1910.00	55	B	2	B	A	2
	4425	1403 ATTACHMENT-MODEL 7	10440.00	592.00					47.50	1910.00	55	B	2	B	A	2
	7492	STORAGE ACCESS CHANNEL 2	523.00	28.00					1.00	304.00	55	B	2	B	A	2
1134	001	PAPER TAPE FEADER	679.00	39.00					17.50		45	C	2	B	B	2
	002	PAPER TAPE READER	1175.00	72.00					18.00		45	C	2	B	B	2
1201	A01	PROOF INSCRIBER	11880.00	385.00					99.50		50	C	1	B	B	2
	A02	PROOF INSCRIBER	11340.00	372.00					93.50		50	C	1	B	B	2
	B01	PROOF INSCRIBER	11880.00	347.00					99.50		50	C	1	B	B	2
	B02	PROOF INSCRIBER	11340.00	333.00					93.50		50	C	1	B	B	2
	R03	PROOF INSCRIBER	10260.00	347.00					85.50		50	C	1	B	B	2
	B04	PROOF INSCRIBER	9720.00	333.00					80.00		50	C	1	B	B	2
	001	PROOF INSCRIBER	11880.00	419.00					99.50		50	C	1	B	B	2
	002	PROOF INSCRIBER	11340.00	410.00					93.50		50	C	1	B	B	2
	003	PROOF INSCRIBER	10260.00	385.00					85.50		50	C	1	B	B	2
	004	PROOF INSCRIBER	9720.00	372.00					80.00		50	C	1	B	B	2
	3792	ENDORSER PLATE - NO ARTWRK	42.00						NC	11.00						
	5701	PROCESS CONTROL-ADDN 5TH DIG	206.00	5.00					1.00	77.00	50	C	1	B	B	2
	5702	PROCESS CONTROL-ADDN 6TH DIG	206.00	5.00					1.00	5.00	50	C	1	B	B	2
1203	001	UNIT INSCRIBER	4140.00	169.00					70.00		50	C	1	B	B	2
	1012	ACCOUNT NO. FIELD INSCRIBER	505.00	20.00					2.00	276.00	50	C	1	B	B	2
	3791	SERIAL NUMBERING/ENDORSER	413.00	20.00					6.50	106.00	50	C	1	B	B	2
	3792	ENDORSER PLATE - NO ARTWRK	46.00	NC					NC	PO						
	3794	ENDORSER OLD STYLE	46.00	NC					NC							
	3796	ART WORK	30.00	NC					25.00							
	5350	NON-ZERO BALANCE TEST	160.00	5.00					2.00	39.00	50	C	1	B	B	2
	5701	PROCESS CONTROL-ADDN 5TH DIG	174.00	5.00					1.00	52.00	50	C	1	B	B	2
	5702	PROCESS CONTROL-ADDN 6TH DIG	174.00	5.00					1.00	52.00	50	C	1	B	B	2
	8020	TRANSIT NO. FIELD INSCRIBER	505.00	22.00					3.00	316.00	50	C	1	B	B	2
1230	001	OPTICAL MARK SCORING READER	12060.00	238.00					46.50		60	C	2		B	2
	1620	CARD PUNCH ATTACHMENT	6185.00	129.00					3.00	52.00	60	C	2		B	2
	2398	COUNTER, FORMULA	2485.00	42.00					4.00	66.00	60	C	2		B	2
	2399	COUNTER, RWO	1240.00	21.00					4.00	52.00	60	C	2		B	2
	4609	ID FIELD CHECKING	321.00	7.00					1.00	29.00	60	C	2		B	2
	7467	STORAGE	1240.00	21.00					2.50	52.00	60	C	2		B	2
1231	NC1	OPTICAL MARK PAGE READER	23760.00	549.00					54.00		45	C	2	B	A	2
	001	OPTICAL MARK PAGE READER	20520.00	465.00					47.00		45	C	2	B	A	2
	1264	ASYNCHRONOUS MODE	1595.00	42.00					4.00	119.00	45	C	2	B	A	2
	4700	ISOLATION CONTROL UNIT	NC	NC					NC							
	5045	MASTER MARK	2025.00	54.00					1.50							
1232	001	OPTICAL MARK PAGE READER	14400.00	353.00					60.50		45	C	2	B	B	2
	5045	MASTER MARK	2225.00	54.00					2.00	77.00	45	C	2	B	B	2
	5262	MULTIPLE SPREAD CARD	1330.00	32.00					2.00	44.00	45	C	2	B	B	2
	6405	SEGMENTED WORD	1330.00	32.00					1.00	21.00	45	C	2	B	B	2
	8580	UNIT RECORD CARD	1775.00	42.00					2.00	44.00	45	C	2	B	B	2
1255	001	MAG CHAR READER -	35460.00	904.00					251.00		40	C	2	B	A	2
	002	MAG CHAR READER	40590.00	1100.00					400.00		40	C	2	B	A	2

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MACH MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUP OPT	M G	P C	W C	R C	L P C
1255 003	MAG CHAR READER	55260.00	1450.00				527.00		40	C	2	B	A	2
1470	BALANCE LIST	2990.00	75.00				7.00	343.00	40	C	2	B	A	2
3215	DASH SYMBOL TRANSMISSION	35.00	56.00	SUC			NC	21.00						
4380	51-COL CARD SORTING	661.00	16.00				NC	93.00	40	C	2	B	A	2
4520	H O ZERO & BLANK SELECTION	1315.00	33.00				5.00	157.00	40	C	2	B	A	2
6303	S/3-5320 ADAPTOR	5335.00	135.00				4.00	518.00	40	C	2	B	A	2
6320	S/360 MOD 20 ADAPTOR	6605.00	168.00				21.00	648.00	40	C	2	B	A	2
6360	S/360/370 ADAPTER	19800.00	506.00				37.00	1255.00	40	C	2	B	A	2
7060	SELF CHECKING NO./IMPROVE	2135.00	54.00				2.50	173.00	40	C	2	B	A	2
7850	2772 ADAPTOR	1915.00	48.00				3.00	323.00	40	C	2	B	A	2
1260 001	ELECTRONIC INSCRIBER	11700.00	308.00				119.00		40	C	1	B	B	2
1010	ACCOUNT NUMBER FIELD	551.00	17.00				4.00	91.00	40	C	1	B	B	2
1071	ADDITIONAL TOTALS	551.00	17.00				5.50	23.00	40	C	1	B	B	2
1294	AUTOMATIC FLOAT ANALYSIS	1060.00	34.00				5.50	32.00	40	C	1	B	B	2
1296	AUTOMATIC FLOAT ANALYSIS	1060.00	34.00				5.50	32.00	40	C	1	B	B	2
1935	CHECKER SIGNAL	25.00	25.00	SUC			NC	92.00						
3791	ENDORSEING & SERIAL NUMBERING	689.00	17.00				6.00	100.00	40	C	1	B	B	2
3792	ENDORSER PLATE - NO ARTWRK	46.00	NC				NC							
3796	ENDORSER PLATE	25.00	NC				NC							
4607	HIGH VOLUME TOTAL	321.00	10.00				1.50	23.00	40	C	1	B	B	2
5705	PROCESS CONTROL KEYBOARD	551.00	17.00				1.50	66.00	40	C	1	B	B	2
6300	ROUTING & TRANSIT FIELD	551.00	17.00				4.00	91.00	40	C	1	B	B	2
7138	SHIFT IDENTIFICATION SWITCH	73.00	2.00				NC	27.00	40	C	1	B	B	2
7948	3RD SET OF PROGRAM CARDS	123.00	3.00				NC	15.00	40	C	1	B	B	2
8016	TRANSIT ANALYSIS	482.00	13.00				3.50	23.00	40	C	1	B	B	2
1282 001	OPTICAL READER CARD PUNCH	64080.00	1848.00				339.00		45	C	2	B	B	2
1250	ALTERNATE FIELD CONTROL	734.00	23.00				3.00	45.00	45	C	2	B	B	2
3435	DPBC DETECTION,GRP OF 20 POS	1090.00	35.00				5.50	66.00	45	C	2	B	B	2
3833	EXPANDED FIELD SUPPRESSION	551.00	17.00				1.50	62.00	45	C	2	B	B	2
3950	FAR.7B REC-NO BAR CD/ALPH BL	6050.00	166.00				3.50	76.00	45	C	2	B	B	2
3951	FARRINGTON 7B FONT RECOG	6050.00	166.00				3.50		45	C	2	B	B	2
3952	FARP.7B FONT REC-W BAR CD BL	6050.00	166.00				3.50	76.00	45	C	2	B	B	2
5480	OP M RD-5 POS,80 COL FR FLD	5425.00	166.00				13.00	104.00	45	C	2	B	B	2
5481	OP M RD-6 POS,80 COL FR FLD	5425.00	166.00				13.00	104.00	45	C	2	B	B	2
5482	OP M RD-12 POS,80 COL	7300.00	215.00				16.00	138.00	45	C	2	B	B	2
5483	OP M RD-5 PS,80/51 C,CTR FLD	5425.00	166.00				13.00	104.00	45	C	2	B	B	2
5484	OP M RD-6 PS,80/51 C,CTR FLD	5425.00	166.00				13.00	104.00	45	C	2	B	B	2
7065	SELF-CHECKING#FIELD CORRECT	4365.00	125.00				3.00	32.00	45	C	2	B	B	2
7090	SEPIAL NUMBER PUNCHING	3735.00	105.00				6.00	84.00	45	C	2	B	B	2
1403 N01	PRINTER	38140.00	1081.00			995.00 12	0	25/5	341.00					
N01						908.00 24	0	25/5						
002	PRINTER	22000.00	925.00			851.00 12	0	25/5	295.00					
002						777.00 24	0	25/5						
005	PRINTER	21070.00	715.00			658.00 12	0	25/5	213.00					
005						601.00 24	0	25/5						
006	PRINTER	18760.00	480.00			442.00 12	0	25/5	195.00					
006						403.00 24	0	25/5						
007	PRINTER	21140.00	777.00			715.00 12	0	25/5	229.00					
007						653.00 24	0	25/5						
1376	AUXILIARY RIBBON FEEDING	2000.00	88.00			81.00 12	0	25/5	26.00					

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1403 1376				74.00	24	0 25/5								
3910	FORMS CAPT 1403 N1	153.00	PURCHASE ONLY				NC							
4740	INTERCHBLE CHAIN CARTR ADAPT	2030.00	88.00	81.00	12	0 25/5	NC	60.00	45	C	3	B	A	2
4740				74.00	24	0 25/5								
5110	MULTIBLE CHARACTER SET	299.00	11.00	10.00	12	0 25/5	2.50		45	C	3	B	A	2
5110				9.00	24	0 25/5								
5111	MULT CHAR SET	426.00	11.00	10.00	12	0 25/5	2.50		45	C	3	B	A	2
5111				9.00	24	0 25/5								
5381	NUMERICAL PRINT	5865.00	267.00	246.00	12	0 25/5	14.00	PO	45	C	3	B	A	2
5381				224.00	24	0 25/5								
5523	PREFERRED CHAR SET FEATURE	1385.00	46.00	42.00	12	0 25/5	3.00	42.00	45	C	3	B	A	2
5523				39.00	24	0 25/5								
5532	PRINT CHAIN-ADDITIONAL	1095.00	1140.00SUC					45.00						
6410	SELECTIVE TAPE LIST MDL 3,N1	7505.00	225.00	207.00	12	0 25/5	15.00		45	C	3	B	A	2
6410				189.00	24	0 25/5								
6411	SEL TAPE LSTG FOR MDLS 1,2	5260.00	225.00	207.00	12	0 25/5	15.00		45	C	3	B	A	2
6411				189.00	24	0 25/5								
6413	STACKER	305.00			12	0 25/5	TM	PO	45		3	B	A	2
6413					24	0 25/5								
8371	FIRST TYPE SLUG SUBSTITUE	6.00	16.00SUC				NC	10.00						
8372	ADDITIONAL TYPE SLUG SUBST	6.00	80.00SUC				NC	2.00						
8640	UNIVERSAL CHAR SET-MOD 3	426.00	11.00	10.00	12	0 25/5	2.50	191.00	45	C	3	B	A	2
8640				9.00	24	0 25/5								
8640	UNIVERSAL CHAR SET-MOD N1	426.00	11.00	10.00	12	0 25/5	2.50	119.00	45	C	3	B	A	2
8640				9.00	24	0 25/5								
8641	UNIVERSAL CHAR SET-MODEL 2	299.00	11.00	10.00	12	0 25/5	2.50	197.00	45	C	3	B	A	2
8641				9.00	24	0 25/5								
9950	ARTWORK SERVICE CHARGE	115.00	PURCHASE ONLY				NC							
9951	MATRIX SERVICE CHARGE	173.00	PURCHASE ONLY				NC							
9952	SET-UP SERVICE CHARGE	58.00	PURCHASE ONLY				NC							
ACC.	838300 FORMS CART 1403 N1	133.00	PURCHASE ONLY				NC							
1416 001	INTERCHANGE TRAIN CARTRIDGE	2665.00	101.00				TM		55		3	B	B	1
8373	FIRST TYPE SLUG SUBSTITUE	18.00	230.00SUC				TM	5.00						
8374	ADDITIONAL TYPE SLUG SUBST	18.00	180.00SUC				TM							
9950	ARTWORK SERVICE CHARGE	115.00	PURCHASE ONLY				NC							
9951	MATRIX SERVICE CHARGE	173.00	PURCHASE ONLY				NC							
9952	SET-UP SERVICE CHARGE	58.00	PURCHASE ONLY				NC							
1419 001	MAGNETIC CHARACTER READER	120100.00	2665.00				418.00		50	C	3	B	A	2
1445	BATCH NUMBERING	6805.00	145.00				15.00	575.00	50	C	3	B	A	2
3215	DASH SYMBOL TRANSMISSION	38.00	56.00SUC				NC	21.00						
3610	ELECTRONIC ACCUM & SEQ CHECK	10620.00	293.00				31.00	PO	50	C	3	B	A	2
3791	ENDORSER	19950.00	441.00				55.00	PO	50	C	3	B	A	2
3792	ENDORSER PLATE - NO ARTWRK	67.00	NC				NC	11.00						
3795	ENDORSE ONLY	13100.00	293.00				35.50	PO	50	C	3	B	A	2
3796	ART WORK	30.00	NC				NC							
3800	EXPANDED CAPABILITY	8185.00	181.00				1.00	108.00	50	C	3	B	A	2
4380	51-COL CARD SORTING	NC	NC				NC							
4700	ISOLATION , CONTPOL UNIT	NC	NC				NC							
5201	MULTIPLE COLUMN CONTROL	2445.00	58.00				3.00	189.00	50	C	3	B	A	2
5739	PRG CONTROL-PKT LIGHTS 2-6	1080.00	30.00				1.00	113.00	50	C	3	B	A	2

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TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C	
1419	5741	PROG CONTROL-PKT LIGHTS 7-12	426.00	10.00					1.50	65.00	50	C	3	B	A	2	
	7061	SELF-CHECKING NO.,MODULUS 10	2110.00	46.00					2.50	32.00	50	C	3	B	A	2	
	7062	SELF-CHECKING NO.,MODULUS 11	3260.00	75.00					3.50	26.00	50	C	3	B	A	2	
	7440	SPLIT FIELD	1335.00	22.00					1.50	26.00	50	C	3	B	A	2	
	7720	SYSTEM/360 ADAPTER	5770.00	116.00					10.00	966.00	50	C	3	B	A	2	
	7730	S/360 ADAPTER-DUAL ADDRESS	14210.00	315.00					13.00	966.00	50	C	3	B	A	2	
1442	005	CARD PUNCH	9720.00	330.00					98.00		45	C	3	B	A	2	
	006	CARD READ PUNCH	11110.00	342.00					104.00		45	C	3	B	A	2	
	007	CARD READ PUNCH	11970.00	498.00					122.00		45	C	3	B	A	2	
	3630	1130/1442 MDL 5 COUPLING	177.00	5.00					NC	PO	45	C	3	B	A	2	
	3950	5410 COUPLING	1160.00	36.00					1.50		45	C	3	B	A	2	
1443	001	PRINTER	18290.00	353.00	325.00	12	0	25/5	89.50		45	C	3	B	A	2	
	001				297.00	24	0	25/5									
	002	PRINTER	18400.00	488.00	449.00	12	0	25/5	130.00		45	C	3	B	A	2	
	002				410.00	24	0	25/5									
	003	PRINTER	23360.00	465.00					107.00		45	C	3	B	A	2	
	004	PRINTER	37030.00	741.00					156.00		45	C	3	B	A	2	
	1890	CHARACTER SET-13 CHARACTERS	400.00	400.00SUC					NC								
	1891	CHARACTER SET-39 CHARACTERS	450.00	450.00SUC					NC								
	1892	CHARACTER SET-52 CHARACTERS	475.00	475.00SUC					NC								
	1893	CHARACTER SET-63 CHARACTERS	500.00	500.00SUC					NC								
	1895	ADDL 52 CHAR SET FOR 1800	475.00	475.00SUC					NC								
	1896	ADDL 63 CHAR SET FOR 1800	500.00	500.00SUC					NC								
	4700	ISOLATION CONTROL UNIT-NO1	NC	NC					NC								
	5559	PRINT POSITIONS-24 ADDL	2290.00	48.00	44.00	12	0	25/5	3.00	189.00	45	C	3	B	A	2	
	5559				40.00	24	0	25/5									
	5567	PRINTER CONTROL	12120.00	255.00	235.00	12	0	25/5	7.00	PO	45	C	3	B	A	2	
	5567				214.00	24	0	25/5									
	5568	PRINTER CONTROL	25010.00	510.00	469.00	12	0	25/5	15.00	PO	45	C	3	B	A	2	
	5568				428.00	24	0	25/5									
	5569	PRINTER CONTROL FOR 1800	25010.00	510.00	469.00	12	0	25/5	15.00	PO	45	C	3	B	A	2	
	5569				428.00	24	0	25/5									
	5585	PRINT STORAGE	9080.00	177.00	163.00	12	0	25/5	5.50		45	C	3	B	A	2	
	5585				149.00	24	0	25/5									
	6401	SELECTIVE CHARACTER SET	1265.00	25.00	24.00	12	0	25/5	3.00	26.00	45	C	3	B	A	2	
	6401				22.00	24	0	25/5									
	6404	SEGMENT, EACH	30.00	30.00SUC					NC								
1627	001	PLOTTER	4930.00						68.00					C	2	B	2
1801	C1A	PROCESSOR-CONTROLLER	33630.00	1435.00					109.00		65	B	2	B	B	2	
	01B	PROCESSOR-CONTROLLER	39620.00	1735.00					113.00		65	B	2	B	B	2	
	01C	PROCESSOR-CONTROLLER	52500.00	2330.00					127.00		65	B	2	B	B	2	
	01D	PROCESSOR-CONTROLLER	77770.00	3510.00					152.00		65	B	2	B	B	2	
	02A	PROCESSOR-CONTROLLER	38670.00	1795.00					109.00		65	B	2	B	B	2	
	02B	PROCESSOR-CONTROLLER	44650.00	2155.00					115.00		65	B	2	B	B	2	
	02C	PROCESSOR-CONTROLLER	57400.00	2865.00					127.00		65	B	2	B	B	2	
	02D	PROCESSOR-CONTROLLER	82760.00	4305.00					152.00		65	B	2	B	B	2	
	1CB	PROCESSOR-CONTROLLER	65310.00	2925.00					139.00		65	B	2	B	B	2	
	2CB	PROCESSOR-CONTROLLER	70280.00	3580.00					139.00		65	B	2	B	B	2	
	1231	ANALOG-DGTL CONVERTER MOD 1	3850.00	174.00					3.50	1140.00	65	B	2	B	B	2	
	1232	ANALOG-DGTL CONVERTER MOD 2	4205.00	212.00					3.50	1140.00	65	B	2	B	B	2	

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MAC	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	QPT	G	C	C	P	C
1801	1233	ANALOG INPUT DATA CH ADPTR 1	662.00	26.00					2.00	114.00	65	B	2	B	B	2
	1234	ANALOG INPUT DATA CH ADPTR 2	294.00	10.00					1.00	110.00	65	B	2	B	B	2
	2185	COMPARATOR	1070.00	42.00					2.50	130.00	65	B	2	B	B	2
	3220	DATA CHANNEL EXPANDER	1855.00	75.00					19.00	2025.00	65	B	2	B	B	2
	3222	DATA CHANNEL	368.00	16.00					1.50	56.00	65	B	2	B	B	2
	3262	DIGITAL INPUT ADAPTER	589.00	23.00					0.75	119.00	65	B	2	B	B	2
	3285	DIGITAL INPUT-CONTACT	236.00	10.00					1.25	85.00	65	B	2	B	B	2
	3286	DIGITAL INPUT-VOLTAGE	412.00	14.00					2.00	85.00	65	B	2	B	B	2
	3287	DIGITAL INPUT-VOLTAGE,HI SPD	412.00	14.00					2.00	85.00	65	B	2	B	B	2
	3290	DG & ANLG DTPT DATA CH ADPTR	662.00	26.00					1.50	108.00	65	B	2	B	B	2
	3291	DIGITAL INPUT DATA CH ADPTR	662.00	26.00					1.50	108.00	65	B	2	B	B	2
	3295	DIGITAL OUTPUT ADAPTER	442.00	15.00					2.00	119.00	65	B	2	B	B	2
	3296	DIGITAL OUTPUT CONTROL	442.00	15.00					2.00	81.00	65	B	2	B	B	2
	3612	ELECTRONIC CONTACT OPERATE	589.00	23.00					1.25	85.00	65	B	2	B	B	2
	3703	1803 ADAPTER	1180.00	56.00					5.50	447.00	65	B	2	B	B	2
	4430	1442 ADAPTER	1565.00	75.00					12.50	311.00	65	B	2	B	B	2
	4431	1443/1627 ADAPTER	442.00	15.00					2.00	133.00	65	B	2	B	B	2
	4432	1443 CONTROL	996.00	38.00					5.50	246.00	65	B	2	B	B	2
	4709	INTERRUPT LEVELS	589.00	23.00					2.00	45.00	65	B	2	B	B	2
	5256	MULTIPLEXOR/R CONTROL	589.00	28.00					6.00	35.00	65	B	2	B	B	2
	5257	MULTIPLEXOR/R CONTROL,ADOL	294.00	13.00					2.50	35.00	65	B	2	B	B	2
	5258	MULTIPLEXER/S CONTROL	713.00	28.00					2.00	35.00	65	B	2	B	B	2
	5259	MULTIPLEXER OVERLAP	222.00	8.00					0.75	85.00	65	B	2	B	B	2
	5487	OUTPUT PRINTER EXPANDER	1425.00	56.00					2.50	380.00	65	B	2	B	B	2
	5710	PROCESS INTERRUPT ADAPTER	662.00	26.00					1.50	119.00	65	B	2	B	B	2
	5715	PROCESS INTERRUPT-CONTACT	471.00	23.00					2.50	175.00	65	B	2	B	B	2
	5716	PROCESS INTERRUPT-VOLTAGE	589.00	28.00					0.75	175.00	65	B	2	B	B	2
	5861	PULSE COUNTER ADAPTER	662.00	26.00					0.75	138.00	65	B	2	B	B	2
	5862	PULSE COUNTER	185.00	8.00					0.75	65.00	65	B	2	B	B	2
	5863	PULSE OUTPUT	589.00	23.00					1.25	85.00	65	B	2	B	B	2
	5867	PULSE COUNTER-16 BIT	368.00	16.00					1.00	85.00	65	B	2	B	B	2
	6125	REGISTER OUTPUT	662.00	26.00					1.25	85.00	65	B	2	B	B	2
	7188	1627 CONTROL	1145.00	46.00					5.50	168.00	65	B	2	B	B	2
	7925	1053 ADAPTER	713.00	33.00					5.50	138.00	65	B	2	B	B	2
	7926	1054/1055 ADAPTER	1145.00	56.00					9.50	344.00	65	B	2	B	B	2
1802	01A	PROCESSOR-CONTROLLER	43070.00	1825.00					134.00		65	B	2	B	B	2
	01B	PROCESSOR-CONTROLLER	49040.00	2120.00					140.00		65	B	2	B	B	2
	01C	PROCESSOR-CONTROLLER	61860.00	2715.00					152.00		65	B	2	B	B	2
	01D	PROCESSOR-CONTROLLER	86990.00	3910.00					174.00		65	B	2	B	B	2
	02A	PROCESSOR-CONTROLLER	48030.00	2190.00					133.00		65	B	2	B	B	2
	02B	PROCESSOR-CONTROLLER	54010.00	2545.00					136.00		65	B	2	B	B	2
	02C	PROCESSOR-CONTROLLER	66830.00	3255.00					152.00		65	B	2	B	B	2
	02D	PROCESSOR-CONTROLLER	92170.00	4680.00					175.00		65	B	2	B	B	2
	1CB	PROCESSOR CONTROLLER	74170.00	3310.00					163.00		65	B	2	B	B	2
	2CB	PROCESSOR-CONTROLLER	79160.00	3970.00					163.00		65	B	2	B	B	2
	1231	ANALOG-DGTL CONVERTER MOD 1	3850.00	174.00					3.00	1140.00	65	B	2	B	B	2
	1232	ANALOG-DGTL CONVERTER MOD 2	4205.00	212.00					3.00	1140.00	65	B	2	B	B	2
	1233	ANALOG INPUT DATA CH ADPTR 1	662.00	26.00					1.75	114.00	65	B	2	B	B	2
	1234	ANALOG INPUT DATA CH ADPTR 2	294.00	10.00					1.00	110.00	65	B	2	B	B	2
	2185	COMPARATOR	1070.00	42.00					2.50	130.00	65	B	2	B	B	2

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MACH MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUR QPT	M G	P C	W C	R C	L C
18C2 3220	DATA CHANNEL EXPANDER	1855.00	75.00				18.50	2025.00	65	B	2	B	B	2
3222	DATA CHANNEL	368.00	16.00				1.50	56.00	65	R	2	B	B	2
3290	DG & ANLG DTPT DATA CH ADPTR	662.00	26.00				1.50	108.00	65	B	2	B	B	2
3291	DIGITAL INPUT DATA CH ADPTR	662.00	26.00				1.50	108.00	65	B	2	B	B	2
3703	1803 ADAPTER	1180.00	56.00				5.50	447.00	65	B	2	B	B	2
4430	1442 ADAPTER	1565.00	75.00				12.00	311.00	65	B	2	B	B	2
4431	1443/1627 ADAPTER	442.00	15.00				1.75	133.00	65	B	2	B	B	2
4432	1443 CONTROL	996.00	38.00				5.50	246.00	65	R	2	B	B	2
4709	INTERRUPT LEVELS	589.00	23.00				2.00	45.00	65	B	2	B	B	2
5256	MULTIPLEXER/R CONTROL	589.00	28.00				6.00	35.00	65	B	2	B	B	2
5257	MULTIPLEXER/R CONTROL, ADDL	294.00	13.00				2.50	35.00	65	B	2	B	B	2
5258	MULTIPLEXER/S CONTROL, ADDL	713.00	28.00				2.00	35.00	65	B	2	B	B	2
5259	MULTIPLEXER OVERLAP	222.00	8.00				0.75	85.00	65	B	2	B	B	2
5487	OUTPUT PRINTER EXPANDER	1425.00	56.00				2.50	380.00	65	B	2	B	B	2
7125	7 TRACK COMPATIBILITY	1710.00	70.00				2.00	163.00	65	B	2	B	B	2
7188	1627 CONTROL	1145.00	46.00				5.50	168.00	65	B	2	B	B	2
7925	1053 ADAPTER	713.00	33.00				5.50	138.00	65	B	2	B	B	2
7926	1054/1055 ADAPTER	1145.00	56.00				9.00	344.00	65	B	2	B	B	2
18C3 02A	CORE STORAGE UNIT	19950.00					90.50							
02B	CORE STORAGE	32770.00	1710.00				90.50		55	B	2	B	B	2
02C	CORE STORAGE	45590.00	2415.00				130.00		55	R	2	B	B	2
02D	CORE STORAGE	58400.00	3140.00				164.00		55	B	2	B	B	2
02E	CORE STORAGE	71220.00	3855.00				199.00		55	B	2	B	B	2
181C A01	DISK STORAGE	9580.00	396.00				72.50		50	C	2	B	B	2
A02	DISK STORAGE	15200.00	651.00				118.00		50	C	2	B	B	2
A03	DISK STORAGE	20820.00	906.00				167.00		50	C	2	B	B	2
B01	DISK STORAGE	19950.00	788.00				86.50		50	C	2	B	B	2
B02	DISK STORAGE	29890.00	1180.00				136.00		50	C	2	B	B	2
B03	DISK STORAGE	39830.00	1575.00				191.00		50	C	2	B	B	2
1816 001	PRINTER-KEYBOARD	2085.00	98.00				14.50		55	C	2	B	B	2
9509	PIN FEED PLATEN, REGULAR	61.75						TM						
1826 001	DATA ADAPTER UNIT	1960.00	98.00				4.00		60	B	2	B	B	2
002	DATA ADAPTER UNIT	1725.00	94.00				4.00		60	B	2	B	B	2
003	1826 DATA ADAPTER UNIT	3355.00	158.00				8.00		60	B	2	B	B	2
1231	ANALOG-DGTL CONVERTER MOD 1	3850.00	174.00				3.00	334.00	60	B	2	B	B	2
1232	ANALOG-DGTL CONVERTER MOD 2	4205.00	212.00				3.00	334.00	60	B	2	B	B	2
1233	ANALOG INPUT DATA CH ADPTR 1	662.00	26.00				1.75	114.00	60	R	2	B	B	2
1234	ANALOG INPUT DATA CH ADPTR 2	294.00	10.00				1.00	110.00	60	B	2	B	B	2
1237	ANALOG INPUT EXPANDER	4635.00	235.00				8.00	806.00	60	B	2	B	B	2
2185	COMPARATOR	1070.00	42.00				2.50	130.00	60	B	2	B	B	2
3262	DIGITAL INPUT ADAPTER	589.00	23.00				0.75	119.00	60	B	2	B	B	2
3285	DIGITAL INPUT-CONTACT	236.00	10.00				1.25	85.00	60	B	2	B	B	2
3286	DIGITAL INPUT-VOLTAGE	412.00	14.00				1.75	85.00	60	B	2	B	B	2
3287	DIGITAL INPUT-VOLTAGE, HI SPD	412.00	14.00				1.75	85.00	60	B	2	B	B	2
3295	DIGITAL OUTPUT ADAPTER	442.00	15.00				2.00	119.00	60	B	2	B	B	2
3296	DIGITAL OUTPUT CONTROL	442.00	15.00				1.75	81.00	60	B	2	B	B	2
3612	ELECTRONIC CONTACT OPERATE	589.00	23.00				1.25	85.00	60	B	2	B	B	2
4700	ISOLATION CONTROL UNIT-NO1	NC	NC				NC							
5256	MULTIPLEXER/R CONTROL	589.00	28.00				4.50	35.00	60	B	2	B	B	2
5257	MULTIPLEXER/R CONTROL, ADDL	294.00	13.00				2.50	35.00	60	B	2	B	B	2

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MACT MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUP OPT	M G	P C	W C	R C	L P
1826 5258	MULTIPLEXER/S CONTROL	713.00	28.00				2.00	35.00	60	B	2	B	B	2
5259	MULTIPLEXER OVERLAP	222.00	8.00				0.75	85.00	60	B	2	B	B	2
5710	PROCESS INTERRUPT ADAPTER	662.00	26.00				1.50	119.00	60	B	2	B	B	2
5715	PROCESS INTERRUPT-CONTACT	471.00	23.00				2.50	175.00	60	B	2	B	B	2
5716	PROCESS INTERRUPT-VOLTAGE	589.00	28.00				0.75	175.00	60	B	2	B	B	2
5861	PULSE COUNTER ADAPTER	662.00	26.00				0.75	138.00	60	B	2	B	B	2
5862	PULSE COUNTER	185.00	8.00				0.75	65.00	60	B	2	B	B	2
5863	PULSE OUTPUT	589.00	23.00				1.25	85.00	60	B	2	B	B	2
5867	PULSE COUNTER-16 BIT	368.00	16.00				1.00	85.00	60	B	2	B	B	2
6125	REGISTER OUTPUT	662.00	26.00				1.25	85.00	60	B	2	B	B	2
7550	COMMUNICATIONS ADAPTER	6555.00	270.00				61.00	1260.00	60	B	2	B	B	2
7551	LINE ADAPTER	4845.00	200.00				24.00	507.00	60	B	2	B	B	2
7552	CLOCK	206.00	7.00				1.00	114.00	60	B	2	B	B	2
7570	1800/2790 ADAPTER	18510.00	771.00				49.00	1300.00	60	B	2	B	B	2
7710	SELECTOR CHANNEL	9220.00	384.00				23.00	1520.00	60	B	2	B	B	2
7720	SYSTEM/360 ADAPTER	3560.00	154.00				4.00	718.00	60	B	2	B	B	2
1827 001	DATA ADAPTER UNIT	5345.00	223.00				24.50		60	B	2	B	B	2
1230	ANALOG INPUT BASIC	2705.00	110.00				13.50	602.00	60	B	2	B	B	2
1231	ANALOG-DGTL CONVERTER MOD 1	3850.00	174.00				3.50	334.00	60	B	2	B	B	2
1232	ANALOG-DGTL CONVERTER MOD 2	4205.00	212.00				3.50	334.00	60	B	2	B	B	2
2185	COMPARATOR	1070.00	42.00				2.50	130.00	60	B	2	B	B	2
3262	DIGITAL INPUT ADAPTER	589.00	23.00				0.75	119.00	60	B	2	B	B	2
3284	DIGITAL INPUT BASIC	1995.00	80.00				9.50	175.00	60	B	2	B	B	2
3285	DIGITAL INPUT-CONTACT	236.00	10.00				1.25	85.00	60	B	2	B	B	2
3286	DIGITAL INPUT-VOLTAGE	412.00	14.00				2.00	85.00	60	B	2	B	B	2
3287	DIGITAL INPUT-VOLTAGE-HI SPD	412.00	14.00				2.00	85.00	60	B	2	B	B	2
3289	DGTL & ANALOG OUTPUT BASIC	1995.00	80.00				11.50	175.00	60	B	2	B	B	2
3295	DIGITAL OUTPUT ADAPTER	442.00	15.00				2.00	119.00	60	B	2	B	B	2
3296	DIGITAL OUTPUT CONTROL	442.00	15.00				2.00	81.00	60	B	2	B	B	2
3612	ELECTRONIC CONTACT OPERATE	589.00	23.00				1.25	85.00	60	B	2	B	B	2
4700	ISOLATION CONTROL UNIT-N01	NC	NC				NC							
5256	MULTIPLEXER/R CONTROL	589.00	28.00				5.00	35.00	60	B	2	B	B	2
5257	MULTIPLEXER/R CONTROL, ADDL	294.00	13.00				2.50	35.00	60	B	2	B	B	2
5258	MULTIPLEXER/S CONTROL	713.00	28.00				2.00	35.00	60	B	2	B	B	2
5861	PULSE COUNTER ADAPTER	662.00	26.00				0.75	138.00	60	B	2	B	B	2
5862	PULSE COUNTER	185.00	8.00				0.75	65.00	60	B	2	B	B	2
5863	PULSE OUTPUT	589.00	23.00				1.25	85.00	60	B	2	B	B	2
5867	PULSE COUNTER 16-BIT	368.00	16.00				1.00	85.00	60	B	2	B	B	2
6125	REGISTER OUTPUT	662.00	26.00				1.25	85.00	60	B	2	B	B	2
1828 001	ENCLOSURE	442.00	23.00						65	B	2	B	B	2
002	ENCLOSURE	294.00	15.00				NC		65	B	2	B	B	2
1851 001	MULTIPLEXER TERMINAL	713.00	33.00				2.50		60	B	2	B	B	2
002	MULTIPLEXER TERMINAL	1070.00	51.00				2.50		60	B	2	B	B	2
3246	DIFFERENTIAL AMPLIFIER	442.00	23.00				1.25	65.00	60	B	2	B	B	2
3593	CONNECTOR ELEMENT	3.00	3.00SUC				NC	3.50						
3594	CURRENT ELEMENT	4.00	5.00SUC				NC							
3595	CURRENT/HL ELEMENT	4.00	5.00SUC				NC							
3596	CUSTOM ELEMENT	3.00	3.00SUC				NC							
3597	FILTER ELEMENT	8.00	10.00SUC				NC	3.50						
3598	VOLTAGE/R ELEMENT	10.00	13.00SUC				NC	3.50						

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MACH MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L % CHG	TERM	MMMC	FIC	PUP	M	P	W	R	L
1851 3599	VOLTAGE/S ELEMENT	10.00	13.00	SUC			NC	3.50						
5252	MULTIPLEXER/R	368.00	17.00				1.50	175.00	60	B	2	B	B	2
5253	MULTIPLEXER/S-MLSE	851.00	46.00				2.00	150.00	60	B	2	B	B	2
1856 001	ANALOG OUTPUT TERMINAL	1640.00	86.00				14.00		55	B	2	B	B	2
CC2	ANALOG OUTPUT TERMINAL	1215.00	56.00				12.00		55	B	2	B	B	2
1227	ANAGOG DRIVER AMPLIFIER	185.00	8.00				1.25	61.00	55	B	2	B	B	2
1507	BUFFER REG-SINGLE 13 BIT	148.00	5.00				1.50	70.00	55	B	2	B	B	2
1508	BUFFER REG-DOUBLE 13 BIT	294.00	10.00				2.50	95.00	55	B	2	B	B	2
3251	DGTL ANALOG CNVTR-DAC-MDL 1	236.00	10.00				2.00	70.00	55	B	2	B	B	2
3252	DGTL ANALOG CNVTR-DAC-MDL 2	471.00	23.00				4.00	70.00	55	B	2	B	B	2
3253	DGTL ANALOG CNVTR-DAC-MDL 3	713.00	33.00				2.50	70.00	55	B	2	B	B	2
3254	DGTL ANALOG CNVTR-DAC-MDL 4	1425.00	70.00				6.00	70.00	55	B	2	B	B	2
5527	PRECISION VOLTAGE REF MDL 1	713.00	33.00				1.50	23.00	55	B	2	B	B	2
5528	PRECISION VOLTAGE REF MDL 2	1070.00	56.00				2.00	23.00	55	B	2	B	B	2
20 20	BC1 PROCESSING UNIT	22000.00	1160.00				79.50		50	B	2	B	B	2
	BC2 PROCESSING UNIT	23730.00	1250.00				84.00		50	B	2	B	B	2
	BC3 PROCESSING UNIT	13950.00	741.00				79.50		50	B	2	B	B	2
	BC4 PROCESSING UNIT	14810.00	788.00				84.00		50	B	2	B	B	2
	BC5 PROCESSING UNIT	24070.00	1355.00				164.00		50	B	2	B	B	2
	BC6 PROCESSING UNIT	16860.00	980.00				182.00		50	B	2	B	B	2
	BC1 PROCESSING UNIT	11740.00	611.00				61.00		50	B	2	B	B	2
	B02 PROCESSING UNIT	13470.00	702.00				65.50		50	B	2	B	B	2
	BC3 PROCESSING UNIT	8210.00	433.00				61.00		50	B	2	B	B	2
	BC4 PROCESSING UNIT	9220.00	480.00				65.50		50	B	2	B	B	2
	CC1 PROCESSING UNIT	16200.00	857.00				69.50		50	B	2	B	B	2
	CC2 PROCESSING UNIT	17930.00	950.00				74.00		50	B	2	B	B	2
	CC3 PROCESSING UNIT	10370.00	549.00				69.50		50	B	2	B	B	2
	CC4 PROCESSING UNIT	11260.00	598.00				74.00		50	B	2	B	B	2
	CC5 PROCESSING UNIT	18950.00	1070.00				148.00		50	B	2	B	B	2
	CC6 PROCESSING UNIT	11150.00	702.00				164.00		50	B	2	B	B	2
	DC5 PROCESSING UNIT	38100.00	2080.00				190.00		50	B	2	B	B	2
	DC1 PROCESSING UNIT	27360.00	1455.00				85.50		50	B	2	B	B	2
	DC2 PROCESSING UNIT	29090.00	1555.00				91.00		50	B	2	B	B	2
	DC3 PROCESSING UNIT	17360.00	931.00				85.50		50	B	2	B	B	2
	DC4 PROCESSING UNIT	18220.00	980.00				91.00		50	B	2	B	B	2
	DC5 PROCESSING UNIT	30200.00	1670.00				172.00		50	B	2	B	B	2
	DC6 PROCESSING UNIT	22850.00	1215.00				190.00		50	B	2	B	B	2
	E05 PROCESSING UNIT	44430.00	2500.00				215.00		50	B	2	B	B	2
1315	AUTOMATIC CALLING	477.00	38.00				1.25	145.00	50	B	2	B	B	2
1580	CARD PRINT CONTROL	466.00	28.00				3.50	145.00	50	B	2	B	B	2
2074	BINARY SYNCH COMMUNI ADAPTER	6555.00	500.00				27.00	1560.00	50	B	2	B	B	2
3228	DATA CONVERSION	1075.00	58.00				12.50	81.00	50	B	2	B	B	2
3480	DUAL FEED CARRIAGE CONTROL	201.00	10.00				2.00	98.00	50	B	2	B	B	2
3901	1401/1440 COMPATIBILITY	5880.00	334.00				47.50	PO	50	B	2	B	B	2
4100	FULL TRANSPARENT TEXT MODE	280.00	23.00				1.00	128.00	50	B	2	B	B	2
4442	1403 ATTACHMENT-MODEL 2	4230.00	273.00				36.00	1810.00	50	B	2	B	B	2
4447	1403 ATTACHMENT-MODEL 7	4135.00	243.00				36.00	1810.00	50	B	2	B	B	2
4448	1403 ATTACHMENT-MODEL N1	4422.00	334.00				36.00	1810.00	50	B	2	B	B	2
4460	1442 ATTACHMENT-MODEL 5	560.00	34.00				3.50	351.00	50	B	2	B	B	2
4500	HIGH SPEED-19200 BPS	678.00	56.00				1.25	168.00	50	B	2	B	B	2

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MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUR OPT	M G	P C	W C	R C	L P	
2020 45C1	HIGH SPEED-50000 BPS	678.00	56.00				1.25	168.00	50	B	2	B	B	2	
4658	INPUT/OUTPUT CHANNEL	2820.00	181.00				7.00	583.00	50	B	2	B	B	2	
470C	INTERMEDIATE BLOCK CHECKING	490.00	23.00				1.00		50	B	2	B	B	2	
4703	INTERNAL CLOCK	352.00	28.00				1.00	175.00	50	B	2	B	B	2	
5301	NATIVE TAPE ATTACHMENT	9410.00	537.00				281.00	2160.00	50	B	2	B	B	2	
5302	NATIVE TAPE ATTACHMENT	11425.00	654.00				412.00	2475.00	50	B	2	B	B	2	
532C	9 TRACK COMPATABILITY	3215.00	181.00				71.00	102.00	50	B	2	B	B	2	
5575	PRINTER FEATURES CONTROL	991.00	66.00				2.50	85.00	50	B	2	B	B	2	
7081	SERIAL I/O CHANNEL	1990.00	120.00				10.50	526.00	50	B	2	B	B	2	
7125	7 TRACK COMPATIBILITY	1075.00	58.00				31.50	102.00	50	B	2	B	B	2	
7126	7 TRACK COMPATIBILITY	2360.00	133.00				53.50	102.00	50	B	2	B	B	2	
7135	7&9 TRACK COMPATABILITY	5210.00	297.00				53.50	133.00	50	B	2	B	B	2	
7477	STATION SELECTION	409.00	33.00				1.00	133.00	50	B	2	B	B	2	
7495	STORAGE CONTROL	4230.00	273.00				7.00	2090.00	50	B	2	B	B	2	
7496	STORAGE CONTROL	3165.00	208.00				7.00	2090.00	50	B	2	B	B	2	
7497	STORAGE CNTL FOR SUBMDL 5	4230.00	273.00				7.00	2090.00	50	B	2	B	B	2	
7498	STORAGE CONTROL FOR SUMDL 6	4230.00	273.00				7.00	2090.00	50	B	2	B	B	2	
807C	2152 ATTACHMENT	1745.00	103.00				6.50	712.00	50	B	2	B	B	2	
8082	2203 ATTACHMENT-120 PRNT PDS	1040.00	66.00				7.00	PO	50	B	2	B	B	2	
8083	2203 ATTACHMENT-144 PRNT PDS	1040.00	66.00				7.00	PO	50	B	2	B	B	2	
8084	2203 ATTACHMENT	1040.00	66.00				7.00	PO	50	B	2	B	B	2	
8085	2203 ATTACHMENT	1040.00	66.00				7.00	PO	50	B	2	B	B	2	
8090	2501 ATTACHMENT	383.00	23.00				2.50	293.00	50	B	2	B	B	2	
8092	2520 ATTACHMENT-MODEL A1	935.00	58.00				9.50	380.00	50	B	2	B	B	2	
8095	2520 ATTACHMENT-MODEL A2,A3	486.00	28.00				4.00	351.00	50	B	2	B	B	2	
8099	2560 ATTACHMENT	1410.00	89.00				7.00	407.00	50	B	2	B	B	2	
8100	2560 ATTACHMENT	1410.00	89.00				7.00	407.00	50	B	2	B	B	2	
8637	UNIVERSAL CHARACTER SET ADAP	289.00	15.00				5.00	293.00	50	B	2	B	B	2	
2152 001	PRINTER KEYBOARD	5745.00	168.00				92.50		35	C	2	B	B	2	
4450	FORMS STAND STACKER	61.00					NC	NC							
2203 AC1	PRINTER	13880.00	571.00	525.00	12	0	25/5	122.00	45	C	2	B	A	2	
AC1				480.00	24	0	25/5								
AC2	PRINTER	10620.00	437.00	402.00	12	0	25/5	122.00	45	C	2	B	A	2	
AC2				367.00	24	0	25/5								
1897	63 CHAR ASC11 CODE	500.00	500.00SUC				NC								
1901	CHARACTER SET-13 CHARACTERS	460.00	460.00SUC				NC								
1902	CHARACTER SET-39 CHARACTERS	520.00	520.00SUC				NC								
1903	CHARACTER SET-52 CHARACTERS	550.00	550.00SUC				NC								
1904	CHARACTER SET-63 CHARACTERS	580.00	580.00SUC				NC								
3475	DUAL FEED CARRIAGE	3035.00	110.00	101.00	12	0	25/5	13.00	PO	45	C	2	B	A	2
3475				92.00	24	0	25/5								
5558	PRINT POSITIONS,24 ADDITIONL	1495.00	49.00	45.00	12	0	25/5	5.50	515.00	45	C	2	B	A	2
5558				41.00	24	0	25/5								
6404		25.00	25.00SUC				NC								
7815	TAPE CHANNELS,6 ADDITIONAL	258.00	10.00	9.00	12	0	25/5	1.50	66.00	45	C	2	B	A	2
7815				8.00	24	0	25/5								
2213 001	PRINTER	4220.00	145.00				42.00		35	B	2	B	B	2	
002	PRINTER	6515.00	190.00				46.00		35	B	2	B	B	2	
4450	FORMS STAND STACKER	62.00					NC	NC							
6200	ROLL PAPER FEED	459.00	10.00				NC	PO	35	B	2	B	B	2	

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TEPM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C
2213	9509	PIN FEED PLATEN-REGULAR	61.75	PURCHASE ONLY												
2222	001	PRINTER W/LEDGER CARD DEV	12860.00	392.00					144.00		35	B	2	B	A	2
	002	PRINTER W/LEDGER CARD DEV	13020.00	432.00					157.00		35	B	2	B	A	2
2250	001	DISPLAY UNIT	57530.00	1185.00					198.00		40	A	3	B	A	1
	003	DISPLAY UNIT	34830.00	1740.00					223.00		40	A	3	B	A	1
	1001	ABSOLUTE VECTORS	15210.00	381.00					12.00	509.00	40	A	3	B	A	1
	1002	ABSOLUTE VECTORS & CONTROL	17410.00	437.00					13.00	388.00	40	A	3	B	A	1
	1245	ALPHAMERIC KEYBOARD	3910.00	81.00					4.50	306.00	40	A	3	B	A	1
	1248	ALPHAMERIC KEYBOARD	3910.00	81.00					2.50		40	A	3	B	A	1
	1498	BUFFER-4096 POSITIONS	18290.00	381.00					8.50	179.00	40	A	3	B	A	1
	1499	BUFFER-8192 POSITIONS	26110.00	544.00					12.00	179.00	40	A	3	B	A	1
	1880	CHARACTER GENERATOR	19610.00	409.00					18.50	275.00	40	A	3	B	A	1
	3250	DISPLAY COPIER ATTACH-MDL 1	3655.00	75.00					2.50		40	A	3	B	A	1
	3251	DISPLAY COPIER ATTACH-MDL 3	3655.00	75.00					2.50		40	A	3	B	A	1
	4485	GRAPHIC DESIGN	16960.00	353.00					16.00	1030.00	40	A	3	B	A	1
	4700	ISOLATION CONTROL UNIT		NC					NC							
	4785	LIGHT PEN	5220.00	108.00					13.00	161.00	40	A	3	B	A	1
	5475	1ST OPERATOR CONTROL PANEL	2170.00	48.00					NC	231.00	40	A	3	B	A	1
	5476	2ND OPERATOR CONTROL PANEL	1680.00	37.00					NC	115.00	40	A	3	B	A	1
	5855	PROGRAMMED FUNCTION KEYBOARD	7840.00	162.00					9.50	318.00	40	A	3	B	A	1
2260	001	DISPLAY STATION	1025.00	33.00					12.50		45	B	3	B	B	1
	002	DISPLAY STATION	1025.00	33.00					12.50		45	B	3	B	B	1
	3605	KEYBOARD ALPHAMERIC NUMERIC	1235.00	42.00					6.50	63.00	45	B	3	B	B	1
	3606	KEYBOARD ALPHAMERIC	954.00	33.00					2.00	39.00	45	B	3	B	B	1
	3607	KEYBOARD NUMERIC	635.00	21.00					1.50	32.00	45	B	3	B	B	1
	4765	KBOARD, ALPHA-NUMERIC INSET	954.00	32.00					6.50	56.00	45	B	3	B	B	1
	4766	KEYBOARD, ALPHAMERIC	635.00	21.00					2.00	33.00	45	B	3	B	B	1
	4767	KEYBOARD, NUMERIC	317.00	10.00					1.50	26.00	45	B	3	B	B	1
	ACC.	323921 BULK CABLE	RPQ	PURCHASE ONLY												
	ACC.	5213814 BULK CABLE	RPQ	PURCHASE ONLY												
	ACC.	5213866 BULK CABLE	RPQ	PURCHASE ONLY												
	ACC.	5214887 BULK CABLE	RPQ	PURCHASE ONLY												
	ACC.	5727685 CABLE ASSEMBLY	RPQ	PURCHASE ONLY												
	ACC.	5727686 CABLE ASSEMBLY	RPQ	PURCHASE ONLY												
	ACC.	5727687 CABLE ASSEMBLY	RPQ	PURCHASE ONLY												
	ACC.	5728291 CABLE ASSEMBLY	RPQ	PURCHASE ONLY												
	ACC.	5728292 CABLE ASSEMBLY	RPQ	PURCHASE ONLY												
	ACC.	5728293 CABLE ASSEMBLY	RPQ	PURCHASE ONLY												
2265	002	DISPLAY STATION	4700.00	183.00					32.00		50	B	1	B	B	2
2310	B01	DISK STORAGE	6945.00	277.00					51.50		50	C	2	B	A	2
	B02	DISK STORAGE	11170.00	445.00					92.00		50	C	2	B	A	2
2311	001	DISK STORAGE DRIVE	16510.00	639.00	588.00	12	0	25/5	82.50		55	C	3	B	A	1
	001				537.00	24	0	25/5								
	011	DISK STORAGE DRIVE	16510.00	639.00	588.00	12	0	25/5	82.50		55	C	3	B	A	1
	011				537.00	24	0	25/5								
	012	DISK STORAGE DRIVE	14430.00	391.00	360.00	12	0	25/5	51.50		55	C	3	B	A	1
	012				328.00	24	0	25/5								
	3601	2311 MDL11 ATTACH TO 1133 MD	119.00	5.00	5.00	12	0	25/5	1.00	NC	55	C	3	B	A	1
	3601				4.00	24	0	25/5								
	3602	2311 MDL12 ATTACH TO 1133 MD	119.00	5.00	5.00	12	0	25/5	1.00	NC	55	C	3	B	A	1

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MAC	MDL/		PURCHASE	MONTHLY	MONTHLY	BASE	U/L	TERM		PUR	M	P	W	R	L
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P_C
2311	3602				4.00	24	C	25/5							
2312	AC1	DISK STORAGE	22920.00	599.00	551.00	12	C	25/5	107.00		55	C	2	B	B 1
	AC1				503.00	24	C	25/5							
2313	AC1	DISK STORAGE	75290.00	1945.00	1789.00	12	C	25/5	331.00		55	C	2	B	B 1
	A01				1634.00	24	C	25/5							
2314	AC1	STORAGE CONTROL	63810.00	1650.00	1518.00	12	C	25/5	82.50		55	C	3	B	A 1
	AC1				1386.00	24	C	25/5							
	B01	STORAGE CONTROL	63810.00	1650.00	1518.00	12	C	25/5	82.50		55	C	3	B	A 1
	BC1				1386.00	24	C	25/5							
	001	DIRECT ACCESS STOR.FACILITY	199450.00	5890.00	5419.00	12	C	25/5	856.00		55	C	3	B	A 1
	001				4948.00	24	C	25/5							
	4700	ISOLATION CONTROL UNIT	NC	NC					NC						
	6148	REMOTE SWITCH ATTACHMENT	NC	NC					NC						
	7949	2844 ATTACHMENT	NC	NC					NC						
	8170	TWO CHANNEL SWITCH	5340.00	156.00	144.00	12	C	25/5	3.50	767.00	55	C	3	B	A 1
	8170				131.00	24	C	25/5							
2318	A01	DISK STORAGE	37430.00	1030.00	948.00	12	C	25/5	185.00		55	C	3	B	B 1
	A01				865.00	24	C	25/5							
2319	BC1	DISK STORAGE	35100.00	1080.00	994.00	12	C	25/5	254.00		55	C	3	B	B 1
	BC1				907.00	24	C	25/5							
	BC2	DISK STORAGE	35100.00	1080.00	994.00	12	C	25/5	254.00		55	C	3	B	B 1
	BC2				907.00	24	C	25/5							
2401	001	MAGNETIC TAPE UNIT	14440.00	375.00	345.00	12	C	25/5	113.00		45	C	3	B	A 1
	001				315.00	24	C	25/5							
	002	MAGNETIC TAPE UNIT	20940.00	544.00	500.00	12	C	25/5	128.00		45	C	3	B	A 1
	002				457.00	24	C	25/5							
	003	MAGNETIC TAPE UNIT	33950.00	881.00	811.00	12	C	25/5	156.00		45	C	3	B	A 1
	003				740.00	24	C	25/5							
	004	MAGNETIC TAPE UNIT	16530.00	432.00	397.00	12	C	25/5	136.00		45	C	3	B	A 1
	004				363.00	24	C	25/5							
	005	MAGNETIC TAPE UNIT	23140.00	600.00	552.00	12	C	25/5	149.00		45	C	3	B	A 1
	005				504.00	24	C	25/5							
	006	MAGNETIC TAPE UNIT	36150.00	937.00	862.00	12	C	25/5	180.00		45	C	3	B	A 1
	006				787.00	24	C	25/5							
	008	MAGNETIC TAPE UNIT	15210.00	447.00	411.00	12	C	25/5	156.00		45	C	3	B	A 1
	008				375.00	24	C	25/5							
	3471	DUAL DENSITY-800-1600 BPI	1100.00	26.00	24.00	12	C	25/5	2.50	78.00	45	C	3	B	A 1
	3471				22.00	24	C	25/5							
	5121	MODE COMPATIBILITY	426.00	10.00	9.00	12	C	25/5	NC	27.00	45	C	3	B	A 1
	5121				8.00	24	C	25/5							
	5519	POWER WINDOW	308.00	308.00SUC					NC	NC					
2402	001	MAGNETIC TAPE UNIT	26670.00	696.00	640.00	12	C	25/5	221.00		45	C	3	B	A 1
	001				585.00	24	C	25/5							
	002	MAGNETIC TAPE UNIT	39790.00	1030.00	948.00	12	C	25/5	253.00		45	C	3	B	A 1
	002				865.00	24	C	25/5							
	003	MAGNETIC TAPE UNIT	65800.00	1705.00	1569.00	12	C	25/5	313.00		45	C	3	B	A 1
	003				1432.00	24	C	25/5							
	3472	DUAL DENSITY-800-1600 BPT	2145.00	54.00	50.00	12	C	25/5	4.50	157.00	45	C	3	B	A 1
	3472				45.00	24	C	25/5							
	5122	MODE COMPATIBILITY	864.00	21.00	19.00	12	C	25/5	NC	55.00	45	C	3	B	A 1

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TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P
2402	5122				18.00	24	C	25/5							
	5519	POWER WINDOW	308.00	308.00	SUC				NC	NC	45	C	3	B	A 1
	7161	SIMULTNEOUS READ WHILE WRITE	864.00	21.00	19.00	12	G	25/5	NC	102.00	45	C	3	B	A 1
	7161				18.00	24	J	25/5							
2403	3228	DATA CONVERSION	1935.00	49.00	45.00	12	C	25/5	1.50	88.00	45	C	3	B	A 1
	3228				41.00	24	C	25/5							
	3471	DUAL DENSITY 80C-160C	1100.00	26.00	24.00	12	J	25/5	2.50	78.00	45	C	3	B	A 1
	3471				22.00	24	J	25/5							
	4701	ISOLATION, CONTROL UNIT	NC	NC					NC						
	4703	ISOLATION, CONTROL UNIT	NC	NC					NC						
	4704	ISOLATION, CONTROL UNIT	NC	NC					NC						
	5320	9 TRACK COMPATIBILITY	9925.00	256.00	236.00	12	C	25/5	47.00	946.00	45	C	3	B	A 1
	5320				215.00	24	C	25/5							
	5519	POWER WINDOW	308.00	308.00	SUC				NC	NC					
	7125	7 TRACK COMPAT-MODEL 1,2,3	2145.00	54.00	50.00	12	C	25/5	2.00	131.00	45	C	3	B	A 1
	7125				45.00	24	C	25/5							
	7127	7 TRACK COMPAT-MODEL 4,5,6	7545.00	195.00	179.00	12	J	25/5	31.00	869.00	45	C	3	B	A 1
	7127				164.00	24	C	25/5							
	7135	7 & 9 TRACK COMPATIBILITY	16090.00	420.00	386.00	12	C	25/5	80.50	1245.00	45	C	3	B	A 1
	7135				353.00	24	C	25/5							
	7185	16 DRIVE ADDRESSING	1100.00	26.00	24.00	12	C	25/5	1.50	66.00	45	C	3	B	A 1
	7185				22.00	24	C	25/5							
2404	3236	DATA CONVERSION	3610.00	77.00					2.00	179.00	45	C	3	B	A 1
	5519	POWER WINDOW	308.00	308.00	SUC				NC	NC					
	7126	7 TRACK COMPATIBILITY	3855.00	84.00					3.00	179.00	45	C	3	B	A 1
2415	001	MAG TAPE UNIT AND CONTROL	32950.00	841.00	774.00	12	C	25/5	187.00		45	C	3	B	A 1
	001				706.00	24	C	25/5							
	002	MAG TAPE UNIT AND CONTROL	52690.00	1345.00	1237.00	12	C	25/5	334.00		45	C	3	B	A 1
	002				1130.00	24	C	25/5							
	003	MAG TAPE UNIT AND CONTROL	72420.00	1845.00	1697.00	12	C	25/5	486.00		45	C	3	B	A 1
	003				1550.00	24	C	25/5							
	004	MAG TAPE UNIT AND CONTROL	40010.00	1015.00	934.00	12	C	25/5	214.00		45	C	3	B	A 1
	004				853.00	24	C	25/5							
	005	MAG TAPE UNIT AND CONTROL	64260.00	1630.00	1500.00	12	C	25/5	382.00		45	C	3	B	A 1
	005				1369.00	24	C	25/5							
	006	MAG TAPE UNIT AND CONTROL	98510.00	2240.00	2061.00	12	C	25/5	553.00		45	C	3	B	A 1
	006				1882.00	24	C	25/5							
	3228	DATA CONVERSION	1935.00	49.00	45.00	12	C	25/5	1.50	88.00	45	C	3	B	A 1
	3228				41.00	24	C	25/5							
	4701	ISOLATION, CONTROL UNIT	NC	NC					NC						
	4703	ISOLATION, CONTROL UNIT	NC	NC					NC						
	5320	9 TRACK COMPATIBILITY	5825.00	150.00	138.00	12	J	25/5	15.00	480.00	45	C	3	B	A 1
	5320				126.00	24	C	25/5							
	7125	7 TRACK COMPAT-MODELS 1,2,3	2145.00	54.00	50.00	12	C	25/5	2.00	527.00	45	C	3	B	A 1
	7125				45.00	24	C	25/5							
	7127	7 TRACK COMPAT-MODELS 4,5,6	4085.00	105.00	97.00	12	C	25/5	4.50	527.00	45	C	3	B	A 1
	7127				88.00	24	C	25/5							
	7135	7 & 9 TRACK COMPATIBILITY	6675.00	172.00	158.00	12	C	25/5	21.00	665.00	45	C	3	B	A 1
	7135				144.00	24	C	25/5							
2501	A01	CARD READER	12330.00	250.00					56.50		40	C	3	B	A 2

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MACH/MDL/ TYPE FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE TERM	U/L %	TERM CHG	MMMC	FIC	PUP OPT	M G	P C	W C	R C	L P C
2501 AC2	CARD READER	12550.00	330.00				80.50		40	C	3	B	A	2
3630	1130/2501 COUPLING	168.00	5.00				NC	53.00	40	C	3	B	A	2
2502 A01	CARD READER	6160.00	143.00				50.50		30	C	3	B	B	2
AC2	CARD READER	6680.00	179.00				50.50		30	C	3	B	B	2
4650	INTERCHANGEABLE FEED 51/80	1330.00	31.00				16.00	106.00	30	C	3	B	B	2
4651	INTERCHANGEABLE FEED 66/80	1330.00	31.00				16.00	106.00	30	C	3	B	B	2
5450	OPTICAL MARK READ FEATURE	5830.00	141.00				29.00	266.00	30	C	3	B	B	2
2520 AC1	CARD READ PUNCH	35380.00	949.00				184.00		40	C	3	B	A	2
AC2	CARD PUNCH	31630.00	844.00				173.00		40	C	3	B	A	2
AC3	CARD PUNCH	31410.00	609.00				136.00		40	C	3	B	A	2
2560 A01	MULTI-FUNCTION CARD MACHINE	21230.00	799.00				182.00		40	C	3	B	A	2
AC2	MULTI-FUNCTION CARD MACHINE	15590.00	621.00				182.00		40	C	3	B	A	2
1575	CARD PRINT-FIRST 2 LINES	4625.00	172.00				24.50	PO	40	C	3	B	A	2
1576	CARD PRINT-SECOND 2 LINES	4625.00	172.00				24.50	388.00	40	C	3	B	A	2
1577	CARD PRINT-THIRD 2 LINES	4625.00	172.00				24.50	388.00	40	C	3	B	A	2
2711 001	LINE ADAPTER UNIT	6610.00	145.00				24.00		50	R	3	B	B	2
4639	IBM LINE ADAPTER 2W VOICE GP	448.00	10.00				1.00	39.00	50	B	3	B	B	2
4641	IBM LINE ADAPTER 2W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4642	IBM LINE ADAPTER 2W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4643	IBM LINE ADAPTER 2W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4644	IBM LINE ADAPTER 2W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4647	IBM LINE ADAPTER 4W VOICE GR	448.00	10.00				1.00	39.00	50	B	3	B	B	2
4691	IBM LINE ADAPTER 4W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4692	IBM LINE ADAPTER 4W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4693	IBM LINE ADAPTER 4W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4694	IBM LINE ADAPTER 4W SHRD USE	899.00	21.00				1.50	39.00	50	B	3	B	B	2
4790	IBM LINE ADAPTER 2W TO 8 MI	506.00	10.00				0.50	39.00	50	B	3	B	B	2
4794	LINE ADAPTER MODULE	538.00	10.00				2.00	28.00	50	B	3	B	B	2
4816	LINE SET 1	538.00	10.00				2.00		50	B	3	B	B	2
4817	LINE SET 2	538.00	10.00				2.00		50	B	3	B	B	2
4818	LINE SET 3	538.00	10.00				2.00		50	B	3	B	B	2
6350	SHARED LINE ADAPTER 4/1 TERM	168.00	5.00				0.50	19.00	50	B	3	B	B	2
2740 001	COMMUNICATION TERMINAL	3400.00	105.00				39.00		40	B	1	B	B	2
002	COMMUNICATION TERMINAL	5210.00	162.00				39.00		40	B	1	B	B	2
1313	AUTOMATIC EOB	139.00	3.50				NC	29.00	40	B	1	B	B	2
1495	BUFFER EXP POS 121-248-MOD 2	360.00	10.00				1.00	29.00	40	B	1	B	B	2
1496	BUFFER EXP POS 249-440-MOD 2	537.00	16.00				1.00	29.00	40	B	1	B	B	2
1499	BUFFER RECEIVE-MODEL 2	178.00	5.00				NC	21.00	40	B	1	B	B	2
3255	DIAL UP	116.00	3.00				NC	40.00	40	B	1	B	B	2
3401	DOCUMENT INSERT 6 IN CD-MD 2	217.00	6.00				2.00	PO	40	B	1	B	B	2
3402	DOCUMENT INSERT 7-3/8 CD-M 2	217.00	6.00				2.00	PO	40	B	1	B	B	2
3600	EDIT-MODEL 2	360.00	10.00				NC	23.00	40	B	1	B	B	2
4510	HEADER CONTROL-MODEL 2	178.00	5.00				NC	21.00	40	B	1	B	B	2
4634	IBM LINE ADAPTER 2W TO 4.75M	116.00	3.00				NC	57.00	40	B	1	B	B	2
4635	IBM LINE ADAPTER 4W TO 4.75M	116.00	3.00				NC	57.00	40	B	1	B	B	2
4639	IBM LINE ADAPTER 2W VOICE GR	347.00	10.00				1.50	96.00	40	B	1	B	B	2
4641	IBM LINE ADAPTER 2W SUBCH 1	694.00	21.00				2.00	96.00	40	B	1	B	B	2
4642	IBM LINE ADAPTER 2W SUBCH 2	694.00	21.00				2.00	96.00	40	B	1	B	B	2
4643	IBM LINE ADAPTER 2W SUBCH 3	694.00	21.00				2.00	96.00	40	B	1	B	B	2
4644	IBM LINE ADAPTER 2W SUBCH 4	694.00	21.00				2.00	96.00	40	B	1	B	B	2

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MACH	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TEPM		PUR	M	P	W	R	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C
2740	4647	IBM LINE ADAPTER 4W VOICE GR	347.00	10.00					1.50	96.00	40	B	1	B	B	2
	4691	IBM LINE ADAPTER 4W SUBCH 1	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4692	IBM LINE ADAPTER 4W SUBCH 2	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4693	IBM LINE ADAPTER 4W SUBCH 3	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4694	IBM LINE ADAPTER 4W SUBCH 4	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4790	IBM LINE ADAPTER 2W TO 8 MI	390.00	10.00					1.00	29.00	40	B	1	B	B	2
	6114	RECORD CHECKING	645.00	17.00					NC	32.00	40	B	1	B	B	2
	7106	SPEED BASE-600 BPS-MODEL 2	360.00	10.00					NC	5.00	40	B	1	B	B	2
	7479	STATION CONTROL	585.00	16.00					NC	37.00	40	B	1	B	B	2
	7807	TEL LINE ATTACH-MODEL 2	112.00	3.00					1.50	49.00	40	B	1	B	B	2
	8028	TRANSMIT CONTROL	195.00	5.00					NC	48.00	40	B	1	B	B	2
	8301	2760 ATTACHMENT	390.00	10.00					NC	35.00	40	B	1	B	B	2
	9509	PIN FEED PLATEN,REGULAR	61.75		PURCHASE ONLY				NC							
	9600	SPLIT FRICTION FEED PLATEN	76.00		PURCHASE ONLY				NC							
	ACC.	1186101 ROLL PAPER HOLDER	65.00		PURCHASE ONLY				NC	15.00						
2741	C01	COMMUNICATION TERMINAL	2380.00	105.00					42.00		40	B	1	B	B	2
	3255	DIAL UP	116.00	3.00					NC	34.00	40	B	1	B	B	2
	4634	IBM LINE ADAPTER 2W TO 4.75M	116.00	3.00					NC	57.00	40	B	1	B	B	2
	4635	IBM LINE ADAPTER 4W TO 4.75M	116.00	3.00					NC	57.00	40	B	1	B	B	2
	4639	IBM LINE ADAPTER 2W VOICE GR	347.00	10.00					1.50	96.00	40	B	1	B	B	2
	4641	IBM LINE ADAPTER 2W SUBCH 1	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4642	IBM LINE ADAPTER 2W SUBCH 2	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4643	IBM LINE ADAPTER 2W SUBCH 3	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4644	IBM LINE ADAPTER 2W SUBCH 4	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4647	IBM LINE ADAPTER 4W VOICE GR	347.00	10.00					1.50	96.00	40	B	1	B	B	2
	4691	IBM LINE ADAPTER 4W SUBCH 1	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4692	IBM LINE ADAPTER 4W SUBCH 2	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4693	IBM LINE ADAPTER 4W SUBCH 3	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4694	IBM LINE ADAPTER 4W SUBCH 4	694.00	21.00					2.00	96.00	40	B	1	B	B	2
	4708	INTERRUPT	99.00	2.50					NC	27.00	40	B	1	B	B	2
	4790	IBM LINE ADAPTER 2W TO 8 MI	390.00	10.00					1.00	29.00	40	B	1	B	B	2
	5501	PRINT INHIBIT	303.00	10.00					NC	87.00	40	B	1	B	B	2
	7900	TRANSMIT INTERRUPT	242.00	8.00					NC	132.00	40	B	1	B	B	2
	8341	TYPAMATIC KEYS	195.00	5.00					NC	89.00	40	B	1	B	B	2
	9509	PIN FEED PLATEN,REGULAR	61.75		PURCHASE ONLY				NC							
	ACC.	1186101 ROLL PAPER HOLDER	65.00		PURCHASE ONLY				NC	15.00						
2772	001	MULTI-PURPOSE CONTROL UNIT	10030.00	286.00					46.00		45	A	2	B	B	2
	1340	AUTOMATIC ANSWERING	381.00	10.00					1.00	39.00	45	A	2	B	B	2
	1490	BUFFER EXPANSION	918.00	27.00					9.50	53.00	45	A	2	B	B	2
	1491	BUFFER EXPANSION ADDITIONAL	2090.00	59.00					1.50	515.00	45	A	2	B	B	2
	1910	CONVERSATIONAL MODE	190.00	5.00					NC	27.00	45	A	2	B	B	2
	3250	DISPLAY FORMAT CONTROL	190.00	5.00					NC	36.00	45	A	2	B	B	2
	3650	EBCDIC TRANSPARENCY	381.00	10.00					1.00	39.00	45	A	2	B	B	2
	3830	EXPANDED I/O CAPABILITY	1520.00	42.00					0.50	289.00	45	A	2	B	B	2
	3860	PPINT EXPANSION	762.00	21.00					1.50	90.00	45	A	2	B	B	2
	3940	FIRST 50 ATTACHMENT	1480.00	41.00					1.50	136.00	45	A	2	B	B	2
	3941	2ND 50 ATTACHMENT	229.00	6.00					0.50	86.00	45	A	2	B	B	2
	3950	545 ATTACHMENT	1290.00	36.00					2.50	90.00	45	A	2	B	B	2
	3970	5496 ATTACHMENT	3810.00	108.00					20.00	179.00	45	A	2	B	B	2
	4610	IDENTIFICATION	381.00	10.00					1.00	39.00	45	A	2	B	B	2

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MA	MDL/		PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUP	M	P	W	R	L		
TYPE	FEAT	DESCRIPTION	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C
2772	4690	KEYBOARD CORRECTION	190.00	5.00					1.50	44.00	45	A	2	B	B	2
	4695	KEYLOCK	35.00	38.00SUC					NC	16.00						
	5010	MULTI-POINT DATA LINK CNTRL	572.00	16.00					2.00	44.00	45	A	2	B	B	2
	5450	OPTICAL MARK READ FEATURE	572.00	16.00					2.00	31.00	45	A	2	B	B	2
	5890	HORIZONTAL FORMAT CONTROL	952.00	27.00					0.50	90.00	45	A	2	B	B	2
	6310	SECURITY IDENTIFICATION	572.00	16.00					1.00	82.00	45	A	2	B	B	2
	6555	SPACE COMPRESSION/EXPANSION	1520.00	42.00					2.00	515.00	45	A	2	B	B	2
	7705	SYNCHRONOUS CLOCK	918.00	27.00					2.50	39.00	45	A	2	B	B	2
	7910	1017 ATTACHMENT	918.00	27.00					5.50	109.00	45	A	2	B	B	2
	7915	1018 ATTACHMENT	762.00	21.00					6.00	109.00	45	A	2	B	B	2
	7920	1053 MODEL 1 ATTACHMENT	952.00	27.00					1.50	155.00	45	A	2	B	B	2
	7925	1053 RIBBON SHIFT	190.00	5.00					NC	45.00	45	A	2	B	B	2
	7930	1053 VERTICAL FORMS CONTROL	572.00	16.00					1.00	49.00	45	A	2	B	B	2
	7950	TRANSMIT RECEIVE MONITOR PRT	762.00	21.00					2.00	39.00	45	A	2	B	B	2
	8000	2203 A01 ATTACHMENT	8755.00	248.00					30.50	412.00	45	A	2	B	B	2
	8001	2203 A02 ATTACHMENT	8755.00	248.00					30.50	412.00	45	A	2	B	B	2
	8010	2213 MDL 1 ATTACHMENT	918.00	27.00					6.50	135.00	45	A	2	B	B	2
	8015	2265 ATTACHMENT	2585.00	73.00					10.50	187.00	45	A	2	B	B	2
	8020	2502 MDL A1 ATTACHMENT	2220.00	63.00					1.50	177.00	45	A	2	B	B	2
	8021	2502 MDL A2 ATTACHMENT	2220.00	63.00					1.50	177.00	45	A	2	B	B	2
	8040	3875 ATTACHMENT	190.00	5.00					0.50	113.00	45	A	2	B	B	2
	8700	2213 MDL 2 ATTACHMENT	918.00	27.00					6.50	135.00	45	A	2	B	B	2
	ACC.	ADDITIONAL KEY	2.50	PURCHASE ONLY					NC							
2780	001	DATA TRANSMISSION TERMINAL	33240.00	983.00					325.00		35	B	2	B	B	1
	002	DATA TRANSMISSION TERMINAL	36930.00	1090.00					392.00		35	B	2	B	B	1
	003	DATA TRANSMISSION TERMINAL	27710.00	813.00					301.00		35	B	2	B	B	1
	004	DATA TRANSMISSION TERMINAL	25840.00	763.00					271.00		35	B	2	B	B	1
	1340	AUTOMATIC ANSWERING	572.00	16.00					1.50	203.00	35	B	2	B	B	1
	1350	AUTOMATIC TURNAROUND	381.00	10.00					1.50	174.00	35	B	2	B	B	1
	1894	39 CHARACTER BAR 6 BIT TRANS	520.00	520.00SUC					NC							
	1895	47 CHARACTER BAR 6 BIT TRANS	535.00	535.00SUC					NC							
	1897	63 CHARACTER BAR ASCII	580.00	580.00SUC					NC							
	1902	EBCDIC	520.00	520.00SUC					NC							
	1903	EBCDIC	550.00	550.00SUC					NC							
	1904	EBCDIC	580.00	580.00SUC					NC							
	3401	DUAL COMMUNICATION INTERFCE	952.00	28.00					1.00	111.00	35	B	2	B	B	1
	5010	MULTIPLE RECORD TRANSMISSION	572.00	16.00					2.50	144.00	35	B	2	B	B	1
	5020	MULTI-POINT LINE CONTROL	918.00	28.00					3.00	157.00	35	B	2	B	B	1
	5800	PRINTER HORIZ FORMAT CONTROL	802.00	32.00					1.50	115.00	35	B	2	B	B	1
	5820	PRINT LINE 120-CHARACTER	3145.00	91.00					8.50	436.00	35	B	2	B	B	1
	5821	PRINT LINE 144-CHARACTER	1660.00	48.00					3.50	855.00	35	B	2	B	B	1
	6400	SELECTIVE CHARACTER SET	918.00	28.00					4.00	115.00	35	B	2	B	B	1
	6404	EACH SEGMENT	25.00	25.00SUC					NC							
	7705	SYNCHRONOUS CLOCK	918.00	28.00					1.50	196.00	35	B	2	B	B	1
	7850	TERMINAL IDENTIFICATION	952.00	28.00					2.50	38.00	35	B	2	B	B	1
	8030	EBCDIC TRANSPARENCY	572.00	16.00					1.00	203.00	35	B	2	B	B	1
2791	001	AREA STATION	7140.00	205.00					56.50		40	C	1	B	B	2
	002	AREA STATION	5880.00	151.00					56.50		40	C	1	B	B	2
	3330	DIGITAL DEVICE READ IN	434.00	10.00					1.00	72.00	40	C	1	B	B	2
	3690	EXT ALARM CONTACTS	434.00	10.00					1.00	189.00	40	C	1	B	B	2

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MACH TYPE	MDL/ FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY BASE LEASE	U/L TERM	CHG	MMMC	FIC	PUR OPT	M G	P C	W C	R C	L P
2791	3874	EDR RECEIVE	520.00	13.00				3.00	96.00	40	C	1	B	B	2
	3875	EDR SEND	520.00	14.00				3.00	96.00	40	C	1	B	B	2
	7990	2798 ATTACHMENT BASIC	2075.00	56.00				14.00	188.00	40	C	1	B	B	2
	7991	2798 ATTACHMENT ADDITIONAL	832.00	21.00				4.50	109.00	40	C	1	B	B	2
	8030	1035 ATTACHMENT	650.00	16.00				2.00	72.00	40	C	1	B	B	2
	8050	1053 ATTACHMENT	841.00	21.00				1.50	111.00	40	C	1	B	B	2
	8295	2795/2796 ATTACHMENT -BASIC	1045.00	28.00				2.50	99.00	40	C	1	B	B	2
	8296	2795/2796 ATTACHMENT -ADDTL	650.00	16.00				1.50	51.00	40	C	1	B	B	2
2792	001	REMOTE COMMN CONTROLLER	10710.00	308.00				82.50		45	D	1	B	B	1
	002	REMOTE COMMN CONTROLLER	10710.00	308.00				82.50		45	D	1	B	B	1
2793	001	AREA STATION	5255.00	135.00				19.00		45	B	1	B	B	2
	3690	EXT ALARM CONTACTS	434.00	10.00				0.50	189.00	45	B	1	B	B	2
	3874	EXTEND DIST REPEATER REC	520.00	13.00				2.50	96.00	45	B	1	B	B	2
	3875	EXTEND DIST REPEATER SEND	520.00	14.00				2.50	96.00	45	B	1	B	B	2
	5550	PULSE COUNTERS BASIC	3900.00	99.00				14.50	362.00	45	B	1	B	B	2
	5551	PULSE COUNTERS ADDL	694.00	17.00				1.00	71.00	45	B	1	B	B	2
	5552	PULSE COUNTER EXPANSION	1640.00	41.00				4.50	71.00	45	B	1	B	B	2
	7990	2798 ATTACHMENT BASIC	2075.00	56.00				12.00	188.00	45	B	1	B	B	2
	7991	2798 ATTACHMENT ADDITIONAL	832.00	21.00				4.00	109.00	45	B	1	B	B	2
	8050	1053 ATTACHMENT	841.00	21.00				1.00	111.00	45	B	1	B	B	2
	8296	2795/2796 ATTACHMENT -ADDTL	650.00	16.00				1.00	51.00	45	B	1	B	B	2
	8710	VISUAL READOUT	1300.00	33.00				1.00	77.00	45	B	1	B	B	2
2796	001	DATA ENTRY UNIT	986.00	28.00				7.50		45	B	1	B	B	2
2797	001	DATA ENTRY UNIT	1990.00	52.00				9.00		45	B	1	B	B	2
2798	001	DISPLAY UNIT	3740.00	96.00				18.50		45	B	1	B	B	2
2841	001	STORAGE CONTROL	24460.00	589.00	542.00	12	C	25/5	70.50	45	B	3	B	A	1
	001				495.00	24	C	25/5							
	1024	ADDITIONAL STORAGE	7180.00	223.00	205.00	12	C	25/5	1.50	94.00	45	B	3	B	A
	1024				187.00	24	C	25/5							
	4385	FILE SCAN	1255.00	38.00	35.00	12	C	25/5	1.50	34.00	45	B	3	B	A
	4385				32.00	24	C	25/5							
	4700	ISOLATION, CONTROL UNIT	NC	NC					NC						
	6118	RECORD OVERFLOW	381.00	10.00	9.00	12	C	25/5	1.00	34.00	45	B	3	B	A
	6118				8.00	24	C	25/5							
	6148	REMOTE SWITCH ATTACHMENT	NC	NC					NC						
	7950	7302 ATTACHMENT	8990.00	278.00	256.00	12	C	25/5	3.50	191.00	45	B	3	B	A
	7950				234.00	24	C	25/5							
	8077	2303 ATTACHMENT	16960.00	447.00	411.00	12	C	25/5	9.00	1175.00	45	B	3	B	A
	8077				375.00	24	C	25/5							
	8079	2321 ATTACHMENT	6290.00	195.00	179.00	12	C	25/5	2.00	191.00	45	B	3	B	A
	8079				164.00	24	C	25/5							
	8100	TWO CHANNEL SWITCH	3810.00	110.00	101.00	12	C	25/5	4.50	575.00	45	B	3	B	A
	8100				92.00	24	C	25/5							
2848	001	DISPLAY CONTROL	16630.00	404.00				39.00		50	C	3	B	B	1
	002	DISPLAY CONTROL	17770.00	437.00				39.50		50	C	3	B	B	1
	003	DISPLAY CONTROL	19020.00	471.00				40.00		50	C	3	B	B	1
	021	DISPLAY CONTROL	34620.00	813.00				47.00		50	C	3	B	B	1
	022	DISPLAY CONTROL	37010.00	869.00				47.00		50	C	3	B	B	1
	3355	DISPLAY ADAPTER FOR MODEL 1	1585.00	43.00				3.00	104.00	50	C	3	B	B	1
	3356	DISPLAY ADAPTER FOR MODEL 2	3175.00	89.00				5.50	152.00	50	C	3	B	B	1

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MDL/	PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L	
FEAT	PRICE	RENTAL	LEASE TERM	%	CHG	MMMC	FIC	OPT	G	C	C	P	C
DESCRIPTION													
2848 3357	DISP LAY ADAP T ER FOR MODEL 3	3990.00	112.00				201.00	50	C	3	B	B	1
3368	DISP LAY ADAP T ER-FOR MODEL 21	2770.00	65.00				192.00	50	C	3	B	B	1
3369	DISP LAY ADAP T ER-FOR MODEL 22	5550.00	129.00				255.00	50	C	3	B	B	1
3857	EXP ANS ION UN I T-ALL MODEL S	1940.00	49.00				NC	50	C	3	B	B	1
3858	EXP ANS ION UN I T-MODEL S 1,2	2385.00	61.00				43.00	50	C	3	B	B	1
3859	EXP ANS ION UN I T-MODEL S 1,2,3	1940.00	49.00				98.00	50	C	3	B	B	1
3868	EXP ANS ION UN I T-MODEL S 21,22	2305.00	54.00				98.00	50	C	3	B	B	1
3901	DISP LAY CN T L	1755.00	49.00				49.00	50	C	3	B	R	1
4700	ISOLATION, CONTROL UNIT	NC	NC				NC						
4787	LINE ADDRESSING	476.00	10.00				70.00	50	C	3	B	B	1
5340	NON-DESTRUCTIVE CURSOR	455.00	10.00				70.00	50	C	3	B	B	1
5341	NON-DESTRUCTIVE CURSOR ADAP	227.00	5.00				38.00	50	C	3	B	B	1
7927	1053 ADAP T ER FOR MODEL 1,2	1585.00	43.00				147.00	50	C	3	B	B	1
7928	1053 ADAP T ER FOR MODEL 3	1585.00	43.00				194.00	50	C	3	B	B	1
7938	1053 ADAP T ER-FOR MODEL 21,22	4850.00	114.00				680.00	50	C	3	B	B	1
3262 A01	PR I N T ER 650 LPM BOLT-ON	14000.00	411.00	350.00	24	5	25/5	120.00	45	D	1	B	D
B01	PR I N T ER 650 LPM STAND-ALONE	14000.00	411.00	350.00	24	5	25/5	120.00	45	D	1	B	D
5940	PR I N T BEL T 48 CHAR	170.00	PURCHASE ONLY										
5943	PR I N T BEL T 60 CHAR S/38 SPE	170.00	PURCHASE ONLY										
5944	PR I N T BEL T 64 CHAR EBCDIC	170.00	PURCHASE ONLY										
5945	PR I N T BEL T 64 CHAR ASCII	170.00	PURCHASE ONLY										
5946	PR I N T BEL T 64 CHAR EBCDIC	170.00	PURCHASE ONLY										
5947	PR I N T BEL T 64 CHAR ASCII	170.00	PURCHASE ONLY										
5948	PR I N T BEL T 96 CHAR EBCDIC	170.00	PURCHASE ONLY										
5949	PR I N T BEL T 96 CHAR ASCII	170.00	PURCHASE ONLY										
5962	PR I N T BEL T 64 CHAR MULTI	170.00	PURCHASE ONLY										
5963	PR I N T BEL T 96 CHAR MULTI	170.00	PURCHASE ONLY										
5964	PR I N T BEL T 188 CHAR MULTI	170.00	PURCHASE ONLY										
3271 001	CON T ROL UN I T REMOTE ATT	4735.00	155.00	132.00	24	5	25/5	17.50	60	A	1	B	B
002	CON T ROL UN I T REMOTE ATT	5240.00	169.00	144.00	24	5	25/5	19.50	60	A	1	B	B
1550	COPY	NC	NC				NC						
3250	DEV I CE ADAP T ER	779.00	51.00	43.00	24	5	25/5	0.50	60	A	1	B	B
7820	1200 BPS	NC	NC	NC			NC						
7821	4800 BPS	145.00	4.00	3.00	24	5	25/5	0.50	60	A	1	B	B
3272 001	CON T ROL UN I T LOCAL ATT	5465.00	179.00	152.00	24	5	25/5	17.50	60	A	1	B	B
002	CON T ROL UN I T LOCAL ATT	5970.00	193.00	164.00	24	5	25/5	39.00	60	A	1	B	B
3250	DEV I CE ADAP T ER	779.00	51.00	43.00	24	5	25/5	0.50	60	A	1	B	B
3274 C01	CON T ROL UN I T	13190.00	344.00	293.00	24	5	25/5	70.00	55	A	1	B	B
1801	CON T ROL STORAG E EXP ANS ION	1055.00	31.00	26.00	24	5	25/5	5.50	55	A	1	B	B
3622	EXTENDED FUNCTION STORAGE	1170.00	58.00	49.00	24	5	25/5	10.00	55	A	1	B	B
3625	STORAGE	1170.00	58.00	49.00	24	5	25/5	10.00	55	A	1	B	B
3627	STORAGE	1170.00	58.00	49.00	24	5	25/5	10.00	55	A	1	B	B
3701	EXTERNAL MODEM INTERFACE	400.00	12.00	10.00	24	5	25/5	4.00	55	A	1	B	B
5650	DDS ADAP T ER PT-TO-PT	840.00	24.00	20.00	24	5	25/5	2.00	55	A	1	B	B
5651	DDS ADAP T ER MULTIPOINT	840.00	24.00	20.00	24	5	25/5	2.00	55	A	1	B	B
6302	COMMON COMMUNICATIONS ADAPT	450.00	12.00	10.00	24	5	25/5	2.50	55	A	1	B	B
6901	TERMINAL ADAPTER TYPE A1	1215.00	32.00	27.00	24	5	25/5	2.50	55	A	1	B	B
6902	TERMINAL ADAPTER TYPE A2	1215.00	32.00	27.00	24	5	25/5	2.50	55	A	1	B	B
6903	TERMINAL ADAPTER TYPE A3	1215.00	32.00	27.00	24	5	25/5	2.50	55	A	1	B	B
7802	TERMINAL ADAPTER TYPE B1	1300.00	38.00	32.00	24	5	25/5	5.00	55	A	1	B	B

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MACH TYPE	MDL/ FEAT	DESCRIPTION	PURCHASE PRICE	MONTHLY RENTAL	MONTHLY LEASE	BASE TERM	U/L %	TERM CHG	MMMC	FIC	PUR OPT	M G	P C	W C	R L
3274	7803	TERMINAL ADAPTER TYPE B2	1100.00	32.00	27.00	24	5	25/5	3.00		55	A	1	B	B 2
	7804	TERMINAL ADAPTER TYPE B3	1100.00	32.00	27.00	24	5	25/5	3.00		55	A	1	B	B 2
	7805	TERMINAL ADAPTER TYPE B4	1100.00	32.00	27.00	24	5	25/5	3.00		55	A	1	B	B 2
3275	001	DISPLAY STATION	4005.00	113.00	96.00	24	5	25/5	14.50		60	A	1	B	B 2
	002	DISPLAY STATION	4735.00	136.00	116.00	24	5	25/5	21.00		60	A	1	B	B 2
	1090	AUDIBLE ALARM	145.00	4.00	3.00	24	5	25/5	0.50		60	A	1	B	B 2
	3440	DIAL IBM ASSIGND TERMNL IDEN	328.00	8.00	7.00	24	5	25/5	1.00		60	A	1	B	B 2
	4600	OPER IDENT CARD RDR	437.00	13.00	11.00	24	5	25/5	3.50		60	A	1	B	B 2
	4630	KEYBD 66 KEY EBCDIC TYPEWRTR	520.00	13.00	11.00	24	5	25/5	5.50		60	A	1	B	B 2
	4631	KEYBOARD	520.00	13.00	11.00	24	5	25/5	6.50		60	A	1	B	B 2
	4632	KEYBD 78 KEY OPERATOR CONSL	1010.00	32.00	27.00	24	5	25/5	15.00		60	A	1	B	B 2
	4633	KEYBD 78 KEY EBCDIC TYPEWRTR	869.00	28.00	24.00	24	5	25/5	9.00		60	A	1	B	B 2
	4634	KEYBD 66 KEY ASC11 TYPEWRTR	520.00	13.00	11.00	24	5	25/5	5.50		60	A	1	B	B 2
	4635	KEYBD 78 KEY ASC11 TYPEWRTR	869.00	28.00	24.00	24	5	25/5	9.00		60	A	1	B	B 2
	4636	66 KEY EBCDIC KEYBOARD	522.00	15.00	13.00	24	5	25/5	6.50						
	4690	KEYBOARD NUMERIC LOCK	NC	NC	NC				NC						
	5500	LINE ADAPTR	535.00	16.00	14.00				3.00		60	A	1	B	B 2
	5501	LINE ADAPTR WITH AUTO-ANSWER	714.00	21.00	18.00	24	5	25/5	3.50		60	A	1	B	B 2
	5550	PRINTER ADAPTER	NC	NC	NC	24	5	25/5	NC						
	6340	SECURITY LOCK	35.00	35.00SUC					NC						
	6350	SELECTOR LIGHT-PEN	728.00	24.00	20.00	24	5	25/5	1.50		60	A	1	B	B 2
	7820	1200 BPS	NC	NC	NC				NC						
	7821	4800-BPS	145.00	4.00	3.00	24	5	25/5	0.50		60	A	1	B	B 2
	ACC.	ADDITIONAL KEY	2.50	PURCHASE ONLY					NC						
3276	002	CONTROL UNIT DISPLAY STATION	6570.00	172.00	146.00	24	5	25/5	33.00		55	A	1	B	B 2
	1009	ADDRESS KEY LOCK	60.00	60.00SUC					NC						
	1090	AUDIBLE ALARM	90.00	2.00	2.00	24	5	25/5	NC		55	A	1	B	B 2
	3255	TERMINAL ADAPTER NO. 1	630.00	16.00	14.00	24	5	25/5	1.50		55	A	1	B	B 2
	3256	TERMINAL ADAPTER NO. 2	630.00	16.00	14.00	24	5	25/5	1.50		55	A	1	B	B 2
	3257	TERMINAL ADAPTER NO. 3	630.00	16.00	14.00	24	5	25/5	1.50		55	A	1	B	B 2
	3701	EXTERNAL MODEM INTERFACE	400.00	12.00	10.00	24	5	25/5	4.00		55	A	1	B	B 2
	4621	75 KEY TYPEWRITER KEYBOARD	495.00	13.00	11.00	24	5	25/5	2.50		55	A	1	B	B 2
	4622	75 KEY DATA ENTRY KEYBOARD	495.00	13.00	11.00	24	5	25/5	3.50		55	A	1	B	B 2
	4623	75 KEY DATA ENTRY KEYBOARD	495.00	13.00	11.00	24	5	25/5	3.50		55	A	1	B	B 2
	4624	75 KEY ASC 11 TYPEWRITER KEY	495.00	13.00	11.00	24	5	25/5	2.50		55	A	1	B	B 2
	4627	87 KEY EBCDIC TYPE KEYBOARD	675.00	18.00	15.00	24	5	25/5	3.00		55	D	1	B	B 2
	4628	87 KEY ASC 11 TYPE KEYBOARD	675.00	18.00	15.00	24	5	25/5	3.00		55	D	1	B	B 2
	4690	KEYBOARD NUMERIC LOCK	NC	NC	NC				NC						
	5500	1200 BPS INTEGRATED MODEM NS	668.00	19.00	16.00	24	5	25/5	5.00		55	A	1	B	B 2
	6301	COMM FEATURE W/BUS MACH C1	670.00	19.00	16.00	24	5	25/5	3.00		55	A	1	B	B 2
	6302	COMM FEATURE W/D BUS MACH C1	450.00	12.00	10.00	24	5	25/5	2.50		55	A	1	B	B 2
	6340	SECURITY KEYLOCK	35.00	35.00SUC	NA				NC						
	6350	SELECTOR LIGHT PEN	585.00	15.00	13.00	24	5	25/5	0.50		55	A	1	B	B 2
	ACC.	0323921 COAX CABLE	RPQ	PURCHASE ONLY					NC						
	ACC.	1830818 STATION PROTECTOR CA	48.75	PURCHASE ONLY					NC						
	ACC.	1833104 STATION PROTECTOR ER	15.80	PURCHASE ONLY					NC						
	ACC.	1833106 STATION PROTECTOR AT	16.70	PURCHASE ONLY					NC						
	ACC.	1833108 CABLE ASSEM OUTDOOR	RPQ	PURCHASE ONLY					NC						
	ACC.	1836418CONNECTOR KIT	3.90	PURCHASE ONLY					NC						
	ACC.	1836419 CONNECTOR KIT	6.35	PURCHASE ONLY					NC						

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MACH	MDL /	PURCHASE	MONTHLY	MONTHLY BASE	U/L	TERM		PUR	M	P	W	R	L			
TYPE	FEAT	PRICE	RENTAL	LEASE	TERM	%	CHG	MMMC	FIG	OPT	G	C	C	P		
DESCRIPTION																
3276	ACC.	2577672	CABLE ASSEM INDOOR	RPQ	PURCHASE ONLY			NC								
	ACC.	2577741	ADDITIONAL KEY	2.50	PURCHASE ONLY			NC								
	ACC.	2621414	MODIFICATION KIT	5.30	PURCHASE ONLY			NC								
	ACC.	5252643	ADAPTER	2.65	PURCHASE ONLY			NC								
	ACC.	5252750	COAX WIRE	RPQ	PURCHASE ONLY			NC								
	ACC.	5252772	STATION PROTECTOR CR	2.10	PURCHASE ONLY			NC								
	ACC.	5252899	STATION PROTECTOR GA	8.40	PURCHASE ONLY			NC								
3277	001	DISPLAY STATION	2470.00	71.00	60.00	24	5	25/5	9.00		60	A	1	B	B	2
	002	DISPLAY STATION	3200.00	103.00	88.00	24	5	25/5	19.50		60	A	1	B	B	2
	1090	AUDIBLE ALARM	145.00	4.00	3.00	24	5	25/5	0.50		60	A	1	B	B	2
	4600	OPER IDENT CARD READER	437.00	13.00	11.00	24	5	25/5	3.50		60	A	1	B	B	2
	4630	KYBD 66 KEY EBCDIC TYPEWRTR	520.00	13.00	11.00	24	5	25/5	5.00		60	A	1	B	B	2
	4631	KYBD 66 KEY EBCDIC DATA ENTR	520.00	13.00	11.00	24	5	25/5	6.00		60	A	1	B	B	2
	4632	KYBD 78 KEY OPERATOR CONSOL	1010.00	32.00	27.00	24	5	25/5	14.00		60	A	1	B	B	2
	4633	KYBD 78 KEY EBCDIC TYPEWRTR	869.00	28.00	24.00	24	5	25/5	8.50		60	A	1	B	B	2
	4634	KYBD 66 KEY ASC11 TYPEWRTR	520.00	13.00	11.00	24	5	25/5	5.00		60	A	1	B	B	2
	4635	KYBD 78 KEY ASC11 TYPEWRTR	869.00	28.00	24.00	24	5	25/5	8.50		60	A	1	B	B	2
	4636	66 KEY EBCDIC KEYBOARD	522.00	15.00	13.00	24	5	25/5	6.00		60	A	1	B	B	2
	4690	KYBD NUMERIC LOCK	NC	NC	NC			NC								
	6340	SECURITY KEYLOCK	35.00	35.00	SUC			NC								
	6350	SELECTOR LIGHT-PEN	728.00	24.00	20.00	24	5	25/5	1.50		60	A	1	B	B	2
	ACC.	0323921	COAX CABLE	RPQ	PURCHASE ONLY			NC								
	ACC.	1830818	STATION PROTECTOR GA	48.75	PURCHASE ONLY			NC								
	ACC.	1833104	STATION PROTECTOR CR	15.80	PURCHASE ONLY			NC								
	ACC.	1833106	STATION PROTECTOR AT	16.70	PURCHASE ONLY			NC								
	ACC.	1833108	CABLE ASSEM OUTDOOR	RPQ	PURCHASE ONLY			NC								
	ACC.	1836418	CONNECTOR KIT	3.90	PURCHASE ONLY			NC								
	ACC.	1836419	CONNECTOR KIT	6.35	PURCHASE ONLY			NC								
	ACC.	2577672	CABLE ASSEM INDOOR	RPQ	PURCHASE ONLY			NC								
	ACC.	2577741	ADDITIONAL KEY	2.50	PURCHASE ONLY			NC								
	ACC.	2621414	MODIFICATION KIT	5.30	PURCHASE ONLY			NC								
	ACC.	5252643	ADAPTER	2.65	PURCHASE ONLY			NC								
	ACC.	5252750	COAX WIRE	RPQ	PURCHASE ONLY			NC								
	ACC.	5252772	STATION PROTECTOR CR	2.10	PURCHASE ONLY			NC								
	ACC.	5252899	STATION PROTECTOR GA	8.40	PURCHASE ONLY			NC								
3278	002	DISPLAY STATION	2340.00	61.00	52.00	24	5	25/5	12.00		55	S	1	B	B	2
	1090	AUDIBLE ALARM	90.00	2.00	2.00	24	5	25/5	NC		55	D	1	B	B	2
	1720	SWITCH CONTROL UNIT	180.00	5.00	4.00	24	5	25/5	NC		55	D	1	B	B	2
	4621	75 KEY TYPEWRITER KEYBOARD	495.00	13.00	11.00	24	5	25/5	2.50		55	D	1	B	B	2
	4622	75 KEY DATA ENTRY KEYBOARD	495.00	13.00	11.00	24	5	25/5	3.50		55	D	1	B	B	2
	4623	75 KEY DATA ENTRY KEYBOARD	495.00	13.00	11.00	24	5	25/5	3.50		55	D	1	B	B	2
	4624	75 KEY ASC 11 TYPE KEYBOARD	495.00	13.00	11.00	24	5	25/5	2.50		55	D	1	B	B	2
	4627	87 KEY EBCDIC TYPE KEYBOARD	675.00	18.00	15.00	24	5	25/5	3.00		55	D	1	B	B	2
	4628	87 KEY ASC 11 TYPE KEYBOARD	675.00	18.00	15.00	24	5	25/5	3.00		55	D	1	B	B	2
	4690	KEYBOARD NUMERIC LOCK	NC	NC	NC	24	5	25/5	NC							
	4999	MAGNETIC READER CONTROL	405.00	11.00	9.00	24	5	25/5	4.50		55	D	1	B	B	2
	6340	SECURITY KEYLOCK	35.00	35.00	SUC			NC								
	6350	SELECTOR LIGHT PEN	585.00	15.00	13.00	24	5	25/5	0.50		55	D	1	B	B	2
	ACC.	0323921	COAX WIRE	RPQ	PURCHASE ONLY			NC								
	ACC.	1830818	STATION PROTECTOR GA	48.75	PURCHASE ONLY			NC								

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**1231 OPTICAL MARK PAGE READER**

Purpose: Reads marked data from 8-1/2" x 11" data sheets directly into an 1130, 1401 (except A or H Models), 1440 (except with 1441 Model A2), 1460 or S/360 Model 22, 25, 30, 40 or 50.

Model 1—For use with 1130, 1401, 1440 or 1460.

Model N1—For use with S/360 Model 22, 25, 30, 40 or 50.

Model Changes: Cannot be made in the field.

Highlights: Data sheets are fed from a pneumatically controlled hopper with a 600-sheet capacity, through the reading area, and directed to one of two stackers. The main stacker has a capacity of 600 sheets. Sheets with detected errors are directed to a separate stacker with a 50-sheet capacity. Documents are stacked in reverse sequence in both stackers.

Data to be read can be placed on data sheets with ordinary #2 pencils, or by a 1403 Printer, a 1443 Printer Model 1 or 2 with a 52- or 63-character type bar with arrangement A, H or K, or a 1443 Model N1 or 2203 Model A1 with a 52- or 63-character type bar, or a 5203 Printer. The 1403/5203 print chain or train, or 1443/2203 type bar must be equipped with an enlarged dash which replaces the standard dash ... see "Type Catalog."

1130—documents are read under computer program control with speeds varying up to 2,000 documents/hour. The 1231 mode switch must be set to "Demand." Data is transferred to the 1131 one word at a time on a fully buffered interrupt basis. Master mark data is only transferred to the 1131 during reading of the master mark sheet. The 1231 Model 1 can be located up to 25 feet from the 1131.

S/360—documents can be read at a maximum constant rate of 2,000 documents/hour. Actual throughput depends upon computer programming. Sheets are fed upon command from the computer. Data is transferred to the processor by operation of the channel to which the 1231 is attached.

Data Transmission

1130 Marks are read from the data sheet and stored in a sonic delay line storage. As soon as the first word of data has been loaded on the delay line, data transfer may begin. An interrupt recognized by the 1130 allows the 1130 to read the 1231. Fully buffered transmission of data, one word at a time, occurs. The 1231 recognizes when the last data word from the sheet has been transferred and signals the 1130.

S/360 Marks read from the data sheet are stored in the 1231 Model N1 by word and are transferred to the processor by operation of the channel to which the 1231 is attached.

Data Sheets: 8-1/2" x 11" ... up to 1,000 mark positions printed on a side ... 2,000 positions when printed on both sides. Preprinted mark positions are printed in rows of 20 positions. Each row is divided into two 10-position groups. Each 10-position group is called a word for the purpose of defining a marking area. Each word can be divided into two 5-position segments. Data words and segments can be grouped in various combinations to form fields for recording the source data.

Prerequisites: For **1130** An Expansion Adapter (#3854) and 1231 Attachment (#8034) on the 1131 Central Processing Unit ... Asynchronous Mode (#1264) is also required on the 1231 itself. See "Special Features."

(Note: A 1231 cannot be installed with an 1131 Model 1A, 1B, 4A or 4B ... in addition, the 1130 system must have 208 V or 230 V power. See "Voltage" under "Specify" for the 1131.)

For **S/360**—up to four 1231 Model N1s can be attached to a

system ... each requires a channel control unit position.

S/360 Model 25—special feature on 2025: Multiplexer Channel, or Selector Channel ... see 2025.

S/360 Model 22, 30, 40, 50 Standard multiplexer channel, or Selector Channels (special features, except on 2022 one selector channel is standard) ... see 2022, 2030, 2040, 2050.

(Note: If the 1231 is attached to a multiplexer channel, special consideration must be given to priority.)

Limitations: 1130—if a 2501 Model A1 or A2 is used in a system, a 1231 cannot be attached ... a 1231 can be attached only to a 208 V or 230 V system.

S/360 Model 25, 30 Operation of 1231's is not included under 1401/1440/1460 Compatibility Features.

S/360 Model 40 Operation of 1231s is not included under the 1401/1460 Compatibility Feature (#4457).

Bibliography: 1130—GA26-5916

Metering: I/O Unit (Online)

Specify:

- 1) Voltage: (AC, 1-phase, 60 cycle): #9902 for 208 V, or #9904 for 230 V ... must be consistent with system voltage.
- 2) Color (Model N1 only): #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray or #9046 for white.
- 3) Kickstrips: #9431 ... field installable. When kickstrips are installed, the open area under the machine is enclosed. This reduces the amount of "toe-room" for the operator and may be inconvenient to customer if power outlet is located under machine.
- 4) Use with 1130: Requires Asynchronous Mode (#1264) on the Model 1 ... see "Special Features."
- 5) Isolation Feature: May be required on units shipped prior to December 29, 1967 ... see "Special Features."

Special Features

Asynchronous Mode (#1264): [Model 1 only] Modifies the Model 1 for operation with an 1131. Data is transferred to the CPU one word at a time, instead of all the words from a data sheet in one burst. Master mark data is identified and transferred to the 1131 only once per master mark sheet. **Maximum:** One. **Prerequisite:** 1231 Attachment (#8034) on the 1131.

Isolation, Control Unit (#4700): [For field installation only on units shipped prior to December 29, 1967 ... standard on units shipped after that] To turn power on or off on the 1231 without generating spurious signals. Thus, a CPU program, if it can be logically disconnected from the system before power is turned off, can continue operating. **Prerequisite:** Since in all cases there are compatible EC level requirements, the concurrence of the branch CE manager is required for any order for this feature.

Master Mark (#5045): A master data sheet, containing up to 10 words of marked data, can be read by the 1231. The master data sheet is identified by a special preprinted mark and contains data that is to be associated with all subsequent sheets until a new master sheet is read. Thus, data common



series of data sheets need be recorded and read only once. When used with a 1401, 1440 or 1460, the 1231 Model 1 stores master mark data on the sonic delay line and transfers the data with the data for each subsequent detail sheet ... in an 1130 system, the 1231 Model 1 stores master mark data on the sonic delay line and transfers it to the 1130 only one time, during the reading of the master mark sheet ... when used with a S/360, the 1231 Model N1 transfers master mark data only one time, as it is being read from the master mark sheet.

**1232 OPTICAL MARK PAGE READER**

Purpose: Reads marked data from 8-1/2" x 11" data sheets into a 534 Card Punch Model 3 for punched card output.

Prerequisite: A 534 Card Punch Model 3.

Highlights: Data sheets are fed from a pneumatically controlled hopper with a 600-sheet capacity, through the reading area, and directed to one of two stackers. The main stacker has a capacity of 600 sheets. Sheets with detected errors are directed to a separate stacker with a 50-sheet capacity. Documents are stacked in reverse sequence in both stackers.

Data to be read can be placed on the data sheets with ordinary #2 pencils, or by a 1403 Printer, a 1443 Printer Model 1 or 2 with a 52- or 63-character type bar with arrangement A, H or K, or a 1443 Model N1 or 2203 Model A1 with a 52- or 63-character type bar, or a 5203 Printer. The 1403/5203 print chain or train or 1443/2203 type bar must be equipped with an enlarged dash which replaces the standard dash ... see "Type Catalog."

A 534 Card Punch Model 3 is cable-connected to the 1232 to punch data read from the data sheets. All marks read from a document are stored as bits in a sonic delay line storage unit until transferred to the card punch. The duplicating feature of the card punch can be used to duplicate common information into a group of cards. When not used with the 1232, the 534 can be used as an independent card punch ... see 534 for details.

Documents are read at varying rates of speed, depending upon how many card columns are punched into a card. Throughput ranges from approximately 850 to 2,000 documents/hour.

Data Sheets: 8-1/2" x 11" ... up to 1,000 mark positions printed on a side ... 2,000 positions when printed on both sides. Preprinted mark positions are printed in rows of 20 positions. Each row is divided into two 10-position groups. Each 10-position group is called a word for the purpose of defining a marking area. If Segmented Word (#6405) is installed, each word can be divided into two 5-position segments. Data words and segments can be grouped into various combinations to form fields for recording the source data.

Manuals: See *IBM Marketing Publications KWIC Index*, G320-1621.

Specify:

- 1) Voltage: (115 V AC, 1-phase, 60 cycle): #9880 for locking plug, or #9881 for non-lock plug.
- 2) Kickstrips: #9431 field installable. When kickstrips are installed, the open area under the machine is enclosed. This reduces the amount of "toe-room" for the operator and may be inconvenient to customer if power outlet is located under machine.

Special Features

Master Mark (#5045): A master data sheet, containing up to 10 words of marked data, can be read and stored on the delay line for punching into output cards. The information read from the master sheet is retained on the delay line until a new master data sheet is read. The master data sheet is identified by a special preprinted mark and contains data that is to be associated with all subsequent data sheets until a new master sheet is read. Thus, data common to a series of data sheets need be recorded and read only once.

Multiple Spread Card (#5262): For punching up to four cards for each data sheet read. Each card will be numbered sequentially by a punch in column 1. Any or all of the following can be punched into each card: master sheet data [if Master Mark (#5045) is installed] ... page or identification data ... and a portion of the detail data from the data sheet in spread card form.
Limitation: Cannot be installed with Unit Record Card (#8580).

Segmented Word (#6405): For punching data from a word or segment into a single card column. A two-position mode switch marked "Segment" and "Word" controls mode of operation. When set to "Segment", marks in positions 0 through 4 are punched in one card column and marks in positions 5 through 9 are punched in the next card column. When set to "Word", marks in positions 0 through 9 are punched in one card column.

Unit Record Card (#8580): For punching a separate card for each field on the data sheet. Cards will be punched only for those fields containing marks. Each card can contain: master sheet data [if Master Mark (#5045) is installed] ... identification data (page number, order number, salesman's number, etc.) ... field number (to identify item) ... and marked detail data (quantity, etc.).
Limitation: Cannot be installed with Multiple Spread Card (#5262).

Document Inspection Gauge: One is furnished for each 1230, 1231 or 1232 as a Customer Engineering tool. Used for checking printing alignment on data sheets. Additional gauges (628848) are \$20 each.

**1255 MAGNETIC CHARACTER READER**

Purpose: Sorts documents, used in banking and other applications, meeting specifications under "Highlights" below. Available as a stand-alone sorter, or with an appropriate attachment feature, reads magnetic character data into a System/3 Model 6, 8, 10, 12, or 15, a S/360 Model 20, 22, 25, 30, 40, 50, or a S/370 Model 115 through 158, a System/32 or System/34.

Model 1 Reads and/or sorts up to 500 six-inch documents per minute into six stackers.

Model 2 Reads and/or sorts up to 750 six-inch documents per minute into six stackers.

Model 3 Reads and/or sorts up to 750 six-inch documents per minute into twelve stackers.

Model Changes: Field installable only between Model 1 and Model 2.

Highlights: Actual sorting and processing speeds depend upon length of document, paper quality, atmospheric conditions, or host system limitations. Reads all fields and sorts on any field.

Uses a new, lower cost, single gap MICR reading technique, providing MICR capabilities for smaller volume operations. Reading performance may differ from other reader sorters. Pre-installation runs of actual documents are strongly recommended to determine expected performance. The input hopper holds 5-1/2" of documents in a gravity feed permitting non-stop feeding. Models 1 and 2 each have six horizontal stackers in one vertical bay, while model 3 has twelve horizontal stackers arranged in two vertical bays of six stackers each. Individual stackers have a document capacity of 2-1/2". The transport mechanism opens for access to the document path. An operator-resettable document counter is provided.

Designed for ease of operation and operator training. The operator panel, feed hopper, and stackers are in a compact area for operator convenience and minimum space requirements.

In addition to performing the basic modulus 10 or 11 checking function, the self-checking number/improved recognition feature, when installed and operative, is integrated with the MICR reading circuitry to reduce account number rejects and substitutions. This field is especially subject to folds, banding, and print specification deviations. Rejects and character substitutions will be reduced in proportion to the severity of document degradations, thus reducing customer reconciliation expense.

Sorting: For Models 1 and 2, off-line sorting uses five sort stackers and one reject stacker for a two-phase digital sort. Phase 1 sorts even digits, rejecting odd digits which are sorted in phase 2. This conforms to the sort pattern of other six-stacker sorters and permits the start of phase 2 sorting without removing phase 1 documents from the stackers. If Alternate Sort Pattern (#9301) is specified, digits 0-4 sort in phase 1 and digits 5-9 sort in phase 2.

For Model 3, One-phase sorting on digits 0-9 with rejects directed to stacker "R" at top of first bay. Stacker "A" at top of second bay is used to select items when the High Order Zero and Blank Column Selection feature is installed.

Stacker selection is under program control when operating online to a computer system.

Field Lengths: The amount field and transit-routing field are fixed length ... the process control field and serial number field are variable length ... the account number field may be fixed or variable length. See "Specify" below.

Checking: Readability of each magnetic character and special

symbol, and the field length check on fixed-length fields, are checked on all fields designated by the operator for reading into the system or terminal in the online mode, or on all fields designated for checking in the offline mode.

MICR F13B Printing: The type font, print quality, and code line arrangement on the documents must meet the specifications recommended by the American Bankers Association Technical Committee on Check Handling. The specifications and related data are available in booklets 147R3 and the Supplement to 147R3, both of which are available at a nominal charge

Documents: Intermixed paper and card documents (including travelers checks) within the following specifications can be processed:

Width—2.5" to 4.25"

Length—5.75" to 8.875"

Thickness—.003" to .007"

Paper Stock—20 lb. to 44 lb. (card stock)

Carrier documents, enclosing a non-processable item, up to .013" in thickness may be processed.

Document Evaluation: Documents must be evaluated at least six months prior to installation to determine whether the level of print quality is acceptable to the customer, with time for corrective action if necessary. Sub-standard E13B quality may cause excessive rejects and character substitutions.

Prerequisites:

For 1255 All documents must be mechanically jogged prior to each pass through the machine ... jiggers are available from commercial sources. A sorting tray is recommended.

For System/3: One 1255 can be attached. Serial I/O Channel (#7081) is required on the 5406, 5408, 5410 or 5415 ... System/3/32/34 Adapter (#6303) is required on the 1255 itself. See "Special Features" for additional information to be specified.

Limitations: The 1255 utility program (5702-UT2 for both the Model 8 and Model 10 disk systems and 5703-UT2 for the Model 6) requires at least 12K bytes of main storage. The 1255 support for the Model 12 and Model 15 requires a minimum system. IBM's ability to service a Model 10 card system with a 1255 attached may be impaired with an effect on system availability.

For System/32: One 1255 can be attached. System/3/32/34 Adapter (#6303) is required on the 1255. 1255 Attachment (#1100) is required on the 5320.

For System/34: One 1255 can be attached. System/3/32/34 Adapter (#6303) is required on the 1255. 1255 Attachment (#1100) is required on the System/34.

For S/360 Model 20: One 1255 can be attached to a system ... a 2020 Processing Unit submodel 2, 5 or 6 with a recommended minimum of 12,288 bytes of core equipped with a Serial I/O Channel (#7081) is required ... System/360 Model 20 Adapter (#6320) is required on the 1255 itself. See "Special Features."

Bibliography: System/3 GC20-8080, System/32 GC20-0032.

Metering: I/O Unit (Online/Offline)



Specify:

- 1) Voltage: (AC, 1-phase, 60 cycle): For standalone; Locking plug—#9880 for 115V, #9884 for 208V, or #9886 for 230V ... Non-lock plug—#9881 for 115V, #9885 for 208V, or #9887 for 230V. For use with System/3, S/360 or S/370; #9902 for 208V, or #9904 for 230V. For use with System/32; Locking plug—#9884 for 208V or #9886 for 230V ... Non-lock plug—#9885 for 208V or #9887 for 230V. Must be consistent with system voltage ... specify code consistent with system/voltage for pre-system installation.
- 2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- 3) Alternate Sort Pattern: #9301 if desired. Replaces the standard even/odd pattern with the 0-4/5-9 pattern ... see "Sorting" under "Highlights." May be changed in the field
- 4) Account Number Field Length: Specify one # from the table below. A fixed field length assures maximum processing accuracy. However, a variable field length may be specified in lieu of a fixed length. Length of the account number field may be changed in the field

Fixed Field				
Length (positions)	5	6	7	
Account Number	9210	9211	9212	
Fixed Field				Variable
Length (positions)	8	9	10	Field Length
Account Number	9213	9214	9215	9219

- 5) Superior Reading Performance: Self-checking Number/Improved Recognition (#7060) is recommended ... see "Highlights" above and "Special Features" below.
- 6) Use with System/3/System/32, or System/34: System/3/32/34 Adapter is required ... See "Special Features" below.
- 7) Use with S/360 Model 20 System/360 Model 20 Adapter (#6320) is required ... see "Special Features" below.
- 8) Kickstrips: #9431, if desired. **Field installable:** Yes

Note: When installed, the open area under the machine is enclosed. This reduces the amount of "toe-room" for the operator and may be inconvenient to the customer if the power outlet is located under the machine.

Special Features

Dash Symbol Transmission (#3215): Transmits the E13B dash symbol from transit field to storage. With symbol in storage, the program can distinguish between duplicate foreign and U.S. transit numbers. **Field installable:** Yes

51-column Card Sorting (#4380): Model 1—for reading and sorting 51-column card documents. When installed, machine speed is reduced to approximately 405 dpm for six-inch documents. For 51-column cards, speed is approximately 500 dpm. Models 2 and 3—when installed machine speed is reduced to approximately 605 dpm for six-inch documents. For 51-column cards, speed is approximately 750 dpm. Note: For optimum performance on all models, card documents should be separated out from standard size ABA documents on first pass operations. **Field installable:** Yes

High Order Zero & Blank Selection (#4520): This permits selection to pocket A of documents during a digit sort having only blanks or zeros in the sort position and in all higher order

positions of the field. **Limitation:** Available on Model 3 only ... operates offline only. **Field installable:** Yes

System/3-/32/34 Adapter (#6303): To attach the 1255 to the Serial I/O Channel #7081 on the 5406, 5408, 5410, 5412, 5415 or to the 1255 Attachment #1100 on the System/32 or to the 1255 Attachment #1100 on the System/34: **Specify:** #9791 for use with 5406, or #9792 for use with 5408, 5410, 5412, 5415 or 5320. #9791 can be changed in the field to #9792, or vice versa. **Field Installable:** Yes

S/360 Model 20 Adapter (#6320): To attach the 1255 to the Serial I/O Channel (#7081) on the 2020. **Field installable:** Yes

Self-checking Number/Improved Recognition (#7060): For reducing rejects and substitutions caused by defects in the account number field and for checking Modulus 10 or 11 self-check digit account numbers up to 10 positions long, including the self-check digit and dashes. SLT pluggable card wiring determines the modulus calculated and weighting factor for each digit. SLT card is removed and inserted by the CE for customer wiring. An operator panel on/off switch is the only customer control of the feature. The self-check digit may be in any position, always using a weighting factor of 1. Modulus 10 will check any weighting factor 0 through 9, summing the product digits, and checking for an even multiple of 10. Modulus 11 will check any weighting factor, summing the products, and checking for either an even multiple of 11, or for a constant remainder of 4.

This feature, when installed and operative, replaces the basic character substitution checking circuitry with the more accurate modulus 10 or 11 checking circuitry while the account number field is being read. Documents with marginal printing that might normally be rejected as potential substitutions will be processed if all characters pass the self-checking digit test, thus reducing the chances of a reject. All account numbers that fail the self-checking digit test will cause the document to reject, thus reducing the chances of a substitution. Since the account number field is frequently subject to folds, banding, mutilation and print specification deviations, rejects and substitutions will be reduced in proportion to the severity of document degradation. **Field installable:** Yes

**1260 ELECTRONIC INSCRIBER**

Purpose: A key operated unit for proving deposits, sorting and listing of checks into eight individual stackers, and MICR inscribing of checks and deposits in the ABA recommended E13B format.

Highlights: The ten-key keyboard permits fast, accurate, touch amount entry for sorting, listing, proving, inscribing and, with Endorsing and Serial Numbering (#3791), endorsing checks in a single operation. Has eight machine distribution stackers and detail tapes. Three or five external stackers are provided for non-processable documents ... see "Specify" below.

Intermixed card and paper documents within the following specifications can be inscribed: Length—5.750" to 9.000", plus 51-column cards ... Width—2.750" to 3.750" ... Thickness—.003" to .007".

All arithmetic functions are accomplished by a single electronic accumulator which has a ten-digit addition, subtraction and accumulation capability. Electronic storage is provided to store the following data and totals: Thirteen distribution totals, nine of which develop item count (maximum, 9999) [see Additional Totals (#1071) under "Special Features"] ... group debit total ... group net total ... grand total ... second field storage and/or adding machine total ... serial number (control tape - maximum 99999) ... deposit item count (maximum, 9999) ... grand total item count (maximum, 10 digits).

Inscribing: As standard, two fields can be inscribed in E13B font on the face of documents in the clear band field. The fields are, from right to left: Amount—set up in the amount keyboard and inscribed as ten digits bracketed by the amount symbol ... Process Control—emitted under program and selector key control and inscribed adjacent to the amount for identification of transaction or batch. Deposit item count total also inscribes in the process control field on deposit tickets. Distribution totals with automatic process control codes identifying the stacker and item count totals are inscribed on control documents. Six positions of process control inscribing and printing are standard ... for Routing and Transit, and Account Number, see "Special Features" below.

One cycle automatic group balance with efficient multiple credit ability provides printout of total debits and net debit/credit difference on non-balance.

Automatic high dollar selection may be accomplished through program wiring to override normal selector key operation and sort, add and list checks of \$1,000.00 and over into pocket number 8.

Programs: Three programs may be stored in the machine and are selected by a dial program switch. One set of program cards is shipped with each machine. A second set will be provided, if specified ... see "Specify" below. A third set is also available ... see "Special Features."

Specify:

- 1) Voltage: (AC, 1-phase, 60 cycle, locking plug): #9880 for 115V, #9884 for 208V, or #9886 for 230V.
- 2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- 3) External Stackers: #9686 for three, or #9687 for five.
- 4) Up-ending Kit: #9840, if required ... loan basis, remains property of IBM.
- 5) Program Cards, Second Set: #9552, if required ... also available

Special Features

Account Number Field (#1010): Permits inscribing of the amount, process control, and account number in one pass of the document. Operation is similar to that of the Routing and Transit Field (#6300), in that the account number may be transferred to storage and inscribed in the same pass as the amount and process control field. A repeat key and a means of clearing the storage area are provided. Includes an additional setup key adjacent to the ten-key keyboard which allows the operator to set a blank or dash in either the account number or routing and transit field.

Additional Totals (#1071): Adds sufficient counters to provide a total of 20 distribution totals, each with a 4-digit item count. These counters are used and controlled in the same manner as the normal distribution counters in the basic machine. **Limitation:** Cannot be installed with Automatic Float Analysis (#1294, 1296).

Automatic Float Analysis (#1294, 1296): #1294 Designed to be used when the Routing and Transit Field of the deposit ticket has not been pre-printed. A 4-digit serial number is printed in the field on the deposit ticket and is repeated in the four high-order positions of the field on each float document.

#1296 Designed to be used when the Routing and Transit Field of the deposit ticket has been pre-printed with the bank number. No printing will occur in the field on the deposit ticket, but 5555 is printed in the four high-order positions of the field on each float document.

Either #1294 or #1296 permit from one to six float amounts in dollars and cents (10 digits) and corresponding item counts (4 digits) to be classified and accumulated under program control wiring and selector key control as the debit items are processed for proof of deposit. The activity of programmed float classes is detected, so that when the balance status of the deposit is established as the deposit ticket is processed the developed float data can be inscribed. Operator feeding of one float ticket is required for each two classes of float developed. No documents or machine cycles are required for inactive float accumulators. When this feature is installed, the total number of assignable counters is 20, each with an associated 4-digit item count. When the "Float" switch is "OFF", these may be used as normal distribution counters ... when the switch is "ON", only 14 of these are available as distribution counters. **Maximum:** One, #1294 or #1296. **Limitation:** Cannot be installed with Additional Totals (#1071).

Checker Signal (#1935): A light signal under switch control that provides the operator with a means of signalling a supervisor.

Serial Numbering (#3791): The endorsement prints at random in an area approximately 3" wide. In addition to printing the bank's endorsement stamp, a date, a 5-digit machine, batch or branch identification, and a 5-digit serial number is provided.



The serial number may be programmed in advance for each document fed, or to advance for each deposit. The serial number printed on the check is also printed on the control tape to provide a complete audit trail.

High Volume Total (#4603): To print one quick kill total in the Routing and Transit Field of the deposit ticket. The quick kill total will print in the normal Routing and Transit format with a dash symbol separating the four high-order and four low-order digits. This feature assumes only one float level of quick kill items. **Limitation:** Cannot be installed with Transit Analysis #8016).

Process Control Keyboard (#5705): Consists of two rows of keys, numbered blank through 9, located to the right of the ten-key keyboard. Used either to key in a special transaction code or to override any two digits of the emitted process control code.

Routing and Transit Field (#6300): Permits printing of the Routing and Transit Field as well as the Amount Field and Process Control Field in one pass of the document. The field is keyed in the ten-key keyboard and transferred into a storage area. The amount is then keyed and the document dropped into the check chute. The document will be positioned at the inscribing station, the amount will be inscribed and process control if programmed. The document will advance to the Routing and Transit Field and the field will be inscribed. A "Routing and Transit" key and a means of clearing the routing and transit storage are provided.

Shift Identification Switch (#7138): A dial switch, labelled OFF-1-2-3, that provides the operator with a means of identifying a shift number in any one of the five positions of the Distribution Total identification number. The switch is located adjacent to the program switch.

Third Program (#7948): Provides program cards, wires and overlays for a third program.

Prerequisite: Program Cards, Second Set (#9552) ... see "Specify" above.

Transit Analysis (#8016): To print two float figures in the Routing and Transit Field of the deposit ticket. The four high-order digits of the field will inscribe one class of float in hundreds of dollars ... the four last (or low-order) digits of the field will inscribe a second class of float in hundreds of dollars. The feature uses two of the standard distribution amount accumulators. **Limitation:** Cannot be installed with High Volume Total

Accessories: The endorsing plate is a purchase item made to the customer's specifications. An additional charge is made for an endorser plate that requires art and layout work which cannot be accomplished by straight line typesetting. This additional charge applies to single plate orders and the first plate of multiple plate orders. For information on endorser plates for 1260, see Endorser Plate Specification Sheet, 120-1348. For plant installation on 1260 specify #3792 (or #3793 for Blank Endorser Plate where applicable) at prices listed below. A completed Endorser Plate Specification Sheet for each #3792 must be attached to the DPOW or IAC.

It is recommended that the customer stock at least one spare endorser plate for each group of machines with identical plates since plates cannot be immediately replaced.

For feature Numbers for Color of Ink to be used, see unit under "Machines."

Replacement: Mechanical and Capacity Replacement Machines (1260 to 1260) A replacement endorser plate will be

shipped with each replacement machine at no charge when the machine being replaced has an endorser. If any change in plate design is desired, there is a charge only for art and layout work if applicable. The endorser plate on a displaced machine is to be left with the machine, but defaced and rendered unusable.

Installed Machines: The normal plate charge will apply whenever replacement of a worn or damaged plate is required. Charges for art and layout work are added, if applicable. **Note:** Endorser plates are interchangeable only within the machine groupings shown above ... the Serial Numbers/Endorser plate for the 1203 is not interchangeable with the old style Endorser plate.

Specify:

An Individual completed Endorser Plate Specification Sheet (102-1348 or 120-0563) ... see above, including machine and serial number, must accompany each order for an endorser plate. On mechanical and capacity replacement orders, also attach a sample endorsement.



1282 OPTICAL READER CARD PUNCH

Purpose: Optically reads numeric data and three special characters from printed 51 or 80 column cards and punches the data read into the same card at a maximum rate of 200 cards per minute.

Highlights: The digits 0-9 and three special characters, plus (+), dash (-) and a solid vertical line (|), are read at a character recognition station. A maximum of 32 characters can be read and punched during a single pass. Unreadable information is automatically rescanned up to two times. Standard card punching, punch suppression, special symbol punching, gang punching, zero insertion, and double punch-blank column detection are determined by control panel wiring. A program card is pre-marked by the user to control field selection. A line selection device permits operator selection of any one of eight to ten horizontal line positions on the form, depending upon the type font to be read. Self-checking number detection is controlled by the premarked program card and control panel wiring.

Printing: For efficient operation, the printing to be read must conform to the specifications established for the 1282. Cards can be printed by a 1403 Printer model 1, 2, 3, 7 or N1, 1404 Printer model 2, IBM Selectric® Typewriter model 721, 723 or 725, and IBM Standard Electric Typewriter model C. They can also be created by any imprinters which produce the specified print quality.

The standard machine can be ordered to read any two of the following (see Item 2 under "Specify"): (1) 1428 front reading for typewriters, 1403 and 1404 ... (2) 1428 enlarged front reading for imprinters ... (3) 1428 enlarged reverse reading for imprinters.

The 1403 and 1404 normally print 10 characters per inch (10 pitch). However, there is no restriction on the pitch of printing to be read other than that it be no greater than 10 pitch. Any number of characters less than 10 per inch can be read. Adjacent fields can have differing pitch.

Documents: Both 51-column and 80-column cards can be processed, but only one size can be processed at a time. Additional document considerations, relating to the printing device, recommended ribbons, and type styles, are specified in the table below.

Standard Features: One single-section, 22-hub, self-contacting control panel with complement of wires (see "Specify" below) ... a 1,200-card capacity hopper ... a lens selector knob [a 2-position selector to change between the reading of either enlarged font (1428 or Farrington 7B) or 1428 standard font] ... a digit emitter ... a character reading station ... a rescan feature ... self-checking number detection ... twenty positions of DPBC detection ... two document counters ... two radial stackers, each with a 1,000-card capacity ... charcoal covers and a white operator console.

Manuals: See "Catalog of Marketing Publications," G320-1621.

Specify:

- 1) Voltage: (AC, 1-phase, 3-wire, 60 cycle): #9884 for 208 V, or #9886 for 230 V (locking plugs only).
- 2) Characters to be Read: Specify one of the following:
 - #9090 For 1428 standard front reading and 1428 enlarged front reading.
 - #9091 For 1428 standard front reading and 1428 enlarged reverse reading.
 - #9092 For 1428 enlarged front reading and 1428 enlarged reverse reading.

- 3) Test Decks: One or both of the following test decks must be specified unless Farrington 7B Font Recognition (#3950, 3952) is ordered ... to test the machine, either #9719, 9720 or Farrington 7B Font test documents must be used, depending upon the application.

#9719 For 1428 enlarged front test deck ... #9090 or #9092 above is required.

#9720 For 1428 enlarged reverse test deck ... #9091 or #9902 above is required.

- 4) Scan Line Boundary: Specify one—#9576 for right edge, #9577 for left edge, or #9500 for center. **Limitation:** #9500 cannot be specified with #9092 above.
- 5) Control Panel: Specify one—#9081 for self-contacting with manual wires, #9082 for self-contacting with fixed wires, or #9084 for no panel or wires ... specify #9084 for all mechanical replacement machines.
- 6) Extended Memory: #9145, if applicable. Provides for storing the variable wheel amount field (5-digit only) or account number field when a rescan is necessary to read the other field. *Note:* Will not operate with other than a 5-digit variable wheel amount field. Can be field installed.

Special Features

Alternate Field Control (#1250): To select field for reading under control of hand-printed vertical field mark.

Double Punch and Blank Column Detection (#3435): An additional group of 20 positions. **Maximum:** One group.

Expanded Field Suppression (#3833): Basic machine permits punch suppression of up to four fields, each containing a maximum of 12 character positions ... this feature increases the number of punch suppression control fields to six ... it is prerequisite for Optical Mark Reading (#5480-5484).

Farrington 7B Font Recognition (#3950, 3952): To read and punch documents printed in Farrington 7B Font by credit plate imprinters. #3950—without Bar Code or Alpha Blanking ... #3952—with Bar Code and Alpha Blanking. **Specify:** Either or both—#9714 for front reading test deck, #9716 for reverse reading test deck.

Optical Mark Reading (#5480-5484): Information marked on cards in addition to printed characters can be read and converted to punched holes. Similar to mark-sensing, but location of marking positions and type of marking pencil differ. See Manual GA24-3106 for details. **Specify:** One of the following—#5480 for 5 positions, 80-column card, front field ... #5481 for 6 positions, 80-column card, front field ... #5482 for 12 positions, 80-column card ... #5483 for 5 positions, 80-column card, center field, and 51-column card ... #5484 for 6 positions, 80-column card, center field, and 51-column card. **Prerequisite:** Expanded Field Suppression (#3833)

Self-checking Number Field Correction (#7065): Operates in conjunction with the standard self-checking number error detection feature. Documents with a single unreadable character in a self-check field ordinarily are rejected. This feature automatically corrects a single unreadable character and makes the document acceptable. Documents with more than a single unreadable character are rejected. This feature is not recommended for use with imprinter applications.

Serial Number Punching (#7090): To punch consecutive numbers from one to five digits in length in ascending or descending sequence. The first number to be punched is manually set by the operator.



Printing Unit		Recommended Ribbon/ Carbon Paper (or equivalent)	Type Style Required for Reading by 1282
Other Than System/360	1403 mdl 1 or 2	MYLAR (424325)/Nylon (414486)	1428 Type Style J4 (#9599)
	1416 (1403 mdl 3)	Nylon (414486)	1428 Type Style J4 (#9599)
	1404 model 2	Nylon (419031)	1428 Type Style J4 (#9599)
System/360	1403 mdl 2 or 7	MYLAR (424325)/ Nylon (414486)	1428 Type Style AN4 (#9621)
	1416 (1403 mdl 3 or N1)	Nylon (414486)	1428 Type Style AN4 (#9621)
	1404 model 2	Nylon (419031)	1428 Type Style AN4 (#9621)
Available through OP Division	Model C - IBM Electric Type- writer with keyboard 069	Nylon No. 50 (1010655) 5121 Poly- ethylene (1010760)	Type Code 097, Type Mark VA5 Type Code 096, Type Mark VA8
	Selectric Typewriter model 721 723 or 725 with Keyboard 009	Nylon No. 50 (1136076)	Type Code 009
Credit Card Imprinter		Carbon paper to be used will be based on the application.	1428 Enlarged Font or Far- rington 7B Self- check



1316 DISK PACK

Purpose: High-speed, removable, interchangeable disk storage for all models of the 1311 Disk Storage Drive and 2311 Disk Storage Drive.

**1403 PRINTER**

Purpose: Printed output unit for the data processing systems indicated below.

Model	Print Pos.	Speed (max.)	For Use With
2	132	600 lpm	S/360 mdl 20 S/3 mdls 10, 12 and 15
5††	132	465 lpm	S/3 mdls 12 and 15
7	120	600 lpm	1130, S/360 mdl 20
N1	132	1,100 lpm	S/360 mdl 20 S/3 mdls 10, 12 and 15

†† 1403 Model 5 is available only on the S/3 Model 12, and S/3 Model 15.

Model Changes: Can be made in the field between models 2 and 7 or models 5 and 2.

Prerequisites: 1403 Model N1 only—a 1416 Interchangeable Train Cartridge is required on each 1403 Model N1 ... see 1416.

System/3 Model 10 One 1403 Model 2 or N1 can be attached to a system via the 5421 Printer Control Unit. The 5410 must also be equipped with an appropriate 1403 Printer Attachment ... see "Special Features" under 5410. *Note:* Appropriate adapters are also required on the 1403 itself ... see item (3) under "Specify."

System/3 Model 12 One 1403 Model 2, 5 or N1 can be attached to a system via the 5421 Printer Control Unit. The 5412 must also be equipped with the 1403 Printer Base Attachment (#4160) and the appropriate 1403 Printer Model Attachment ... see "Special Features" under 5412. *Note:* Appropriate adapters are also required on the 1403 itself ... see item (4) under "Specify."

System/3 Model 15 One 1403 Model 2, 5 or N1 can be attached to a system via the 5421 Printer Control Unit. The 5415 must also be equipped with an appropriate 1403 Printer Attachment ... see "Special Features" under 5415. *Note:* Appropriate adapters are also required on the 1403 itself ... see item (5) under "Specify."

System/360 Model 20 One 1403 Model 2, 7 or N1 can be attached to a system. The appropriate 1403 Attachment is required on the 2020 ... see "Special Features" under 2020. *Note:* To attach the 1403 to a 2020 submodel 5 or 6, appropriate adapter(s) are required on the 1403 itself ... see item (4) under "Specify." **Limitations:** [1] A 1403 cannot be attached to a 2020 submodel 3 or 4 ... [2] A 1403 Model N1 cannot be attached to a 2020 with a serial no. under 20000.

Highlights: Actual speeds depend upon the operation. The system's processing unit performs all format and analysis control. A line of printing is presented to the printer in the arrangement in which it is to be printed. All data printed is checked against data received from core storage.

Each print position can print any one of 48 characters ... alphabetic, numeric, and 12 special characters. Characters are spaced 10/inch. Line spacing is 6 or 8 lines/inch, under operator control. Continuous marginally punched forms from 3 1/2" to 18 3/4" in overall width are fed by an automatic carriage. Minimum form depth is 1" ... maximum is 22" at 6 lines/inch, or 16 1/2" at 8 lines/inch. Forms spacing and skipping are governed by the 5410, 5412 or 5415 and the stored program. A standard pre-punched 12-channel tape is supplied with each 1403 for use in verification of forms movement. Standard skipping is approximately 33"/second. The standard carriage on printers used with

all systems is dual-speed, except for a 1403 Model 6 or 7 regardless of system. The dual speed carriage permits skipping at approximately 75"/second on skips over 8 lines long. *Note:* On a Model N1, under certain unique conditions, the 75"/second skip is turned off and skipping continues at approximately 33"/second ... see SRL GA24-3073 for details.

The printer and carriage open for easy loading and alignment of forms. On all models except Model N1, forms are wheeled to and from the printer on a double-duty, two-section forms stand which reduces paper handling and set-up time. The Model N1 has sound absorbent covers extending to the floor for reduced noise level. A motorized cover facilitates operator handling. The accoustical cover design incorporates platforms for feeding and stacking of forms. A forms cart may be purchased for the Model N1 ... see Accessories in this section.

The 1403 Model N1 is program compatible with the Model 2 used in S/360 Model 20. Existing programs for Model 2s need not be changed for a Model N1, except in those cases where, because of the reduced time required to print a line, the overall I/O scheduling must be re-optimized.

The 1403 Model 2 is program compatible with 5203 Printer Models, including the tapeless carriage facility. Existing programs for the 5203 need not be changed, except in those programs where the overall I/O scheduling must be re-optimized to utilize the reduced print time/line, or if the user wishes to use more print positions on a 1403 than were on the 5203 being replaced.

Printed Output for Optical Character Reading: 1403 print chains and 1416 trains can be equipped for printing on documents to be read by the following optical character readers:

- 1230 Optical Mark Scoring Reader
- 1231/1232 Optical Mark Page Reader
- 1282 Optical Reader Card Punch
- 1287 Optical Reader
- 1288 Optical Page Reader
- 1418 Optical Character Reader
- 1428 Alphanumeric Optical Reader
- 3881 Optical Mark Reader
- 3886 Optical Character Reader

Depending upon system with which the 1403 will be used, and the optical character reader involved, see appropriate section of the "Type Catalog" for feature #(s) to be specified for the required 1403 print arrangement. The ribbons used on the 1403 must be capable of producing printed characters suitable for recognition by the optical reader used. For recommended ribbons and document specifications, see appropriate optical reader description.

Limitations:

- (1) The dual-speed carriage is not available on a 1403 Model 7.
- (2) A 1403 Model 2, 7 or N1 cannot be installed in a S/360 Model 20 with a 2203 Printer ... a 1403 Model N1 cannot be attached to a 2020 with serial no. under 20,000 ... a 1403 cannot be attached to a 2020 submodel 3 or 4.
- (3) 1403 Model N1: Forms sets used on 1403 Models 2, 5, or 7 (chain printers) may not produce acceptable results when used on 1403 N1 (train printer). A six-part set which gave satisfactory results on a chain printer may show a decrease in the print quality of the last copies when used on a 1100 lpm train printer ... for details, see SRL GA24-3041.
- (4) Multiple-part forms are not recommended for OCR printing. The print quality of the top sheet is affected by the under



ing sheets. Under no circumstances should the copy sheets be used for optical scanning. For best results, use single-part forms for OCR printing.

Bibliography: System/360 Model 20—GA26-3565, System/3—GC20-8080.

Metering: I/O Unit (online)

Prerequisites: Special Feature 6410 or 6411.

Specify:

- 1) Voltage (AC, 3-phase, 4-wire, 60 cycle): #9903 for 208V, or #9905 for 230V ... must be consistent with system voltage.
- 2) Voltage Adapter: #9709. Required when a 1403 Model 2 is to be attached to any model of S/360, or a Model 2 to a System/3 Model 10, or a Model 2 or 5 to a S/3 Model 12 or 15. *Note:* When an installed Model 2 or 5 (from other than S/360 or S/370 or a Model 2 from other than System/3 Model 10) is retained for attachment to these systems, new cables must be ordered. Refer to *Physical Planning Manual* for cable requirements and ordering procedure.

When #9709 is field installed, the standard configuration chain/train previously installed will be modified to an AN or HN arrangement of the same type size or style. See "Type Catalog" (S/360 - 1403 Printer) for feature # to which chain (or train) is to be modified.

If Interchangeable Chain Cartridge Adapter (#4740) is installed on Model 2, both alphanumeric chains (standard configuration only) will be modified, one to AN and one to HN. Modification is restricted to same type size or style as previously installed.

- 3) Attachment to 5410 via 1403 Model 2 or Model N1 Attachment (#4140, 4150) and the 5421 Printer Control Unit. The following features are required on the 1403: 600 LPM Voltage Conversion Adapter (#9725) for 1403 Model 2, or 1100 LPM Voltage Conversion Adapter (#9726) for 1403 Model N1. These can be changed in the field. Voltage Adapter (#9709) is also required for a Model 2 ... see item (2) above.
- 4) Attachment to 5412 via 1403 Base Attachment (#4160), and the appropriate Printer model attachment ... Model 2, 5 or N1 Printer (#4135, 4140 4150) ... and the 5421 Printer Control Unit. The following features are required on the 1403:
600 LPM Voltage Conversion Adapter (#9725) for 1403 Model 2 or 5, or 1100 LPM Voltage Conversion Adapter (#9726) for 1403 Model N1. These can be changed in the field. Voltage Adapter (#9709) is also required for a Model 2 or 5 ... see item (2) above. *Note:* When 1403 Model 5 is attached to 5412, see 5421 for necessary prerequisite.
- 5) Attachment to 5415 of a 1403 Model 2, 5 or N1. Requires a #4160 Basic Attachment Control, appropriate speed attachment (#4135, 4140 4150) and the 5421 Printer Control Unit. The following features are required on the 1403: 600 LPM Voltage Conversion Adapter (#9725) for 1403 Model 2 or 5, or 1100 LPM Voltage Conversion Adapter (#9726) for 1403 Model N1. These can be changed in the field. Voltage Adapter (#9709) is also required for a Model 2 or 5 ... see item (2) above. *Note:* When 1403 Model 5 is attached to 5415, see 5421 for necessary prerequisite.
- 6) Attachment to 2020 submodel 5 of 6: The following adapters are required on the 1403: On 1403 Model 2 or 7, a 600 LPM Voltage Conversion Adapter (#9725) ... on 1403 Model N1, a 1100 LPM Voltage Conversion Adapter (#9726). These

can be field installed. *Notes:* [1] An appropriate 1403 attachment is required on the 2020 ... see "Special Features" under 2020 ... [2] On a 1403 Model 2, a Voltage Adapter (#9709) is also required ... see item (2) above.

7) Print Chain/Train Arrangement:

With S/360 (1403 Model 2 or N1) See "S/360—1403 and 1404 Printers" in "Type Catalog." For N1, also see item (8) below. Universal Character Set Feature (#8640, 8641) is required on a Model 2 or N1, or Multiple Character Set Feature (#5110, 5111) on a Model 2 or N1 for any arrangement other than the 48-character set composed of identical arrays of standard sequence ... see "Special Features" below and "Type Catalog" page TC 71, etc.

With System/3 Model 10, 12 and 15 See System/3 in "Type Catalog" page TC 109.1, for arrangements and required feature numbers. For Model N1, see item (8) below. Universal Character Set Feature (#8640, 8641) is required on a Model 2, 5 or N1 for any print arrangement requiring more than 48 characters (e.g., PN or GN).

With 1130 (1403 Model 7) #9614 for HN2, or #9615 for HN3. See "S/360 - 1403 and 1404 Printers" in "Type Catalog" for characteristics of these chains.

- 8) 1416 Interchangeable Train Cartridge (Model N1 only): At least one 1416 is required with each 1403 Model N1 ... see 1416.
- 9) Color: For Models 2, 5, 7—Color Accent—#9043 for blue, or, if other system units are to have red, yellow or gray accents, #9044 for charcoal. Extended Color—#9031 for red, #9032 for yellow, or #9033 for blue. For Model N1—#9041 for Red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- 10) Tape Punch: Order Part No. 120910
if the 1403 is for a New Name Account. One punch is furnished at no charge per installation. A tape punch is not required when the 1403 is attached to System/3 Model 10 or Model 15.
- 11) For Model N1, cross reference Branch/Plant Order No. or 1416(s) which will be used with the 1403.
- 12) Kickstrips (on 1403 N1 only): #9350, if desired.
When kickstrips are installed, the open area underneath the machine is enclosed. This reduces the amount of "toe-room" and may be inconvenient to the user if the power outlet is located beneath the machine.

Special Features

Any of the following field installable special features, as appropriate, are on an "as available" basis for field installation on discontinued 1403 models.

Auxiliary Ribbon Feeding Feature (#1376): (Models 2, 5, 7 ... Standard on N1). Not available for use on Model 7 when used with the 1130 system. Recommended for satisfactory utilization of polyester film ribbons ... can also be used for conventional fabric ribbons. The polyester film (424325), or its equivalent, provides improved print quality for both optical character recognition and other quality printing applications.

Note: For specific details for optical character recognition covering printing unit, document types, recommended ribbons and typestyle, see 1282.

Interchangeable Chain Cartridge Adapter (#4740): (Models 2,



5, 7 only). Permits operator to insert an interchangeable chain cartridge with different type font, style or special character arrangement. The change can be made quickly without special tools. Operation of the printer remains unchanged. Two interchangeable cartridges with chains are supplied, one in lieu of the standard fixed cartridge and one additional. See "Type Catalog" for feature #s of available arrangements.

For Plant Installation Specify: For other than S/360 or S/370, #4740 and any two alphanumeric print chain arrangements, except if Numerical Print Feature (#5381) is also ordered. If #5381 is ordered, specify #4740, one numeric chain (#9485 for .095" type size, or #9484 for .079") and one alphanumeric print chain arrangement. See appropriate section of "Type Catalog." For Model 2 to be used with a S/360 Model 20, specify #4740 and any two alphanumeric printer chain arrangements. See "Type Catalog - S/360 - 1403 Printer" for available arrangements.

For Field Installation The installed fixed cartridge is modified for interchangeability and an additional interchangeable cartridge with chain is supplied. Specify #4740 and any one alphanumeric print chain arrangement. *Note:* When an installed 1403 Model 2 is to be modified for use with S/360, both alphanumeric chains will be modified at no charge ... see item (2) under "Specify."

Selective Tape Listing Feature (#6410, 6411): (S/360 only). #6410—for Model N1 ... #6411—for Model 2. Permits operation of eight 1.5" or four 3.1" tapes ... may be fanfold or roll (fanfold only on Model N1) ... up to 13 characters per 1.5" tape; up to 29 per 3.1" tape. Combinations of 3.1" and 1.5" tapes are possible; however, each 3.1" tape requires one of the following pairs of 1.5" tape positions: 1 and 2, 3 and 4, 5 and 6, or 7 and 8. Each tape is individually spaced under program control. No form skipping is provided when the feature is in use. Easily interchangeable by the operator between tape listing and standard 1403 forms printing. On Model 2 a feature mode switch is provided. This switch temporarily disconnects the standard carriage control circuits and activates the tape feeding circuits when the tape-spool assembly tray is latched in the operating position. On Model N1, this switching is accomplished when the center guide plate is installed. Can be used with Universal Character Set Feature (#8641) on a Model 2, with an alphanumeric train, or with an alphanumeric train or Universal Character Set Feature (#8640) on a Model N1. A stacker (#6413) is available for stacking tapes. See "Prices" on the M 10000 pages. **Limitations:** A 1403 Model 2 or N1 is required to utilize the full capacity of this feature ... see SRL GA24-3073 for details. **Prerequisites:** Printer Features Control (#5575) on the 2020. **Warning:** Orders are no longer being accepted for #6410 on 1403 Model N1s to be used in any S/360 other than S/360 Model 20.

Universal Character Set Feature (#8640, 8641): (For S/360 Model 20 or S/3 Model 10, 12 or 15). #8640—for Model N1 ... #8641—for Model 2 and 5. Required on a 1403 Model 2, 5, or N1 for any print arrangement other than a 48-character set composed of identical arrays of standard character sequence. Any set of 240 codes can be loaded from cards into a 2020 Processing Unit submodel 2, 5, or 6. Any set of 120 codes can be loaded into the 5410, 5412 or 5415 Processing Unit.

The 240 codes (120 maximum for S/3 Model 10, 12 and 15) must correspond in sequence to codes assigned to the graphics on the chain or train selected. This includes any announced print arrangement for S/360, or any arrangement of characters selected/assigned by the customer for optimization of his application requirements ... see "Type Catalog." Charges for artwork,

matrix, etc., for special slugs are to be added if applicable. **Limitations:** (1) Printing speed of the 1403 Model 2 is limited to 750 lpm; that of the 1403 Model 5 to 585 lpm; that of the 1403 N1 to 1,400 lpm ... (2) The allowable code/graphic selection is restricted to the 256 code positions of the EBCDIC Code ... see SRL GA24-3312. **Prerequisites:** For each 1403 with #8640 or #8641, the appropriate UCS Adapter is required on the 2020 ... see "Special Features" under the appropriate unit ... for System/3 Model 10 or 15, there is no UCS Adapter required on the 5410/5415 ... for Model 2, Interchangeable Chain Cartridge Adapter (#4740) ... for Model N1, each different train arrangement requires its own 1416 interchangeable Train Cartridge ... for S/360 Model 20, UCS Utility Program ... 2020s must be serial no. 20000 or above ... if this feature is to be used in emulation mode in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under "Special Features" for 2020.

These are in addition to the time for installing the Universal Character Set Adapter (#8638) on the 2020 Processing Unit.

Note: If this feature is to be field installed on a 1403 Model 2 or 5 equipped with a fixed cartridge and an AN or HN arrangement, Interchangeable Chain Cartridge (#4740) must also be ordered. Specify any two UCS print arrangements ... see Type Catalog, "S/360 and S/370 - 1403 and 1404 Printers."

If customer desires to retain the former arrangement and to receive one additional one, the fixed cartridge will be modified for interchangeability and an additional interchangeable cartridge with selected print arrangement will be furnished.

If #4740 is already installed with AN or HN arrangements, and customer desires to change to any other arrangement(s), order new chain(s) as follows:

Purchase Customer Purchase new chain(s) ... see "New Print Chains" under "S/360—1403 and 1404 Printers", in Type Catalog.

Accessories:

FORMS CART: The acoustical cover design of the 1403 Model N1 incorporates platforms for feeding and stacking of forms. The forms cart, specially designed for transporting forms, facilitates transfer of forms to and from the printer platform.

STACKER FOR 1403: (For use with Selective Tape Listing Feature) Used by 1403s equipped with Selective Tape Listing Feature (#6410, 6411) for orderly stacking of both selective listing tapes and fold pack paper. It is mounted on the back of the printer directly beneath the present stacker rolls. The pocket separators can be moved to obtain 4 to 8 pockets which will stack 3.1" or 1.5" width paper respectively. Combinations of 3.1" and 1.5" width papers can be processed on the same run. Each pocket holds approximately 1,000' of fanfold paper, or 20' of selective listing tapes. The stacker contains its own motor which drives the stacker roll shaft. When the Selective Tape Listing Feature is not in use, the stacker can be easily removed. For plant installation, order Feature #6415

**1416 INTERCHANGEABLE TRAIN CARTRIDGE**

Purpose: A cartridge and print train which provides interchangeability of type font for the 1403 Printer Model N1.

Highlights: At least one 1416 is required with each 1403 Model N1.

Interchangeability: Where multiple 1416s are available, they can be interchanged by the operator, providing flexibility for printing different type fonts, type styles, or character arrangements. This flexibility opens new application areas with unique printing requirements such as form-letter writing, engineering and scientific data, chemical abstracts, and text printing.
Prerequisite: The 1416 functions only when mounted in a 1403 Model N1.

Bibliography:

S/360, S/370—GA22-6822.

Specify:

Print Train Arrangement—see "Type Catalog" for characters in each available arrangement and feature #s to be specified.

1) A rental 1416 must be capacity replaced (unless customer desires to order an additional 1416) when the following are to be field installed:

- (a) Universal Character Set Feature (#8640) on 1403 Model N1 in S/360.
- (b) Any 1403 Model N1 already equipped with Universal Character Set Feature (#8640).
- (c) A change in type size or style.

2) Except as stated in (1) and (2) above, order type slug substitutions whenever changes between the following train arrangements are to be made in the field: A and H ... AN and HN ... PCS-A and PCS-H ... PCS-AN and PCS-HN. See "Type Catalog" for applicable charges.

3) A separate 1416 is required for each print train.

4) Depending upon the system involved, see appropriate section of "Type Catalog" for feature #s of desired OCR arrangements and associated sales manual "Reader" description pages to assure compatibility or printer/reader recognition ability.

Note: The ribbons used on the 1403 or 3203 must be capable of producing printed characters suitable for recognition by the optical reader used. Recommended ribbons and document specifications are included in the optical reader "Machines" pages.

5) Cross reference Branch/Plant Number of 1403 on which 1416 will be used. If multiple 1416s are ordered, reference appropriate 1403 order number(s).

The required information should be entered into the "Remarks Section" of the order at order entry time.

6) Storage Container: #9668, if needed for the 1416. (Recommended for use when multiple 1416s are ordered for a single printer)

Inspection:

Field inspection of damaged 1416s will be at no charge (except for travel time and expense, if applicable).

Repair: Purchased 1416s which become damaged or inoperable may be returned to the IBM plant for repair. Transportation charges to and from the plant are to be paid by the customer. The following repairs will be performed at the prices indicated per 1416:

- Disassemble, inspect, test, clean, replace idler gear and drive gear, and reassemble.
- Replace cams on original base plate assembly.
- Replace base plate assembly (856186).
- Replace standard type slugs.

In the event a 1416 is damaged to the point where, in the opinion of IBM, repair is not possible, the 1416 will be returned to the customer. In this case, none of the prices listed above will apply. If the customer chooses not to have the 1416 repaired upon receiving an estimate, the customer will be billed the disassemble, inspect, test, clean, replace idler gear and drive gear, and reassemble charges.

1416s for temporary installation are available at a daily rental, based on the regular monthly charge, until the repaired 1416 is returned. Shipping charges for the temporary 1416 will be charged to the customer.

IBM will bear the transportation and repair charges when the damage to a purchased 1416 is categorized as "IBM responsibility" 1416 received in damaged condition, IBM employee drops a 1416, etc. In cases of IBM responsibility, a temporary replacement 1416 will be supplied at no charge.

IBM guarantees that the repaired 1416 will be returned to the customer in operable condition.



1419 MAGNETIC CHARACTER READER

Purpose: Reads magnetically inscribed data from card and paper documents into a S/360 Model 20. Can be used for off-line sorting. Refer for attachment to 1401, 1410, 1460, S/360 Models 22, 25, 30, 40, 50, 65, 67 or S/370 Model 115 through 168.

Highlights: Documents read at a maximum rate of 1,600 documents a minute. Actual speed depends upon length of document and stored program. Contains the standard features and performs all functions of a 1219 Reader Sorter. Pocket selection may be controlled by the 1419 or system's program. Feeding is controlled by the system. Can also be used for off-line sorting. Processing Overlap (#5730) is required on the 1401 or 1461 (1460) to take full advantage of 1419's speed. Individual fields can be processed immediately after they are read. Document reading can be overlapped with processing. Minimum processing time, including pocket selection, is 32.2 milliseconds ... more than ample for sophisticated applications.

Documents: Magnetic characters must be recorded in the type font (E13B) and location designated by American Bankers Association Technical Committee on Mechanization of Check Handling. Intermixed paper and card documents within the following specifications can be processed: Width—2 3/4" to 3 2/3" ... Length—6" to 8 3/4" ... Thickness—.003" to .007" ... Paper Stock—20 lb. short grain to 44 lb. card stock. 51-column card stock can be fed at a rate of approximately 1,960 cards/minute. Note: For sorting 51-column cards, see 51-column Card Sorting (#4380) under "Special Features" below.

Checking: Readability of each magnetic character, including special symbols, in each field processed can be verified each time a document is read and/or sorted. A field length check is made on all fixed length fields being processed to assure that all numeric digits in the field have been printed. Documents not satisfying checking conditions are rejected. Fixed field lengths provide a powerful technique for controlling accuracy of processing.

Prerequisites: For S/360 Model 20 One 1419 can be attached. It requires a S/360 Model 20 Attachment (#9710). See "Specify" below. A 2020 Model B2, C2, BC2, D2, C5, BC5, D5, DC5, E5, C6, BC6 or D6 equipped with a Serial I/O Channel (#7081) is required.

Bibliography: S/360 Model 20—GA26-3565.

Metering: I/O Unit (On-line/Off-line)

Accessories: Endorser Plate: Used with Endorser (#3791) or Endorse Only (#3795). A purchase item made to customer's specifications. It is recommended that at least one spare plate be stocked, as they cannot be immediately replaced.

Specify:

- 1) Voltage (AC, 1-phase, 60 cycle): #9902 for 208 V, or #9904 for 230 V ... must be consistent with system voltage.
2) Color: Color Accent #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray ... or, Extended Color—#9031 for red, #9032 for yellow, or #9033 for blue.
3) Field Lengths: Specify two feature #s, one for Account Number, one for Process Control ... see table below. Fixed field lengths assure maximum processing accuracy. Variable length fields may be specified in lieu of fixed lengths. Field lengths on installed machines may be changed

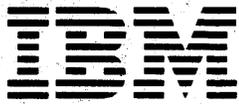
Table with 2 columns: Fixed Field Length (positions) and Account Number/Process Control. Rows show configurations for 5 and 10 positions.

- 4) Shipping Instructions: #9691 for stackers assembled (sorter section 35-3/4" deep), or #9692 for stackers disassembled (sorter section approximately 32" deep).
5) Up-ending Kit (sorter section only): #9840, if required ... loan basis, on initial machine order only, remains property of IBM. Note: Also see 9) below.
6) System/360 Model 20 Attachment: #9710. Required to attach the 1419 to a S/360 Model 20. For field installation the 1419 must have EC 127384 or above ... can be removed in the field. Note: With #9710 installed, the 1419 cannot be used interchangeably with a 1400 series processor or a S/360 Model 22, 25, 30, 40, 50, 65 or 67 or a S/370 Model 115, 125, 135, 145, 155, 158, 165 or 168.
7) Kickstrips: #9431, if desired ... also available on MES. When kickstrips are installed, the open area underneath the machine is enclosed. This reduces the amount of "toe-room" for the operator and may be inconvenient to the customer if the power outlet is located under the machine.
8) Isolation Feature: May be required on units shipped prior to December 29, 1967 for attachment to a S/360 ... see "Special Features."
9) Crane/Hoist Cable: #9070 ... specify only if delivery of machine requires lifting by crane or hoist. Loan basis on initial machine order only, remains property of IBM. Prerequisite: Up-ending Kit (#9840).

Special Features

Batch Numbering (#1445): Provides an automatic means of advancing a batch number document identification under program control. Consists of a 6-position impact printer which prints up to 999,999. The five low-order digits are advanced under processor control ... the high-order digit is set manually. The batch number can be printed in any one of six locations on the back of the document. Limitations: (1) Batch number advance instructions given more often than once in a given three second period will cause suspension of feeding for remainder of the period. Minimum batch sizes that can be processed without restriction are influenced by those factors affecting throughput. Refer to Reference Manual ... (2) Legibility of batch numbers is influenced by the quantity of reverse side printing, the color and density of the ink used in reverse side printing, and surface irregularities caused by the printing process used. Typical examples of documents with one or more surface irregularities are Traveler's and Certified Checks. Customers must be advised that on these types of documents reduced ribbon life can be expected ... (3) When 51-column cards are processed, print location 6 cannot be used ... (4) This feature is not available for use in 1410 systems ... (5) Cannot be installed with Endorser (#3791). Uses purple ribbon (413193), or equivalent. See SRL GA24-3342 for details. Prerequisite: For field installation, 1419 must have EC 127244 or above.

Dash Symbol Transmission (#3215): Transmits the E13B dash



symbol from transit field to storage. With symbol in storage, program can distinguish between duplicate Canadian and U.S. transit numbers. **Maximum:** One.

Electronic Accumulator and Sequence Checking (#3610): (Plant installation only) Accumulating—amounts read from documents and accumulated total printed on paper tape. Maximum accumulation is ten digits. Rejected documents not accumulated. Sequence Checking—selected positions in a field compared with same positions in preceding documents to assure that all documents are in proper order. Maximum of ten positions can be sequence checked in single pass. **Limitation:** This feature does not function when 1419 operates in "online" mode with any S/360 or S/370. **Note:** The feature is a separate unit, cable connected to 1419 ... 17" x 20-1/2" x 38-1/2" ... weight, 105 lbs. **Prerequisite:** Multiple Column Control (#5201).

Endorser (#3791): (Plant installation only) Imprints full endorsement at speed of 1419. Operator can select one of six endorsing positions in accordance with ABA specifications. For Endorser Plate, see #3792 below. **Limitation:** Cannot be installed with Batch Numbering (#1445) or Endorse Only (#3795).

Endorse Only (#3795): [Plant installation only ... if Endorser (#3791) is installed, it can be changed in the field to #3795.] Imprints full endorsement at speed of 1419. Vertical location of endorsement is specified by customer and set at plant. A left or right printing position can be selected by operator. Identification number printing is not provided. The date printing unit is at trailing end of endorsing device. For Endorser Plate, see #3792 below. Specify #9167 for endorsement at top, #9168 for center, or #9169 for bottom. **Limitation:** Cannot be installed with Endorser (#3791).

Expanded Capability (#3800): Provides a command for operation under OS. When in OS mode, stacker select time available using the Dual Address Adapter (#7730) is reduced by 2 ms. Exposure to data overruns caused by 1419s interfering with other 1419s operating on the same channel is eliminated. Overrun exposure and maximum number of 1419s per channel are configuration and application dependent ... refer to SRL C21-5006. Compatibility with DOS Dual Address Support is provided for conversion to OS. OS or DOS mode of operation is established by a field modification to the feature by CE.

51-column Card Sorting (#4380): For sorting 51-column card documents, which may be intermixed with documents and cards within the specifications listed under "Documents" above. When installed, machine speed is reduced. Formula for calculating feeding rate is: $15,720 \div (L + .725L)$, where L is document length in inches. For 51-column cards, speed is approximately 1,875 documents/minute ... for 6-inch documents, approximately 1,515 documents/minute. Decks containing 51-column cards must be mechanically joggled prior to each pass.

Isolation, Control Unit (#4700): (Field installation on units shipped prior to December 29, 1967 only ... standard on units shipped after that) To turn power on or off on the 1419 without generating spurious signals. Thus, a CPU program, if it can be logically disconnected from the system before power is turned off, can continue operating.

Multiple Column Control (#5201): To select documents with specific numbers in four or less columns of any field.

Program Control for Pocket Lights (#5739): To facilitate control of output batches in the transit application. On 1419s attached to a S/360, S/370, 1401 or 1460, the program stops the 1419 when a predetermined number of documents has

entered one of six pockets designated by the program and turns on the appropriate pocket light(s) (A-3). **Limitation:** Not available for use in a 1410 system.

Program Control for Pocket Lights, 7-12 (#5741): Facilitates control of output batches in the transit application when more than six pockets are being filled. Provides lights for pockets 4-9, enabling program to turn on light(s) for any of the first twelve pockets designated. **Limitation:** Not available for use in a 1410 system. **Prerequisites:** Program Control for Pocket Lights (#5739), plus EC 125358A, or, for field conversion, FBM 488231.

Self-checking Number (#7061, 7062): A self-checking number consists of two parts, the basic identifying number and its check digit. The check digit, derived from the basic identifying number by one of two techniques, is always the units digit of a self-checking number. The feature assures that all digits in a self-checking number have been correctly recorded. The field is verified as it is read during any pass. **Limitation:** Self-checking numbers for Modulus 10 are not compatible with those for Modulus 11.

#7061 Modulus 10—has weighting factor of 1, 2, 1, 2, 1, 2. Will not detect the following types of errors: 09 or 90 transpositions ... interchange of digits between alternate columns, e.g., 32647 for 34627 ... substitution of one self-checking number for another ... in some instances, transpositions having the formula "BAB" for "ABA", e.g., 121 for 212 ... in some instances, random errors, e.g., 23 printed as 56.

#7062 Modulus 11—has weighting factor of 7, 6, 5, 4, 3, 2 ... when self-checking number is greater than six digits, weighting factor is repeated. In some instances, random type errors will not be detected, nor can a basic number requiring a check digit of 10 be used.

Split Field (#7440): The first ABA dash symbol following a digit (e.g., a dash in units position of a field is ignored) will separate any field into two elements. Each of the elements may vary in length. With this feature, either element can be treated as a separate field. **Specify:** First Element (#9180) ... required when Self-checking Number (#7061, 7062) is ordered and is to operate only on the first element of the split field.

S/360 Adapter (#7720 for Single Address, #7730 for Dual Address): To attach a 1419 to a S/360 Model 20, a S/360 Model 20 Attachment (#9710) is required ... see "Specify." **Limitation:** Once #7720 or #7730 has been installed, the 1419 cannot be used with a 1400 series processor without submission of an RPQ. **Maximum:** One per 1419 #7720 or #7730.

S/360 Adapter - Single Address (#7720): Up to six 1419s attached to a system are supported by DOS ... exposure to late stacker selects should be considered in determining the maximum number of 1419s that may effectively operate on a system, in addition to those factors outlined under DOS in "Programming." **Limitation:** Programming support precludes concurrent operation of 1419s equipped with #7720 and those equipped with #7730.

Prerequisites: In order to operate with DOS or BPS, Direct Control (#3274) or External Interrupt (#3895) is required on the processing unit. **Note:** Intersystem attachment via Direct Control is limited when the 1419 uses external interrupt lines. Signal in lines used by 1419s cannot be shared with the second processing unit. To operate with DOS, the 1419 must have EC 131182. When equipped with #7720, it is recommended that 1419s be attached to a multiplexer channel and they should normally be the highest priority devices on the channels.



S/360 Adapter - Dual Address (#7730): With this feature more stacker select time is available than with #7720. Available stacker select time is based on the last field selected for reading; account number—27 ms, transit number—21 ms, serial number—15 ms. In order for these times to be valid, document field placement must be within ABA Common Machine Language specifications. The feature includes two distinct control units ... each with a separate address, its own set of executable commands, and status and sense indicators.

Prerequisite: If the 1419 is attached to a 2022 or a 2030 multiplexer channel via #7730, 1419 Dual Address Compatibility (#9185) must be specified on the 2022 or 2030. If #7720 is changed to Dual Address #7730 by MES, #9185 must be added to the 2022 or 2030.

-----DOS-----

Up to six 1419s attached to a system are supported by DOS. The limiting factors concerning the number of 1419s that may be attached to a system are stacker select time requirements and channel capacity. Since these factors are application and configuration dependent, consult the appropriate channel loading and DOS SRL's to determine the maximum number that may be operated effectively. **Limitation:** DOS support precludes concurrent operation of 1419's equipped with #7730 and those equipped with #7720 ... 1419's equipped with #7730 can be attached only to a multiplexer channel and should normally be the highest priority devices on the channel.

Prerequisites: Direct Control (#3274), or External Interrupt (#3895) or External Signal (#3898) is required on the processing unit. **Note:** Intersystem attachment via Direct Control is limited when the 1419 uses the external interrupt lines. Signal in lines used by 1419s cannot be shared with the second processing unit. For field installation of #7730, the 1419 must have EC 131196 or above.

-----OS-----

Limitation: 1419s equipped with #7730 (required for OS) can be attached only to a multiplexer channel, must be physically cabled last on the channel, and should be the highest priority devices on the channel.

Prerequisite: For operation under OS each 1419 must be equipped with Expanded Capability (#3800).

Accessories:

The endorsing plate is a purchase item made to the customer's specifications. An additional charge is made for an endorser plate that requires art and layout work which cannot be accomplished by straight line typesetting. This additional charge applies to single plate orders and the first plate of multiple plate orders. For information on endorser plates for 1419, see Endorser Plate Specification Sheet, 120-0563. For plant installation on 1419 specify #3792 (or #3793 for Blank Endorser Plate where applicable) at prices listed below. A completed Endorser Plate Specification Sheet for each #3792 must be attached to the DPOW or IAC.

It is recommended that the customer stock at least one spare endorser plate for each group of machines with identical plates since plates cannot be immediately replaced.

For feature Numbers for Color of Ink to be used, see unit under "Machines."

Replacement: Mechanical and Capacity Replacement Machines (1219/1241/1419/1421 to 1210/1219/1241/1419/1421 only)—a replacement endorser

plate will be shipped with each replacement machine at no charge when the machine being replaced has an endorser. If any change in plate design is desired, there is a charge only for art and layout work if applicable. The endorser plate on a displaced machine is to be left with the machine, but defaced and rendered unusable.

Installed Machines—the normal plate charge will apply whenever replacement of a worn or damaged plate is required. Charges for art and layout work are added, if applicable. **Note:** Endorser plates are interchangeable only within the machine groupings shown above ... the Serial Numbering/Endorser plate for the 1203 is not interchangeable with the old style Endorser plate.

Specify:

An Individual completed Endorser Plate Specification Sheet (102-1348 or 120-0563) ... see above, including machine and serial number, must accompany each order for an endorser plate. On mechanical and capacity replacement orders, also attach a sample endorsement.



1442 CARD PUNCH - Model 5

Purpose: Punched card output unit for a S/360 Model 20 or 1130 Computing System ... punches cards at a rated speed of 160 columns/second.

Model 5 For S/360 Model 20, or 1130 System Model 1, 2 or 3 only.

Model Changes:

Model 5 cannot be changed to any other model, or vice versa, in the field.

Highlights: Format control and analysis are performed by the system's processing unit. Blank or prepunched cards are punched serially. Actual speed depends upon the number of columns punched, including interspersed blank columns. Rated speed in cards/minute: Columns 1 through 10 is 265 ... columns 1 thru 80 is 91. Punching is checked. The unit has a 1,200-card capacity hopper and a 1,300-card capacity stacker. The Extended BCD Interchange Code (256 codes) is punched. The model 5 when attached to an 1131 can punch binary codes.

Maximum:

1130—one 1442, Model 5, 6 or 7, can be attached ... see 1130 in "Systems" for allowable I/O unit configurations.

S/360 Model 20—one 1442 Model 5 can be attached to the 2020 Processing Unit ... see S/360 Model 20 in "Systems" for allowable I/O unit configurations.

Prerequisites:

1130 A 1442 Model 5 Attachment (#4449) on the 1131 Central Processing Unit, plus 1130/1442 Model 5 Coupling (#3630) on the 1442 itself ... see "Special Features."

Note: A 1442 Model 5 cannot be attached to an 1131 Model 4A or 4B.

S/360 Model 20 A 2020 Processing Unit submodel 1, 2, 5 or 6 equipped with a 1442 Model 5 Attachment (#4460) ... if the installed 2020 has a serial no. under 20000, a Cable Adapter (#9099) is required on the 1442. See "Specify" below.

Card Limitations:

Generally, scored cards require careful handling and a favorable environment. Use of the following scores has been approved:

Internal Scores (before separation)—M-4, M-5, S-1, ID-1.

External Scores (after separation)—M-7, M-11 (with round corners) or CF-11 (with round corners) on either end, M-3 on column 80 end only.

Bibliography:

1130 GA26-5916, S/360 Model 20—GA26-3565.

Metering: I/O Unit (On-line)

Specify:

1) Voltage (must be consistent with system voltage): With S/360 Model 20, #9903 for 208V, or #9905 for 230V; with 1130, #9902 for 208V, or #9904 for 230V.

2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray, or #9046 for white.

Cable Adapter: #9099. Required if the 1442 is to be attached

to an installed 2020 which has a serial no. under 20000. Plant installation only, but can be removed in the field.

4) Use with 1130: 1130/1442 Model 5 Coupling (#3630) is required ... see "Special Features."

5) If the 1442 Model 5 is to be used as an emulating unit in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under 2020.

Special Features

1130/1442 Model 5 Coupling (#3630). (Plant installation only) Required to attach a 1442 Model 5 to an 1130 system.

Prerequisite: 1442 Model 5 Attachment (#4449) on 1131.

**1442 CARD READ PUNCH - Models 6 and 7**

Purpose: Combination I/O punched card unit for an 1130 Computing System, 1800 Data Acquisition and Control System, System/3 Model 10 Disk System, and System/3 Models 12 and 15 Systems.

Model 6 Reads at a rated speed of 300 cards/minute ... punches at rated speed of 80 columns/second.

Model 7 Reads at a rated speed of 400 cards/minute ... punches at rated speed of 160 columns/second.

Model Changes: Can be made between models 6 and 7.

Highlights: Format control and analysis are controlled by the system's processing unit.

Input Section: Model 6 has a serial reading speed of 300 cards/minute ... Model 7 up to 400 cards/minute. Mispositioned cards are detected. The light sensing mechanism is checked for proper functioning in every read cycle. Binary image of cards is read. Hopper holds 1,200 cards.

Output Section: Cards are punched serially after passing through the light sensing station. Cards can be either blank or prepunched. Card codes punched are determined by the system program and can include binary punching. Actual speeds depend upon the number of columns punched, including interspersed blank columns. Rated speed for punching columns 1-80 is 50 cards/minute for Model 6 and 91 cards/minute for Model 7 ... for punching columns 1-10 is 180 cards/minute for Model 6 and 256 cards/minute for Model 7. Cards go to stacker 1 unless program-directed to stacker 2. Two stackers each hold 1,300 cards. Punching is checked.

Card Limitations:

Generally scored cards require careful handling and a favorable environment. Use of the following scores has been approved:

Internal Scores (before separation)—S-1, ID-1, ID-2, ID-3, and for a maximum of three passes, M-4 and M-5.

External Scores (after separation)—for reading and punching: on the column 80 end—M-3, M-7, M-11 (with round corners), CF-11 (with round corners); on the column 1 end—M-7, M-11 (with round corners) and CF-11 (with round corners) only. For reading only: on the column 80 end—M-6, and for a maximum of three passes, M-5, OM-2 and CF-4.

Maximum:

1800 Two 1442s, models 6 and 7 in any combination, can be attached ... see 1800 in "Systems" for I/O unit configurations possible.

System/3 Model 10 Disk System One 1442 Model 6 or 7 can be attached.

System/3 Model 12 System One 1442 Model 6 or 7 can be attached.

System/3 Model 15 System One 1442 Model 6 or 7 can be attached.

Prerequisites:

For 1130 1442 Model 6 or 7 Attachment (#4454, 4455) on the 1131.

For 1800 A 1442 Adapter (#4430) on the 1801 or 1802 for each

1442 attached ... one Data Channel (standard or additional) is required for one or two 1442s. If desired, each 1442 can be attached to its own data channel ... see 1801/1802 for data channel assignments.

For System/3 Model 10 or 15A A 5410/5412/5415 Coupling (#3950) on the 1442 Model 6 or 7 (see "Special Features" below), a 1442 Model 6/7 Card Read Punch Attachment (#4130) on the 5410, 5412 or 5415 and a 5422 Disk Enclosure with one or two 5444 Disk Storage Drives. If the system includes a 5445 Disk Storage(s), 1442/2560 Compatibility (#9751) is required on each 5445 Model 1 or 3. **Limitations:** Cannot be attached with a 5424 MFCU on the Model 10 or 12 ... cannot be attached with a 5424 MFCU or a 2560 MFCM on the Model 15.

For System/3 Model 12 or Model 15 B/C/D: A 5410/5412/5415 Coupling (#3950) on the 1442 Model 6 or 7 (see "Special Features" below) and a 1442 Model 6/7 Card Read Punch Attachment (#4130) on the 5410, 5412, or 5415. **Limitation:** Cannot be installed with a 5424 on the Model 12, cannot be installed with a 5424 or a 2560 on the Model 15.

Bibliography: System/3—GC20-8080

Specify:

- 1) Voltage (AC, 1-phase, 60 cycle): must be consistent with system voltages: With 1130—#9901 for 115V, #9902 for 208V, or #9904 for 230V. If required, an installed 1442 Model 6 or 7 with 115V can be changed to 208/230V .
With 1800—#9902 for 208V, or #9904 for 230V. With System/3 Model 10, 12, or 15—#9902 for 208V, or #9904 for 230V.
- 2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray or #9046 for white.

Special Features

5410/5412/5415 Coupling (#3950): Required to attach a 1442 Model 6 or 7 to a 5410, 5412 or 5415. **Prerequisites:** 1442 Model 6/7 Card Read Punch Attachment (#4130) on the 5410/5412/5415, a 5422 Disk Enclosure and one or two 5444 Disk Storage Drives on 5412 or 5415B/C/D in lieu of 5422 Disk Enclosure. Field Installation: Yes.



1443 PRINTER

Purpose: Printed output unit for a 1240, 1440, 1620 and 1800.

Model 1 For 1240, 1440, 1620 or 1800 ... 150 lpm rated speed with 52-character set.

Model 2 For 1240, 1440, 1620 or 1800 ... 240 lpm rated speed with 52-character set.

Model 3 (No longer available) For 1450 ... 140 lpm rated speed with 52-character set.

Model 4 (No longer available) For 1450 ... 230 lpm rated speed with 52-character set.

Note: For speeds with other character sets, see Selective Character Set (#6401, 6402) under "Special Features."

Model Changes: Can be made in the field between Models 1 and 2, or 3 and 4, only ... see "Limitations."

Limitations:

When a model change is made between a Model 1 and 2 or 3 and 4, serial no. 10330 and below, type bars (less segments) must be replaced ... replacement bars will be furnished at no charge on a one-for-one basis. Previously installed segments will be installed in the new type bar(s) without charge.

- (a) Model change from 1 to 2 or 3 and 4, or vice versa.
- (b) Feature #(s) and quantity of each character set requiring a new type bar.
- (c) Feature # for type size, #9731 for .079", or #9733 for .095".

A 120 print-position bar cannot be used in a machine equipped with Print Positions, 24 Additional (#5558, 5559) unless one additional segment is added and all segments are rearranged in the required sequence ... conversely, a 144 print position bar cannot be used in a 120 print-position machine unless one segment is removed and the remaining segments are rearranged in the required sequence ... see "Type Catalog."

Neither segments nor type bars are interchangeable between any model 1443 and 2203 Printers.

Prerequisites:

For 1240 Printer Control (#5567) on the 1443 itself. See "Special Features" below ... #9553 on the 1241 Processing Unit.

For 1440 Printer Control (#5567) on the 1443 itself. See "Special Features" below ... Printer Attachment (#5561) on the 1441 Processing Unit Model A2-A6. *Note:* Only one #5561 is required to attach both a 1443 and a 1444 Card Punch to the 1441. **Limitation:** Only one printer (1403, 1443 or 1445) can be attached to a 1440 system.

For 1450 Attachment features are standard on the 1441 and the 1443. **Limitation:** Only one printer, a 1443, can be attached to a 1450 system.

Highlights: Models 3 and 4 have 144 print positions ... standard on all models are 120 print positions. On all models the 52-character set is standard. Actual speed depends upon the operation ... see Selective Character Set (6401, 6402) under "Special Features." The system's processing unit performs all format and analysis control. A line of printing is presented to the printer in the arrangement in which it is to be printed.

Each print position can print any of 52 characters ... alphabetic, numeric and 16 special characters. Characters are spaced

10/inch. Line spacing is 6 or 8 lines/inch, under operator control. Marginally punched continuous forms from 4" to 16-3/4" in overall width are fed by an automatic carriage. Maximum form depth is 22" at 6 lines/inch ... 16-1/2" at 8 lines/inch. Forms spacing and skipping are controlled by a 12-channel tape in the carriage. Skipping is at approximately 15"/second.

An enlarged dash (character no. 830704) is available for printing on documents to be read by 1230, 1231 and 1232 optical mark readers. Depending upon the system, see appropriate section of "Type Catalog" for ordering instructions. The ribbon used on the 1443 must be capable of producing printed characters suitable for recognition by the optical reader used. Recommended ribbons and document specifications are listed under 1230, 1231 and 1232.

Bibliography: 1240/1440/1450—GA24-3005

Metering: I/O Unit (Online)

Specify:

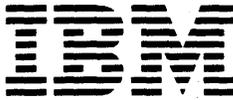
- 1) Voltage: For 1240, 1440 or 1450 (AC, 3-phase, 4-wire, 60 cycle)—#9903 for 208 V, or #9905 for 230 V. For 1620, 1800, (AC, 1-phase, 3-wire, 60 cycle)—#9902 for 208V, or #9904 for 230V ... must be consistent with system voltage.
- 2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray, or #9046 for white.
- 3) Print arrangement for standard 52-character set unless Selective Character Set (#6401 or 6402) is ordered and the 63-character set is desired instead ... see appropriate section of "Type Catalog" (page 41 or 81) depending upon the system involved. Character substitutions are also covered in the "Type Catalog."
- 4) Type Size: #9731 for .079", or #9733 for .095".
- 5) Order tape punch, Part No. 120910, group code 91, from Endicott if 1443 is for New Name Account ... one is furnished at no charge per installation.
- 6) Isolation, Control Unit (Model N1 only): May be required on units shipped prior to December 29, 1967 ... see "Special Features" below.

Special Features

Character Sets #1890-1893, 1895-1896 for Model 1, 2, 3 or 4: #1901-1904 for Model N1. See "Type Catalog" for graphics and ordering instructions. **Prerequisites:** On Model 1 or 2, Selective Character Set(#6401) is required for any character set other than #1892 or #1895.

Print Positions, 24 Additional (#5558, #5559): (Standard on Models 3,4) #5559—for Model 1 or 2. Increases print span from 120 positions to 144 positions. Operation of printer remains unchanged. When this feature is field installed, all character sets must be modified. This modification will be made at no charge, provided that only a standard segment is to be furnished ... see "Character Sets" in appropriate section of "Type Catalog." ordering #5559 should include the following: (1) Quantity and feature #(s) of all installed character sets that require an additional segment ... (2) Feature # for type size, #9731 for .079", or #9733 for .095" ... (3) 1443 Type Specification Sheet (120-0658), if non-standard segments are involved. See "Substitute Characters" in "Type Catalog" for charges that apply.

Printer Control (#5567): Model 1, 2 only ... standard on Model 3, 4 (Plant installation only) Controls for operation of the 1443 in a 1240 or 1440 system ... required on each 1443 in such a system.



Printer Control for 1800 (#5569): (Model 1, 2 only) (Plant installation only) Controls and print storage required for operation of the 1443 in an 1800 system ... required on each 1443 in such a system.

Print Storage (#5585): (Model 1, 2 only ... not available for Model 3 ... Standard on Model 4) (For 1240 or 1440 only) Additional storage to store a print line from main storage with the "Write a Line" instruction. Upon completion of the transfer, normal program execution is resumed while the printer writes a line from print storage, increasing available process time by the 374 milliseconds (52-character set) normally interlocked by a "Write a Line" operation. Reduces job time on combination I/O operations involving printing. See *SRL Reference Manual* for details.

Selective Character Set #6401, 6402: For Model 1 or 2 ... standard on Models 3 and 4. Required if any type bar other than the standard 52-character bar is to be used. Provides controls which permit the 1443 to use all available character sets. When ordered for plant installation, the 63-character set may be specified at no charge in lieu of the standard 52-character set for use with this feature. See "Type Catalog" for characters in each set. The various character sets print at the following speeds:

Character Set	LPM			
	Mdl 1	Mdl 2	Mdl 3	Mdl 4
13	430	600	385	565
39	190	300	175	285
52	150	240	140	230
63	120	200	110	190



2152 PRINTER-KEYBOARD

Purpose: A Selectric® typewriter for use as an input (keyboard) and output (printer) unit with the S/360 Model 20 ... serves primarily as an inquiry device and secondary printer.

Highlights: Consists of a modified Selectric printer-keyboard mounted on a specially designed table and is connected to a native interface in the CPU via a cable which allows convenient placement. Operates in overlap mode with other I/O or processing operations except when tape, disk or high speed BSCA data transfers are in progress on a 2020 submodel 2 or 4.

The printer has an 88-character set and a maximum 125-character print line ... spacing is 10 characters/inch. One element is supplied with the machine ... for graphics, see PTTC/EBCD, 10-pitch, Data 1 Font element, Part. No. 1167963 in "Type Catalog." A pin feed platen (13-1/8" pin-to-pin) is standard ... operates at a rated speed of 15.5 characters/second. An original and four carbon copies may be printed, depending upon paper, carbon quality and thickness.

The keyboard is typewriter style with the top row of keys used for numerics and special characters. Functional keys (Request, Cancel and EOT) and indicator lights (Request, Proceed and Check) are located to the right for easy operator usage.

Only those functions which are useful and necessary in a systems environment are offered...functions such as tab, back space, ribbon shift, end of line bell, tab set and clear, etc. are removed for reduced maintenance, increased accessibility and improved performance.

Prerequisite: 2152 Attachment (#8070) on a 2020 submodel 4, 5 or 6, or on a submodel 2 with serial no. 20000 or above. Except on submodel 5 or 6, the addition of a 2152 Attachment (#8070) limits space for 2020 RPQs. Therefore, in any situation where co-residency is desired between a 2152 and an RPQ in a 2020 submodel 2 or 4, another RPQ must be submitted

Bibliography: GA26-3565.

Specify

- (1) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray, or #9046 for white.
- (2) Friction Platen: #9255, for plant installation in lieu of standard pin feed platen. **Maximum:** One.
- (3) Line feeding: #9435 for 6 lines/inch, or #9436 for 8 lines/inch.
- (4) If the 2152 is to be used as an emulating unit in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under 2020.

Accessories

Forms Stand: Permits placement of continuous forms on the stand above floor level and provides for stacking after printing. This accessory is a two shelf forms stand.

TYPE	FEATURE NO.
2152	4450

**2222 PRINTER**

Purpose: Printer and ledger card device for System/3 Model 6.

Model 1: Prints left-to-right only.

Model 2: Has bi-directional print capability.

Model Changes: Field installable.

Highlights: Prints serially at a maximum rate of 85 cps. Prints in 220 print positions at 10 characters/inch spacing. Electronic tab (both to left and right) and high speed carrier return are under program control. Tapeless vertical forms control by the program on primary forms tractor and incremental spacing on secondary forms tractor enable feeding of marginally-punched continuous forms on either tractor to a maximum overall forms width of 23" ... minimum 3-1/2". Vertical forms skipping at 12"/sec. on primary forms tractor, line spacing only on secondary forms tractor. Forms length is 2-5/16" to 14". Line spacing is 6 lines/inch. Forms up to .025" total thickness can be accommodated; up to 6-part forms can be printed using the primary forms tractor and up to 5-part forms can be printed using the secondary forms tractor. Refer to SRL GA24-3488 for forms design considerations and limitations. A forms stand for stacking continuous forms is standard.

EBCDIC coded matrix characters are formed by 7 vertical wires, each printing a dot in up to 4 of 7 possible horizontal positions. The 26 letters and 10 digits can be printed. The following special characters can be printed:

& @ # ? ¢ \$ % . , ; ' () _ + - * / † = ≠ < > | ~

A special character is used for the Ledger Card Device line finder marks and the identification number coding.

Use of the "underscore" in conjunction with another character will overprint the lowest matrix dot forming that character and is not recommended.

The Ledger Card Device (LCD) posts on ledger cards under program control with automatic line finding and identification number reading. Ledger cards are manually fed ... automatic stacking provided for up to 1/2" stack of cards. Card width from 6" to 14" (6", 8-1/2", 11" and 14" are recommended). Card length from 8" to 11". Cards are to be of .007" thickness without corner cuts. Line spacing is 6/inch.

Refer to SRL GA24-3488 for ledger card design considerations and limitations.

Model 1 allows printing left-to-right only. Model 2 provides bi-directional print capability which increases throughput by eliminating carrier return. It allows printing with the print element moving either left-to-right or right-to-left.

Performance Considerations: An analysis of each document type to be printed is necessary to find actual throughput of a serial printer. When used for dedicated printing jobs, throughput depends upon the ratio (R) of lines printed per page to the maximum number of lines available per page and upon the number of character positions (C) in the printed line. Lines printed per minute (LPM) can be approximated using formulas:

For Model 1 ... $LPM = 2700 R$ where C is average number of $RC + 1$ character positions.

For Model 2 ... $LPM = 4500 R$ where C is maximum number of $RC + 5$ character positions when program prints alternate lines in opposite directions.

EXAMPLE: For Model 2. If 22 of 66 lines on a page are printed.
 $R = 1/3$. Assume maximum line length of 75 character positions.

Then: $LPM = 4500 (1/3) = 50$ (approximate throughput)
 $1/3 (75)+5$

Limitations: Only one printer can be attached to a 5406 Processing Unit ... a 2222 cannot be attached to a System/3 Model 6 that also has a 2265 Display Station Model 2.

Prerequisite: An appropriate 2222 Printer Attachment (#7951 or #7952) on the 5406 Processing Unit.

Supplies: A black ribbon, Part No. 1136906, or equivalent is recommended. **Caution:** Only specified or equivalent ribbons should be used to prevent possible damage to the print head mechanism.

Bibliography: GC20-8080.

Metering: Base Unit (5406)

Specify

Voltage (AC, 1-phase, 3-wire, 60 cycle): #9902 for 208V, or #9904 for 230V ... must be consistent with system voltage.

**2250 DISPLAY UNIT—Models 1, 2, 3**

Purpose: A cathode ray tube unit for displaying output in alphanumeric and graphic form for a S/360 Model 22, 30 thru 85 and 195, or a S/370 Model 115 thru 195. Input features provide broad man-machine communication ability.

Model 1: Includes its own control unit ... used for a single display unit configuration.

Model 2: (No Longer Available) Requires a 2840 Display Control Model 1 ... applicable special features listed below can be ordered for field installation on installed units.

Model 3: Requires a 2840 Display Control Model 2 ... used in multiple display unit configurations for computer-aided design and scientific analysis applications. Up to four 2250 Model 3s can be attached to each 2840 Model 2. Each 2250 Model 3 can be located 2,000 cable feet from the 2840 Model 2.

Model Changes: Cannot be made in the field.

Highlights: An I/O unit offering both pictorial (line drawing) and alphanumeric input and output for analysis, design and file maintenance applications. It features:

Large Display Area Images are drawn anywhere within a 12" x 12" area on the face of the display tube.

Large Capacity Display Up to 3,848 character positions ... 52 lines with 74 characters to the line.

Vector Graphics Straight lines of any length, at any angular orientation and at any position on the screen. [Note: For this function, Absolute Vectors and Control (#1002) is required on a Model 1, or Absolute Vectors (#1001) on a Model 2.]

Dynamic Display Buffer areas are addressable ... individual characters or lines can be changed rapidly without time-consuming re-write of complete buffer area.

Additional Data Modes Incremental vectors permit improved buffer utilization and programming flexibility. (Note: This function is standard on Model 3 ... on Model 1, Graphic Design Feature (#4485) is required.)

Format Flexibility Characters, point plots, and vector end points can be positioned in any combination at any of the 1,048,576 program addressable positions on the 1,024 x 1,024 grid.

Large Capacity Display (Model 3 only) Up to 2,100 characters or 2,800 incremental vectors may be displayed at 40 cps regeneration rate without noticeable flicker ... up to 2,800 characters or 3,700 incremental vectors at 30 cps regeneration rate with commonly accepted flicker. (Note: Vector and character times vary depending on cable length.)

Fast Turn-around (Model 3 only) A complete buffer (32K) can be rewritten in less than a tenth of a second ... manual inputs are presented to the CPU as fast as they are presented to the display unit.

Graphic Input Program controllable light pen provides for a variety of input techniques, including pen search and tracking. (Note: For this function, Graphic Design Feature (#4485) is required on Model 1.)

Light Pen Detection Processing (Model 3 only) Extensive order set reduces CPU attention handling requirements ... see 2840 Model 2.

Application Flexibility Optional alphanumeric and program-

med function keyboards for operator input ... see "Special Features."

Prerequisites: For either model in any S/360 or S/370, a minimum of 64K of core storage is required for use of graphic support under OS/360. A minimum of 16K is required for diagnostic support only.

For model 1 A Buffer (#1498 or #1499) on the 2250 Model 1 itself. See "Special Features." A control unit position is also required on a system channel.

S/360 Model 22, 30, 40, 50 Multiplexer channel (standard), Selector Channels (special features, except on 2022 one selector channel is standard) ... see 2022, 2030, 2040, 2050.

S/360 Model 44 Special features on 2044: Multiplexer Channel, Additional High Speed Multiplexer Subchannels ... see 2044.

S/360 Model 65, 67, 75 Selector channel of 2860, Selector Subchannels (special features) on 2870 ... see 2860, 2870.

S/360 Model 85, 195 or S/370 Model 165, 168, 195 Selector channel of a 2860, Selector Subchannels (special feature) of 2870, or the shared subchannel of a 2880 ... see 2860, 2870, 2880.

S/370 Model 115, 125 Multiplexer channel ... see 3115, 3125. (No DOS support).

S/370 Model 135 Multiplexer channel ... see 3135.

S/370 Model 145 Multiplexer channel (standard), selector channels ... see 3145.

S/370 Model 155, 158 Multiplexer channel (standard), 2nd Byte Multiplexer Channel (special feature), block multiplexer channels (first two are standard) ... see 3155, 3158.

For model 3 A 2840 Display Control Model 2.

Bibliography: GA22-6822.

Metering: Assignable Unit

Specify

- (1) Voltage (AC, 1-phase, 3-wire, 60 cycle): #9902 for 208V, or #9904 for 230V.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (3) Buffer (Model 1 only): Buffer (#1498 or #1499) is required ... see "Special Features."
- (4) Isolation, Control Unit (Model 1 only): May be required on units shipped prior to December 29, 1967 ... see "Special Features."

Special Features

Absolute Vectors (#1001): (Model 2 only) Provides ability to "draw" a continuous straight line between any two points of the 1,024 x 1,024 reference grid. **Prerequisite:** Absolute Vectors and Control (#1003) on 2840 Model 1.

Absolute Vectors and Control (#1002): (Model 1 only) Provides controls and ability to "draw" a continuous straight line between any two points of the 1,024 x 1,024 reference grid.

Alphanumeric Keyboard (#1245): (Any model) A keyboard similar to that on a 1052 Printer-Keyboard ... for alphanumeric data entry.

Buffer (#1498, 1499): (Model 1 only) #1498—provides 4,096 bytes of core storage for display regeneration ... #1499—provides 8,192 bytes. **Maximum One, #1498 or**



#1499.

Note: One of these features is required on each 2250 Model 1 ... if 1498 is installed, it must be removed in order to install 1499.

Character Generator (#1880): (Model 1 only) A digital decoder which speeds character generation and conserves buffer space. Special circuits draw characters from stored EBCDIC codes rather than from sequences of programmed vectors. *Note:* This feature is required when using a 2250 Model 1 as an operator's console under DIDOCS programming support.

Graphic Design (#4485): (Model 1 only) Provides two additional data modes ... 2-byte incremental vectors and point plotting, four light pen control orders to enable CPU program-directed pen tracking, and a fiber optic light pen with a tip switch. **Limitation:** Cannot be installed with Light Pen (#4785). **Prerequisite:** Absolute Vectors and Control (#1002).

Note: CPU interaction for light pen tracking will generally be great enough to limit such interaction to one 2250 Model 1 at a time.

Isolation, Control Unit (4700): (Model 1 only ... for field installation on units shipped prior to December 29, 1967 ... standard on units shipped after that) To turn power on or off on the 2250 Model 1 without generating spurious signals. Thus, a CPU program, if it can be logically disconnected from the system before power is turned off, can continue operating.

Light Pen (#4785): (Model 1 or 2 only) A hand-held electronic pointer, activated by a foot switch, that allows program detection of lines, characters and symbols that are displayed on the face of the tube. **Limitation:** On Model 1, cannot be installed with Graphic Design (#4485).

Note: A fiber optic light pen with a tip switch is provided with Graphic Design (4485) on a Model 1 and with the basic 2250 Model 3.

Operator Control Panel, First (#5475): (Model 1 only) Provides a duplicate of the on/off and program load facilities (OCP) of a processing unit ... mounted on the 2250 Model 1.

For a remote panel for a 2050, 2065, 2075, 2085, 3165, 3168 or 3195.

Maximum: One.

Specify

#9175 if #5475 is to be installed on a 2085, 3165, 3168 or 3195 equipped with the Extended Channels ... see "Special Features" under those units.

Prerequisite: Remote Operator Control Panel Attachment (#9560) on the 2050, 2065, 2085 or 3195 ... see "Specify" under those units.

Operator Control Panel, Second (#5476): (Model 1 only) Provides a duplicate of the on/off and program load facilities (OCP) of a second processing unit ... mounted on the 2250 Model 1. For a remote panel for a 2050, 2065, 2075, 2085, 3165, 3168 or 3195.

Maximum: One.

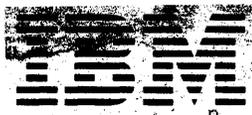
Specify

#9176 if #5476 is to be installed on a 2250 attached to a 2085, 3165, 3168 or 3195 equipped with the Extended Channels ... see "Special Features" under those units.

Prerequisites: #5476 requires Operator Control Panel, First (#5475) ... Remote Operator Control Panel Attachment (#9560) on the 2050, 2065, 2085 or 3195 ... see "Specify" under those

units.

Programmed Function Keyboard (#5855): (Any model) A 32-key keyboard that allows the operator to indicate program interpretive functions to the system by a single key depression.



2311 DISK STORAGE DRIVE

Purpose: Disk storage drive for a S/360, S/370, 1130 or an 1800 System.

Model 1: For a S/360 Model 22 thru 85 or 195, a S/370 Model 135 thru 195, or an 1800 ... up to 7.25 million bytes or 14.5 million packed decimal digits ... accesses 200 cylinders.

Prerequisites: All Models—use vented hub 1316 Disk Packs, which must be ordered separately .

Model 1

For S/360 Models 22 and 30 thru 85, 195, S/370 Models 135 thru 195, 1800—a 2841 Storage Control. Each 2841 can control up to eight 2311s ... see 2841 for specifications of additional cables and connectors required for attachment of fifth thru eighth 2311s and for limitations when used with other storage units.

Highlights: Disk Pack Each 2311 uses a vented hub 1316 Disk Pack that is removable and provides virtually unlimited offline disk storage.

Limitations: Vented hub 1316s can be used on 1311 Disk Storage Drives as well as on any 2311 Model, but data written on a 1316 by a 1311 cannot be read by a 2311.

Note: When a S/360 uses one of the 1400 Compatibility Features for disk storage, the 1316, though residing in a 2311 Model 1, will store 2 million characters in "Sector Format" or 2.98 million in "Track Record Format." These disk packs are written at 2311 Model 1 track and bit densities and cannot be read on 1311s ... one 2311 Model 1 is required for each 1311 required in the original 1400 system configuration.

Cylinder Concept: The "comb-type" access mechanism, with ten vertically aligned heads, one for each disk surface, minimizes access time and increases throughput.

Model 1 Accesses 200 cylinders ... up to 36,250 bytes (or 72,500 packed decimal digits) are available at one setting of the mechanism.

Formats: The 2311 Model 1 uses the track format prescribed for all storage units attached to the 2841 Storage Control.

Data Transfer Rate: Up to 156,000 bytes/second (or 312,000 packed decimal digits/second) ... permits efficient sequential and random access processing.

Bibliography:

System/360, System/370—GA22-6822, 1800—GA26-5921.

Metering: Assignable Unit

Specify

(1) Voltage (AC, 3-phase, 60 cycle): #9903 for 208V, or #9905 for 230V.

(2) Drive Number Identification Button: Order each 2311 separately, indicating its position by one of the following codes:

Model 1 #9121 for 1st drive, #9122 for 2nd, #9123 for 3rd, #9124 for 4th, #9125 for 5th, #9126 for 6th, #9127 for 7th, or #9128 for 8th. **Prerequisite:** For #9125 thru #9128, Additional 2311 Attachment (#9706) is required on the 2841 ... see "Specify" under 2841.

(3) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.

(4) 1316 Disk Pack: Must be ordered separately .

(5) If the 2311 is to be used as an emulating unit in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under 2020.

(6) If the 2311 is to be used on an 1130 system an appropriate 1130 Attachment (#3601 or 3602) is required.



2312 DISK STORAGE - Model A1

Purpose: Single disk storage module for a 2314 DASF - A Series, or attachment to the 2319 Disk Storage Model A1/A2/A3.

Highlights: See 2314 DASF - A Series.

Prerequisites: The 2312 Model A1 is designed for interconnected operation as part of a 2314 DASF-A Series, or attachment to the 2319 Disk Storage Model A1/A2/A3. Customers who wish to order a 2312 Model A1 for stand-alone or individual use should submit an RPQ to provide the necessary safety elements (covers, cable connectors, etc) to complete the unit for a non-standard (i.e., not interconnected with a 2314 or 2319) environment. In lieu of the RPQ, the customer may provide safety elements equivalent to the standard 2314/2312 or 2319/2312 configuration or that provided by the above RPQ. If not provided, the unit will be offered on a purchase only basis.

Agreement for IBM to install and maintain the 2312 Model A1 in any non-standard environment must be reviewed with Management prior to making a commitment to the customer.

Bibliography: GA22-6822.

Specify

- (1) Refer to the "Specify" section under 2314 DASF - A Series for ordering instructions, codes, voltage, position designator, etc. required for this unit when part of a 2314 DASF - A Series. Refer to the 2319 Disk Storage Facility for ordering instructions when this unit is to be attached to the 2319.
- (2) 2316 Disk Packs are required and must be ordered separately ... see 2316.
- (3) Non-Standard Environment: #9485 ... must be specified if the 2312 is not to be installed as part of a 2314 DASF - A Series or attached to a 2319 Disk Storage Model A1/A2/A3. Also see "Prerequisites" above.

Special Features

See "Special Features" under 2314 DASF - A Series. Those features are available on this machine when it is ordered as part of a 2314 DASF - A Series ... they cannot be ordered when this machine is ordered for separate use.

2313 DISK STORAGE - Model A1

Purpose: Disk storage unit composed of four disk storage modules for a 2314 DASF - A Series, or attachment to the 2319 Disk Storage Model A1.

Highlights: See 2314 DASF - A Series.

Prerequisites: The 2313 Model A1 is designed for interconnected operation as part of a 2314 DASF-A Series or for attachment to the 2319 Disk Storage Model A1. Customers who wish to order a 2313 Model A1 for stand-alone or individual use should submit an RPQ to provide the necessary safety elements (covers, cable connectors, etc.) to complete the unit for a non-standard (i.e., not interconnected with a 2314 or 2319) environment. In lieu of the RPQ, the customer may provide safety elements equivalent to the standard 2314/2313 or 2319/2313 configuration or that provided by the above RPQ. If not provided, the unit will be offered on a purchase only basis.

Agreement for IBM to install and maintain the 2313 Model A1 in any non-standard environment must be reviewed with Management prior to making a commitment to the customer.

Bibliography: GA22-6822.

Specify

- (1) Refer to the "Specify" section under 2314 DASF - A Series for ordering instructions, codes, voltage, position designator, etc. required for this unit when part of a 2314 DASF-A Series. Refer to the 2319 Disk Storage Facility when this unit is to be attached to the 2319.
- (2) 2316 Disk Packs are required and must be ordered separately ... see 2316.
- (3) Non-Standard Environment: #9485 ... must be specified if the 2313 is not to be installed as part of a 2314 DASF - A Series or attached to a 2319 Disk Storage Model A1. Also see "Prerequisites" above.

Special Features

See "Special Features" under 2314 DASF - A Series. Those features are available on this machine when it is ordered as part of a 2314 DASF - A Series ... they cannot be ordered when this machine is ordered for separate use.

**2314 DIRECT ACCESS STORAGE FACILITY – A SERIES**

Purpose: Large capacity high speed direct access storage and control for a S/360 Model 30, 40, 50, 65, 67, 75, 85, or 195, or a S/370 Model 135 thru 195.

Configurations: The 2314 DASF - A Series is composed of a 2314 Storage Control Model A1 and various combinations of the following disk storage units, up to a maximum of eight active, plus one spare, disk storage modules.

2312 Disk Storage Model A1 One disk storage module

2313 Disk Storage Model A1 Four disk storage modules

2318 Disk Storage Model A1 Two disk storage modules

Each disk storage module provides up to 29.176 million bytes of storage, thus a 2314 DASF - A Series can provide from 29.176 to 233.408 million bytes of online storage.

Configuration Changes: Can be made in the field ... see "Specify" below for ordering instructions and configuration limitations.

Note: A 2314 DASF Model 1 cannot be converted in the field to a 2314 DASF - A Series. A 2314 DASF-A Series can be converted in the field to a 2314 DASF-B Series ... see 2314 Storage Control.

Highlights: The 2314 DASF - A Series provides an advanced method of utilizing disk storage. Average access time is 60 milliseconds with a minimum of 25 milliseconds and a maximum of 130 milliseconds. Self-formatting tracks allow variable length identifiers and records to be easily handled. Command Chaining—multiple records within a cylinder can be read/written by a sequence of channel commands without rotational delays between records—permits index and directory searches without processor intervention. The command structure is optimized to yield efficient random or sequential processing with either randomly or sequentially organized data files. The ability to protect "logical" files is provided by the combination of commands in the 2314 DASF and checks within the control programs servicing the file system. Cyclic code and bit count checking are used to assure the integrity of stored data. The controls necessary to attach the unit to a system channel are included in the 2314 DASF.

Cylinder Concept: One cylinder has 20 tracks ... up to 7,294 bytes on each track ... providing up to 145,880 bytes per cylinder, available under one setting of the access mechanism.

Data Rate: 312,000 bytes per second ... with packed decimal the rate is 624,000 digits per second.

Interchangeable 2316 Disk Packs: used on the disk storage modules ... provide flexibility and virtually unlimited offline storage in addition to high online capacity of up to 29.176 million bytes per pack.

Standard Features: Include the following: **File Scan:** For performing a comparison on selected bytes of file information.

Record Overflow: For greater utilization of storage by allowing a record to start in one track and end in another within the same cylinder.

Control Unit Isolation: Allows power to be turned on or off on the 2314 DASF without generating spurious signals that could affect operation of the CPU program.

Prerequisites: A control unit position on a system channel.

S/360 Model 30, 40, 50 Special feature, Selector Channel ... see 2030, 2040, 2050.

S/360 Model 65, 67, 75 A selector channel of 2860 ... see

2860.

S/360 Model 85, 195 or S/370 Model 165, 168, 195—a selector channel of 2860, or shared subchannel of 2880 ... see 2860, 2880.

S/370 Model 135 Selector Channel (special feature) ... see 3135.

S/370 Model 145 Selector Channel (standard) ... see 3145.

S/370 Model 155, 158 Block multiplexer channels. See 3155, 3158.

Each disk storage module requires a 2316 Disk Pack ... these must be ordered separately ... see 2316.

Limitations: The number of disk storage units that may be attached to a 2314 Model A1 is limited ... see item (3) under "Specify."

S/360 Model 30: The 2314 DASF - A Series requires a 1.5 microsecond 2030 and can be attached only to the first selector channel. Further, when it is attached, the second selector channel is restricted as to devices that may be attached ... see "Channel Control Capabilities" under 2030. When a 2841 Control Unit and a 2314 DASF are both attached to a 2030, both must be attached to the first selector channel. Because of the high data rate of the 2314 DASF and the cycle stealing concept of the selector channel, available program processing time is reduced during 2314 DASF operations. This is of particular concern when handling time dependent I/O devices, i.e., 1412, 1418, 1419, 1428. To determine the 2314 DASF loading effect, refer to "System/360 Model 30 Channel Characteristics and Functional Evaluations", GA24-3411. For full diagnostic support of 2314 A Series DASFs, a minimum of 16K core storage (2030 Model D) is required.

S/360 Model 40: The 2314 DASF may be attached to either the first or second selector channel. However, 2314 DASFs may not be attached to both selector channels.

Bibliography: GA22-6822.

Specify

DASF Components A 2314 DASF - A Series is composed of a 2314 Storage Control Model A1 and various combinations of 2312, 2313, and 2318 Disk Storage Model A1s to a maximum of eight active, plus one spare disk storage modules. Each 2312 Model A1 provides one module ... each 2313 Model A1 provides four modules ... each 2318 Model A1 provides two modules.

These units have been designed for interconnected operation as part of a 2314 DASF-A Series. Customers who wish to order them for stand-alone or individual use should submit an RPQ to provide the necessary safety elements (covers, cable connectors, etc.) to complete the unit for a non-standard (i.e., not interconnected as part of a 2314 DASF-A Series) environment. In lieu of the RPQ, the customer may provide safety elements equivalent to the standard 2314 DASF-A Series configuration or that provided by the above RPQ. If not provided, the unit will be offered on a purchase only basis.

Agreement for IBM to install and maintain the 2314 DASF components in any non-standard environment must be reviewed with Management prior to making a commitment to the customer.



Each 2314 DASF - A Series is to be specified on the order as follows:

- a) One 2314 Storage Control Model A1 with appropriate specify codes indicated for it below.
- b) One or more 2312 and/or 2313 and/or 2318 Disk Storage Model A1 units, as required to provide the amount of data storage desired by the customer. Appropriate specify codes are required on each disk storage unit as indicated below.

(1) Voltage (AC, 3-phase, 60 cycle): Specify the same code on the 2314 and each 2312, 2313 and 2318—#9903 for 208V, or #9905 for 230V.

(2) Color: For 2314 only—#9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.

(3) Position Designators: For cable definitions, a position designator code(s) must be specified for each disk storage unit, indicating its position relative to the 2314 Model A01, as indicated in the following diagram:

Possible Positions	#9495	#9494	#9493	#9492	#9491	2314 Model A01
2312	9495	9494	9493	9492	9491	
				9492 +	9491	
			9493 +	9492		
2313		9494 +	9493			
	9495 +	9494				
2318	9495	9494	9493	9492	9491	

Note: With each 2312 or 2318, specify one of the above codes ... with each 2313, specify two. A maximum of five position designator codes can be specified for a DASF.

(4) Drive Identifier Groups: Each disk storage module must have a group identifier code specified to identify the ready lens and module select plug (each DASF will receive a "Service" module select plug) ... #9111 for lens A and plug 0, #9112 for lens B and plug 1, #9113 for lens C and plug 2, #9114 for lens D and plug 3, #9115 for lens E and plug 4, #9116 for lens F and plug 5, #9117 for lens G and plug 6, #9118 for lens H and plug 7, #9119 for lens J and plug "S." Only one of each of the above codes can be specified for a DASF and these must be arranged in sequence starting with #9111 as shown in the following diagram:

Possible Drive Identifier Groups	Position Codes					2314 Model A01
	#9495	#9494	#9493	#9492	#9491	
	9115	9114	9113	9112	9111	
		9115	9114	9113	9112	
	9117	9116	9115	9114		
	9118	9117	9116			
	9119	9118				

With each 2312—specify one identifier group.
 With each 2313—specify four consecutive groups.
 With each 2318—specify two consecutive groups.

(5) End Cover: #9180 ... specify for the 2312, 2313 or 2318 which has the highest Position Designator code in the DASF.

Note: #91180 can be specified on only one of the disk storage units ... specify on initial DASF orders only.

(6) Power Cord - 60 Amp: #9580 ... specify for the 2314 Model A1 if seven or more disk storage modules are to be attached. A standard 30 amp cord is provided if six or less modules are to be attached. Field Installation: Yes. Note: Be alert to this 60 amp cord requirement when ordering additional disk modules.

(7) Additional Codes: See "Special Features" below for additional codes required on the 2312, 2313 and 2314 if a 2844 Auxiliary Storage Control is attached to the 2314 DASF.

(8) Field Configuration Changes: Various changes, involving installed units in a 2314 DASF - A Series, may require submission of an MES as follows:

(1) With any configuration change (increase or decrease) if the position of installed 2312, 2313, or 2318s is changed, their position designator codes must be changed by MES.

(2) Order new drive identifier group(s) and end cover only if required for the revised configuration.

(3) Refer to item (6) above for possible change in power cord requirements.

(9) 2316 Disk Packs: 2316s are required for the 2312s, 2313s and 2318s. They must be ordered separately ... see 2316.

Special Feature

The following features are available on the 2314 Model A1 when it is ordered as part of a 2314 DASF - A Series ... they cannot be ordered when the unit is ordered for separate use.

Remote Switch Attachment (#6148): To attach the Two Channel Switch (#8170) to a 2167 Configuration Unit in a S/360 Model 67-2 or to a S/360 Model 65 MP which has the Configuration Control Panel (#1505) installed.

2844 Attachment (#7949): To attach a 2844 Auxiliary Storage Control. This feature should be ordered only when a 2844 is to be installed ... installation of the feature without concurrent installation of the 2844 will render the 2314 DASF inoperative. **Maximum One.**

Prerequisites

(1) The 2314 DASF must have a full configuration of eight active and one spare modules composed of two 2313 Model A1s and one 2312 Model A1 ... the 2312 must be located next to the 2314 Model A1.

(2) 2844 Attachment (#9750) must be specified for each 2313 Model A1 and the 2312 Model A1 ... #9750 can be field installed on these units.

(3) If the 2844 has a Two Channel Switch (#8171), a 2844 Two Channel Switch (#9765) must be specified for the 2314 Model A1 ... #9765 can be field installed.

(4) If the 2844 has a Remote Switch Attachment (#6150), a 2844 Remote Switch Attachment (#9510) must be specified for the 2314 Model A1 ... #9510 can be field installed.

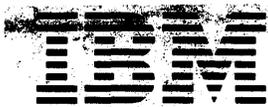
(5) If the 2844 to be used with this 2314 DASF was previously installed with a 2314 DASF Model 1, order #9775 (2314-A Series Compatibility) by MES for the 2844.

Two Channel Switch (#8170): To attach the 2314 DASF - A Series to a second channel ... switching is under program control ... includes partitioning.

Prerequisite: If the Two Channel Switch is routed through the Configuration Control Panel (#1505) of a multiprocessing S/360 Model 65 system, Remote Switch Attachment (#6148) is re-



quired. #6148 is required in a S/360 Model 67-2 ... see #6148 above.



2314 DIRECT ACCESS STORAGE FACILITY - B SERIES

Purpose: Large capacity high speed direct access storage and control for a S/360 Model 30, 40, 50, 65, 67, 75, 85, 91, 195, or S/370 Model 135 thru 195.

Configurations: The 2314 DASF-B Series is composed of a 2314 Storage Control Model B1 and combinations of the 2319 Disk Storage Models B1 and B2 ... providing three, six or nine (eight active plus one spare) disk storage modules. Each disk storage module provides up to 29 million bytes ... 87 million bytes per 2319. Thus a 2314 DASF-B Series can provide 87, 175 or 233 million bytes of online storage.

Configuration Changes: Can be made in the field ... see "Specify" below for ordering instructions and configuration limitations.

Note: A 2314 DASF Model 1 cannot be converted to a 2314 DASF-A or B Series. A 2314 DASF-A Series can be converted in the field to a 2314 DASF-B Series... see 2314 Storage Control.

Highlights: The 2314 DASF-B Series provides an advanced method of utilizing disk storage. Average access time is 60 milliseconds with a minimum of 25 milliseconds and a maximum of 130 milliseconds. Self-formatting tracks allow variable length identifiers and records to be easily handled. Command Chaining—multiple records within a cylinder can be read/written by a sequence of channel commands without rotational delays between records ... permits index and directory searches without processor intervention. The command structure is optimized to yield efficient random or sequential processing with either randomly or sequentially organized data files. The ability to protect "logical" files is provided by the combination of commands in the 2314 DASF and checks within control programs servicing the file system. Cyclic code and bit count checking are used to assure the integrity of stored data. The controls necessary to attach the unit to a system channel are included in the 2314 DASF.

Cylinder Concept One cylinder has 20 tracks ... up to 7,294 bytes on each track ... providing up to 145,880 bytes per cylinder, available under one setting of the access mechanism.

Data Rate 312,000 bytes per second ... with packed decimal the rate is 624,000 digits per second.

Interchangeable 2316 Disk Packs Used on the disk storage modules ... provide flexibility and virtually unlimited offline storage in addition to high online capacity of up to 29.176 million bytes per pack.

Standard Features include the following: **File Scan**—for performing a comparison on selected bytes of file information. **Record Overflow**—for greater utilization of storage by allowing a record to start in one track and end in another within the same cylinder. **Control Unit Isolation**—allows power to be turned on or off on the 2314 without generating spurious signals that could affect operation of the CPU program.

Prerequisites: A control unit position on a system channel.

S/360 Model 30, 40, 50—special feature, Selector Channel ... see 2030, 2040, 2050.

S/360 Model 65, 67, 75—a selector channel of 2860 ... see 2860.

S/360 Model 85, 195 or S/370 Model 165, 168, 195—a selector channel of 2860, or a shared subchannel of 2880 ... see 2860, 2880.

S/370 Model 135—Selector Channel (special feature) ... see 3135.

S/370 Model 145—Selector Channel ... see 3145.

S/370 Model 155, 158—block multiplexer channels ... see 3155, 3158.

Each disk storage module requires a 2316 Disk Pack. These must be ordered separately ... see 2316.

Limitations: The number of disk storage units (i.e., 2319s) that may be attached to a 2314 Model B1 is limited ... see item (3) under "Specify."

The 2314 DASF-B Series cannot be attached to a 2844 Auxiliary Storage Control.

S/360 Model 30 The 2314 DASF-B Series requires a 1.5 micro-second 2030 and can be attached only to the first selector channel. Further, when it is attached, the second selector channel is restricted as to devices that may be attached ... see "Channel Control Capabilities" under 2030. When a 2841 Control Unit and a 2314 DASF are both attached to a 2030, both must be attached to the first selector channel. Because of the high data rate of the 2314 and the cycle stealing concept of the selector channel, available program processing time is reduced during DASF operations. This is of particular concern when handling time dependent I/O devices, i.e., 1412, 1418, 1419, 1428. To determine the 2314 DASF loading effect, refer to "S/360 Model 30 Channel Characteristics and Functional Evaluations", A24-3411. For full diagnostic support of 2314 DASF Bs, a minimum of 16K core storage (2030 Model D) is required.

S/360 Model 40—the 2314 DASF may be attached to either the first or second selector channel. However, 2314 DASFs may not be attached to both selector channels.

Bibliography: GA22-6822.

Specify

DASF Components—a 2314 DASF-B Series is composed of a 2314 storage Control Model B1, one 2319 Disk Storage Model B1 and optionally, one or two 2319 Disk Storage Model B2s up to a maximum of eight active, plus one spare, disk storage modules. Each 2319 Model B1 or B2 provides three modules.

These units have been designed for interconnected operation as part of a 2314 DASF-B Series. Customers who wish to order them for stand-alone or individual use should submit an RPQ to provide the necessary safety elements (covers, cable connectors, etc.) to complete the unit for a non-standard (i.e., not interconnected as part of a 2314 DASF-B Series) environment. In lieu of the RPQ, the customer may provide safety elements equivalent to the standard 2314 DASF-B Series configuration or that provided by the above RPQ. If not provided, the unit will be offered on a purchase only basis.

Agreement for IBM to install and maintain the 2314 DASF components in any non-standard environment must be reviewed with Area Management prior to making a commitment to the customer.

- a) One 2314 Storage Control Model B1 with appropriate specify codes indicated for it below ... also see "Special Features."



b) One 2319 Disk Storage Model B1 plus one or two 2319 Disk Storage Model B2s as required to provide the amount of data storage as required by the customer. Appropriate specify codes are required on the disk storage units as indicated below.

(1) Voltage (AC, 3-phase, 60 cycle): Specify the same code on the 2314 and each 2319 ... #9903 for 208V, or #9905 for 230V.

(2) Position Designators: For cable definitions, drive identifiers, and module select plugs, a position designation code must be specified for each 2319 Model B2 indicating its position relative to the 2319 Model B1. The 2319 Model B1 will be the first device attached to the 2314 Model B1 and be shipped with Drive Identifiers A, B and C, and Module Select Plugs 0, 1 and 2, plus a Service Module Select Plug. The first 2319 Model B2 will be shipped with Drive Identifiers D, E and F, and Module Select Plugs 3, 4 and 5. The second 2319 Model B2 will be shipped with Drive Identifiers G, H and J and Module Select Plugs 6, 7 and S.

On the first 2319 Model B2 specify #9181.

On the second 2319 Model B2 specify #9182.

(3) Power Cord - 60 Amp: #9580 ... specify for the 2314 Model B1 if three 2319s are to be attached; otherwise, a standard 30 amp cord is provided. #9580 can be field installed.

Note: Be alert to this 60 amp cord attachment requirement when ordering the second 2319 Model B2.

(4) Color: For 2314 only ... #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.

(5) 2316 Disk Packs: 2316s are required for the 2319s. They must be ordered separately ... see 2316.

Special Features

The following features are available on the 2314 Model B1 when it is ordered as part of a 2314 DASF-B Series ... they cannot be ordered when the unit is ordered for separate use.

Remote Switch Attachment (#6148): To attach Two Channel Switch (#8170) to a 2167 Configuration Unit in a S/360 Model 67-2 or to a S/360 Model 65 MP which has the Configuration Control Panel (#1505) installed.

Two Channel Switch (#8170): To attach the 2314 DASF-B Series to a second channel ... switching is under program control ... includes partitioning.

Prerequisite: If the Two Channel Switch is routed through the Configuration Control Panel (#1505) of a multiprocessing S/360 Model 65 system, Remote Switch Attachment (#6148) is required. Also in a S/360 Model 67-2, Remote Switch Attachment (#6148) is required ... see #6148 above.



2315 DISK CARTRIDGE

Purpose: High-speed removable disk storage unit for a drive in an 1810 or 2310 Disk Storage, the drive in an 1131 Central Processing Unit (Model 2, 3), or the standard single disk storage drive or Second Single Disk Storage Drive (#6415) of a 2044 Processing Unit.

2316 DISK PACK

Purpose: High-speed, removable, interchangeable disk storage unit for the 2314 DASD, the 2319 Disk Storage, or the 5445 Disk Storage Drive.

**2314 STORAGE CONTROL**

Purpose: Control unit for a 2314 DASF-A Series or 2314 DASF-B Series.

Model A1 Controls up to a maximum of eight active and one spare disk storage modules (various combinations of 2312 Model A1s, 2313 Model A1s, 2318 Model A1s) in a 2314 DASF - A Series

Model B1 Controls three, six or nine (eight active and one spare) disk storage modules (one 2319 Model B1 and up to two 2319 Model B2s) in a 2314 DASF-B Series.

Highlights: See 2314 DASF-A Series or 2314 DASF-B Series.

Prerequisites: The 2314 Model A1 and 2314 Model B1 are designed respectively for interconnected operation as part of a 2314 DASF-A Series or 2314 DASF-B Series. Customers who wish to order a 2314 for stand-alone or individual use should submit an RPQ to provide the necessary safety elements (covers, cable connectors, etc.) to complete the unit for a non-standard (i.e., not interconnected as part of a 2314 DASF-A or 2314 DASF-B Series) environment. In lieu of the RPQ, the customer may provide safety elements equivalent to the standard 2314 DASF configuration or that provided by the above RPQ. If not provided, the unit will be offered on a purchase only basis.

Agreement for IBM to install and maintain the 2314 Model A1 or B1 in any non-standard environment must be reviewed with CE Management prior to making a commitment to the customer.

Bibliography: GA22-6822.

Metering: Assignable Unit (2844 metered by A1)

Specify

- (1) Refer to the "Specify" section under DASF-A Series or 2314 DASF-B Series for ordering instructions and codes required for this unit when part of a 2314 DASF-A Series or 2314 DASF-B Series.
- (2) Non-Standard Environment: #9485 ... must be specified if the 2314 is not to be installed as part of a 2314 DASF-A Series or 2314 DASF-B Series. Also see "Prerequisites" above.

Note: Refer to "Specify" under 2314 DASF-A Series or 2314 DASF-B Series for codes to indicate desired Voltage (1) and Color (2) or (4).

Special Features

See "Special Features" under 2314 DASF-A Series or 2314 DASF-B Series. Those features are available on this machine when it is ordered as part of a 2314 DASF-A Series or 2314 DASF-B Series ... they cannot be ordered when this machine is ordered for separate use.

2318 DISK STORAGE - Model A1

Purpose: Disk storage unit composed of two disk storage modules for a 2314 DASF-A Series, or attachment to the 2319 Disk Storage Model A1/A2/A3.

Highlights: See 2314 DASF - A Series.

Prerequisites: The 2318 Model A1 is designed for interconnected operation as part of a 2314 DASF-A Series or attachment to the 2319 Disk Storage Model A1/A2/A3. Customers who wish to order a 2318 Model A1 for stand-alone or individual use should submit an RPQ to provide the necessary safety elements (covers, cable connectors, etc.) to complete the unit for a non-standard (i.e., not interconnected with a 2314 DASF-A Series or 2319) environment. In lieu of the RPQ, the customer may provide safety elements equivalent to the standard 2314/2318 or 2319/2318 configuration or that provided by the above RPQ. If not provided, the unit will be offered on a purchase only basis.

Agreement for IBM to install and maintain the 2318 Model A1 in any non-standard environment must be reviewed with Management prior to making a commitment to the customer.

Bibliography: GA22-6822.

Specify

- (1) Refer to the "Specify" section under the 2314 DASF-A Series for ordering instructions, codes, voltage, position designator, etc. required for this unit when part of a 2314 DASF-A Series. Refer to the 2319 Disk Storage when this unit is to be attached to the 2319. Refer to the 2319 Disk Storage when this unit is to be attached to the 2319.
- (2) 2316 Disk Packs are required and must be ordered separately ... see 2316.
- (3) Non-Standard Environment: #9485 ... must be specified if the 2318 is not to be installed as part of a 2314 DASF-A Series or attached to a 2319 Disk Storage Model A1/A2/A3. Also see "Prerequisites" above.

Special Features

See "Special Features" under 2314 DASF - A Series. Those features are available on this machine when it is ordered as a part of a 2314 DASF - A Series ... they cannot be ordered when this machine is ordered for separate use.



2401 MAGNETIC TAPE UNIT

Purpose: Magnetic tape unit for a S/360 Model 20 (submodel 5) or an 1800 system.

Models: Operate at the following 8-bit bytes/second data rates:

- Model 1 - 30,000 at 800 bpi
- Model 2 - 60,000 at 800 bpi
- Model 3 - 90,000 at 800 bpi
- Model 4 - 60,000 at 1600 bpi

Model Changes: Mdl 2 can be field changed to Model 3 ... Model 5 to Model 6 ... no other changes are possible.

System: S/360 Model 20 (submodel 5)—only models 1, 2 and 4 attached via Native Tape Attachment (#5301, or #5302) on the 2020.

1800 Only models 1, 2 and 3 can be attached.

Highlights: Single tape unit which reads or writes the following half-inch magnetic tapes: IBM Heavy Duty, IBM Dynexcel, IBM Series 500, or competitive formulations which meet the specifications described in SRL GA32-0006. IBM Mylar* is suitable for use at 200, 556 or 800 bpi, but it should not be used at 1600 bpi.

On models 1, 2 and 3, a 9-Track Read/Write Head (#9558) or a 7-Track Read/Write Head (#9557) may be specified. See "Specify" below. On models 4, 5 and 6, use of Dual Density 800-1600 BPI (#3471) permits operation at 800 bpi density as well as at 1600 bpi. See "Special Features" below.

Nine Track Operation In 9-track format, data is recorded parallel by bit, serial by byte, in 9 tracks across the width of the tape ... tape data format uses eight of the nine bits for data, the ninth bit serving as a parity bit. The eight data bits can represent an alphanumeric or special character, two digits, a signed digit, or eight binary bits. For this operation on a Model 1, 2 or 3, #9558 is required ... see "Specify" below.

Seven Track Operation On models 1, 2, 3 only ... tape is written in 7-track format compatible with tape written by 727/729/7330/7335/7701/7702/7765 tape units and by 2401/2415s (or 2402s), or 3420s equipped with 7-Track Read/Write Heads. For this operation, #9557 is required. See "Specify." Seven Track Compatibility (#7125, 7126, 7127) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135, 7136) is also required on the 2803/2804 (or 2403/2404) tape control unit, except on 2803/2804 Model 3s. See "Special Features" under those units.

Checking Read-back-check-while-write on all models ... vertical parity recording on models 4 and 6 ... vertical, longitudinal and diagonal parity recording on models 1, 2, and 3.

Error Correction Automatic in-flight single track error correction is provided for 1600 bpi 9-track format ... automatic single track error correction for 800 bpi 9-track format during the reread of a record containing one or more errors confined to a single track ... all other errors are detected and conventional error recovery routines apply.

Read Backwards All tapes (9 or 7-track) written on a 2401/2402/2403/2404/2415/2420 (9-track 1600 BPI PE only)/3420 can be read by any 2401/2402/2403/2404/2415/2420 (9-track 1600 BPI PE only)/3420 in a forward or backward direction ... Data Conver-

*"Mylar" is a trademark of E.I. Dupont de Nemours & Co., Inc. "IBM Mylar" is a brand of magnetic tape which includes a Mylar polyester substrate and which was previously marketed by IBM.

sion (#3228, 3236) cannot be used on the tape control unit when reading 7-track tape backwards ... tapes written by 727/729/7330/7335/7701/7702/7765s cannot be read backward.

Power Window On machines shipped after April 1, 1966, a powered access window, raised or lowered under push-button control and always lowered upon completion of the program-initiated rewind unload command, is standard ... for units shipped prior to April 1, 1966, see Power Window (#5519) under "Special Features."

Quick Release Latch Facilitates mounting and removal of tape reels.

Characteristics

800 BPI	Model 1	Model 2	Model 3
Bytes/second	30,000	60,000	90,000
Density (bytes/inch)	800	800	800
Tape Speed (inches/second)	37.5	75.0	112.5
Nominal Interrecord Gap	.6	.6	.6
Nominal IRG Time (milliseconds)	16.0	8.0	5.3
Rewind Time, incldg reload (minutes)	3.0	1.4	1.0
Rewind and Unload (minutes)	2.2	1.5	1.1

1600 BPI	Model 4
Bytes/second	60,000
Density (bytes/inch)	1,600
Tape Speed (inches/second)	37.5
Nominal Interrecord Gap (inches)	.6
Nominal IRG Time (milliseconds)	16.0
Rewind Time, incldg reload (minutes)	3.0
Rewind and Unload (minutes)	2.2

Prerequisites: 2401 Models 1, 2, 3—an 1802 Processor-Controller ... one Data Channel (standard or #3222) is required on the 1802 for one or two 2401 Models 1, 2 or 3 (or one 2402 Model 1, 2 or 3). See 1802.

Maximums

S/360 Any combination of 2401 Models 1, 2 and 4 which does not exceed six tape drives can be attached to a Native Tape Attachment (#5301, #5302) on a 2020 submodel 5.

1800 Two 2401s, Models 1, 2 and 3 in any combination, (or one 2402 Model 1, 2 or 3) can be attached to an 1802.

Bibliography: S/360, S/370—GA22-6822, 1800—GA26-5921.

Metering: I/O Unit (Online)

Specify

- (1) Voltage (AC, 3-phase, 4-wire, 60 cycle): #9903 for 208 V, or #9905 for 230 V.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- (3) Read/Write Head: (For Model 1, 2 or 3 only (800 bpi NRZI)) #9557 for 7-track, or #9558 for 9-track.

Prerequisite: For #9557, Seven Track Compatibility or Seven and Nine track Compatibility feature on the tape control ... see "Special Features" under 1802, (2403/2404), or 2803/2804.

Note: #9557 can be changed in the field to #9558, or vice versa, at no charge to the rental customer. On purchase machines, the changes can be made on an RPQ basis



when ordering specify #9557 or #9558, machine type and model.

- (4) Tape Reels: If any color other than gray is desired, specify #9051 for red, #9053 for blue, or #9054 for white.
- (5) Use with Native Tape Attachment #5302 on a 2020 submodel 5: Mode Compatibility (#5121) is required on each 2401 Model 1, 2 or 3 ... see "Special Features" below.

Special Features

Dual Density 800 - 1600 BPI (#3471): (2401 Model 4, 5, 6 only) Permits these drives to operate at 800 bpi in addition to 1600 bpi.

Prerequisite: Nine Track (800 BPI NRZI) Compatibility (#5320, 5321) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135, 7136) on the 2403 Model 4, 5 or 6 controlling the 2401.

Mode Compatibility (#5121): (2401 Model 1, 2, 3 only) Required to attach these units to Native Tape Attachment (#5302) on a 2020 submodel 5.

Power Window (#5519): (For field installation on units shipped before April 1, 1966) All units shipped after April 1, 1966 are equipped with a power window as a standard feature. This feature may be ordered for field installation on units installed without the feature.

Specify

Serial number of 2401.

Simultaneous Read-while-Write (#7160): Limitation: When equipped with this feature, 2401s will not operate with the Native Tape Attachment (#5301, 5302) on the S/360 Model 20.

**2402 MAGNETIC TAPE UNIT**

Note: These units have been withdrawn and new orders cannot be accepted ... the special features listed below are available for field installation.

2402 two independently operating drives in a single unit.

Models Models of all units denote the tape data rate in 8-bit bytes/second ... 2404s were available only in models 1, 2 and 3.

Model 1 30,000 at 800 bpi
Model 2 60,000 at 800 bpi
Model 3 90,000 at 800 bpi

Model Changes: 2402 a model 2 can be field converted to a model 3.

Metering: 2402 I/O Unit (Online)

Limitations: In 1800 only a 2402 model 1, 2 or 3 can be used.

Highlights: See "Highlights" under 2401.

Prerequisites: See "Prerequisites" under 2401.

Maximums: See "Maximums" under 2401.

Specify

- (1) Voltage (AC, 3-phase, 4-wire, 60 cycle): #9903 for 208 V, or #9905 for 230 V.
- (2) Read/Write Heads: (For Model 1s, 2s or 3s only (800 bpi NRZI)) #9557 for 7-track, or #9558 for 9-track.

Prerequisite: For #9557, Seven Track Compatibility or Seven and Nine Track Compatibility feature on the tape control ... see "Special Features" below or under 1802.

Note: #9557 can be changed in the field to #9558, or vice versa for the rental customer. On purchased machines, the changes can be made on an RPQ basis ... when ordering specify #9557 or #9558, machine type and model.

- (3) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- (4) Tape Reels: If any color other than gray is desired, specify #9051 for red, #9053 for blue, or #9054 for white.

Special Features

Note: The following features are available for field installation.

Data Conversion (#3228, 3236): Program controlled feature for processing data with maximum packing efficiency. On a write operation, three 8-bit bytes are written as four 6-bit tape characters ... on a read operation, four 6-bit tape characters are converted to three 8-bit bytes. #3228—on 2403 ... #3236—on 2404. **Limitation:** Cannot be used when reading 7-track tapes backward. **Prerequisite:** Seven Track Compatibility (#7125, 7126, 7127) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135).

Power Window (#5519): (Only for field installation on units shipped prior to April 1, 1966 ... power window(s) are standard on units shipped after that) If ordered, two #5519s are required for each 2402.

Specify

Machine type and serial number.

Seven Track Compatibility (#7125 - 7127): Required if any 2401 or 2402 Model 1, 2 or 3 attached to the 2403 or 2404 has a 7-Track Read/Write Head (#9557). Permits such drives to read or write in 7-track format compatible with tape generated by 727/729/7330/7335/7701/7702/7765 tape units and other 2401/2402/2403/2404 or 2415 tape drives equipped with 7-Track Heads.

#7125 for 2403 Model 1, 2 or 3.

#7126 for 2404 Model 1, 2 or 3.

#7127 for 2403 Model 4, 5 or 6.

Limitation: Cannot be installed with Nine Track (800 BPI NRZI) Compatibility (#5320) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135) on a 2403 Model 4, 5 or 6.

Specify

The number of tape drives associated with this feature that will be equipped with 7-Track Read/Write Heads (#9557).

Seven and Nine Track (800 BPI NRZI) Compatibility (#7135): (2403 Model 4, 5 or 6 only) Satisfies the requirements of both the Seven Track Compatibility (#7127) and Nine Track (800 BPI NRZI) Compatibility (#5320) features ... permits reading and writing of both 7-track and 9-track 800 bpi NRZI tapes on suitably equipped tape drives attached to the 2403 Model 4, 5 or 6. **Limitation:** Cannot be installed with Nine Track (800 BPI NRZI) Compatibility (#5320) or Seven Track Compatibility (#7127).

Specify

The number of tape drives associated with this feature that will be equipped with 7-Track Read/Write Heads (#9557). **Prerequisites:** 7-Track Read/Write Head(s) on 2401/2402 Models 1, 2 or 3 attached to this 2403 and/or Dual Density (#3471, 3472) on the 2403 or attached 2402(s).

Simultaneous Read-while-Write (#7161): (2402 Model 1, 2, 3, 4, 5, 6 only) Required on any 2402 attached to a two-channel, simultaneous read-while-write tape control ... 2402 Models 1, 2 or 3 require this feature when attached to a 2404 Model 1, 2 or 3 or a 2804 Model 1 or 2 ... 2402 Models 4, 5 or 6 require it when attached to a 2804 Model 2. **Limitation:** When equipped with this feature, 2402s will not operate with a 2403 or 2803 control unit.

Sixteen Drive Addressing (#7185): (2403 Model 1, 2, 3, 4, 5, 6 only) Required where the pool of drives attached through 2816 Switching Units exceeds eight ... permits the 2403 to address up to sixteen tape drives ... see 2816.



2415 MAGNETIC TAPE UNIT AND CONTROL

Purpose: Magnetic tape unit and control for a S/360 Model 20

Models: Each model has one single-channel tape control and multiple independently operating tape drives.

15,000 bytes/second 30,000 bytes/second*

Model 1 - 2 drives Model 4 - 2 drives
 Model 2 - 4 drives - 800 bpi Model 5 - 4 drives 1600 bpi
 Model 3 - 6 drives Model 6 - 6 drives

*When equipped with an appropriate compatibility feature, drives on these models can operate at 15,000 bytes/second (800 bpi) ... see "Special Features."

Model Changes: A model 1, 2 or 3 can be field converted to another model within that group ... a model 4, 5 or 6 to another model within that group ... no other changes are possible. See item (1) under "Specify."

Highlights: Tape drives read and write the following half-inch magnetic tapes: IBM Heavy Duty, IBM Dynexcel, IBM Series 500, or competitive formulations which meet the specifications described in SRL GA32-0006. IBM Mylar* is suitable for use at 200, 556 or 800 bpi, but should not be used at 1600 bpi.

The standard drives read or write 9-track tapes. Special features permit reading and writing of 7-track tapes ... see "Special Features."

Nine Track Operation In 9-track format, data is recorded parallel by bit, serial by byte, in 9 tracks across the width of the tape ... tape data format uses 8 of the 9 bits for data, the 9th bit serving as a parity bit. The 8 data bits can represent an alphanumeric or special character, two digits, a signed digit, or eight binary bits.

Seven Track Operation Tape is written in 7-track format compatible with tape written by 727/729/7330/7335/7701/7702/7765 tape units and by 2401/2415 (or 2402/2403/2404) and 3420s equipped with 7-Track Read/Write Heads. For this operation, a compatibility feature #7125, #7127 or #7135 is required ... see "Special Features."

Checking Read-back-check-while-write on all drives ... vertical parity recording on 1600 bpi drives ... vertical, longitudinal and diagonal parity recording on 800 bpi drives.

Error Correction Automatic in-flight single track error correction is provided for 1600 bpi 9-track format ... all other errors are detected and conventional error recovery routines apply. The cyclic redundancy check character is recorded on 800 bpi 9-track format to maintain 2400 series compatibility ... drives are not capable of error correction during read operations ... all errors are detected and conventional error recovery routines apply.

Read Backward All tapes (9 or 7-track) written on a 2401/2402/2403/2404/2415/2420 (9-track 1600 BPI PE only)/3420 can be read by any 2401/2402/2403/2404/2415/2420 (9-track 1600 BPI PE only)/3420 in a forward or backward direction ... Data Conversion (#3228) cannot be used when reading 7-track tape backwards ... tapes written by 727/729/7330/ 7335/7701/7702/7765s cannot be read backwards.

Quick Release Latches: Each drive has quick release latches to facilitate mounting and removing of tape reels.

*"Mylar" is a trademark of E.I. Dupont de Nemours & Co., Inc. "IBM Mylar" is a brand of magnetic tape which includes a Mylar polyester substrate and which was previously marketed by IBM.

Characteristics:

	Model 1,2,3	Model 4,5,6
Bytes/second	15,000	30,000/15,000
Density (bytes/inch)	800	1600/800
Tape Speed (inches/second)	18.75	18.75
Nominal Interrecord Gap (inches)	.6	.6
Nominal IRG Time (milliseconds)	32.00	32.00
Rewind Time, incldg reload (minutes)	4.0	4.0
Rewind and Unload (minutes)	4.0	4.0

Prerequisites: For S/360 Model 20—Input/Output Channel (#4658) on the 2020 Processing Unit ... see 2020.

Bibliography: S/360 Model 20—GA26-3565.

Metering: Assignable Unit

Specify

(1) All 2415 models are to be ordered as follows:

2415 Model	Specify
1	One 2415 Model 001
2	One 2415 Model 002 and one 2416 Model 001
3	One 2415 Model 003 and two 2416 Model 001s
4	One 2415 Model 004
5	One 2415 Model 005 and one 2416 Model 004
6	One 2415 Model 006 and two 2416 Model 004s

Notes: The 2416 type number is to be specified at no charge and is to be used only for internal IBM ordering and control purposes. List each 2415 and 2416 separately with all its associated features.

(2) Voltage 3-phase, 4-wire, 60 cycle): For 2415 only—208V, or #9905 for 230V.

(3) Read/Write Heads: A 9-track head is furnished as standard for each of the two drives in each 2415 and 2416, unless Seven Track Compatibility (#7125, 7127) or Seven and Nine Track Compatibility (#7135) is ordered for the 2415 and 7-track Read/Write Heads are specified as indicated under those features ... see "Special Features."

(4) Color: For 2415 and each 2416 listed in (1) above, specify one of the following—#9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray ... the same color must be specified for all units comprising the 2415.

(5) Empty Tape Reels: If other than standard gray reels are desired, for 2415 and each 2416 listed in (1) above, specify two of the following in any combination—#9051 for red, #9053 for blue, or #9054 for white.

(6) Isolation, Control Unit: May be required on units shipped prior to December 29, 1967 ... see "Special Features."

(7) If the 2415 is to be used as an emulating unit in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under 2020.



Special Features

Data Conversion (#3228): Program-controlled feature for processing data with maximum packing efficiency. On a write operation, three 8-bit bytes are written as four 6-bit tape characters ... on a read operation, four 6-bit tape characters are converted to three 8-bit bytes. Limitation: Cannot be used when reading 7-track tapes backward. Note: Specify on 2415 only.

Prerequisite: Seven Track Compatibility (#7125 or 7127) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135).

Isolation, Control Unit (#4701, 4703): (For field installation on units shipped prior to December 29, 1967 ... standard on units shipped after that) To turn power on or off on the 2415 without generating spurious signals. Thus, a CPU program, if it can be logically disconnected from the system before power is turned off, can continue operating.

#4701—for a 2415 Model 1, 2 or 3 ... #4703—for a 2415 Model 4, 5 or 6. Note: Specify on 2415 only.

Nine Track (800 BPI NRZI) Compatibility (#5320): (Models 4, 5, 6 only) Required if any of the 2415 (or 2416) drives is to read or write 800 bpi 9-track NRZI in addition to 1600 bpi. Limitation: Cannot be installed with Seven Track Compatibility (#7127) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135). Note: Specify on 2415 only.

Seven Track Compatibility (#7125, 7127): Required if any of the 2415 (or 2416) drives is to read or write 7-track tape. Note: Each 2415 and 2416 has two drives. Permits them to read or write tape in 7-track format compatible with tape generated by 727/729/7330/7335/7701/7702/7765 tape drives and by 2401/2402/2403/2404/2415/3420 tape drives with 7-track Read/Write Heads. #7125—for Model 1, 2 or 3 ... #7127—for Model 4, 5 or 6. Limitation: Cannot be installed with Nine Track (800 BPI NRZI) Compatibility (#5320) or Seven and Nine Track (800 BPI NRZI) Compatibility (#7135).

Specify

Depending on 2415 model, #7125 or #7127 for 2415 only ... do not specify on 2416(s) since only the unit containing control circuits is affected. Either or both drives in the 2415 and/or any 2416 may be equipped with a 7-track Read/Write Head ... from the following table, order only for the specific position(s) on each unit which is to read/write 7-track tape:

Type	Model	7-track Read/Write Heads	
		Left Drive (A)	Right Drive (B)
2415	1 or 4	#9680	#9681
2415	2 or 5	9680	9681
2416	1 or 4	9682	9683
2415	3 or 6	9680	9681
2416	1 or 4 (first)	9682	9683
2416	1 or 4 (second)	9684	9685

Note: For any drive where a 7-track head is not specified, a 9-track head will be furnished.

7-track heads 9-track heads

2415 Model 2	9680 (left drive)	Standard on right drive
2416 Model 1	9683 (right drive)	Standard on left drive

It is desired to switch 7- and 9-track heads on the 2415 and also on the 2416.

- On 2415—Remove 9680 and install 9681
- On 2416—Remove 9683 and install 9682

Removal of 9680 and 9683 in effect causes these drive positions to revert to standard 9-track heads and installation of 9681 and 9682 changes these other positions to 7-track heads. Parts (and instructions) supplied with the MES will enable all drives to function in the desired manner when installed.

Seven and Nine Track (800 BPI NRZI) Compatibility (#7135): (Models 4, 5, 6 only) Satisfies the requirements of both Nine Track (800 BPI NRZI) Compatibility (#5320) and Seven Track Compatibility (#7127). Permits reading and writing of both 7- and 9-track 800 bpi NRZI tape. Limitation: Cannot be installed with #5320 or #7127. For purchased machines, RPOs are available to convert #5320 or #7127 to #7135.

Specify

#7135 for 2415 only ... do not specify on 2416(s) since only the unit containing control circuits is affected. Either or both drives in the 2415 and/or any 2416 may be equipped with a 7-track read/write head ... from the following table, order only for the specific position(s) on each unit which is to read/write 7-track tape:

Type	Model	7-track Read/Write Heads	
		Left Drive(A)	Right Drive (B)
2415	4	#9680	#9681
2415	5	9680	9681
2416	4	9682	9683
2415	6	9680	9681
2416	4 (first)	9682	9683
2416	4 (second)	9684	9685

Note: For any drive where a 7-track head is not specified, a 9-track head will be furnished.



2501 CARD READER

Purpose: Punched card input unit for a S/360 Model 20 through 85 and 195, a S/370 Model 115 thru 195, an 1130 Computing System, or a System/3 Model 15.

Mdl Rated 80-col Card Speed For Use With

A1	600/minute	S/360 Model 20, 1130
A2	1,000/minute	submodel 1, 2 or 3, S/3 Model 15

Model Changes: Can be made only between Models A1 and A2.

Highlights: The system's processing unit performs all format control and analysis. The unit provides high-speed, low-cost card input. Cards are read serially by a light-sensing mechanism which is checked for proper functioning in every card cycle. The Extended BCD Interchange Code (256 codes) can be read ... invalid codes, off-punching and mispositioned cards are detected ... when used with an 1130, all codes are considered valid.

Binary Codes When attached to a 2020 Processing Unit submodel 2, 5 or 6, or an 1130 Central Processing Unit, or a 5415 Processing Unit, a Model A1 or A2 can read binary codes.

All models have a 1,200-card capacity hopper and a 1,300-card capacity stacker.

Maximum: 1130—one 2501 Model A1 or A2 can be attached to any 1131 model except 1A, 1B, 4A or 4B ... see 1130 in "Systems" for allowable I/O unit configurations.

System/3 Model 15 One 2501 Model A1 or A2 can be attached ... see System/3 Model 15 in "Systems" for allowable I/O unit configurations.

S/360 Model 20 One 2501 Model A1 or A2 can be attached ... see S/360 Model 20 in "Systems" for allowable I/O unit configurations.

Prerequisites: 1130—a 2501 Attachment (#8042) on the 1131 ... in addition, a 2501 Coupling (#3630) is required on the 2501. See "Special Features" below.

Note: A 2501 cannot be installed with an 1131 Model 1A or 1B ... in addition, the 1130 system must have 208V or 230V power. See "Voltage" under "Specify" for the 1131.

System/3 Model 15 A 2501 Attachment (#8090) on the 5415 ... 2501 Coupling (#3630) on the 2501. In addition, a 5424 MFCU or a 2560 MFCM or a 1442 Model 6 or 7 is required on the System/3 Model 15, except when Channel Terminator Feature #1601 is installed.

Note: When a 2501 is retained from a S/360 Model 20 to be attached to a 5415 Processing Unit, new cables must be ordered.

S/360 Model 20 A 2020 submodel 1, 2, 5 or 6 with a 2501 Attachment (#8090) ... if the installed 2020 has a serial no. under 20000, a Cable Adapter (#9099) is required on the 2501. See "Specify" below.

Card Limitations: Generally, scored cards require careful handling and a favorable environment. Use of the following scores has been approved:

Internal Scores (before separation) M-4, M-5, OM-2, OM-3, S-1 and ID-3 (2" x 3-1/4" or 2-3/16" x 3-3/4" sizes only). *Note:* When using OM-2 or OM-3, reading must be terminated prior to the column that is scored.)

External Scores (after separation) M-3, M-4, M-5, M-6,

M-7, M-11, OM-2, CF-4 and CF-11. OM-3 may be used if the score is on the column 1 end. *Note:* Upper left corner cut required when the M-11 or CF-11 is used on column 1 end.)

All other scores may result in unsatisfactory performance.

Bibliography:

System/360 Model 20, GA26-3565; 1130, GA26-5916; System/3, GC20-8080.

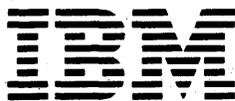
Metering I/O Unit (Online)

Specify

- (1) Voltage (must be consistent with system voltage): Model A1 or A2 (AC, 60 cycle, power provided by system)—with S/360 Model 20 or S/3 Model 15, #9903 for 208 V, or #9905 for 230 V; with 1130 #9902 for 208 V, or #9904 for 230 V ... Model B1 or B2 (AC, 1-phase, 3-wire, 60 cycle)—#9902 for 208 V, or #9904 for 230 V.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (3) Cable Adapter (Model A1 or A2 with S/360 Model 20 only): #9099. Req'd on a 2501 being attached to an installed 2020 which has a serial no under 20,000. Plant installable only, but can be removed in the field.
- (4) Use with 1130 (Model A1 or A2 only): A 2501 Coupling (#3630) is req'd ... see "Special Features" below.
- (5) Isolation, Control Unit (Model B1 or B2 only): May be required on units shipped prior to December 29, 1967 ... see "Special Features" below.
- (6) If the 2501 Model A1 or A2 is to be used as an emulation unit in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under 2020.

Special Features

2501 Coupling (#3630). [Models A1, A2 only] Required to attach a 2501 to an 1130 system or a System/3 Model 15. **Prerequisites** For 1130—2501 Attachment (#8042) on the 1131. Also requires a 208 V or 230 V power source ... see 1131. For System/3 Model 15—2501 Attachment (#8090) on the 5415.

**2502 CARD READER**

Purpose: Punched card input for a 3770 Data Communication System and S/7 (5024).

Model	Rated 80-column Card Speed
A1	150/minute (not with S/7)
A2	300/minute

Model Changes: Can be made in the field.

Highlights: On the 3774 or 3775, used for automatic entry of punched card data to the transmission line or to offline operation units. The 3774, or 3775 Communication Terminal performs all format control and analysis.

Cards are read serially by a sensing mechanism which is checked for proper functioning in every card cycle. EBCDIC (256 characters) or ASCII (128 characters) code can be read, depending upon the transmission code specified for the 3774 or 3775. Invalid codes, off-punching, and mispositioned cards are checked.

On the System/7 used for automatic entry of punched card data to the system. The 5024 I/O Attachment Enclosure (Models 2 or 3) performs all format control and analysis.

Hopper capacity is 700 cards ... stacker capacity is 600 cards.

Card Limitations: Generally, scored cards require careful handling and a favorable environment. Use of the following has been approved:

External Scores: Column 1 End—M-3, M-4, M-5, M-6, M-7, M-11, OM-2, OM-3, CF-4, and CF-11. Column 80 End—M-5, M-7, M-11, CF-4, and CF-11.

Internal Scores: M-4, M-5, S-1, S-2, ID-1, ID-2 and ID-3.

All other scores may result in unsatisfactory performance.

C-4 corner cut cards cannot be used.

Prerequisite: For Model A1 3782/2502 Card Reader Attachment (#8149) on the 3774 or 3775 Communications Terminal and a 3782 Card Attachment Unit Model 2.

For Model A2 3782/2502 Card Reader Attachment (#8149) on the 3774 or 3775 Communications Terminal and a 3782 Card Attachment Unit Model 2. 5024 Model 2 or 3 with System/7.

Specify

- (1) Voltage (AC, 1-phase, 3-wire, 60 cycle): For use with 3774, 3775 or S/7—#9901 for 115 V AC. Must be consistent with system voltage.
- (2) Color: #9046 for white when used with a 3774, 3775 or S/7.
- (3) Cabling: Fixed length cables are supplied as standard.
- (4) Documentation: One must be specified
9103 for use with System/7

Special Features: (not with System/7—5024)

Interchangeable Feed, 51/80 Column (#4650). Permits reading of 51- or 80-column cards. Operator can readily set up machine to read 51-column cards and reconvert it to read 80-column cards. **Limitation:** Cannot be installed with Interchangeable Feed, 66/80 Column (#4651).

Interchangeable Feed, 66/80 Column (#4651). Permits reading of 66- or 80-column cards. Operator can readily set up machine to read 66-column cards and reconvert it to read 80-column cards. **Limitation:** Cannot be installed with Interchangeable Feed, 51/80 Column (#4650); or Optical Mark Read (#5455) on a 3782 Model 2 attached to a 3774 or 3775.

Optical Mark Read (#5450). For reading of up to 40 columns of marked data. Either marked and/or punched hole data can be read from the same card. Cards on which a mark was unacceptable are offset stacked and the reader continues operation when in line mode.



2560 MULTI-FUNCTION CARD MACHINE

Purpose: A multi-function card input/output unit for a S/360 Model 20 or a System/3 Model 15.

Model A1: For a 2020 submodel 1, 2, 5 or 6 or for native attachment to a 5415.

Model A2: For a 2020 submodel 3 or 4, or for a 5415.

Model Changes: Can be made in the field only from Model A2 to A1 (without Card Print feature) ... this also requires conversion from 2020 submodel 3 or 4 to 2020 submodel 1 or 2 and change of its 2560 Attachment from #81 to #8099, both of which can be done in the field ... or replacement of a 2020 submodel 3 or 4 by a 2020 submodel 5 or 6 equipped with 2560 Attachment (#8099).

Highlights: Provides the combined functions of a card reader/punch, collator, and, with Card Print (#1575-1577) on a Model A1, card interpreter/document printer in one unit. Permits collating, gangpunching, reproducing, summary punching, punching of calculated results, printing and classifying of cards in a single pass of the cards. The Extended BCD Interchange Code (256 codes) can be read and punched ... with a 2020 submodel 2, 4, 5 or 6 or a 2025, binary codes may also be read.

Input Section Separate primary and secondary card hoppers, each with a 1,200 card capacity, feed cards independently in separate paths through pre-read, read and pre-punch stations. Rated serial reading is at 500 cards/minute from either hopper with Model A1, or 310 cards/minute with Model A2. The common reading unit, a light sensing mechanism, is checked for proper functioning on each read cycle. Invalid codes, off-punching and mispositioned cards are detected.

Output Section From the separate primary and secondary pre-punch stations, cards merge into a common path past the punch, pre-print and print stations, and on into any one of the radial stackers, each with a 1,300 card capacity. Mdl A1 has five stackers and Model A2 has four stackers. Blank or prepunched cards can be punched.

	Model A1	Model A2
Rated serial punching speeds	160 cols/sec	120 cols/sec
Some rated throughputs, in cards/minute, are:		
First 10 columns only	260	173
First 40 columns only	145	100
First 60 columns only	112	79
80 columns	91	65

Actual speed depends upon the last column punched. Interspersed columns between fields to be punched are counted at the rated serial punching speed.

Multi-function With the ability to move cards from either hopper under independent control to the punching station and with complete stacker selection flexibility, the common card functions of collating, reproducing, gangpunching, summary punching, and selective stacking can be accomplished ... singly or in combination.

Limitation: When attached to the System/3 Model 15, only Extended BCD Interchange Code can be read or punched.

Maximum: One 2560 can be attached to a S/360 Model 20, or a S/3 Model 15, in "Systems" for allowable I/O unit configurations.

Prerequisites: For S/360 Model 20, submodel 1, 2, 5 or 6—the

2560 Model A1 requires a 2560 Model A1 Attachment (#8099) on the 2020. If it is to be attached to an installed 2020 with serial no. under 20000, a Cable Adapter (#9099) is required on the 2560 ... see "Specify."

For S/360 Model 20, submodel 3 or 4 the 2560 Model A2 requires a 2560 Model A2 Attachment (#8100) on the 2020.

For System/3 Mdl 15 the 2560 Model A1 or A2 requires a 2560 Attachment (#8100) on the 5415. In addition, a 2560 Model A1 requires a 2560 Mdl A1 Attachment (#9801) on the 5415. If the system includes a 5445 Disk Storage(s), 1442/2560 Compatibility (#9751) is required on each 5445 Model 1 or 3. A 5422 Disk Enclosure with a minimum of one 5444 Model A2 is also required. **Limitation:** Cannot be attached with a 5424 MFCU or a 1442 Model 6 or 7. *Note:* When a 2560 is retained from a S/360 Model 20 to be attached to a 5415, new cables must be ordered.

Card Limitations: Generally, scored cards require careful handling and a favorable environment. Use of the following scores has been approved.

Internal Scores (before separation)—S-1, and for a maximum of five passes, M-4...M-5 may be used if the operator limits the stackers to 1,000 cards and the number of passes does not exceed five ... cards folded at the crease (card fold crease S-2) must be properly flattened.

External Scores (after separation)—for reading, punching and printing: On the column 1 end—M-7, M-11 and CF-11; on the column 80 end—M-3, M-6*, M-7, OM-2* and CF-4* (maximum of five passes for CF-4). For reading only: On the column 80 end—M-4, M-5, M-11 and CF-11.

*Punching not recommended if card has O.K. verify notch.

All other scores may result in unsatisfactory performance.

Bibliography: System/360 Model 20, GA26-3565; System/3, GC20-8080.

Metering: I/O Unit (Online)

Specify

- (1) Voltage (AC, 60 cycle, power provided by system): #9903 for 208V, or #9905 for 230V ... must be consistent with system voltage.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (3) Cable Adapter (Model A1 only): #9099. Required if the 2560 is to be attached to an installed 2020 which has a serial no. under 20000 ... plant installation only, but can be removed in the field.
- (4) If the 2560 is to be used as an emulation unit in a S/360 Model 20 with 1401/1440 Compatibility (#3901), see #3901 under 2020.

Special Features

Card Print (#1575, 1576, 1577). Model A1 only #1575 (plant installation only) Each provides a print unit with two print heads for printing two lines. Printing is on the face-down side of cards passing through the print unit. Each head prints a maximum horizontal line of 64 printing positions, spaced 10 characters/inch, extending approximately between card columns



2 and 75. Printing can be operator-adjusted to any of the 25 line positions from above the "12-punch" row to below the "9-punch" row ... see "Limitation" below. Each head prints any of the characters from the standard 63-character set printed by a 2203 Printer. Rated speed is 140 print positions/second, regardless of the number of heads per print position simultaneously activated ... interspersed blank print positions between fields to be printed count at the 140 position/second rate. Actual speed depends upon the location of the last position, on any line, printed on a card. #1575—for first two lines ... #1576—for second two lines ... #1577—for third two lines. **Limitation:** In punched fields, printing on any of the twelve even numbered lines will probably result in parts of characters being lost because of printing on holes, and should normally be avoided ... printing on line position 5 should be avoided because of possible smearing. **Prerequisites:** Card Print Control (#1580) on the 2020 submodel 1, 2, 5 or 6 or 5415 ... #1576 requires #1575 ... #1577 requires #1576.



TERMINOLOGY

In these pages, the term "Data Terminal Equipment" and its abbreviation "DTE" will mean any business machine which has a telecommunications capability, be it a terminal, a multiplexer or a CPU with an integrated communications adapter.

Also, the term "Data Communications Equipment" and its abbreviation "DCE" will mean any equipment whose function it is to convert DTE signals into a form suitable for transmission over a communication facility, and to convert signals received from a communication facility into a form suitable for transfer to a DTE. This DCE may be a modem (MOdulator/DEModulator), a telegraph line adapter or another type of signal converter equipment.

Finally, the term "Automatic Calling Equipment" and its abbreviation "ACE" will mean that equipment which will accept dial digits from the DTE and present them to the telephone central office for the purpose of effecting a switched network connection.

ORGANIZATION

These pages are organized into three intercommunication capability charts, which are:

- #1, IBM Start/Stop DTE Intercommunication Capability Table
- #2, IBM Synchronous DTE Intercommunication Capability Table
- #3, IBM Parallel Tone DTE Intercommunication Capability Table

and seven communication facility charts, which are:

- #A, Common Carrier Private Line (non-switched) Telegraph Channels
- #C, Common Carrier Public Switched Networks
- #D, Common Carrier Private Line (non-switched) Voice Grade Channels
- #E, Common Carrier Private Line (non-switched) Wideband Channels
- #G, Customer Owned and Maintained Limited Distance Facilities
- #H, Common Carrier Parallel Transmission Channels
- #X, Common Carrier Private Line (non-switched) Digital Data Communication Services

UTILIZATION

To utilize these pages:

- First, refer to the appropriate intercommunication chart, finding the desired DTEs, and determining if they are capable of intercommunication.
- At the intersection of the row and column associated with the desired DTEs, read the alphabetic designations for the facilities over which they may communicate.
- Refer to the charts for the facilities so designated to find the particular facility and the required feature codes for the DTEs which will allow their communication.
- Refer to the individual "Machines" pages for the DTE's to determine prerequisites, restrictions, etc.

For example, assume that communication between a 2740 mdl 2 and a 3705 is desired.

Since this would obviously be in Start/Stop mode, the first reference would be to Chart 1.

- In Chart 1, at the intersection of the 2740 mdl 2 row and the 3705 column, the entry reads "ADG." This entry points to Facility Charts A, D and G.
- Reference to these Charts show that, since feature codes are entered for both the 2740 mdl 2 and the 3705, communication between them is possible over Facilities A4, D1, D1M, D2, D2M, G1 and G2.
- Further, the A and G Facility Charts show, for both the 2740 mdl 2 and the 3705, the feature codes required on each to allow this intercommunication.
- Finally, reference should be made to the M 2740 and the 3705 pages to assure that any restrictions or prerequisites to the installation of the indicated features are satisfied.

MULTIPLE SUPPLIER SYSTEMS POLICY

Non-IBM modems are attached to IBM DTE's under the provisions of the IBM Multiple Supplier Systems Policy

Such attachments are delineated in the "M" suffix facilities in these pages, and information on the DCE's so attached is available. See "Reference Material" following:

REFERENCE MATERIAL

The HONE configurator, CFM2700, is available for information on TP configurations and IBM and non-IBM DCEs.

CUSTOMER RESPONSIBILITIES

The customer must be advised, in writing, that:

- He is responsible for making arrangements for price quotations, installation and cost (initial and recurring) of the common carrier supplied facilities/services.
- He is responsible for all toll charges incurred in the installation and maintenance of the IBM equipment.
- He must be prepared to relinquish the system for service in those cases in which service aids or available error message printouts do not permit localization of a malfunction to the communication facility or terminal location.
- He is responsible for the DTE/DCE and DTE/ACE interface compatibility when he, or the common carrier, provides the DCE or ACE.

Due to the nature of the teleprocessing environment, it is possible that the throughput anticipated on the specified network configuration with recommended channel conditioning will not be achieved. The probability of this is slight, though it is more likely at the higher data signalling rates or when using an acoustic coupler. Some actions that can be taken if anticipated throughput is not achieved are:

- re-dialing the connection if operating on the Public Switched Telephone Network
- adjusting the block size, where possible, to optimize throughput based on the error characteristics of the communications facility being used
- requesting the Common Carrier, if appropriate, to provide alternate routing or facility improvements. This is normally



provided at extra cost. The Common Carrier's representative should be contacted for further details.

However, it is possible that, at a particular location, only lower speed operation will be possible.

In addition, the customer should be advised that his local IBM representative is available to assist him in analyzing and planning for his responsibilities in installing or operating teleprocessing configurations.

The Marketing Representative must have the customer obtain a firm installation date for the start of transmission service prior to processing the OC card.

When using IBM Modems, IBM Integrated Modems or IBM Line Adapters, it is recommended that the customer investigate the economics of providing alternate voice grade service to facilitate installation and maintenance.

CHART 1

Start/Stop Data Terminal Equipment Intercommunication Capability Chart

	1051	2025	2701	2702	2703	3115	3125	3135	3704	3705	3792	4953	4955
1031A		DG	DG	DG	DG	D	D		DG	DG			
1034		D	D	D	D	D	D		D	D			
1051	ACDG	ACDG	CDG	ACDG	ACDG	ACD	ACD	CD	ACDG	ACDG			
1061		DG	DG	DG	DG	D	D		DG	DG			
1071			DG	DG	DG								
2740 mdl 1		CDG	CDG	CDG	CDG	CD	CD	CD	CDG	CDG			CD
2740 mdl 2		ADG	DG	ADG	ADG	AD	AD	D	ADG	ADG			
2741		CDG	CDG	CDG	CDG	CD	CD	CD	CDG	CDG	CD		
2845			D					D	D	D			
2848			D					D	D	D			
5010		CDG	CDG	CDG	CDG	CD	CD	CD	CDG	CDG			
5100						CD	CD	CD	CD	CD			
5110						CD	CD	CD	CD	CD			
CMCST			C	C	C	C	C	C	C	C			
TTY (1)			A	A	A	A	A		A	A			
TWX 33/35			C	C	C	C	C	C	C		C		
TWX 37									C	C			

MULTIPOINT OPERATION

Duplex communication facilities are required for multipoint systems in which it is desired that a continuous carrier be maintained on the line from the control station, thereby eliminating the control station "Ready for Sending" delays.

The use of duplex facilities and the operation in the continuous carrier mode is strongly recommended since control station operation in a non-continuous carrier mode will subject the system to inordinate delays, particularly in the polling and addressing sequences.

**CHART 3****PARALLEL TONE DATA TERMINAL EQUIPMENT INTER-COMMUNICATION CAPABILITY CHART**

	024/026	1001	1092	1093	7770	7772
024/026		H	H	H		
1001	H				H	H
1092	H				H	H
1093	H				H	H
7770		H	H	H		
7772		H	H	H		

Notes for CHARTS 1, 2 and 3

- (1) The TTY terminals referred to are Telephone Company 83B2/83B3 or Western Union Plan 115A terminals.
- (2) The 1131, 1826, 2715 mdl 2, 2772, 2780, 3271, 3275, 3735, 3780, System/3, System/32, System/34 and S/360 mdl 20 can be intermixed as tributary stations on a multipoint non-switched line. The control station must be one of the following:
- a S/360 mdl 25 with an Integrated Communications Adapter and the appropriate BSC features.
 - a S/370 mdl 115, 125 or 135 with an Integrated Communications Adapter and the appropriate BSC features.
 - a S/360 or S/370 with an attached, appropriately configured, 2701, 2703, 3704 or 3705 ... see M 2701, M 2703, M 3704 and M 3705 pages for the CPU models to which these multiplexers may be attached.

The 1131, 2772, 2780, 3671 and S/360 model 20 can be intermixed as tributary stations on a multipoint non-switched line when the control station is a S/360 mdl 50 (or larger) or a S/370 mdl 145 (or larger) with an attached, appropriately configured 2701, 2703, 3704 or 3705.

See SRL GA27-3004 for information on which BSC terminals may communicate with each other over point-to-point non-switched lines.

See SRL's GC30-1005, GC30-2004 and GC30-5001 for the limitations and restrictions on these types of operations.

- (3) Appropriately configured 1131's, 1826's, 2701's, 2703's, 2715 mdl 2's, 2772's, 2780's, 3704's, 3705's, 3735's, 3741's, 3747's, 3780's, System/3's, System/32's, System/34's, S/360 mdl 20's and 25's, and S/370 mdl 115's, 125's and 135's may communicate over the public switched telephone network to the same BSC line appearance on a S/360 mdl 25 (except for the 3741's and 3747's), a S/370 mdl 115, 125 or 135 or a S/360 or S/370 with an attached, appropriately configured, 2701, 2703, 3704 or 3705.

See SRL's GC30-1005, GC30-2004 and GC30-5001 for the limitations and restrictions on this type of operation.

- (4) The 3271 models 11 and 12, 3274, 3275 models 11 and 12, 3276, 3601, 3602, 3614, 3651 model 50, 3767, 3771, 3773, 3774, 3775, 3776, 3791 and System/32 may communicate over a non-switched voice grade line with a 3704

or 3705 using Synchronous Data Link Control. This communications uses the Synchronous Data Link Control, in which the control station may be receiving from one tributary station while it is transmitting to a second tributary station. For this mode of operation, a duplex communications facility and a duplex line set at the 3704/3705 is required. Normal half-duplex or duplex communications facilities is also supported.

- (5) See the SCP Programming pages for information on which intercommunication capability is supported by the 3704/3705 Emulation and Network Control Programs.
- (6) The 5251 Model 12 will communicate over non-switched and switched communication lines with a 5340 (System/34) and a 5381 (System/38) via the SNA/SDLC protocol. When a multipoint line is used, the 5340 provides the necessary control station support for the 5251 Model 12. Normal half-duplex operation on half-duplex or duplex communication facilities is supported under SDLC.



CHART A

COMMON CARRIER NON-SWITCHED D. C. TELEGRAPH CHANNELS

FACILITIES A1 — Type 1002 Channel, Pt-to-Pt or Multipoint at 45.5 bps (1)

IBM MACHINE TYPE	2025	2701	2702	2703	3115	3704
Telegraph Line Adapter	7411	7860	7911	7911	7881	4721
	9641		9680	4873	9733	9601
	(2)		7895	7876	(2)	
			7897			
			(3)			

FACILITIES A2 — Type 1002 Channel, Pt-to-Pt or Multipoint at 56.9 bps (1)

IBM MACHINE TYPE	2025	2701	2702	2703	3115	3704
Telegraph Line Adapter	7411	7861	7911	7911	7881	4721
	9645		9681	4874	9734	9602
	(2)		7895	7876	(2)	
			7897			
			(3)			

FACILITIES A3 — Type 1002 Channel, Pt-to-Pt or Multipoint at 74.2 bps (1)

IBM MACHINE TYPE	2025	2701	2702	2703	3115	3704
Telegraph Line Adapter	7411	7862	7911	7911	7881	4721
	9649		9682	4875	9735	9603
	(2)		7895	7876	(2)	
			7897			
			(3)			

FACILITIES A4 — Type 1005 Channel, Pt-to-Pt or Multipoint at 75 bps (1)

IBM MACHINE TYPE	1051	2025	2702	2703	2704	3115	3704
Telegraph Line Adapter	7873	7411	4615	4696	7807	7881	4721
		9637	9683	4876		9736	9604
		(2)	7895	7876		(2)	
			7897				
			(3)				

Notes for CHART A

- (1) Facilities A1, A2, A3 and A7 are Telephone Company supplied Type 1002 or Type 1005 Channels, Facilities A4, A5, A6 and A8 are Western Union supplied Type 1002 or Type 1005 Channels. The terminals on the A1 through A6 Facilities are Telephone Company 83B2 or 83B3 or Western Union Plan 115A terminals.
- (2) The 2025, 3115 and 3125 codes are for the attachment of the first communication line. See the M2025, M3115 and M3125 pages for additional line attachment feature codes.
- (3) The 2703 Line Set code (#7897) is for the attachment of up to eight communication lines. See the M2703 pages for additional line attachment feature codes. When operating two 2703s in series on the same telegraph channel, RPO S30017 (no charge) must be installed on one 2703 and RPO S30018 (no charge) must be installed on the other 2703. These RPOs are not required to operate two telegraph line appearances on the same 2703 in series on the same telegraph channel.



IBM MACHINE TYPE	3705	3735	3741	3747	3767	3771	3774 3775 3776	3780	3791	4953 4955	5010	5110	5231 M2	5251 2-12	5320	5340	5381	5406 5408 5410 5412 5415
2400 bps Integrated Modem	4761	5610					5610	5610							5610	2500 5610 (2)	3701	
Interface to IBM 3872 Modem	4714 (9)	(4)	9121	1660 9121	3718 9533 9619	1481 3701	1481 3701	9120 9402	3701 6302 (12)	2074 or 2094 or 2090	4800	2074 3701	4780 9483 9753		3701	2500 3701 (2)	5760	2074 9392 9483 9753 (2)
Interface to ACO Feature (#1091) on IBM 3872 (7)	4715													3701				1315 (2)

FACILITY C5M — Synchronous Operation @ 2000 or 2400 bps on the Public Switched Telephone Network via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

IBM MACHINE TYPE	1131	1826	2020	2025	2701	2703	2715 M2	2772	2780	3115	3125	3135	3276 M11 -14	3704 3705	3735	(Contd below)
Interface to Standalone DCE (1)	7690	7551	2074	7551 (2)	7698 (8)	7710 (3)	(4)	9120 9402	9110 9402	7151 (2)	7131 9758 or 7151 (2)	4640 9609 or 9625 9649 (2)	9821 9822 3701 6302 9490	4714 (9)	(4)	
Interface to Standalone ACE (5)			1315	1300 (2)	1314	1340 (3)				1295 (2)	1295 (2)	1290 9777 (2)		4715		

IBM MACHINE TYPE	3741	3747	3767	3773	3776 3777	3780	3791	4953 4955	5010	5110	5231 M2	5251 2-12	5320	5340	5381	5406 5408 5410 5412 5415
Interface to Standalone DCE (1)	9121	1660 9121	3718 9533 9619	1481 3701	1481 3701	9120 9402	3701	2074 6302 (12) 2094 or 2090	4800	2074 3701	4780 9483 9752 or 9753	3701	3701	2500 3701 (2)	3701	2074 9392 9483 9753 (2)
Interface to Standalone ACE (5)														5760	1315 (2)	

FACILITY C6 — Synchronous Operation @ 4800 bps on the Public Switched Telephone Network

IBM MACHINE TYPE	1131	1826	2020	2025	2701	2703	2715 M2	3115 3125	3135	3276 M11 14	3651 M50	3704 3705	3735	3771 3773	3774 3775	(Contd below)
4800 bps Integrated Modem																
Interface to IBM 3874 Modem	7690	7551	2074	7551 (2)	7698 (8)	7710 (3)	(4)	7151 (2)	4640 9609 9625 9490 9649 (2)	3701 6302 9823	9126	4714 (9)	(4)	1481 3701	1481 3701	
Interface to ACO Feature (#1091) on IBM 3874			1315	1300 (2)	1314	1340 (3)		1295 (2)	1290 9777 (2)			4715				

IBM MACHINE TYPE	3777	3780	4953 4955	5010	5110	5231 M2	5251 2-12	5320	5340	5381	5406 5408 5410 5412 5415
4800 bps Integrated Modem	5710 (14)										
Interface to IBM 3874 Modem	1481 3701	9128 9402	2074 or 2094 or 2090	4800	2074 3701	4780 9483 9754	3701	3701	2500 3701 (2)	3701	2074 9392 9483 9754 (2)
Interface to ACO Feature (#1091) on IBM 3874								5760	1315 (2)		



FACILITY D2M — Point-to-point or Multipoint Start-stop or Synchronous Operation @ 600 bps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

	1031						2740	3115				4953		
IBM MACHINE TYPE	1034	1071	2025	2701	2702	2703	M2	3125	3135	3704	3705	3767	4955	5010
Interface to Standalone DCE for Start-stop Operation (3,8)	2068	9110	9625 or 9629 7401 (2)	4640 9582 or 4648	4616 or 4615 9685 7387 3233	4696 or 4697 4879 3205 (5)	7106 9121	9739 or 9740 1231 (2)	4640 9601 or 9721 (2)	4711 or 4714 9607 9607	4711 or 4714 9607 9615 (10, 22)	7112 or (22)	1610 9541 or 2092 2094 or 2090 (10, 22)	2165
Interface to Standalone DCE for Synchronous Operation (3)										4714 or 4718 9607 (10, 22)	4714 or 4718 9607 9615 (10, 22)	9531 or (22)	2074 or 2094 or 2090 (10, 22)	

FACILITY D3 — Point-to-point or Multipoint Start-stop or Synchronous Operation @ 1200 bps on a Half-duplex or Duplex Type 3002 (or equivalent) Channel

			3275		3276										(Contd below)
IBM MACHINE TYPE	2701	3115	3275	M11	3276	M11-	3601			3704		3741		3771	
		3125	M1,2	12	M1-4	14	3614	3603	3604	3705	3735	3747	3767	3773	
1200 bps Integrated Modem, Start-stop (1)		4781 1231 9739 (2)			5500 9491 9651 or 9652 (16)	5500 9491 9651 or 9652 (16)				4781 9608				7112 9542 5500	
1200 bps Integrated Modem, Synchronous (1)	4781	4781 7141 (2)	5500 7820 (22)	5500 7820 (22)			5500 8001 (22)	(15, 21)	8001 (15)	4781 or 4784 9608 (10, 22)	5500	5500	9532 5500 (22)	5500 (22)	
1200 bps Integrated Modem, Synchronous (1)		3774 3775	3791	5010	5110	5231 M2	5251 2-12	5320	5340	5381	5415				
1200 bps Integrated Modem, Synchronous (1)		5500 (22)	5500 6301 (22)	5500	5500	5500	5500	5500		5500	4781 5508 (2)				

FACILITY D3M — Point-to-point or Multipoint Start-stop or Synchronous Operation @ 1200 bps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

							2715			2845	3115		3271	M11	(Contd below)	
IBM MACHINE TYPE	1131	1826	2020	2025	2701	2703	M2	2772	2780	2848	3125	3135	M1,2	12		
Interface to Standalone DCE for Start-stop Operation (3)					4646 (8)					9012 (8)	1231 9739 (2)	4640 9753 (2, 8)				
Interface to Standalone DCE for Synchronous Operation (3)	7690	7551 7552	4703	7551 7541 (2)	7698 7692 (7)	7705 7710 (5)	7705 (7)	7705 9122 (7)	7705 9110		7141 (2)	4640 9649 (2)	7820	7820 (22)		
Interface to Standalone DCE for Synchronous Operation (3)		3275 3275	M11, 12	3276 M1-4	M11 -14	3601 3614	3704	3705	3735	3741 3747	3767	3773	3774 3775	3780	3791	(Contd below)
Interface to Standalone DCE for Start-stop Operation (2)				3701 6301 9491 (16)	3701 6301 9491 (16)		4711 or 4714 9608 (8)	4711 or 4714 9608 (8)			7112 or 9542 3719					
Interface to Standalone DCE for Synchronous Operation (3)	7820	7820 (22)			3701 6301 (16)	4714 or 4718 9608 (10, 16)	4714 or 4718 9608 (10, 16)	7705 5010	7705 9122	9532 3719 (22)	1482 3701 (22)	1482 3701 (22)	7705 9122 (22)	3701 6301 (22)		



IBM MACHINE TYPE														5406							
	3771	3773	3774	3775	3776	3777	3780	3791	5010	5110	5231	5251	5320	5340	5381	5410	5412	5415			
2400 bps Integrated Modem, Pt-to-Pt (11)			5600	5600									5600	2500							
														5600							
														5602	2500						
														5602							
														5602	2500						
														5602							
Interface to IBM 3872 Modem for Start-stop Operation (9)																					
Interface to IBM 3872 Modem for Synchronous Operation (9)	9533	1481	1481	9121	3701	4800	2074	4780	3701	3701	2500	3701	2074	3718	3701	3701	9402	6301	3701	9753	9753
	(22)	(22)	(22)		(22)			9481			(16)			(2)	22)					(2)	19)

FACILITY D4M — Point-to-point or Multipoint Start-stop or Synchronous Operation @ 2000 or 2400 bps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

IBM MACHINE TYPE														3271	(Contd below)				
	1131	1826	2020	2025	2701	2703	2715	M2	2772	2780	2845	2848	3115	3125	3135	M1,2			
Interface to Standalone DCE for Start-stop Operation (3)					4657						9013				4640				
					(8)						(8)				9609				
															9753				
															(2, 8)				
Interface to Standalone DCE for Synchronous Operation (3)	7690	7551	2074	7551	7698	7710	(6)	9120	9110				7151	7131	4640	(6)			
				(2)	(7)	(5)		or 9121	(7)				(2)	9758	9609				
														or 7151	9649				
														(2)	(2)				

IBM MACHINE TYPE														3771	(Contd below)			
	12	1C	3271	3274	3275	3276	M11	M11	3601	3671	3704	3705	3735	3741	3747	3767	3773	
Interface to Standalone DCE for Start-stop Operation (3)			9891		9891	9891					4714							
			or 9822		or 9822	or 9822					(8)							
			3701		3701	3701												
			6302		6302	6302												
			(16)		9491	9491												
					(16)	(16)												
Interface to Standalone DCE for Synchronous Operation (3)	(6, 16)		(6)				(6, 16)	3701	9753	4714	5010	9120	9120	9553	1481			
								6302		or 4718		or 9121	or 9121	or 9121	3718	3701		
								(22)		(10, 22)			1660					

IBM MACHINE TYPE														5406			
	3774	3775	3776	3777	3780	3791	4953	5010	5110	5231	5251	5320	5340	5381	5410	5412	5415
Interface to Standalone DCE for Start-stop Operation (3)							1610										
							or 2092										
Interface to Standalone DCE for Synchronous Operation (3)	1481	9120	3701	2074	4800	2074	4780	3701	3701	2500	3701	9752	3701	9752	9753	2074	
	3701	or 9121	6302	or 2094		3701	or 9753			3701	22)		or 3701	or 9753	2074		
	(22)		(22)	or 2090			9481							(2, 19)			



FACILITY D4SB — Point-to-point or Multipoint Synchronous Operation @ 2400 bps on a Type 3002 (or equivalent) Channel with Backup @ 2400 bps or 1200 bps on the Public Switched Telephone Network

IBM MACHINE TYPE	2020	2701	2703	2772	2780	3115	3125	3271 M1,2	3271 M11, 12	3274 1C	3275 M1,2	3275 M11, 12	3276 M1-4	3276 M11 -14	(Contd below)
2400 bps Integrated Modem										3701 6302 9822 (16)			3701 6302 9491 9822 (16)	3701 6302 9491 9822 (16)	
Interface to IBM 3872 Modem (9,12)	2074	7698 (7)	7710 (5)	9121 9402	9110 9402 (7)	7151 (2)	7131 9758 or 7151 (2)	(6)	(6)		(6)	(6,		22)	
													5406 5408 5410 5412 5415		
IBM MACHINE TYPE	3851 M50	3704 3705	3735	3771 3773	3776 3777	3780	5110	5251 2-12	5320	5340	5381	5415			
2400 bps Integrated Modem			5600 or 5602 7951 (29)		5600 or 5602 7951	5600 or 5602 7951	2074 or 3701		5600 or 5602 7951 or 7952 2074	2500 or 5600					
Interface to IBM 3872 Modem (9,12)	9121 or 9122	4714	5010	1461 or 1462 1481 3701	1461 or 1462 1481 3701	9125 9402		3701	3701	2500 3701 (2,	3701	2074 9753 (2,			

FACILITY D5 — Point-to-point or Multipoint Synchronous Operation @ 4800 bps on a Duplex Type 3002 with C1 Conditioning (or equivalent) Channel

IBM MACHINE TYPE	1131	1826	2020	2025	2701	2703	2715 M2	2772	2780	3115	3125	3135	3271 M1,2	3271 M11, 12	(Contd below)
4800 bps Integrated Modem (19)															
Interface to IBM 3874 Modem (9)	7690	7551	2074	7551 (2)	7698 (7)	7710 (5)	(6)	9124 9402	9110 9208 (7)	7151 (2)	7131 9758 or 7151 (2)	4640 9609 9649 (2)	7821	(6, 22)	
IBM MACHINE TYPE	3274 1C	3275 M1,2	3275 M11, 12	3276 M1-4	3276 M11 -14	3601 3614	3651 M50	3671	3704 3705	3735	3771 3773	3774 3775	3776 3777	3780	(Contd below)
4800 bps Integrated Modem (19)	3701 6302 9823 (16)			3701 6302 9491 9823 (16)	3701 6302 9491 9823 (16)				3704 3705	3735	3771 3773	3774 3775	3776 3777	3780	
Interface to IBM 3874 Modem (9)		7821	(6, 22)			3701 6302 (22)	9124 or 9125	9754	4714 or 4718 (10, 22)	5010	1481 3701 (22)	1481 3701 (22)	1481 3701 (22)	9124 9402	
															5406 5408 5410 5412 5415
IBM MACHINE TYPE	5010	5110	5231 M2	5251 2-12	5320	5340	5381	5415							
4800 bps Integrated Modem (19)															
Interface to IBM 3874 Modem (9)	4800	2074 3701	4780 9754	3701	3701 (22)	2500 2701 (2,	3701 (2,	2074 9754 (19)							



that the 3872 be equipped with #5101 or #5102. #5602 Integrated Modems are compatible with the basic 3872 (control station). The 3659 requires that the 3872 be equipped with #6101 or #6102.

- (13) The 4800 bps Integrated Modem, Point-to-point (#5700), is line compatible and suitable for communication with an IBM 3874 Modem equipped with the Point-to-point feature (#6101). The 4800 bps Integrated Modem, Multipoint (#5702), is line compatible and suitable for communication with an IBM 3874 Modem equipped with the Multipoint Control feature (#5100).
- (15) IBM STR Data Terminal Equipments will communicate in point-to-point mode only.
- (16) The 3271 Models 11 and 12, 3274, 3275 Models 11 and 12, 3276, 3601, 3602, 3614, 3651 Model 50, 3767, 3771, 3773, 3774, 3775, 3776, 3777, 3791 and 5320 will communicate with a 3704 or 3705 using Synchronous Data Link Control (SDLC). In a multipoint network, SDLC allows the control station (The 3704/3705) to receive from one tributary station (the 3271/3274/3275/3276/3601/3602/3614/3651/3767/3771/3773/3774/3775/3776/3777/3791/5320) while it is transmitting to another tributary station. Operation in this mode requires that the 3704/3705 be equipped with one of the following:
- #4784 for communication with a tributary station equipped with a 1200 bps Integrated Modem, or
 - #4755 for communication with a tributary station equipped with a 2400 bps Integrated Modem or attaching an IBM 3872 Modem, or
 - #4718 for communication via standalone DCEs.
- Duplex communication facilities are required to support the above type operation. SDLC also supports the normal data-half-duplex mode of operation over half-duplex or duplex communication facilities.
- (17) The IBM 4872 Modem is a purchase-only modem, available in three models, as follows: Model 1—for point-to-point communication with another model 1 ... Model 2—for the multipoint control station for communication with model 3s at the tributaries ... Model 3—for the multipoint tributary station for communication with a model 2 at the control station. This modem requires C2 conditioning instead of C1 on D8 facility.
- (19) Only the System/3 and 8 (5408), model 10 (5410), model 12 (5412) or model 15 (5415) may be installed as the control station in a multipoint network.
- (20) The S/360 model 20 (2020) does not support Intermediate Block Checking at speeds greater than 4800 bps.
- (21) The 3604 and 3614, when equipped with #8001, will communicate with a 3601 (similarly equipped) over a normal 3600 System "loop." When more than one 3604 or 3614 is on the loop, half-duplex, point-to-point, 2 wire terminated communication facilities are required from the 3601 to the first station on the loop, between successive stations on the loop and from the last station on the loop back to the 3601. When only one station is on the loop, a duplex point-to-point 4 wire terminated facility is required between it and the 3601.
- The 3601 and 3614, when equipped with #5500 will communicate with a 3704 or 3705 over non-switched voice grade lines either point-to-point or multipoint. See Note (22) following.
- (22) 3601, 3614, 3651 model 50, 5320, 5340, and 3791 communication with a 3704 or 3705 uses Synchronous Data Link Control, which allows the control station (the 3704/3705) to receive from one tributary station (the 3601/3614/3651 model 50/3791/5320/5340) while it is transmitting to a second tributary station. Operation in this mode requires that the 3704/3705 be equipped with either: #4784—for communication with a 3601/3614/3651 model 50/3791 with an IBM 1200 bps Integrated Modem, or ... #4755—for communication with a 3601/3614/3651 model 50/3791/5320/5340 attaching an IBM 3872 Modem, or ... #4718 for communication via standalone modems.
- Duplex communication facilities are required to support the above mode of operation. The Synchronous Data Link Control also supports the normal "data half-duplex" mode of operation over half-duplex or duplex facilities.
- (23) The 3651 model 50 will communicate over this facility with a 3704 or 3705 at the host S/370, or with a 3659 at a remote store site. Communication with the 3704/3705 requires #9121 or #9122. Communication with a 3659 requires #6111. The 3659 at the remote store site includes an IBM 2400 bps Integrated Modem as part of the basic unit.
- (24) Leased Line Adapters are available as features on the 3704 and 3705 as noted. However, additional Leased Line Adapters may be attached via the 2711 Line Adapter Unit. The 3704 and 3705 feature code for each pair of lines so attached is either #4711 or #4714.
- (25) Performance of modems on Switched Networks: Satisfactory data transmission cannot be achieved with all Switched Network voice services, specifically those on which proper conditioning of the local loop is not available. For example, off premises PBX extensions, tandem tie line networks, foreign exchange lines, WATS lines may present characteristics that are not suitable for satisfactory data transmission. It is recommended to carefully plan ahead with the common carrier the installation of such communication systems.
- (26) The 3767 terminal will communicate over this Facility at 300 bps with a 3115, 3125, 3135, 3704 or 3705. The speed specifies for this operation are:
- #9739 on the 3115 and 3125
 - #9593 on the 3135
 - #9612 on the 3704 and 3705
 - #9540 on the 3767.
- (27) The basic 3603 includes a 1200 bps Integrated Modem which is line compatible and suitable for communication with the 3601's 1200 bps Loop Integrated Modem.
- (28) Features #4751 and #4754 on 3705 require an RPQ.
- (29) Features #5600 and #5602 on 3735 require an RPQ.
- (30) Features #5600 and #5602 on 3780 require an RPQ.



CHART E

COMMON CARRIER TYPE 8800 WIDEBAND SERVICE

FACILITY E1 — Point-to-point at 40.8 Kbps

IBM STR MACHINES 2701

Interface to 7695
Standalone DCE (1) (2)

5406
5408
5410
5412

IBM SYNC MACHINES 2020 2701 3115 3704 4953 5010 5415

Interface to 2074 7697 7121 4717 2075 4805 2074
Standalone DCE 4500 (2) (3) 2058 9755

FACILITY E2 — Point-to-point at 50 Kbps

IBM STR MACHINES 2701

Interface to 7695
Standalone DCE (1) (2)

5406
5408
5410
5412

IBM SYNC MACHINES 2020 2701 3115 3704 4953 5010 5415

Interface to 2074 7697 7121 4717 2075 4805 2074
Standalone DCE (1) 4501 (2) (3) 2058 9755

FACILITY E3 — Point-to-point at 19.2 Kbps

5408
5410
5412

IBM SYNC MACHINES 2020 2701 3115 3704 4953 5010 5415

Interface to 2074 7697 7121 4717 2075 4805 2074
Standalone DCE (1) 4501 (2) (3) 2058 9755

FACILITY E4 — Point-to-point at 230.4 Kbps

IBM SYNC MACHINES 2701

Interface to 7697
Standalone DCE (1) (2)

Notes for CHART E

- (1) See the IBM Data Communications Handbook
- (2) This feature code is for the attachment of a single communication line.
See the M2701 pages for the conditions under which a second line may be attached via the Dual Communications Interface Feature.
- (3) A line attached to the ICA via this feature will have a 100% load factor and must not be operated simultaneously with any other line on the ICA.



CHART X

COMMON CARRIER PRIVATE LINE (NON-SWITCHED) DIGITAL DATA COMMUNICATION SERVICES

FACILITY X1 — Point-to-point or Multipoint Synchronous Operation @ 2400 bps

	3776	
	M3,4	
	3777	3274
IBM MACHINE TYPE	M3	MIC
Interface to	5650	5650
AT&T	or	or
Dataphone*	5651	5651
Digital Service	9822	6302
(1)		9822

FACILITY X1M — Point-to-point or Multipoint Synchronous Operation @ 2400 bps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

										3271			3275	(Contd below)
IBM MACHINE TYPE	1131	1826	2020	2701	2772	2780	3115	3125	3135	3271 M1,2	M11, 12	3274 1C	3275 M1,2	12
Interface to	7690	7551	2074	7698	9121	9110	7151	7131	4640	(3)	(3,	3701	(3)	(3,
Standalone DCE				(2)	(2)	(4)	9758	9609			5)	6302		5)
(1)							or	9649				9822		
							7151	(4)				(5)		
							(4)							

										3774				(Contd below)
			3276							3775				
IBM MACHINE TYPE	3276 M1-4	M11-14	3601 3614	3704 3705	3735 3741	3747 3767	3773 3777	3780 3791	4953 4955	5010				
Interface to	3701	3701	3701	4714	5010	9121	1660	9533	1481	1481	9121	3701	2074	4800
Standalone DCE	6302	6302	6302	or		9121	3718	3701	3701			6302	or	
(1)	9491	9491	(5)	4718			(5)	(5)	(5)			(5)	2094	
	9822	9822		(5,									or	
	(5)	(5)		6)									2090	

										5408				
										5408				
										5410				
										5412				
IBM MACHINE TYPE	5100	M2	5231 5251	5320	5340	5381	5415							
Interface to	2074	4780	3701	3701	2500	5650	2074							
Standalone DCE	3701	9753	or	(5)	3701	5651	9753							
(1)		9481	5651		or		(4,							
					5650		7)							
					or									
					5651									
					(5,									
					7)									

FACILITY X2 — Point-to-point or Multipoint Synchronous Operation @ 4800 bps

	3776	
	M3,4	
	3777	3274
IBM MACHINE TYPE	M3	MIC
Interface to	5650	5650
AT&T	or	or
Dataphone*	5651	5651
Digital Service	9823	6302
(1)		9823

FACILITY X2M — Point-to-point or Multipoint Synchronous Operation @ 4800 bps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

										3271			3275	(Contd below)
IBM MACHINE TYPE	1131	1826	2020	2701	2772	2780	3115	3125	3135	3271 M1,2	M11, 12	3274 1C	3275 M1,2	12
Interface to	7690	7551	2074	7698	9124	9110	7151	7131	4640	7821	(3,	3701	7821	(3,
Standalone DCE				(2)	(2)	(4)	9758	9609			5)	6302		5)
(1)							or	9649				9823		
							7151	(4)				(5)		
							(4)							

*Registered Trademark of AT&T



IBM MACHINE TYPE	3276													3774	5406						
	3276 M1-4	3276 14	3601 3614	3704 3705	3735	3771 3773	3776 3777	3780	4953 4955	5010	5110	5231 M2	5251 2-12	5320	5340	5381	3775 3776	5408	5410	5412	5415
Interface to Standalone DCE	3701	3701	3701	4714	5010	1481	1481	9124	2074	4800	2074	4780	3701	3701	2500	5650	3701	5650	2074		
(1)	6302	6302	6302	or		3701	3701		or		3701	9754	or	(5)	3701	5651		9754			
	9491	9491	(5)	4718		(5)	(5)		2094				5651						(4,		
	9823	9823		(5,					or						5650				7)		
	(5)	(5)		6)					2090						or						
															5651						
															(5,						
															7)						

FACILITY X3M — Point-to-point or Multipoint Synchronous Operation @ 9600 bps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

IBM MACHINE TYPE	3276									
	3274 1C	3276 M1-4	M11-14	3704 3705	3777	4953 4955	5251 2-12	5340	5381	
Interface to Standalone DCE	6302	3701	3701	4714	1481	2074	3701	2500	5650	
(1)	or	6302	6302	or	3701	or	or	3701	5651	
	6303	6315	9491	4718	(5)	2094	5651	or		
	3701	9491	9825	(5,		or		5650		
	9825	9825	(5)	6)		2090		or		
	(5)	(5)						5651		
								(5,		
								7)		

FACILITY X3 — Point-to-point or Multipoint Synchronous Operation @ 9600 bps

IBM MACHINE TYPE	3776	
	M3,4	3274
Interface to AT&T	5650	5650
Dataphone*	or	or
Digital Service	5651	5651
(1)	9825	6302
	or	
	6303	
	9825	

FACILITY X4M — Point-to-point Synchronous Operation @ 56 Kbps via Standalone DCEs attached under the provisions of the IBM Multiple Supplier Systems Policy

IBM MACHINE TYPE	4953	
	3705	4955
Interface to Standalone DCE	4720	2074
(1)	(6)	2060

Notes for CHART X

- (1) See the IBM Data Communications Handbook
- (2) The listed feature codes are for the attachment of a single synchronous communications line. See the description of the Dual Communication Interface feature in the M2701 and M2780 pages for the conditions under which a second synchronous communications line may be attached.
- (3) No special feature is required to attach this DTE to this Facility.
- (4) The 3115, 3125 and 3135 feature codes listed are for the attachment of the first communications line. See the M3115, M3125 and M3135 pages for additional line attachment feature codes.
- (5) The 3271 Models 11 and 12, 3275 Models 11 and 12, 3601, 3602, 3614, 3767, 3791, and when not operating in BSC mode, the 3771, 3773, 3774, 3775, 3776, 3777 model 1, 5320 and 5340 will communicate with a 3704 or 3705 using Synchronous Data Link Control (SDLC). In a multipoint network, SDLC allows the control station (the 3704/3705) to receive from one tributary station (the 3271/3275/3601/3602/3614/3651/3767/ 3771/3773/3774/3775/3776/3777 model 1/3791/5320/5340) while transmitting to a second tributary station. Operation in this mode requires duplex communications facilities and 3704/3705 equipped with feature code #4718. SDLC also supports the normal "data-half-duplex" mode of operation over half-duplex or duplex lines.
- (6) 3704/3705 "Remotes" may communicate over this Facility with 3704/3705 "Locals" point-to-point only as their primary communications line. Feature code #4714 will support data-half-duplex operation over half-duplex or duplex facilities, while feature code #4718 will support data-full-duplex (i.e., simultaneous data transmission in both directions) over duplex facilities.
- (7) The 5340, 5408, 5410, 5412, and 5415 feature codes are for the attachment of the first communications line. See M5340, M5408, M5410, M5412, and M5415 pages for additional line attachment feature codes.
- (8) The 3777 model 2 operates in point-to-point mode only.
- (9) Communication over this facility is between a 3276 operating as a multipoint or point-to-point tributary station and a 3791 (with #3211 and #3703) operating as a multipoint control station.



CHART G

COAM LIMITED DISTANCE

FACILITY G1 — Half-duplex or Duplex, Point-to-point or Multipoint, up to 4.75 miles in length at 134.5 bps

	3704				
IBM MACHINE TYPE	2702	2703	2740	2741	3705
Limited Distance Line	4634	4686	4634	4634	4731
Adapter, Type 1A, Half-duplex	9684	4878		(5)	9606
Limited Distance Line	4635	4687	4635	4635	4732
Adapter, Type 1B, Duplex	9684	4878		(5)	9606

FACILITY G2 — Half-duplex, Point-to-point or Multipoint, up to 8 miles in length at 134.5 or 600 bps

	3704											
IBM MACHINE TYPE	1031A	1051	1061	1071	2025	2701	2702	2703	2740	2741	3705	5010
Limited Distance Line		4790	4790	4792	(2)	4636	4612	4688	4790	4790	4741	4750
Adapter, Type 2A at 134.5 bps				9112			9684	4878		(5)	9606	
							(3)	(1, 3)			(3)	
Limited Distance Line (4)				4792	(2)	4637	4613	4688	4790		4741	4750
Adapter, Type 2A at 600 bps				9112			9685	4879	(6)		9607	
							(3)	(1, 3)			(3)	

Notes for CHART G

- (1) The 2703 feature codes are for the attachment of up to eight communication lines. See the M2703 pages for additional line attachment feature codes.
- (2) See the M2025 pages for information on the attachment of the 2025 to this Facility via the 2711 Line Adapter Unit.
- (3) Type 2 Limited Distance Line Adapters are available as features on the 2702, 2703, 3704, and 3705. However, when the maximum number of line adapters is reached on these machines, additional line adapters may be attached via the 2711 Line Adapter Unit. The 2702 feature code required for each line so attached is #3233. The 2703 feature code required for each group of eight lines so attached is either #3205 or #3206. The 3704 and 3705 feature codes required for each pair of lines so attached is either #4714 or #4711.
- (4) The Limited Distance Line Adapter, Type 2B, is included as part of the basic 1031A, unless the IBM Line Adapter, #4647, is ordered.
- (5) This Data Terminal Equipment will operate on this Facility in point-to-point mode only.
- (6) The entry applies to the 2740 model 2 only.

CHART H

PARALLEL TRANSMISSION

FACILITY H1 — Parallel Transmission on Switched or Non-switched Voice Grade Lines. Point-to-point at 13 characters/second.

	024/026					
IBM MACHINE TYPE	Mdl 5,6	1001	1092	1093	7770	7772
Interface to	(2) or	(2)	7795	9470	(2)	9114
Standalone DCE	4702		(3)	or		
(1)	1221			9471, 3239		

Notes for CHART H

- (1) See the IBM Data Communications Handbook
- (2) No special feature is required to attach this Data Terminal Equipment to this Facility.
- (3) This feature is required to allow the 1092 to communicate with an 024, 026, 7770 or 7772 via a 1093 Programmed Keyboard. See the M1092 and M1093 pages for details.

**OPD COMMUNICATING MAG CARD "SELECTRIC" TYPEWRITER****Purpose**

A communicating version of the OPD Mag Card "Selectric" to satisfy the need for incidental communications in the power typing environment. May be used to communicate with another like machine or as a terminal.

Highlights

The Mag Card "Selectric" uses a new I/O, a read/write unit and a Mag Card console housing the electronics. The mag card itself consists of 50 tracks of 100 characters each. The line expansion feature permits recording of 30-35 characters beyond the normal writing line of 65-70 characters. All functional controls and code keys for local and communications mode are provided on the keyboard of the "Selectric" I/O. The communications controls include a "Start" key for initiating transmission to a like machine, "Attention" key, a "CPU" key for initiating transmission to a computer, and a "Line Hold" key for maintaining communication when not transmitting or receiving.

Includes character format checking, dual velocity printing, send and receive indicator lights and a choice of a fabric or film ribbon. Print quality is exactly equivalent to that of a Mag Card "Selectric" Typewriter.

Magnetic cards prepared off-line on any Mag Card "Selectric" may be transmitted at 135 baud. Sending and receiving may also take place directly from the keyboard.

The Standard Communicating Mag Card "Selectric" Typewriter is functionally equivalent on line to a 2741 Communicating Terminal equipped with the following features: Dial Up (#3255), Switched Network Attachment (#9114), Receive Interrupt (#4708), Typamatic Keys (#8341) and Transmit Interrupt (#7900).

Code and systems compatibility provide for transmission to or from a suitably equipped S/360 model 22 through 85 and 195, or a S/370 model 125 through 195. See "Prerequisites" below.

Communication Facilities

The unit operates in half duplex data, full duplex control mode over Common Carrier Public Switched Facilities (C1) at 134.5 bps.

Prerequisites

Communicate with a S/360 model 22 through 85 and 195, or a S/370 model 125 through 195. The data processing system requires a 2701 Data Adapter Unit or a 2702 or 2703 Transmission Control.

VIA 2701 The 2701 requires an IBM Terminal Adapter Type 1 (#4640) and Speed Selection (#9581).

Limitation: The Receive and Transmit Interrupt features on this unit will not be recognized when communication is via a 2701.

Via 2702 The 2702 requires IBM Terminal Control Base (#9696), IBM Terminal Control-Type I (#4615), Selective Speed (#9684), and Data Set Line Adapter (#3233). *Note:* Type I Terminal Interrupt (#8200), when installed on the 2702, will allow the Transmit and Receive Interrupt features of this unit to be recognized. The 2741 Break (#8055) on

the 2702 will allow only the Transmit Interrupt feature of this unit to be recognized.

Via 2703 The 2703 requires either Start-Stop Base Type I (#7505) or Type II (#7506), IBM Terminal Control Base (#4619), IBM Terminal Control Type I (#4696), Line Speed Option (#4878), and Data Line Set (#3205). *Note:* Type I Terminal Interrupt (#8200) will allow the Transmit and Receive Interrupt capability of this unit to be recognized. 2741 Break (#8055) will allow only the Transmit Interrupt feature of this unit to be recognized.

Customer Responsibilities

The customer must be advised that: (1) He is responsible for making arrangements for price quotations, installation and cost (initial and recurring) of common carrier communication facilities/services ... (2) Toll charges, if required for installation and maintenance of the IBM equipment, are to be paid by the customer ... (3) The customer must be prepared to relinquish the data processing system for service in those cases in which servicing aids or available error message printouts do not permit localization of a malfunction of the communication facility or terminal location.

Manuals: *Communicating Mag Card Reference Manual*, G543-0608 ... *Communicating Mag Card Users Guide*, G543-0609 ... *Communicating Mag Card Program Supplement Sheets*, G543-0610.

Specify

- (1) Voltage...115 V, 60 cycle, AC, 15 amps, 3-wire cord only.
- (2) Typing Element...available only in standard correspondence "Selectric" code. One OPD "Selectric" 72 element in correspondence keyboard confirmation 101 is furnished with the unit. See #9811 on page 23 in "Type Catalog." Additional elements may be ordered by specifying the appropriate OPD part number. *Note:* The byte structure of the standard "Selectric" character set differs from that for PTTC/BCD or PTTC/EBCD character sets.
- (3) Character Spacing...10 characters/inch or 12 characters/inch may be specified.
- (4) Line Feeding...6 lines/inch, unless otherwise specified. Pin feed platens are available on an SER (RPQ) basis only.

Operating Procedures

OPD will accept orders for delivery from the plant for the Communicating Mag Card "Selectric" Typewriter and the special features below.

OPD will accept MESs to field convert a Mag Card "Selectric" Typewriter a Communicating Mag Card "Selectric" Typewriter and to add any of the special features below in the field.

Special Features

ACOUSTICAL FILTER HOOD. (Plant or field installable) This feature significantly reduces the amount of noise produced when printing output.

PARAGRAPH INDENT. (Plant or field installable.) Designed for a maximum level of efficiency when preparing and revising



indented material in the local mode. This feature is inoperative when receiving from a computer.

AUTO TERMINAL ID. (Plant or field installable) The four character identification sequence is permanently assigned by IBM. The plant will assign a different combination of characters to each Mag Card "Selectric" Typewriter equipped with this feature. The first character will specify terminal type and the last three will be assigned to that unit. If field installation of a new number or change to an existing number is desired, an MES must be submitted

COMMUNICATE MODE KEYLOCK. (Plant or field installable) The keylock which inhibits the communicate mode will be furnished by IBM. Two keys will be furnished with each lock and additional keys may be purchased.

OPD MAG CARD TYPEWRITERS

Description OPD product family of word processing typewriters (IBM Magnetic Card "Selectric" Typewriter, Mag Card "Executive" Typewriter, IBM Communicating Mag Card "Selectric" Typewriter, IBM Mag Card "A" Typewriter, and IBM Mag Card II Typewriter, all produce magnetic card output or printed reports originating on magnetic cards. The output of these devices can provide input to the System/32 with SCP feature #6002, provided the 5321 Mag Card Unit and Mag-Card Unit Attachment (#4900) are attached to the System/32.

Highlights The mag card typewriter family uses a "Selectric" keyboard and printer to produce magnetic card output. The mag card console is cable connected to the keyboard/printer. The magnetic card itself consists of 50 tracks of 100 + 2 - 0 characters each.

All functional controls and code keys are provided as on the keyboard of the "Selectric" I/O.

Features

IBM Mag Card II Typewriter and IBM Mag Card/A Typewriter.

	IBM Mag Card II Typewriter	IBM Mag Card/A Typewriter
<i>Standard Features</i>		
Printer -		
Acoustical Filter Hood	X	X
Alternate Sections of Memory	X	
Dual Pitch Printer	X	X
End of Ribbon Shut Off	X	X
Internal Scan	X	
Production Tab	X	X
Selective Ribbon System	X	X
Input -		
Automatic Centering	X	X
Automatic Decimal Tabulation	X	X
Automatic Error Correction	X	X
Automatic Line Length and Tab Grid	X	X
Automatic Word Underscore	X	X
Keyboard—Electronic	X	X
Memory Storage - 6,000 characters		X
Memory Storage - 8,000 characters	X	
Pack Feed - 50 cards	X	
Paragraph Indent (14 levels)	X	X
Single Card Feed Slot w/Stacker		X
Unattended Printing	X	
<i>Optional Features</i>		
End of Paper Switch	X	
IBM Correctable Film Ribbon		
Limiting Device	X	X
Pin Feed Platens	X	X
Reverse Index	X	X
Roll Paper Holder	X	X
Mag Card "Executive" Typewriter		Mag Card "Selectric" Typewriter
<i>Standard Features</i>		<i>Standard Features</i>
Acoustical Filter Hood		Acoustical Filter Hood
Automatic Word		



Underscore
End of Ribbon Shut Off
Error Correction -
Backspace/Strikeover
Keyboard - Electronic
Memory Backspace
Paragraph Indent (7 levels)
Production Tab
Proportional Lettering
Removable Card Holder
Selective Ribbon System
Space Expand Button

Optional Features

Pin Feed Platens
Reverse Index

Error Correction -
Backspace/Strikeover
Keyboard - Electronic
Pitch - 10 or 12
Production Tab
Ribbon - Carbon or Fabric

Optional Features

Communicating Feature
Automatic Terminal Identification*
Communicate Mode Keylock*
Paragraph Indent—a no charge
option (7 levels)
Pin Feed Platens
Reverse Index
Roll Paper Holder
Selective Ribbon System

*Access-limiting features for Mag
Card "Selectric" Typewriter with
Communicating feature.



INCLUDED IN SHIPMENT

	IBM Mag Card II Typewriter	IBM Mag Card/A Typewriter	Mag Card "Executive" Typewriter	Mag Card "Selectric" Typewriter
Two "Selectric" Typewriter Elements	X	X		
One Mag Card "Executive" Typewriter Element			X	
One "Selectric" Typewriter Element			X	
One IBM Correctable Film Ribbon	X	X		
One IBM Lift-off Tape	X	X		
One Film/Cartridge Ribbon			X	
One Film or Fabric Ribbon				X
One Magnetic Card	X	X	X	X
One Magnetic Card File Box	X	X	X	X
One Magnetic Card Folder	X	X	X	X
One Magnetic Card Project Box	X	X	X	X
One Magnetic Card Tray	X	X	X	X
Five Additional Removable Card Holders			X	

At the time an order is entered, a minimum quantity of four boxes of cards, one box of folders, and ribbons should be ordered.

SPECIFICATIONS

Description	IBM Mag Card II Typewriter**	IBM Mag Card/A Typewriter**	Mag Card "Executive" Typewriter	Mag Card "Selectric" Typewriter
Cable Length	8.0'	8.0'	7.0'	7.0'
Color Console	Charcoal Black/White	Pebble Gray/Black	White/Raven Black	White/Raven Black
Printer	Charcoal Black/Charcoal Gray	Pebble Gray/Charcoal Gray	Raven Black/White/Charcoal Gray	Raven Black/Accent Gray/Charcoal Gray

Dimensions and Weights

Net				
Width				
Console	12"	12"	10-3/8"	10-3/8"
Printer	22-1/4"	22-1/4"	22-1/4"	22-1/2"
Depth				
Console	19"	19"	20"	20"
Printer	15-5/8"	15-5/8"	15-5/8"	15-1/2"
Height				
Console	26-1/2"	26-1/2"	32"	32"
Printer	7-5/8"	7-5/8"	7-1/8"	7-1/8"
Weight				
Console	64 lbs.	65 lbs.	78 lbs.	75 lbs.
Printer	50 lbs.	50 lbs.	51 lbs.	46 lbs.
Shipping				
Length	27-1/4"	27-1/4"	26-7/8"	27-1/4"
Width	23-1/4"	23-1/4"	22-3/4"	23-1/4"
Height	46-1/2"	46-1/2"	46-3/4"	43-1/2"
Weight(Gross)	160 lbs.	156.5 lbs.	169 lbs.	164 lbs.
Voltage Requirements	115V, 60 HZ -	115V, 60 HZ -	115V, 60 HZ -	115V, 60 HZ
	3 amps current drain	3 amps current drain	2 amps current drain	2 amps current drain



Special Features

Reverse Index Selective Ribbon System

End of Paper Switch
IBM Correctable Film Ribbon Limiting Device
Paragraph Indent
Pin Feed Platens
Roll Paper Holder
Format Feature



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**2711 LINE ADAPTER UNIT**

Purpose: Unit for attachment to 2025 Processing Unit(s) equipped with an Integrated Communications Attachment, 3135 Processing Unit(s) equipped with an Integrated Communications Adapter, and/or 2702/2703 Transmission Control(s), and/or 3704/3705 Communications Controller. It provides for the addition of IBM Line Adapters for a 2025 or 3135 using an ICA feature and attachment of additional IBM Line Adapters for 2702s/2703s/3704s/3705s. The IBM Line Adapters serve as modems for use on appropriate communication facilities, permitting communication with similarly equipped IBM terminals.

Highlights: A modular unit ... provides for installation of up to thirty-two IBM Line Adapters. See "Special Features" below. These adapters are for use by the attached 2702/2703/3704/3705(s). They provide for modulating and demodulating signals over communication facilities in a manner similar to common carrier data sets that would otherwise be required for those functions. Thus, when IBM Line Adapters are used, common carrier data sets are not required.

Three types of IBM Line Adapters can be installed to provide for: limited distance (8 wire-miles) communication ... communication over privately owned or leased common carrier facilities, and/or ... the equivalent of up to four independent low speed channels from a single voice grade channel (each low speed channel may be operated point-to-point or multi-point).

The basic 2711 accommodates up to four IBM Line Adapters, in any combination ... for more than four, Line Adapter Modules (#4794) are required. Each #4794 permits attachment of up to four additional IBM Line Adapters, in any combination. A maximum of seven #4794s can be installed, for a total of thirty-two IBM Line Adapters per 2711 ... see "Special Features" below.

Communication Facilities: The 2711, when equipped with appropriate IBM Line Adapter(s), can attach to common carrier leased private line telephone channels or privately owned communication facilities conforming to the specifications described in SRL GA24-3435* under: Limited Distance Line Adapter, Type 2 ... Leased Line Adapter, or ... Shared Line Adapter.

Attachment to Communication Lines: Attachment to communication facilities conforming to the specifications above is via the appropriate IBM Line Adapter(s) for the type(s) of communication service being used ... see "Special Features" below.

Customer Responsibilities: See M 2700 pages.

Prerequisites: Attachment to 2025 Attachment is made via the Integrated Communications Attachment (#4580) on a per line basis to EIA Start/Stop Data Adapters ... see 2025. *Note:* In a S/360 Model 25, attachment can also be made via a 2702 or 2703 ... see below.

Attachment to 3135 Attachment is made via the Integrated Communications Adapter (#4640) on a per line basis, to a Terminal Adapter Type I Model I (#9721-9728) ... see 3135. **Limitation:** Only IBM Line Adapter (#4647) is supported ... see "Special Features." *Note:* In a S/370 Model 135, attachment can also be made via a 2702 or 2703 ... see below.

Attachment to 2702 Attachment is made on a per line basis to the Data Set Line Adapter (#3233) on the 2702 ... see 2702.

Attachment to 2703 Attachment is made on a per line basis for up to eight lines to each Data Line Set (#3205) or Data Line Set Expander (#3206) ... see 2703.

Attachment to 3704/3705 Attachment is made on a per line basis to Line Set Type 1A or 1D (#4711 or #4714).

Bibliography: GA22-6822.

Specify

- (1) Voltage (AC, 1-phase, 3-wire, 60 cycle): #9902 for 208V, or #9904 for 230V.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- (3) Line Assignments: Must be specified on 2711 Line Assignment Form (120-1468).

Limitations: Up to thirty-two of the IBM Line Adapters below, in any combination, can be installed ... operation with 1030, 1050 or 2741 (with Interrupt (#4708)) is limited to the 4-wire versions of the leased line adapter (#4647) or shared line adapters (#4691, 4692, 4693 or 4694).

Special Features:

tIBM Line Adapter (#4790): A modem for 2-wire limited distance use (up to 8 wire-miles). Line turnaround time is approximately 12 ms ... see Limited Distance Line Adapter, Type 2 in SRL GA24-3435***for specifications and restrictions. For operation with similarly equipped 1030/1050/1060/1070 systems and 2740/2741 terminals at speeds up to 600 bps. **Limitations:** See above. **Prerequisite:** An available position in the basic unit or in a Line Adapter Module (#4794).

tIBM Line Adapter #4639 for 2-wire, #4647 for 4-wire). A modem for leased common carrier or privately owned voice grade facilities. Line turnaround time is approximately 200 ms for #4639 and 20 ms for #4647, both plus line propagation time ... see Leased Line Adapter in SRL GA24-3435* for specifications and restrictions. For operation with similarly equipped 1030/1050/1060 systems and 2740/2741 terminals at speeds up to 600 bps, as applicable. There is no limitation on the length of the communication line that can be served, if it conforms to the specifications in SRL GA24-3435*. **Limitations:** See above. **Prerequisite:** An available position in the basic unit or in a Line Adapter Module (#4794).

tIBM Line Adapter (#4641-4644 for 2-wire, #4691-4694 for 4-wire). A modem for shared use of a leased common carrier or privately owned voice grade facility. Line turnaround time is approximately 200 ms for #4641-4644 and 20 ms for #4691-4694, both plus line propagation time ... see Shared Line Adapter in SRL GA24-3435* for specifications and restrictions. For operation with similarly equipped 1050/1060 systems and 2740/2741 terminals at speeds up to 134.5 bps. When used, a single leased telephone line can provide up to four 134.5 bps "subchannels" ... the equivalent of up to four low-speed lines from a single voice grade channel. Each "subchannel" is obtained through use of one of the four shared line adapters. Thus, to operate four "subchannels" on a single telephone channel, four line adapters (#4641 through #4644) for a 2-wire channel, or (#4691 through #4694) for a 4-wire channel are required. **Limitations:** See above. **Prerequisite:** Each line adapter requires an available position in the basic unit or in a Line Adapter Module (#4794).

Ordering: The terminal with which each "subchannel" on the 2711 is to communicate must be equipped with the same shared line adapter, i.e., the same feature #.



Line adapters for use with each different leased telephone channel must be ordered in sequence, as follows:

	2-wire	4-wire
For subchannel 1	#4641	#4691
For subchannel 2	4642**	4692**
For subchannel 3	4643**	4693**
For subchannel 4	4644**	4694**

**Subchannel 1 is prerequisite for installation of higher numbered subchannels, unless Shared Line Adapter 4/1 Terminator (#6350) is ordered.

Line Adapter Module #4794: For attachment of up to four additional IBM Line Adapters ... any of those above, in any combination. **Maximum Seven.**

Shared Line Adapter 4/1 Terminator (#6350): A pluggable device for physically attaching up to four different 2-wire IBM shared line adapters (#4641-4644) or up to four different 4-wire IBM shared line adapters (#4691-4694) to a single 404B Telephone Co. line terminating jack ... see Shared Line Adapter installation practices in SRL GA24-3435*.

Prerequisite: The appropriate IBM Line Adapters (#4641-4644) or (#4691-4694).

*SRL GA24-3435-2, or subsequent revisions.

†For further information on IBM Line Adapters, see M 2700 pages.

**2740 COMMUNICATION TERMINAL**

Purpose: A Selectric® typewriter terminal (printer/keyboard) for transmission of data or text to or from another terminal or data processing system.

Model 1: Keyboard/printer terminal for transmission to or from another 2740 Model 1, or to or from a S/360 Model 22 thru 85, 195, or S/370 Model 115 thru 195 or a Series/1 Model 3 or 5 ... see "Communication Facilities" and "Prerequisites" below. Also attaches directly to a 2715 Transmission Control for keyboard input or printed output ... see "Prerequisites" below.

Model 2: Buffered keyboard/printer terminal for transmission to or from a S/360 Model 22 thru 85, 195, or S/370 Model 115 thru 195 ... see "Communication Facilities" and "Prerequisites" below.

Model Changes: Cannot be made in the field.

Highlights: The unit's Selectric typewriter provides the optimum in operator/machine relationship. Special features available permit tailoring of terminals to the requirements of a specific work station.

System control keys and indicator lights, located conveniently alongside the keyboard, make it a compact console-like unit. When not used for data transmission, the typewriter may be used for office typing. (*Note:* There are basic design differences in the 2740 which will result in different printing output than the Selectric typewriter. Customers with applications requiring critical printing must be directed to evaluate 2740 output capability in light of their own needs. Statements by IBM must not be made equating 2740 output printing to the Selectric typewriter output.)

Model 1 Code and system capability permit transmission to or from other 2740 Model 1s, or to or from a suitably equipped S/360 or S/370 or Series/1 ... see System Application, under "Specify" below.

Model 2 Code and system application permit transmission to or from a suitably equipped S/360 or S/370. The basic unit has a 120-position magnetic core buffer. Data entered from the keyboard can be stored and visually verified before transmission to the S/360 or S/370. Data from the S/360 or S/370 is received directly by the printer, except when the unit is equipped with Buffer Receive (#1499) ... see "Special Features." This model also includes the functions provided by Station Control (#7479) on the model 1.

Communication Facilities: Either model operates in half duplex mode over the following facilities at the speeds indicated. For information concerning the facilities, see M 2700 pages.

Model 1: At 134.5 bps via facility C1, C2, D1, G1 or G2.

Model 2: At 75 bps via facility A4. At 134.5 bps via facility D1, G1 or G2. At 600 bps via facility D2 or G2.

Note: For attachment to A4, the channels must be capable of 75 bps operation, use non-code sensitive regenerators and a 9-bit character code, and be terminated in a 62.5 ma neutral DC loop of the terminal.

Also see Data Set Attachment under "Specify" for required facility specification code. On appropriate lines, IBM Line Adapters may be used in lieu of data sets ... see "Special Features." IBM Line Adapters and data sets cannot be mixed on the same circuit.

Prerequisites: Attachment to a 2715 Transmission Control Unit

(Model 1 only)—requires a 2715 Model 2, or a 2715 Model 1 equipped with a Local 2740 Adapter (#4850) ... 2715 Attachment (#9715) is also required on the 2740 Model 1 itself. See "Specify" below.

Communication with Another 2740 (Model 1 only)—system Application (#9701) is required on each 2740 ... in addition, the same Data Set Attachment is required on each 2740. See "Specify" below.

Communication with a S/360 Model 25—via the Integrated Communications Attachment (#4580) with appropriate features on the 2025 ... see "Special Features" under 2025.

Note: Communication with a S/360 Model 25 may also be via a 2701, 2702 or 2703.

Communication with a S/370 Model 115, 125, 135—via the Integrated Communications Adapter (#4640) on the 3115, 3125, 3135. Also a 2701, 2702, 2703, 3704 or 3705 can be used ... see below.

Communication with a S/360 Model 22 thru 85, 195, or S/370 Model 115 thru 195—via a 2701 Data Adapter Unit, or 2702/2703 Transmission Control equipped with appropriate features ... see 2701, 2702 or 2703.

Communication with a S/360 Model 30 thru 195 (except Model 44, 67 in TSS Mode, 85 or 91), or S/370 Model 115 thru 195—via a 3704/3705 Communications Controller. *Note:* See the 3704 and 3705 Machines and Programming sales manual pages for attachment capability and refer to Host System Programming pages for possible restrictions to any of the above attachments.

Communications with a Series/1 Model 3 and 5 via Asynchronous Comm. Single Line Control (#1610), or Asynchronous Comm. 8 Line Control (#2091) in conjunction with Asynchronous Comm. 4 Line Adapter (#2092).

Customer Responsibilities: See M 2700 pages.

Bibliography: GA24-3089.

Specify

(1) Voltage (AC, 1-phase, 3-wire, 60 cycle): Locking plug—#9880 for 115 V, #9884 for 208 V, or #9886 for 230 V. Non-lock plug—#9881 for 115 V, #9885 for 208 V, or #9887 for 230 V. If a 2740 is to be installed on a raised floor, specify Moisture Proof Plug —#9902 for 208V, or #9904 for 230V.

(*Note:* Consideration of voltage must be made independently of CPU voltage and should be specified only after checking available voltage at terminal location.)

(2) Printing Element: One element is supplied ... see "Type Catalog", page TC 21, etc. for available PTTC/BCD, PTTC/EBCD and standard Selectric elements available, feature #s, and prices of additional elements. The element specified determines the keyboard arrangement. (*Note:* The byte structure of the standard Selectric character set differs from that for PTTC/BCD or PTTC/EBCD character sets. The 2740 Model 1 or 2 is not Type I programming supported on S/360 with any standard Selectric elements. Standard Selectric elements are not available for the 2740 Model 2.)

(3) Character Spacing: #9104 for 10 characters/inch, or #9105 for 12 characters/inch. (*Note:* #9105 is not recommended unless a 12-pitch element is specified ... intermixing of char-



acter spacing on terminals in any one system should be avoided ... character spacing cannot be changed in the field.)

(4) Line Feeding: #9435 for 6 lines/inch, or #9436 for 8 lines/inch. If a Pin Feed Platen is desired in lieu of the standard friction feed platen, see "Special Features" below. #9435 or #9436 must be specified even though a Pin Feed Platen is ordered.

(5) Data Set Attachment: Unless an IBM Line Adapter, Telegraph Line Attachment (#7807), or 2715 Attachment (#9715) is specified, one of the following #s must be specified; depending upon the facility to be used.

#9114—(Model 1 only) for facility C1 or C2.

Prerequisite: Dial Up (#3255) ... see "Special Features."

#9115, #9116 or #9120 for Facility D1M.

See this Facility in the M2700 pages for applicability of these codes.

#9121 for facility D2.

Prerequisite: Speed Base - 600 BPS (#7106) ... see "Special Features."

See M 2700 pages, this section, for information on these communication facilities.

(6) System Application (Model 1 only): #9700 for terminal-to-multiplexer system (except 2715), or #9701 for terminal-to-terminal.

(7) 2715 Attachment (Model 1 only): #9715 ... required for attachment to a 2715.

Prerequisite: Dial Up (#3255) and Print Element (#9592). Cable for the 2740 must be ordered on the 2715 Cable Order Form.

Limitation: When attached to a 2715, Dial Up #3255) is the only special feature that can be installed on the 2740.

Special Features: For Either Model

IBM Line Adapter (#4634 for 2-wire, #4635 for 4-wire).

A modem for local use up to 4.75 wire-miles over facility G1. See Limited Distance Line Adapter, Type I in SRL GA24-3435** for specifications and restrictions. *Note:* Operation with a 2712 Remote Multiplexer requires #4635.

IBM Line Adapter (#4639 for 2-wire, #4647 for 4-wire):

A modem for leased or privately owned voice grade use (facility D1 or D2). See Leased Line Adapter in SRL GA24-3435** for specifications and restrictions. **Limitation:** For point-to-point terminal-to-multiplexer operation, #4647 cannot be used on the 2740 Model 1 when the multiplexer is operated in continuous carrier mode.

IBM Line Adapter (#4641-4644 for 2-wire, #4691-4694 for 4-wire):

A modem for shared use of a Type 3002 Private Line Service* or privately owned voice grade facility (facility D1). See Shared Line Adapter in SRL GA24-3435** for specifications, use and restrictions. When used, a single voice grade line can provide up to four independent "subchannels" ... the equivalent of up to four independent low-speed lines from a single voice grade line. Each "subchannel" operates on a separate frequency and simultaneous data flow is possible on all four "subchannels," either on a point-to-point or multipoint basis.

2-wire

#4641—for subchannel 1 #4643—for subchannel 3
#4642—for subchannel 2 #4644—for subchannel 4

4-wire

#4691 for subchannel 1 #4693 for subchannel 3
#4692 for subchannel 2 #4694 for subchannel 4

Maximum One per 2740.

Prerequisite: All units expected to communicate directly with each other must be on the same "subchannel", i.e., must be equipped with the same shared line adapter (same feature #) ... it is recommended that if no more than two "subchannels" are required on a line facility, that #4641 and #4642, or #4691 and #4692, be used. **Limitation:** For point-to-point terminal-to-multiplexer operation, #4691 - #4694 cannot be used on the 2740 Model 1 when the multiplexer is operated in continuous carrier mode.

IBM Line Adapter (#4790): A modem for 2-wire limited distance use up to 8 wire-miles at speeds up to 600 bps over facility G2. See Limited Distance Line Adapter, Type 2B, in SRL GA24-3435** for specifications and restrictions.

Pin Feed Platen (#9509): (Purchase Only) For Plant Installation—specify #9509 ... maximum one, in lieu of standard friction feed platen. See "Pin Feed Platens" on M 10000 pages, this section, for available options, Feature #s to be specified and price.

Limitation:

Cannot be used if Document Insertion (#3401 or 3402) is installed.

Record Checking (#6114): Provides a combination of character (parity) checking and block (longitudinal redundancy) checking.

For Model 1 Only

Automatic EOB (#1313): Provides an automatic EOB (End of Block) code following the carriage return code upon depression of the carriage return key.

Prerequisite: Record Checking (#6114).

Dial Up (#3255). Required when a dial data set is used, i.e., when Data Set Attachment (#9114) is specified.

Limitation: Cannot be used with Station Control (#7479).

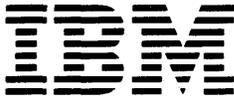
Station Control (#7479): Gives the terminal the ability to react to a poll or address from a multiplexer. The polling scheme employs a "character + space" poll or address. The addressing sequence is identified by the "start of address" (comma) character. **Limitation:** Cannot be used with Dial Up (#3255) or 2760 Attachment (#8301). (*Note:* The functions provided by this feature on a Model 1 are standard on the Model 2.)

Transmit Control (#8028): Gives the terminal the ability to respond to a 2-character control code sequence from a multiplexer and to switch from a standby condition to a transmit condition. **Limitation:** Cannot be used with a 2760 Attachment (#8301). **Prerequisite:** Dial Up (#3255).

2760 Attachment (#8301): To attach a 2760 Optical Image Unit. A PTTC/BCD or PTTC/EBCD Data 1 or Data 2 type font printing element must be specified with this feature. See "Type Catalog," page 23, for feature #s. **Limitations:** Can be field installed only on units serial no. 15000 or above ... cannot be installed with Station Control (#7479) or Transmit Control (#8028). **Prerequisite:** Record Checking (#6114).

For Model 2 Only

Buffer Expansion (#1495, 1496): To increase capacity of the



basic 120-position magnetic core buffer. #1495—for positions 121 to 248 ... #1496—for positions 249 to 440. Prerequisite: #1496 requires #1495.

Buffer Receive (#1499): Permits data to enter the buffer from the communication line in lieu of going directly to the printer. Incoming data is stored until an EOT is received ... terminal then automatically goes to a receive buffer print state and prints out the contents of the buffer.

Document Insertion (#3401, 3402): (Plant installation only) For insertion of single part ledger cards in front of the typewriter platen without using the platen knobs. See SRL GA24-3403 for details on portions of ledger cards which cannot be used for printing. Manual positioning is required for each new print line. Includes controls and lights necessary for a Split Friction Feed Platen (#9600). **Maximum:** One, #3401 or #3402. **Limitation:** Pin Feed Platen (#9509) cannot be used if this feature is installed.

#3401 Accepts a ledger card 6" wide (maximum), with minus 1/32" tolerance, and length of at least 5". With a 10-pitch printing element, 25 characters may be printed before printing on the ledger begins ... with a 12-pitch element, 30 characters. The 26th character (10-pitch) and 31st (12-pitch) are not printable on the ledger card. The 27th (10-pitch) and 32nd (12-pitch) will be the first printable character and the 85th (10-pitch) and 102nd (12-pitch) the last printable character on the ledger card.

#3402 Accepts a ledger card 7-3/8" wide (maximum), with minus 1/32" tolerance, and length of at least 5". With a 10-pitch printing element, 55 characters may be printed before printing on the ledger begins ... with a 12-pitch element, 66 characters. The 56th character (10-pitch) and 67th (12-pitch) are not printable on the ledger card. The 57th (10-pitch) and 68th (12-pitch) will be the first printable character and the 129th (10-pitch) and 155th (12-pitch) the last printable character on the ledger card.

Edit (#3600): Helps in error correction of keyboard-entered data. Provides two additional keys, Line Return and Line Type, for operator use in making corrections.

Header Control (#4510): Permits customer designation of the first 28 positions of the buffer (in groups of 4 positions) for repetitive header information. Under switch control, keyed data may be entered into the header area and played back for verification. Header is transmitted each time the buffer is read out to the line. The header size (4, 8, 12, 16, 20, 24 or 28 positions) is specified by customer at installation time.

Speed Base - 600 BPS (#7106): To transmit and receive data over common carrier leased or privately owned facilities at 600 bps ... transmission character rate is 66.7 characters/second. (Note: Buffer print will be at normal 14.8 cps rate.) **Limitation:** Cannot be used when 2740 is connected to a 2712 Remote Multiplexer. **Prerequisite:** Buffer Receive (#1499).

Split Friction Feed Platen (#9600): (Plant installation only) One 2-section platen with the split located to provide a 5-1/2" printing line on the left and a 7 1/2" printing line on the right can be purchased in lieu of the standard friction feed platen ... with this platen and Document Insertion (#3401, 3402), two separate forms, in addition to printing on a ledger card, can be inserted and individually controlled. For purchase price, see "Split Friction Feed Platen" on M 10000 pages. **Maximum:** One.

Prerequisites: Document Insertion (#3401 or 3402) and Line Feeding (#9435) (6 lines/inch).

- * or equivalent
- ** SRL GA24-2435-2, or subsequent revisions.

† For further information, see M 2700 pages, this section.

†**Telegraph Line Attachment (#7807):** For operation with 75 baud common carrier leased private line telegraph service, or privately owned equivalent, only. With this feature, transmission rate is 8.33 characters/second. (Note: If Buffer Receive (#1499) is also installed, buffer print will be at normal 14.8 cps rate.) **Limitation:** Cannot be used when 2740 is connected to a 2712 Remote Multiplexer.

† For further information, see page M 2700 (1), etc, this section.

Accessories

Roll Paper Holder (for 2740): Provides for mounting of rolls of paper or continuous forms. Includes a tear bar and forms guide.

If ordered on a Single Use-Charge basis prior to August 6, 1973, may be retained by rental customers at any time in the future if they so desire. Upon machine discontinuance, if a customer does not desire to retain roll paper holder, it is to be returned with the machine. If ordered on a purchase basis, the roll paper holder remains the property of the customer and is to be removed when a rental machine is discontinued.

Pin Feed Platens (2704): For feeding of continuous forms that have pre-punched feed holes. On any one machine, one pin feed platen may be ordered for plant installation in lieu of the standard solid platen. The platen becomes the property of the customer and cannot be returned for credit.

One in lieu of std friction feed platen (max 1 per machine)
Pin Feed Platen (regular) #9509

Specify

[1] #9509 ... [2] Line Spacing and Hole-to-hole Width: One feature number, depending upon forms width and line spacing, from "Line Spacing" below. **Prerequisite:** On 2740 the appropriate Feature Number for line spacing on the basic machine (#9435 for 6 lines/inch, or #9436 for 8 lines/inch) is required ... see "Specify" under each unit in "Machines."

Line Spacing With #9509 one of the following Feature Numbers must be specified in accordance with line spacing and hole-to-hole width of the forms to be used.

Over-all Forms Width	Hole-to-Hole Width	Writing Line	Feature No. for Line Spacing	
			6 lines/inch	8 lines/inch
5-3/4"	5-1/4"	4-5/8"	9151	—
6-1/2"	6"	5-3/8"	9152	9272
8"	7-1/2"	6-7/8"	9153	9273
8-1/2"	8"	7-3/8"	9154	9274
9-1/2"	9"	8-3/8"	9155	9275
9-7/8"	9-3/8"	8-3/4"	9156	—
10-3/8"	9-7/8"	9-1/4"	9157	—
10-1/2"	10"	9-3/8"	9158	9278
10-5/8"	10-1/8"	9-1/2"	9159	9279
11-3/4"	11-1/4"	10-5/8"	9160	9280
12"	11-1/2"	10-7/8"	9161	9281
13"	12-1/2"	11-7/8"	9167	9287
13-5/8"	13-1/8"	12-1/2"	9162	9282
14-3/8"	13-7/8"	13-1/4"	9168*	9288*

*No additional installation charges



2741 COMMUNICATION TERMINAL

Purpose: A Selectric® typewriter terminal to satisfy special system applications that require one-terminal-per-line operation.

Highlights: Looks like and includes the optimum operator/machine relationship of the standard Selectric typewriter. The only terminal controls located in the keyboard area are the "On/Off" switch and "Attention" key. Mounted on a stand similar to that of the 2740. The typewriter may be used for office typing when not used for data transmission.

(Note: There are basic design differences in the 2741 which will result in different printing output than the Selectric typewriter. Customers with applications requiring critical printing must be directed to evaluate 2741 output capability in light of their own needs. Statements by IBM must not be made equating 2741 output printing to the Selectric typewriter output.)

Code and systems compatibility provide for transmission to or from a suitably equipped S/360 Model 22 thru 85, 195, or S/370 Model 125 thru 195. The 2741 can attach to a 3790 system via a 3792 Auxiliary Control Unit. See "Prerequisites" below.

Communication Facilities: The 2741 operates in half-duplex mode over the following facilities. For information concerning the facilities, see M 2700 pages.

At 134.5 bps via facility C1, C2, D1, G1, or G2.

Also see Data Set Attachment under "Specify" for required facility specification code. On appropriate lines, IBM Line Adapters may be used in lieu of data sets...see "Special Features." IBM Line Adapters and data sets cannot be mixed on the same circuit.

Prerequisites

Communication with a S/360 Model 25: Via the Integrated Communications Attachment (#4580) with appropriate features on the 2025. Communication with a S/360 Model 25 may also be via a 2701, 2702 or 2703.

Communication with a S/370 Model 115, 125, 135: Via the Integrated Communications Adapter (#4640) on the 3115, 3125, 3135. Also a 2701, 2702, 2703, 3704 or 3705 can be used ... see below.

Communication with a S/360 Model 22 thru 85, 195, or S/370 Model 115 thru 195 Via a 2701 Adapter Unit, or 2702 or 2703 Transmission Control equipped with appropriate features ... see 2701, 2702, 2703.

Communication with a S/360 Model 30 thru 195 (except Model 44, 67 in TSS Model, 85 or 91) or S/370 Model 115 thru 195: Via a 3704 or 3705 Communications Controller. Note: See the 3704 and 3705 Machines and Programming sales manual pages for attachment capability and refer to Host System Programming pages for possible restrictions to any of the above attachments.

Communication with a 3792 Auxiliary Control Unit: Via an IBM Leased Line Adapter (#5400) or EIA Interface (#3701) on the 3792.

Customer Responsibilities: See M 2700 pages, this section.

Bibliography: GA24-3089.

Specify

(1) Voltage†† (AC, 1-phase, 3-wire, 60 cycle): Locking plug—#9880 for 115V, #9884 for 208V, or #9886 for 230V. Non-lock plug—#9881 for 115V, #9885 for 208V, or #9887 for 230V. If a 2741 is to be installed on a raised floor, specify Moisture Proof Plug—#9902 for 208V, or #9904 for 230V. (Note: Consideration of voltage must be made independently of CPU voltage and should be specified only after checking available voltage at terminal location.)

(2) Printing Element: One element is supplied ... see "Type Catalog," page TC 21 etc. for available PTTC/BCD, PTTC/EBCD and standard Selectric elements available, feature #s, and prices of additional elements. The element specified determines the keyboard arrangement. (Note: The byte structure of the standard Selectric character set differs from that for PTTC/BCD or PTTC/EBCD character sets.)

(3) Character Spacing: #9104†† for 10 characters/inch, or #9105 for 12 characters/inch. (Note: #9105 is not recommended unless a 12-pitch element is specified ... intermixing of character spacing on terminals in any one system should be avoided ... character spacing cannot be changed in the field.)

(4) Line Feeding: #9435†† for 6 lines/inch, or #9436 for 8 lines/inch. If a Pin Feed Platen is desired in lieu of the standard friction feed platen, see "Special Features" below. #9435 or #9436 must be specified even though a Pin Feed Platen is ordered.

(5) Data Set Attachment:†† Unless an IBM Line Adapter is specified, one of the following #s must be specified, depending upon the facility to be used.

#9114 For facility C1 or C2.

Prerequisite: Dial Up (#3255) ... see "Special Features."

#9115, #9116 or #9120 For facility D1M.

See the D1M Facility in the M 2700 pages for the availability of these codes.

See M 2700 pages, this section, for information on these communication facilities.

Special Features:

††**Dial Up (#3255):** Required when a dial data set is used, i.e., when Data Set Attachment (#9114) is specified.

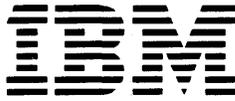
Interrupt, Receive (#4708), Transmit (#7900): Either can be used with any of the communication facilities listed above.

Receive Interrupt (#4708) Used to interrupt transmission from the processor at the operator's convenience.

Transmit Interrupt (#7900) Allows the processor to interrupt transmission from the 2741. **Limitation:** Cannot be used when 2741 is connected to a 2701, or to a S/360 Model 25 via the Integrated Communications Attachment (#4580). **Prerequisites:** For #4708, either 2741 Break (#8055) or Type I Terminal Interrupt (#8200) on a 2702 or 2703 or a S/370 Model 125 Integrated Communications Adapter (#4640) or a S/370 Model 135 Integrated Communications Adapter (#4640) with Write Interrupt (#9745-9752) ... For #7900, Type I Terminal Interrupt (#8200) on a 2702 or 2703 or a S/370 Model 125 Integrated Communications Adapter (#4640) or a S/370 Model 135 Integrated Communications Adapter (#4640) with Read Interrupt (#9737-9744) ... if an IBM Line Adapter is used, it must be a 4-wire version.

††**IBM Line Adapter (#4634 for 2-wire, #4635 for 4-wire):**

A modem for local use up to 4.75 wire-miles over facility G1. See Limited Distance Line Adapter, Type 1 in SRL GA24-3435**



for specifications and restrictions. *Note:* Operation with a 2712 Remote Multiplexer requires #4635.

†IBM Line Adapter†† (#4639 for 2-wire, #4647 for 4-wire):

A modem for leased or privately owned voice grade use (facility D1). See Leased Line Adapter in SRL GA24-3435** for specifications and restrictions.

†IBM Line Adapter (#4641-4644 for 2-wire, #4691-4694 for 4-wire):

A modem for shared use of a Type 3002 Private Line Service* or privately owned voice grade facility (facility D1). See Shared Line Adapter in SRL GA24-3435** for specifications, use and restrictions. When used, a single voice grade line can provide up to four independent "subchannels" ... the equivalent of up to four independent low-speed lines from a single voice grade line. Each "subchannel" operates on a separate frequency and simultaneous data flow is possible on all four "subchannels."

2-wire

- #4641 for subchannel 1 #4643 for subchannel 3
- #4642 for subchannel 2 #4644 for subchannel 4

4-wire

- #4691 for subchannel 1 #4693 for subchannel 3
- #4692 for subchannel 2 #4694 for subchannel 4

Maximum: One per 2741. **Prerequisite:** The multiplexer with which the 2741 is to communicate must be equipped with the same "subchannel," i.e., the same feature # ... it is recommended that if no more than two "subchannels" are required on a line facility, that #4641 and #4642, or #4691 and #4692, be used.

†IBM Line Adapter (#4790): A modem for 2-wire limited distance use up to 8 wire-miles over facility G2 See Limited Distance Line Adapter, Type 2 in SRL A24-3435** for specifications and restrictions.

††Pin Feed Platen (#9509): (Purchase Only) For Plant Installation—specify #9509 ... maximum one, in lieu of standard friction feed platen. See "Pin Feed Platens" on M 10000 pages, this section, for available options, feature #s to be specified and prices.

Print Inhibit (#5501): Allows the processing unit to inhibit the 2741 from printing transmitted or received data.

††Typamatic Keys (#8341): Allows repeat action when key level is depressed to a lower level ... operations included are Hyphen/Underscorer, Space and Backspace.

* or equivalent

** SRL GA24-3435-2, or subsequent revisions.

† For further information, see M 2700 pages, this section

†† Only these specify codes and special features are supported by the 3790 system.

Accessories

Roll Paper Holder (for 2741): Provides for mounting of rolls of paper or continuous forms. Includes a tear bar and forms guide.

If ordered on a Single Use-Charge basis prior to August 6, 1973, may be retained by rental customers at any time in the future if they so desire. Upon machine discontinuance, if a customer does not desire to retain roll paper holder, it is to be returned with the machine. If ordered on a purchase basis, the roll paper

holder remains the property of the customer and is to be removed when a rental machine is discontinued.

Pin Feed Platens (2741): For feeding of continuous forms that have prepunched feed holes. On any one machine, one pin feed platen may be ordered for plant installation in lieu of the standard solid platen. The platen becomes the property of the customer and cannot be returned for credit.

One in lieu of std friction feed platen (max 1 per machine)

Pin Feed Platen (regular)#9509

Specify

(1) #9509 ... (2) Line Spacing and Hole-to-hole Width: One feature number, depending upon forms width and line spacing, from "Line Spacing" below. **Prerequisite:** On 2741 the appropriate Feature Number for line spacing on the basic machine (#9435 for 6 lines/inch, or #9436 for 8 lines/inch) is required ... see "Specify" under each unit in "Machines."

Line Spacing With #9509 or #9510, one of the following Feature Numbers must be specified in accordance with line spacing and hole-to-hole width of the forms to be used.

Over-all Forms Width	Hole-to-Hole Width	Writing Line	Feature No. for Line Spacing	
			6 lines/inch	8 lines/inch
5-3/4"	5-1/4"	4-5/8"	9151	—
6-1/2"	6"	5-3/8"	9152	9272
8"	7-1/2"	6-7/8"	9153	9273
8-1/2"	8"	7-3/8"	9154	9274
9-1/2"	9"	8-3/8"	9155	9275
9-7/8"	9-3/8"	8-3/4"	9156	—
10-3/8"	9-7/8"	8-1/4"	9157	—
10-1/2"	10"	9-3/8"	9158	9278
10-5/8"	10-1/8"	9-1/2"	9159	9279
11-3/4"	11-1/4"	10-5/8"	9160	9280
12"	11-1/2"	10-7/8"	9161	9281
13"	12-1/2"	11-7/8"	9167	9287
13-5/8"	13-1/8"	12-1/2"	9162	9282
14-3/8"	13-7/8"	13-1/4"	9168	9288



2791 AREA STATION

Purpose: An input/output station and local device data controller for a 2790 Data Communication System.

Model 1 For card, identification badge, and 12-key manual entry ... available adapters provide for attachment of up to three 1035 Badge Readers, up to thirty-two 2795/2796/2797 Data Entry Units with a 2715, System/7, or 1800 System, up to twelve 2798 Guidance Display Units (2715 and System/7 only), a 1053 Printer Model 1, and an OEM digital device. See "Special Features" and "2791/2793 Limitations" under 2793.

Model 2 For card, identification badge, and 12-key manual entry only.

Model Changes: Model 2 can be changed in the field to Model 1, but not vice versa.

Prerequisite: The 2790 system controller can be a 2715 Transmission Control Unit or a properly equipped or System/7 1800 System.

With 2715 See 2715 for details.

With System/7. See 2790 Control (#8195) under 5012 or 5013.

Highlights: A solid-state, industrially packaged unit. It features data entry via prepunched cards, identification badges, and 12-key manual entry...display of manually entered data for verification before transmission ... step-by-step display of operator instructions ... display of data in response to an inquiry ... time-of-day display ... designed for attachment to a unique transmission line capable of handling large volumes of short messages from many stations.

Card Reader: Standard or Port-A-Punch® prepunched 80-column cards can be individually inserted and removed manually. An upper left corner cut, C1, is required. M3, M4 and M5 scores can be used. Numbers, letters and certain special character card codes are read...see SRL GA27-3015. Blank card columns are not recognized and are automatically skipped.

Badge Reader: Reads identification badges (22-column card size) prepunched in IBM code with a maximum of ten digits. The badges, which are punched on a 13 Badge Punch, are individually inserted and removed manually. Badges with or without a pocket clip can be used. They can be purchased from vendors or produced by commercially available equipment. See SRL GA21-9028 for badge specification.

Note: A badge gauge is shipped at no charge with each badge punch ... see 13 Badge Punch.

Manual Entry: Ten numeric keys and two special keys provide for entry of variable numeric source data. As each key is depressed, the number or special character is displayed to the operator for verification. Up to six positions are displayed for any one data field. After verification, an enter key is depressed to transmit the data to the system controller. The number of fields that may be entered is specified by the system controller program.

Digital Display: When not being used for display of manual entry, the time-of-day is displayed. Digital display may also be used for display of six digits of data in response to an inquiry.

Operator Guidance: Step-by-step instructions are provided to the operator for each transaction. The thirty-one guidance indicators are designed to permit the user's own terminology. The indicators are activated under program control of the system controller.

Transaction Selection: Nine transaction keys and one release

key are provided. The transactions may be expanded by subsequent card, badge or manual entry to provide a greater number of transactions.

Monitor Key: Used where a supervisor's approval is required before a record can be transmitted. One key is supplied.

Indicators: Advise the operator that: (1) The station is online and ready for use ... (2) The station is in process of transmitting a record ... (3) The record is not valid and the "Repeat Clear" button should be depressed ... (4) A card is in the card reader.

Control Keys: The "Enter" key is used to transmit the manually keyed data ... the "Clear" key is used to reset the station to normal ready status ... the "Next Guidance" key is used to advance the operator guidance when required for unusual transactions.

Attachment Features: On the Model 1, available features permit attachment of up to three 1035 Badge Readers, one 1053 Printer Model 1, up to thirty-two 2795/2796/2797 Data Entry Units (any combination), or up to twelve 2798 Guidance Display Units and up to eight 2795/2796/2797s (2715 and System/7 only), and one OEM digital device such as a scale, meter or counter. See "Special Features" below.

Customer Responsibilities: See 2790 in "Systems."

Environment: See 2790 in "Systems."

Limitations: See "2791/2793 Limitations" following 2793.

Bibliography: GA24-3089.

Specify:

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 cycle): #9880 for locking plug, or #9881 for non-lock plug.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- (3) Cable to Junction Box: #9030, if required. If initial machine order includes #3330, 7990, 8030 or 8295, or any combination of these features, #9030 must be specified. Any subsequent MES to add any of these features must also specify #9030. *Note:* Do not specify #9030 on mechanical replacement orders; see Physical Planning Manual GA27-3017 for requirements.
- Note:* If #9030 is specified, provide complete person's name and address for shipment...cables will be shipped automatically, approximately 30 days prior to scheduled delivery.)
- (4) For initial 2791 machine order having Extended Distance Repeater, Receive or Send (#3874, 3875) specify #9547 and #9548 ... also specify #9548 (oscillator) for each 2791 ordered for the 2790 system.
- (5) If a 2792 Remote Communications Controller is used in the 2790 System, specify #9790 for each 2791 Model 1 or 2 attached to the 2792 Model 2 on the second "loop."

Special Features:

Digital Device Read-in (#3330): [Model 1 only] For attachment of an OEM digital device such as a scale, meter or counter via a customer-supplied junction box and cable...reads up to ten decimal digits. Electrical resistance of OEM device and cable is limited to 10 ohms...OEM device must comply with the 2791 interface ... see "Specify" (3) above. **Maximum:** One.

External Alarm Contacts (#3690): (Model 1 only) Provides a pair of dry contacts which can be momentarily (35 milliseconds nominal) closed to allow operation of a customer's attached



external alarm device (bell, whistle, light, etc.). Momentary closure of the contacts is activated by receipt of an EBCDIC "Bell" character. The contacts are capable of switching 115 V AC or DC at not more than 0.5 amperes. **Maximum:** One. **Note:** Includes a 4-foot 2-wire cable for attachment of a customer-provided alarm or junction box. **Limitation:** Not available when System/7 is the system controller. **Prerequisite:** 1053 Attachment (#8050) on the 2791 and Expanded Capability (#3801) on the 2715 controller.

Extended Distance Repeater, Receive (#3874): Provides for operation with another 2791 or 2793 Area Station or 2715 Transmission Control Unit equipped with Extended Distance Repeater, Send (#3875) located up to 6,000 wire-feet away. See Physical Planning Manual GA27-3017 for cable specifications. **Maximum:** One. **Limitations:** See Limitations for Extended Distance Repeater, Send (#3875) below. Field installable on units shipped prior to October 2, 1971 which also include B/M #5992893 and all units shipped after October 1, 1971. B/M #5992893 is plant installable only ... when #3874 is added anywhere in the 2790 system, #9548 (oscillator change) must be ordered for each 2791 or 2793 ordered for the system. **Prerequisites:** Extended Distance Repeater, Send (#3875) on the "up-line" 2791, 2793, or 2715.

Extended Distance Repeater, Send (#3875): Provides for operation with another 2791 or 2793 Area Station or 2715 Transmission Control Unit equipped with Extended Distance Repeater, Receive (#3874) located up to 6,000 wire-feet away. See Physical Planning Manual GA27-3017 for cable specifications. **Maximum:** One. **Limitations:** (1) The use of two pairs of Extended Distance Repeaters, Receive/Send (#3874, 3875) in tandem is not recommended. If the Area Station having both Receive and Send Repeater should fail, the entire segment would be inactive. (2) When an 1800 System or System/7 is the 2790 System Controller, these repeaters cannot be used between the system controller and the first Area Station or between the last Area Station and the system controller. However, they can be used between all other Area Stations attached to the system within the maximum limit. (3) Maximum of eight pairs per 2715, 1800/2790 Adapter (#7570) or System/7. (4) Maximum of two pairs of EDRs may be used on a secondary loop attached to a 2792. Field installable on units shipped prior to October 2, 1971, which also include B/M #5992893 and all units shipped after October 1, 1971. B/M #5992893 is plant installable only ... when #3875 is added anywhere in the 2790 system, an MES, #9548 (oscillator change) must be ordered for each 2791 or 2793 ordered for the system. **Prerequisites:** Extended Distance Repeater, Receive (#3874) on the "down-line" 2791, 2793 or 2715.

2798 Attachment, Basic (#7990): [Model 1 only] For attachment of up to four 2798 Guidance Display Units. **Maximum:** One. **Limitations:** See "2791/2793 Limitations" on 2793 machine page. Field installable on units shipped prior to October 2, 1971 which also include B/M #5992893 and all units shipped after October 1, 1971. B/M #5992893 is plant installable only. **Prerequisites:** Expanded Capability (#3801) on the 2715 ... see Specify (3) above.

2798 Attachment, Additional (#7991): [Model 1 only] Each provides for attachment of up to four 2798 Guidance Display Units. **Maximum:** Two. **Limitations:** See "2791/2793 Limitations" under 2793 machine page. **Prerequisite:** 2798 Attachment, Basic (#7990).

1035 Attachment (#8030): [Model 1 only] For attachment of up to three 1035 Badge Readers via customer-supplied junction boxes and cable ... see "Specify" (3) above. **Maximum cable**

length is 1,000 feet. Maximum: One.

1053 Attachment (#8050): [Model 1 only] For attachment of one 1053 Printer Model 1 ... maximum 1053 cable length is 8 feet. **Maximum:** One. **Limitation:** Print checking is not performed on the 1053 when attached to 2791.

2795/2796/2797 Attachment, Basic (#8295): [Model 1 only] For attachment of up to eight 2795/2796/2797 Data Entry Units (any combination) ... see Specify (2) above. **Maximum:** One.

2795/2796/2797 Attachment, Additional (#8296): (Model 1 only) Each provides for attachment of up to 8 additional 2795/2796/2797 Data Entry Units (any combination) ... see Specify (2) above. **Maximum:** Three. **Limitations:** See 2791/2793 Limitations on 2793 machine page. **Prerequisite:** 2795/2796/2797 Attachment, Basic (#8295).



2792 REMOTE COMMUNICATIONS CONTROLLER

Purpose: For the 2790 Data Communication System ... controls exchange of data between the 2790 System Controller and remote 2790 terminals via common carrier leased communication facilities.

Model 1 Attaches to the 2790 System Controller (via the "loop") and directly to the local termination of the common carrier facilities.

Model 2 Attaches directly to the remote termination of the common carrier facilities and up to fifteen 2791/2793 Area Stations (via a secondary "loop").

Both a Model 1 and Model 2, operating point-to-point with one another on the common carrier facilities are required to attach each group of up to fifteen Area Stations.

Model Changes: Available at time of manufacture only.

Highlights: For 2790 Systems in which 2790 terminals are inaccessible to the System Controller via in-house wiring, viz., across a thoroughfare, across the city, or in another city; the 2792s enable exchange of data via common carrier leased communication facilities.

Terminal Devices: Each pair of 2792s establishes a secondary communications loop at the remote location to which can be attached up to fifteen 2791/2793 Area Stations with their associated 2795/2796/2797 Data Entry Units, 2798 Guidance Display Units, Production Monitoring Pulse Count (#5550), and other related features ... see 2715 "Maximum Configurations."

Communication Facilities: Between the 2792 Model 1 and 2792 Model 2, the communication facilities must be a leased four-wire duplex channel, Type 32 with C1 conditioning (or better) or privately owned equivalent. No data sets (modems) are required.

If the communication facilities round-trip delay exceed 80 milliseconds, the 2792 cannot be used. If the communications route between the 2792s, Model 1 and Model 2, approximates 1,000 miles or more, or if the communications facilities round-trip delay is expected to approach 80 milliseconds, the customer should be advised to consult the common carrier to determine the expected communication facilities delay.

The 2792 Model 1 attaches to the 2715 or System/7 via the 2-wire high speed communications line, in the "loop", similar to the 2791/2793 Area Stations.

2791/2793 Area Stations attach to the 2792 Model 2 via a 2-wire customer-provided high-speed communication line.

Distances between Area Stations and the 2792 depend upon the characteristics of the line used (e.g., up to 1,000 wire-feet for #22 AWG). The Extended Distance Repeater features cannot be installed on the 2792s. However, they can be installed in the attached Area Stations. See Physical Planning Manual, GA27-3017.

Prerequisites:

- (1) A 2715 Transmission Control Unit with Expanded Capability (#3801) or a System/7 with a 2790 control (#8195 on 5012 or 5013) for the 2790 System Controller.
- (2) Specify #9790 on each 2791 Area Station Model 1 or Model 2 on the secondary "loop." See "Specify" under 2791.

IBM Service: To facilitate servicing of the 2790 terminals on the secondary "loop" by the IBM a minimum of one 1053 Printer is required proximate to each 2792 Model 2. When

System/7 is the 2790 System controller, IBM service requires the resident On-Line Diagnostics program ... see System/7 Programming.

Maximum Configuration: Each 2792 Model 1 is set in the field to respond to its own address plus the address(es) of 1, 3, 7 or 15 of the Area Stations remotely attached or reserved for future attachment. The maximum number of Area Stations that can be locally attached to the 2790 System Controller is reduced by the set number of addresses. The number of 2791/2792 Model 1/2793s is limited by the number of addresses available to the system controller; i.e., maximum of 100 addresses per 2715. See 2790 Configurator SRL GA27-3021. Maximum eight pairs of 2792 Model 1s and 2s per 2715. Maximum of two pairs of Extended Distance Repeater (EDR) features may be used on a secondary "loop." When System/7 is the controller the maximum number of 2792 Model 1s is two per "loop" or four per system.

Limitations:

- (1) 2792 attached is not available when the System Controller is an 1800 System.
- (2) The system configuration and the delays encountered in the common carrier facilities can affect the waiting time at the remote 2790 terminals served by the 2792s. Graphs and formulas to assist the user in determining throughput will be found in SRL GA27-3015. Common carrier communication facilities round-trip delay cannot exceed 80 milliseconds.

Customer Responsibilities: See 2790 in "Systems" and M2700 pages.

Bibliography: GA24-3089.

Specify

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 cycle): #9880 for locking plug, or #9881 for non-lock plug.

**2793 AREA STATION**

Purpose: A local device data controller for a 2790 Data Communication System.

Prerequisite: The 2790 system controller can be a 2715 Transmission Control Unit or a properly equipped 1800 Data Acquisition and Control System or a properly equipped System/7.

With 2715 See 2715 for details.

With 1800 See 1800/2790 Adapter (#7570) under 1826 for details.

With System/7 For details see 2790 Control (#8195) under 5012 in "Machines."

Highlights: A solid-state, industrially packaged unit. It controls data transfer between locally attached I/O units and the system controller. It is designed for attachment to a unique transmission line capable of handling large volumes of short messages from many stations.

The basic unit provides for attachment of up to eight 2795/2796/2797 Data Entry Units (any combination ... available features provide for attachment of up to twenty-four additional 2795/2796/2797s, and a 1053 Printer Model 1, and up to sixteen 2798 Guidance Display Units (2715 and System/7 only). See "Special Features" below.

Customer Responsibilities: See 2790 in "Systems."

Environment: See 2790 in "Systems."

Limitations: See "2791/2793 Limitations" below.

Bibliography: GA24-3089.

Specify

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 cycle): #9880 for locking plug, or #9881 for non-lock plug.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray.
- (3) Cable and Junction Box: #9030, if required. A 4 foot cable and junction box from the 2793 for initial installation of 2795s/2796s/2797s or #7990, or #5550, and #5552 ... see Physical Planning Manual GA27-3017 for requirement.

Note: If #9030 is specified, provide complete person's name and address for shipment...cables will be shipped automatically, approximately 30 days prior to scheduled delivery.)

- (4) For initial 2793 machine order having Extended Distance Repeater, Receive or Send (#3874, 3875), specify #9547 and #9548; also specify #9548 (oscillator) for each 2793 ordered for the 2790 system.

Special Features

External Alarm Contacts (#3690): Provides a pair of dry contacts which can be momentarily (35 milliseconds nominal) closed to allow operation of a customer's attached external alarm device (bell, whistle, light, etc.). Momentary closure of the contacts is activated by receipt of an EBCDIC "Bell" character. The contacts are capable of switching 115 V AC or DC at not more than 0.5 amperes. **Maximum:** One. *Note:* Includes a 4-foot, 2-wire cable for attachment of a customer-provided alarm or junction box. **Limitation:** External Alarm not available when System/7 is the system controller. **Prerequisites:** 1053 Attachment (#8050) on the 2793 and Expanded Capability (#3801) on the 2715 in the system.

Extended Distance Repeater, Receive (#3874): Provides for

operation with another 2793 or 2791 Area Station or 2715 Transmission Control Unit equipped with Extended Distance Repeater, Send (#3875) located up to 6,000 wire-feet away. See *Physical Planning Manual*, GA27-3017 for cable specifications.

Maximum: One. **Limitations:** See Limitations for Extended Distance Repeater, Send (#3875) below. Field installable on units shipped prior to October 2, 1971, which also include B/M #5992893 and all units shipped after October 1, 1971. The B/M is plant installable only ... when #3874 is added anywhere in the 2790 system, an MES, #9548 (oscillator change) must be ordered for each 2791 or 2793 ordered for the system. **Prerequisites:** Extended Distance Repeater, Send (#3875) on the "up-line" 2791, 2793 or 2715.

Extended Distance Repeater, Send (#3875): Provides for operation with another 2793 or 2791 Area Station or 2715 Transmission Control Unit equipped with Extended Distance Repeater, Receive (#3874) located up to 6,000 wire-feet away. See *Physical Planning Manual*, GA27-3017 for cable specifications. **Maximum:** One. **Limitations:** (1) The use of two pairs of EDRs, Receive or Send in tandem is not recommended. If the Area Station having both features should fail, the entire segment would be inactive. (2) When an 1800 System or System/7 is the 2790 System Controller, these repeaters cannot be used between the System Controller and the first Area Station or between the last Area Station and the System Controller. However, they can be used between all other Area Stations attached to the system within the maximum limit. (3) Maximum of eight pairs per 2715, 1800/2790 Adapter (#7570) or System/7. (4) Maximum of two pairs of EDRs may be used on a secondary loop attached to a 2792. Field installable on units shipped prior to October 1, 1971, which also include B/M #5992893 and all units shipped after October 1, 1971. B/M #5992893 is plant installable only ... when #3875 is added anywhere in the 2790 system, an MES, #9548 (oscillator change) must be ordered for each 2791 or 2793 ordered for the system. **Prerequisites:** Extended Distance Repeater, Receive (#3874) on the "down-line" 2791, 2793 or 2715.

Pulse Counters, Basic (#5550): Provides necessary control circuits, a CE diagnostic counter for servicing all counters on the Area Station, and the first 7 pulse counters for customer attachment to his production pulsing points. Each counter may be used as ACCUMULATOR or as a PRE-SET accumulator. Decimal counts to 29,999 may be handled at Area Station level before requiring overflow service from the system controller. Each counter has a unique address. Each counter has Overflow Interrupt and Counter Advance Test indicators. **Maximum:** One. Additional counters are provided via #5551 and #5552 below to a maximum of 63 counters per Area Station. *Note:* In the event of a power failure, all pulse counters so affected will reset to zero with a resultant loss of count. There are commercially available power backup systems via which customers can elect to insure power continuity, if they so choose. Customers should be advised of the exposure and assurance measures available to meet it. Also see Visual Readout (#8710) below.

Specify

#9030 for shipment of a 4-foot cable and junction box for attachment of the counters. See "Specify (3)" above. **Limitations:** Cannot be used if 2798 Attachment, Basic (#7990) is used.

Prerequisites: (1) Customer's production count pulsing contacts must meet the interface requirements for the pulse counter sensing circuits. They are designed to operate with contacts specified as follows: 16 milliseconds minimum closed time; 16 milliseconds open time (equivalent to approximately 30 pulses per second); maximum contact bounce of 4 milliseconds on



open or close; maximum contact resistance of 10 ohms. (2) Wiring (single pair required) from the Area Station pulse counter points to the customer's production pulse counting contacts must be provided, installed and maintained by the customer. The series wire resistance of the wire from the contact to the Area Station must be less than 40 ohms. This requirement can be met by several types of wiring with maximum distance shown such as: Twisted Pair, AWG #22—1,000 feet ... AWG #18—3,000 feet ... AWG #14—7,500 feet ... (3) Expanded Capability (#3801) on the 2715.

Pulse Counters, Additional (#5551): Provides a group of 8 counters. See #5550 above for description of counter functions. **Maximum:** 6 groups. **Prerequisites:** #5550 for the first three additional groups (total 31 counters); #5552 for additional groups 4, 5 and 6.

Pulse Counter Expansion (#5552): Provides a group of 8 counters (nos. 32 - 39) and their necessary circuits and controls. See #5550 for description of counter functions. #5552 also provides controls for adding #5551 groups 4, 5 and 6. **Maximum:** One.

Specify

#9030 for shipment of a 4-foot cable for attachment of the counters to a customer-supplied junction box. See "Specify" (3) above. **Prerequisites:** #5550 and first three groups of #5551.

2798 Attachment, Basic (#7990): For attachment of up to four 2798 Guidance Display Units. **Maximum:** One. **Limitations:** See "2791/2793 Limitations" below. Cannot be used if Pulse Counter (#5550) is used. Field installable on units shipped prior to October 1, 1971, which also include B/M #5992893 and all units shipped after October 1, 1971. B/M #5992893 is plant installable only. **Prerequisites:** Expanded Capability (#3801) on the 2715. See Specify (3) above.

2798 Attachment, Additional (#7991): Each provides for attachment of up to four 2798 Guidance Display Units. **Maximum:** Three. **Limitations:** See "2791/2793 Limitations" below. **Prerequisite:** 2798 Attachment, Basic (#7990).

1053 Attachment (#8050): For attachment of one 1053 Printer Model 1 ... maximum 1053 cable length is 8 feet. **Maximum:** One. **Limitation:** Print checking is not performed on the 1053 when attached to a 2793.

2795/2796/2797 Attachment, Additional (#8296): Each provides for attachment of up to 8 additional 2795/2796/2797 Data Entry Units (any combination) ... cable provided by specify #9030 accommodates #8296 also. **Maximum:** Three.

Visual Readout (#8710): Provides a backup means for manual readout, (inside the Area Station cover via coded display lights) of pulse counters if for some reason the Area Station is bypassed, or the system controller is unable to provide service. This feature is dependent upon continuous power being supplied to the counters. Should power be lost, the counters reset to zero. See the "Note" under Pulse Counters, Basic (#5550) above. **Maximum:** One.

2791/2793 Limitations

(1) When using a 2715 The maximum number of 2791/2793 Area Stations (any combination) is 100 ... the maximum number of 2795/2796/2797 Data Entry Units (any combination) is 1,024 ... the maximum number of 2798 Guidance Display Units is 256 ... the maximum number of Pulse Counters is 1,008.

When using 2792 Remote Communications Controllers with the 2715, the number of Area Stations that can be attached is reduced. Each 2792 Model 1 is set in the field to respond to its own address plus the address(es) of 1, 3, 7 or 15 of the Area Stations remotely attached or reserved for future attachment. The maximum number of Area Stations that can be locally attached to the 2715 is reduced by the set number of addresses. The number of 2791s/2792 Model 1s/2793s is limited by the number of addresses available to the 2715; i.e., maximum 100 addresses. Maximum, eight pairs of 2792 Model 1s and 2s per 2715. Maximum of two pairs of Extended Distance Repeater (EDR) features may be used on a secondary loop. See 2790 Configurator, SRL GA27-3021.

When using an 1800 System, on each of up to two 1800/2790 Adapters (#7570)—the maximum number of 2791/2793s combined is 100 ... the maximum number of 2795/2796/2797s combined is 1,024 ... the maximum number of Pulse Counters is 1,008 ... 2798 attachment is not provided.

When using a System/7 The maximum number of 2791/2792 Model 1s/2793s combined is 64 ... the maximum number of 2795/2796/2797s combined is 512 ... the maximum number of 2798 Guidance Display Units is 256 per 2790 control feature or 256 per System/7 ... External Alarm is not provided.

(2) One 2791 Model 1 will accommodate: (a) Up to thirty-two 2795/2796/2797s (any combination), or (b) up to eight 2795/2796/2797s (any combination) and up to twelve 2798s.

In addition to the above combinations, up to three 1035s, one 1053 Model 1, and one OEM digital device can be attached.

(3) One 2793 will accommodate: (a) Up to thirty-two 2795/2796/2797s (any combination) and up to sixteen 2798s, or (b) up to thirty-two 2795/2796/2797s (any combination) and up to 63 Pulse Counters.

In addition to the above combinations, one 1053 Model 1 can be attached.

(4) The permissible distance between Area Stations or between the Area Stations and the System Controller, depends upon the transmission line characteristics. For example: Without Extended Distance Repeater (#3874, 3875), using #22 AWG outside-type telephone cable, these units may be separated up to 1,000 wire-feet apart ... using #19 AWG cable, separation may be up to 1,750 wire-feet. With Extended Distance Repeaters available on the 2791, 2793 and 2715, units having may be separated up to 6,000 wire-feet apart. For cable specifications and other distances, see *Physical Planning Manual*, GA27-3017. See "Limitations" under Extended Distance Repeater, Send (#3875).

(5) Forms Feed Control (#4452) cannot be installed on a 1053-1 printer when attached to 2791/2793 area stations in a 2790 system, if required, this function is available

(6) **Loop Delay System/7** 2790 performance is affected by delay on the local loop and must be considered when developing a configuration. Maximum loop configurations are determined by a formula for "loop delay" that will assist you in quickly determining the viability of the configuration you are considering. The following calculation should be used for each 5012/5013 module equipped with 2790 Control (#8195). The resultant figure (total usec) must not exceed 316 usec per 5012/5013.



Area Stations.....2791 _____
 2792 Model 1 _____
 2793 _____
Total Area Stations _____ x 17.6 usec = _____
Extended Distance Repeater
 Pairs (send/receive) _____ x 8.4 usec = _____
1000' increments of cable _____ x 2.0 usec = _____
Total usec = _____

For further information on see *IBM 2790 Physical Planning Manual, GA27-3017.*

2796 DATA ENTRY UNIT

Purpose: A data entry unit for a 2790 Data Communication System.

Prerequisite: A•2791 Area Station Model 1 or 2793 Area Station equipped with an appropriate attachment feature ... see 2791 or 2793.

Highlights: A compact, industrially packaged reporting unit for use by one or two production workers at their work stations. It features a unique reader that accepts either the end of a punched card or an identification badge ... four 10-position code selection dials ... 4-position manual entry for quantitative data ... a monitor key ... a telephone jack. It attaches to the 2791 Model 1, 2793 or 5013 via a twisted pair cable. Transmission speed is 40 characters/second.

Card-Badge Reader: Reads up to ten numeric digits from either end of a punched card (columns 1-10, or 71-80) or from an identification badge. Data is read interchangeably, from a card or a badge, into a given record. Cards and badges are inserted manually. For badge specifications, see SRL GA21-9028. Badges with attached pocket clips cannot be accommodated.

Code Selection: Four 10-position (0-9) rotary dials are used to identify various codes such as production status, services required, labor codes or operation, during execution of a production order.

Manual Entry: A group of four rocker thumbwheel switches for entry of quantitative data.

Monitor Key: A three-position, key-operated switch permits supervisory control of specific transactions ... one key is supplied.

Telephone Jack: For supervisor's use in communicating by voice with support groups ... requires a separate voice communication network ... will accommodate a sound powered telephone handset.

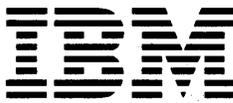
Customer Responsibilities: The Representative must advise the customer that maintenance is provided as defined in "2795/2796/2797 Maintenance" following the 2797. The customer is responsible for: the Agreement[1] Providing a central maintenance facility ... 2 Installation and removal of the unit from its operational location.

Limitations: See "2795/2796/2797 Limitations" following 2797.

Environment: See 2790 in "Systems."

Maintenance: See "2795/2796/2797 Maintenance" following 2797.

Bibliography: GA3089

**2797 DATA ENTRY UNIT**

Purpose: A data entry unit for a 2790 Data Communication System.

Prerequisite: A 2791 Area Station Model 1 or 2793 Area Station equipped with an appropriate attachment feature ... see 2791 and 2793.

Highlights: A compact, industrially packaged reporting unit for use by production workers or other employees at their work stations. It features a unique reader that accepts either the end of a punched card or an identification badge ... two 10-position code selection dials ... 10 keys for manual entry ... 6-position visual display of manual entry data for verification before transmission ... a monitor key ... an "Enter" key to cause data transmission ... a telephone jack. It attaches to the 2791 Model 1, 2793 or 5013 via a twisted pair cable. Transmission speed is 40 characters/second.

Card-Badge Reader: Reads up to 10 numeric digits from either end of a punched card (columns 1-10, or 71-80) or from a punched identification badge. Data is read interchangeably, from a card or a badge, into a given record. Cards and badges are inserted manually. For badge specifications, see SRL GA21-9028. Badges with attached pocket clips cannot be accommodated.

Code Selection: Two 10-position (0-9) rotary dials are used to input codes for things such as status, names or services required during execution of a production order.

Manual Entry: 10-key keyboard provides for entry of variable numeric data. As each key is pressed, the number is displayed to the operator for verification. Up to six positions are displayed per data field.

Visual Display: A 6-position visual display in which digits shift from right to left as keyed. Each position can display any of ten characters, 0 through 9 and blank.

Monitor Key: A 3-position, key-operated switch permits supervisory control over the validity of specific records ... one key is supplied.

Control Buttons: The "Enter" button activates an electric powered unit to transmit to the system controller data read by the card-badge reader, codes selected by the rotary dials, data keyed and visually displayed, and the monitor key digit ... the Reset button is used to reset the visual display when an error is seen during operator verification.

Telephone Jack: For supervisor's use in communicating by voice with support groups ... requires a separate voice communication network ... will accommodate a sound powered telephone handset.

Customer Responsibilities: The Representative must advise the customer that maintenance is provided as defined in "2795/2796/2797 Maintenance" following the 2797. The customer is responsible for: [1] Providing a central maintenance facility ... [2] Installation and removal of the unit from its operational location.

Limitations: See "2795/2796/2797 Limitations" below.

Environment: See 2790 in "Systems."

Maintenance: See "2795/2796/2797 Maintenance" below.

Bibliography: GA24-3089.

Specify

(1) Voltage (115V AC, 1-phase, 3-wire, 60 cycle): #9880 for locking plug, or #9881 for non-lock plug.

2795/2796/2797/2798 Limitations

(1) The 2795/2796/2797 Data Entry Units and 2798 Guidance Display Units may be attached up to 1,000 wire-feet from the 2791 Model 1 or 2793 Area Station or the 5013 Digital Input/Output Module. For cable specifications and other distances, see Physical Planning Manual GA27-3017.

(2) See "2791/2793 Limitations" under 2793 or the D & PT for RPG #D08249 for maximum combinations of Data Entry Units and other devices.

2795/2796/2797 Maintenance

Installation of 2795s, 2796s and 2797s in the immediate work area precludes the acceptability of online repair due to loss of the terminal's use and interruption of the worker's production.

Maintenance of the Data Entry units will be by hardware replacement as opposed to repair at the operational location. The customer will determine the failing input and deliver the unit to the central maintenance facility located at his central site. At this facility the customer engineer will repair and online test the Data Entry Unit. Installation of the units at the operational location is the customer's responsibility. To facilitate CE maintenance and checkout, the customer must provide a dedicated line termination in the central maintenance facility. This line would be wired to address CO of an Area Station. A printer (5028, 1053, 2741, etc.) must be located in the proximity of the maintenance facility.

Although the Data Entry Units of any one type are interchangeable, the customer may wish to replace the failing unit with a spare for availability.

**2798 GUIDANCE DISPLAY UNIT**

Purpose: For the 2790 Data Communication System—an alphameric keyboard, 16-position variable data display and 48 instruction operator guidance panel for interactive transaction via a 2715 Transmission Control Unit with a S/360 or S/370 Data Base or with a System/7 as the 2790 System Controller.

Prerequisite: A 2791 Model 1 or 2793 Area Station equipped with an appropriate attachment feature ... see 2791 or 2793.

Highlights: A small, desk/bench mounted, self-contained, buffered, data entry and output unit for multi-step interactive transactions via a 2715 Transmission Control Unit or with a System/7 as the 2790 System Controller ... packaged for industrial environment ... featuring a typewriter style 56 character alphameric keyboard ... 8 control keys ... a 16-position visual display ... a unique 48 instruction operator guidance panel which can be customized by the user to suit his specific applications ... 6 operational indicators ... a monitor key ... and an ON/OFF switch. Each unit is attached to a 2791 Model 1 or 2793 Area Station via a 4-wire user provided cable (up to 1,000 wire-feet).

Keyboard: The 56 data keys include the 26 alphabetic, 10 numeric, 4 printer functions represented by symbols for tab, new line, line feed and space, 8 special characters and 8 functional keys (assignable by the user) ... the 8 control keys for functions such as Enter, Clear, Cancel, Backspace, Transaction-Lock and Unlock, Advance, and Display-Inhibit.

Display: For visual verification, prior to transmission, of any 16-character combination of the 56 characters entered from the keyboard ... response data or messages ... guidance expansion messages ... time-of-day, when not used for data, from the System Controller.

Guidance Panel: Up to 16 customer defined instructions can be actuated at a time on the guidance panel by the System Controller to direct the operator step-by-step through transactions or for status information ... instructions are written on two removable overlays provided by the customer to suit his specific applications ... overlays are similar to those used on the 2791 Area Station ... three manual settings on each of two panels provide for a total of 48 instructions or lines of information.

Operational Indicators: Advise the operator that: (1) the unit is "online" and ready for use ... (2) a transaction is "in-process" ... (3) the record is not valid, the "Clear" button should be depressed and data re-entered ... (4) the "transaction-selection" code must be entered ... (5) the "transaction-lock" mode is in effect ... (6) the "first step" of a multi-step transaction should be initiated.

Monitor Key: A 2-position common key operated switch permits supervisory control of specific transactions.

ON/OFF Switch: A power on-off switch.

Customer Responsibilities: See 2790 in "Systems."

Environment: See 2790 in "Systems."

Limitations:

(1) Using #22 AWG inside-type telephone cable, 2798s may be attached up to 1,000 wire-feet from the 2791 Model 1 or 2793. See Physical Planning Manual GA27-3017 for cable specifications and other distances... (2) See "2791/2793 Limitations" under 2793 for maximum combinations of 2798s and other devices ... (3) 2798 attachment is not available when an 1800 System is the system controller.

Bibliography: GA24-3089.

Specify:

(1) Voltage (115V AC, 1-phase, 3-wire, 60 cycles): #9880 for locking plug or #9881 for non-lock plug.

**2841 STORAGE CONTROL**

Purpose: Control unit for 2302* Disk Storage Model 3s and 4s, 2303 Drum Storages, 2311 Disk Storage Drive Model 1s and 2321 Data Cell Drives.

S/360 Model 22, 30 2302s, 2311s, 2321s.

S/360 Model 40, 50, 65, 67, 75 2302s, 2303s, 2311s, 2321s.

S/360 Model 44 2311s only.

S/360 Model 85, 195, S/370 Model 135, 145, 155, 158, 165, 168, 195, 2303s, 2311s, 2321s.

1800 Data Acquisition and Control System—2311s only.

* The 2302 Models 3 and 4 have been withdrawn from production and are no longer available.

Control Capabilities: The basic 2841 can control up to eight 2311 Disk Storage Drives ... see Additional 2311 Attachment (#9706) under "Specify" if more than four 2311s are attached. Special features are required to attach 2302s, 2303s and 2321s ... see "Special Features."

Each 2841 can control up to eight storage access mechanisms. Units controlled by the 2841 are considered to have the following number of access mechanisms: 2302 Model 3—two; 2302 Model 4—four; 2303—one; 2311—one; 2321—one.

Except as shown under "Limitations" below, any combination of these units can be attached if the total number of access mechanisms does not exceed eight ... see Additional Storage (#1024) under "Special Features" for controlling up to four 2302 Model 4s with up to sixteen access mechanisms.

Limitations: A 2841 controls up to eight 2311s. With appropriate attachment features it can control up to eight access mechanisms in the following combinations:

With no 2303 Any combination of 2302 Models 3 and 4, 2311s, 2321s.

With one 2303 Up to three 2311s and any combination of 2302 Models 3 and 4, 2321s.

With two 2303s No 2311s, any combination of 2302 Models 3 and 4, 2321s.

In no case can more than two 2303s or four 2302s be attached.

Highlights: The unit provides an advanced method of utilizing disk, data cell and drum storage units. Self-formatting tracks, applicable to all units that attach to the 2841, provide for easy handling of variable length identifiers and records. Variable length record identifiers, up to 255 bytes in length, permit use of data-oriented identifiers for retrieval of information that is organized in either a random or sequential manner.

Command Chaining—multiple records within a cylinder can be read/written by a sequence of channel commands without rotational delays between records.

New commands, together with command chaining, permit index and directory searches without processor intervention. The command structure is optimized to yield efficient random and sequential processing with either randomly or sequentially organized data files. The ability to protect "logical" files is provided by the combination of commands in the 2841 and checks within the control programs servicing the file system. Cyclic code checking is used to assure the integrity of stored data.

Data Rates:

2302 Data is transmitted to and from the 2841 in 8-bit bytes at a rate of 156,000 bytes/second ... with packed decimal at a rate of 312,000 digits/second.

2303 Data is transmitted to and from the 2841 in 8-bit bytes at a rate of 303,800 bytes/second ... with packed decimal at a rate of 607,600 digits/second.

2311 Data is transmitted to and from the 2841 in 8-bit bytes at a rate of 156,000 bytes/second ... with packed decimal at a rate of 312,000 digits/second.

2321 Data is transmitted to and from the 2841 in 8-bit bytes at a rate of 55,000 bytes/second ... with packed decimal at a rate of 110,000 digits/second.

Prerequisite: A control unit position on a system channel:

S/360 Model 22, 30 Multiplexer channel (standard), Selector Channels (special features, except on 2022 one selector channel is standard) ... see 2022, 2030. [No 2303(s)]

S/360 Model 40 For 2303(s), Selector Channel No. 1 or No. 2 (special features), but not both. When 2303s and 2314s or 2844s are used in the same system, they must all be attached to the same Selector Channel ... for all other units, multiplexer channel (standard), Selector Channels (special features) ... see 2040.

S/360 Model 44 [for 2311s only] Special features on the 2044: Multiplexer Channel, High Speed Multiplexer Channels, Additional High Speed Multiplexer Subchannels ... see 2044.

S/360 Model 50 For 2303(s), Selector Channels (special features) ... for all other units, multiplexer channel (standard), Selector Channels (special features) ... see 2050.

S/360 Model 65, 67, 75 Selector channel of 2860, or Selector Subchannels (special features) on 2870 ... see 2860, or 2870. **Limitation:** On Selector Subchannels, the 2841 can be used only to attach up to eight 2321s. Only one 2841 may be attached per Selector Subchannel and its attachment precludes the attachment of any other control unit to that subchannel.

S/360 Model 85, 195, or S/370 Model 165, 168, 195 Selector channel of 2860, Selector Subchannels (special features) on 2870, shared subchannel of a 2880 ... see 2860, 2870, 2880. **Limitation:** On Selector Subchannels, the 2841 can be used only to attach up to eight 2321s. Only one 2841 may be attached per Selector Subchannel and its attachment precludes the attachment of any other control unit to that subchannel.

S/370 Model 135 For all units, Selector Channels or Block Multiplexer Channels (special features) ... see 3135.

S/370 Model 145 For 2303s, selector channels, for all other units multiplexer channel (standard), selector channels ... see 3145.

S/370 Model 155, 158 Block multiplexer channel (first two are standard) ... see 3155, 3158.

1800 [for 2311s only] Selector Channel (#7710) on an 1826 Model 2 or 3 ... see 1826. #9160 is required on the 2841 ... see "Specify."

Bibliography: S/360 and S/370—GA22-6822, 1800—GA26-5921.

Metering: Assignable Unit



Specify

- (1) Voltage (AC, 3-phase, 60 cycle): #9903 for 208 V, or #9905 for 230 V.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (3) Additional 2311 Attachment: #9706. The basic 2841 is equipped with connection facilities for up to four 2311s...this specification provides internal cables and connectors required when five or more 2311s are to be attached ... can be field installed.
- (4) Attachment of 2302s, 2303s, 2321s: Appropriate attachment features are required ... see "Special Features."
- (5) Control Unit Isolation: Field installation may be required on certain units ... see #4700 under "Special Features."
- (6) For use with 1800 System #9160 ... can be field installed.

Special Feature:

Additional Storage: (#1024) For attachment of up to two 2302s having up to eight access mechanisms ... these are in addition to the access mechanisms that can be controlled by the basic 2841. The total number of devices that can be controlled by a 2841 equipped with this feature is limited to a maximum of sixteen access mechanisms, of which all in excess of eight must be 2302 access mechanisms, or eight load units, as follows:

	Load Units (maximum, 8)	Access Mechanisms (maximum, 16)
2302 Model 3	2	4
2302 Model 4	2	4
2303	1	1
2311	none	1
2321	1	1

Limitation: Cannot be installed with Two Channel Switch (#8100).

Maximum: One. **Prerequisite:** 2302 Attachment (#7950).

File Scan: (#4385) For performing a comparison on selected bytes of file information ... not effective for 2303 Drum Storages.

Isolation, Control Unit: (#4700) [For field installation on all units shipped prior to December 29, 1967, and reconditioned units with serial no. 30099 or below shipped prior to March 4, 1968 ... standard on all units shipped subsequently]. To turn power on or off on the 2841 without generating spurious signals. Thus, a CPU program, if it can be logically disconnected from the system before power is turned off, can continue operating.

Prerequisite: Since in all cases there are compatible EC level requirements, the concurrence of the Manager is required for any order for this feature.

Record Overflow (#6118): For greater utilization of available storage ... allows a record to overflow from one track to another.

Remote Switch Attachment (#6148): To attach the Two Channel Switch (#8100) to a 2167 Configuration Unit in a S/360 Model 67-2, to a S/360 Model 65 MP which has the Configuration Control Panel (#1505) installed, or to a S/370 Model 158 MP or 168 MP.

2302 Attachment (#7950): [Not with 1800 or S/360 Model 44,

85 or 195, or S/370 Model 145, 155, 165, 195] To attach up to eight 2302 Model 3 and Model 4 access mechanisms. **Maximum:** One. **Note:** For additional 2302s, see Additional Storage (#1024) above.

2303 Attachment (#8077): Not with 1800 or S/360 Model 22, 30, 44 To attach up to two 2303s. **Limitation:** Attachment of 2303s limits the number of other storage units possible ... see "Control Capabilities" above. **Maximum:** One.

2321 Attachment (#8079): [Not with 1800 or S/360 Model 44] To attach up to eight 2321s. **Maximum:** One.

Two Channel Switch (#8100): To attach the 2841 to a second channel. Switching is under program control ... includes partitioning. **Limitation:** Cannot be installed with Additional Storage (#1024).

Prerequisite: If the Two Channel Switch is routed through the Configuration Control Panel (#1505) of a multiprocessing S/360 Model 65 system, Remote Switch Attachment (#6148) is required. #6148 is also required in a S/360 Model 67-2, or a S/370 Model 158 MP or 168 MP. See above.



3262 PRINTER

Purpose

Printed output unit for System/38.

- Model A1 - 650 LPM Bolt-on
- Model B1 - 650 LPM Standalone

The above nominal rated speed is based on a standard 48 character set.

Model Changes

Cannot be made in the field

Highlights

A universal character set buffer of 288 positions in the 3262 Attachment allows use of graphic sets of up to 288 characters. A general purpose optimized print belt of 64 characters is available. (See 3262 in Type Catalog section.) The 64 character optimized print belt can provide speeds up to a maximum of 625 LPM. Should specific application data have unique characteristics and not conform to the 64 character set optimized print belt, the normal print belts will provide the following nominal rated speeds:

Nominal Rated Speeds

48 Character Set	650 LPM
64 Character Set	467 LPM
96 Character Set	364 LPM

132 print positions are standard. Horizontal spacing is 10 characters per inch. Vertical spacing is 6 or 8 lines per inch under system control. Forms skipping and spacing are controlled. The carriage is a single speed unit allowing skipping up to 20 inches per second. Continuous forms are fed by a forms tractor. See *Forms Design Reference Guide for Printers*, for forms design considerations.

Limitations

1. Only pin fed, continuous forms can be used.
2. Both edges of the forms must be fastened in the forms tractors.
3. No staples are permitted in the areas exposed to the interchangeable print belt.
4. Printer operation and print quality vary with paper and number of copies. Forms sets of more than four parts should be tested in operating conditions to verify that results are satisfactory.

Maximum: Two 3262 Printers on System/38; Limitation: cannot be two Model A1s.

Accessories: Additional print belts permit the customer to print more than one character set for various applications. Can be interchangeably used with the belt provided with the machine. See Type Catalog for print belt arrays. When ordering, indicate one feature code for character set and one feature code for character height.

Two print belts (same specify code) will be included in the ship group. The second belt will be a spare for use by the customer as a back up. When the customer installs this backup belt, a replacement should be ordered via an MES. The customer will be billed at the current accessory belt price. Replacement and installation of the print belt is the customer's responsibility. If the customer desires to have customer engineering replace or

install the print belt, the C.E. time involved will be billed to the customer.

Belt Description	Feature Number
48 Character	5940
60 Character S/38 Special **	5943
64 Character EBCDIC	5944
64 Character EBCDIC Optimized	5946
64 Character ASCII	5945
64 Character ASCII Optimized	5947
96 Character EBCDIC *	5948
96 Character ASCII *	5949
64 Multinational	5964
96 Multinational	5963
188 Multinational	5962

* Available only with .095" character height (#5950).

** This specially designed belt will enable the user to print the System/38 Control Language characters.

Character Set Height	Feature Number
.079 inches	5951
.095 inches	5950

Prerequisites

A 3262 Attachment on the System/38 System Unit. Specify #1100 or #1110 on System/38. See System/38 Special Features.

Specify

3262 Model B1 (1) Voltage (120V AC 1-phase, 3 wire, 60 Hz) #9890 for lock plug, or 9891 for nonlock plug. Model A1 (1) Voltage (AC, 1-phase, 60 Hz).

Printer Voltage	Feature Number
208V	9902
230V	9904

2. **Color:** Background color is Pearl White. One color accent panel must be specified. #9060 for Willow Green, #9061 for Garnet Rose, #9062 for Sunrise Yellow, #9063 for Classic Blue, #9064 for Charcoal Brown, #9065 for Pebble Gray.

3. **Interchangeable Print Belt:** Plant only. See Type Catalog for print belt arrays. When ordering, indicate one specify code for character set and one specify code for character height. When printing 8 LPI, .079" character height is recommended. Installation and replacement of these print belts is the customer's responsibility. If the customer desires to have customer engineering replace or install the print belt, the C.E. time involved will be billed to the customer.



Belt Description	Specify Code
48 Character	9520
60 Character S/38 Special**	9521
64 Character EBCDIC	9522
64 Character EBCDIC Optimized	9523
64 Character ASCII	9524
64 Character ASCII Optimized	9525
64 Multinational	9564
96 Character EBCDIC *	9526
96 Character ASCII *	9528
96 Multinational	9563
188 Multinational	9562

* Available only with .095" character height (#9950).

** This specially designed belt will enable the user to print the System/38 Control Language characters.

Character Set Height	Specify Code
.079 inches	9951
.095 inches	9950

Supplies: A black ribbon, part number 7819690, or equivalent, is required.

Prices: See Price List.

Terms and Conditions: The 3262 is offered for lease and rental as Plan D under the Agreement for Lease or Rental of IBM Machines and its Amendment for Plan D, and is offered for purchase under the applicable IBM Purchase Agreement.

- Additional Monthly Maintenance charge rate: \$120.00
- Initial Period of Maintenance: 3 months



3271 CONTROL UNIT

Purpose: Provides control and multiplexing capabilities for a cluster of 3277 Display Stations, 3284, 3286, 3287 and 3288-2 Printers.

The 3271 communicates with:

- System/3 Model 4 via the Binary Synchronous Communications Adapter
- System/3 Model 10 or 15 via the Binary Synchronous Communications Adapter or the Local Communications Adapter
- System/3 Model 8 or 12 via the Binary Synchronous Communications Adapter or the Integrated Communications Adapter
- System/3 Model 15D via the Binary Synchronous Communications Controller (BSCC)
- System/360 Model 25, 30, 40, 50, 65, 67 (in 65 mode), 75, 85, 195 or System/370 Model 115 through 195 via a 2701 Data Adapter Unit, 2703 Transmission Control, or, except for System/360 Models 25 or 85, a 3704 or 3705 Communications Controller on half-duplex communications facilities using binary synchronous transmission.

Note: 3288 Model 2 attaches only to a 3271 Model 2.

Model 1: For attachment of 3277 Display Station Model 1s (480 characters), 3284 Printer Model 1s, 3286 Printer Model 1s, and 3287 Printer Model 1s and 2s. The basic unit provides attachment of up to four devices at transmission speeds of 2000 to 2400 bps. *Note:* One 3277 Model 1 must be installed with the basic 3271 ... the remaining three devices may be any combination of 3277 Model 1s, 3284 Model 1s, 3286 Model 1s, and 3287 Model 1s and 2s.

Model 2: For attachment of 3277 Display Station Model 2s (1,920 characters), 3277 Model 1s (480 characters), 3284 Printer Model 1s and 2s, 3286 Printer Model 1s and 2s, 3287 Printer Model 1s and 2s, and 3288 Model 2s. The basic unit provides attachment of up to four devices at transmission speeds of 2000 to 2400 bps. *Note:* One 3277 Model 2 must be installed with the basic 3271 ... the remaining three devices may be any combination of 3277 Model 1s and 2s, 3284 Model 1s and 2s, 3286 Model 1s and 2s, 3287 Model 1s and 2s, and 3288 Model 2s.

Highlights: Up to thirty-two devices (3277s, 3284s, 3286s, 3287s and 3288 Model 2s) may be attached in increments of four devices by adding up to seven Device Adapters (#3250) ... see "Special Features."

Efficient telephone line utilization by means of Compacted Data (blank suppression and modified data transmission), program tab, and character addressing.

The 3271 may be multidropped on the same facility with other BSC devices (System/3 Model 4, Model 6, Model 8, Model 10, Model 12 or Model 15, System/360 Model 20, 1130, 1800, 2715, 2770, 2780, 3271, 3275 or 3780) as tributary stations on a multipoint line with a System/360 Model 22-195 (except Model 44) or System/370 Model 115-195 as a control station.

Communication with a System/370 Model 115, 125, 135 can be made via the Integrated Communications Adapter (#4640) and appropriate binary synchronous features on the 3115, 3125 or 3135 as well as via a 2701, 2703, 3704 or 3705.

Communications Facilities: The 3271 operates in half-duplex multipoint mode on half-duplex facilities at transmission speeds of 1200, 2000 or 2400 bps on facilities via the 2701, 2703, 3704, 3705, #4640 on 3115, 3125, or 3135, or #2074 on System/3 Model 4, or #2074/2084 on System/3 Model 10 or 15 or #4645/2074 of System/3 Model 8, using binary synchronous transmission. The 3271 operates in half-duplex multipoint mode on duplex facilities at transmission speeds of 1200, 2000, 2400 or 4800 bps on facilities via the 2701, 2703, 3704, 3705, #4640 on 3115, 3125, 3135, or #2074 on System/3 Model 4, or #2074/2084 on System/3 Model 10, 12 or 15, or #2074 on System/3 Model 8, or #2094 on System/3 Model 15D, using binary synchronous transmission. Half-duplex multipoint operation on duplex facilities at 7200 bps on facility D6 is also available on the 2701, 3704, 3705, or #4640 on 3115, 3125, 3135, or #2074 on System/3 Model 4, or #2074/2084 on System/3 Model 10, 12 or 15 or #2074 on System/3 Model 8, or #2094 on System/3 Model 15D, using binary synchronous transmission. See M2700 pages for facilities.

Modems: One IBM modem can be attached to any model of a 3271. **Prerequisite:** Transmission Speed (#7821) required for speeds over 2400 bps.

Modem	Speed (bps)
3872 Model 1	2400
3874 Model 1	4800/2400
3875 Model 1	7200

Switched network backup operation is available on the 3872 Model 1, 3874 and 3875. For communications capabilities, product utilization and special features, see M 2700, 3872, 3874, 3875 pages.

Prerequisites: Transmission via common carrier facility to a 2701, 2703, 3704, 3705, Integrated Communications Adapter (#4640) on 3115, 3125, 3135, ICA (#4645 and #6202) or BSCA (#2074) on System/3 Model 8, ICA (#4645 and #6202) or BSCA (#2074/#2084) on System/3 Model 12, or BSCA (#2074/#2084) on System/3 Model 10 or 15, or #2094 on System/3 Model 15D requires a modem except when communicating to a System/3 Model 8 with ICA (#4645 and #4801) or EIA Local Attachment (#3601) or to a System/3 Model 12 with ICA (#4645 and #4801), or EIA Local Attachment (#3601/#3602) installed, or System/3 Model 10 or 15 with EIA Local Attachment (#3601/#3602) or Local Communications Adapter (#4765) installed, or System/3 Model 15D with EIA Local (#3603/#3604) installed. See M2700 pages and M5408, M5410, M5412 or M5415 pages.

One 3277 with keyboard must be installed on each 3271 on a model for model basis as a diagnostic aid. That is, 3277 Model 1 on 3271 Model 1, or 3277 Model 2 on 3271 Model 2.

System/3 Models 8 and 10 allow execution of online terminal tests concurrent with a user's TP application program in the same program level in a disk oriented system with at least 16K bytes of main storage.

System/3 Model 12 allows execution of online terminal tests concurrent with a user's TP application program in the same program level with at least 32K bytes of main storage.

System/3 Model 15 allows execution of online terminal tests concurrent with a user's TP application program in the same partition in a system with at least 48K bytes of main storage.

For these systems, diagnostic programs will be executed only under control of the Diagnostic Control Monitor in a dedicated



mode, i.e., not concurrent with user program execution or residence.

Bibliography: See KWIK Index G320-1621 or specific system bibliography.

Specify:

(1) Voltage (AC, 1-phase, 3-wire, 60 Cycle): Locking plug—#9880 for 115V, #9884 for 208V, or #9886 for 230V. Non-lock plug—#9881 for 115V, #9885 for 208V, or #9887 for 230V.

(2) Cables: Cable to attach Data Set must be ordered. See 3270 *Installation Manual—Physical Planning, GA27-2787*.

(3) System Attachment: For record purposes, identify the host processor(s) by specifying the following

Host Processor

- System/3 Model 4
- System/3 Model 8
- System/3 Model 10
- System/3 Model 12
- System/3 Model 15

(4) Transmission Code: Specify one of the following: #9761—for EBCDIC Transmission Code (available at time of manufacture only) ... utilizes 8-bit EBCDIC code over the transmission facilities used in conjunction with EBCDIC Character Set (#9089) on the 3277, 3284, 3286, 3288-2, or EBCDIC Character Set (#9082) on the 3287. #9762—for ASCII Transmission Code (available at time of manufacture only) ... utilizes 8-bit ASCII code over the transmission facilities ... used in conjunction with the ASCII Character Set (A) (#9091) or (B) (#9092) on the 3277, 3284, 3286 or 3288-2, or the ASCII Character Set (B) (#9084) on the 3287.

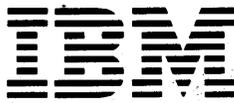
Model Changes: Field Installable

Special Features

Copy (#1550): Provides the ability to transfer the complete contents of the storage buffer of one device into the storage buffer of a second device ... either display or printer. These devices must share a common control unit. **Field Installation:** Yes.

Device Adapter (#3250): Each permits the addition of four devices (3277s, 3284s, 3286s, 3287, and 3288-2s in any combination). **Maximum:** Seven ... for a maximum of 32 attached devices. **Field Installation:** Yes.

Transmission Speed (#7820, 7821): #7820 For transmitting over common carrier facilities at 1200 bps. #7821 For transmitting at speeds of 4800 or 7200 bps. Clocking provided by modem. **Maximum:** One. **Field Installation:** Yes.

**3272 CONTROL UNIT (Local Attachment)**

Purpose: Provides the controls and multiplexing capabilities for a cluster of 3277 Display Stations, 3284, 3286, 3287 and 3288-2 Printers. The 3272 attaches to a System/360 Model 25, 30, 40, 50, 65, 67 (in 65 mode), 75, 85, 195 or a System/370 Model 115 through 195 via a multiplexer, selector, or block multiplexer channel.

Note: 3288 Model 2 attaches only to a 3272 Model 2.

Model 1: For attachment of 3277 Display Station Model 1s (480 characters), 3284 and 3286 Printer Model 1s and 3287 Printer Model 1s and 2s. The basic unit provides for attachment of up to four devices at a data transfer rate of up to 650,000 characters/second. **Note:** One 3277 Model 1 must be installed with the basic 3272 ... the remaining three devices may be any combination of 3277 Model 1s and 3284 and 3286 Model 1s and 3287 Model 1s.

Model 2: For attachment of 3277 Display Station Model 2s (1,920 characters), 3277 Model 1s (480 characters), 3284 and 3286 Printer Model 1s and 2s, 3287 Model 1s and 2s, and 3288 Printer Model 2s. The basic unit provides for attachment of up to four devices at a data transfer rate of up to 650,000 characters/second. **Note:** One 3277 Model 2 must be installed with the basic 3272 ... the remaining three devices may be any combination of 3277 Model 1s and 2s, 3284 and 3286 Model 1s and 2s, 3287 Model 1s and 2s, and 3288 Model 2s.

Highlights: Up to thirty-two devices (3277s, 3284s, 3286s, 3287s, 3288-2s) may be attached in increments of four devices by adding up to seven Device Adapters (#3250) ... see "Special Features."

Basic features include Compacted Data (blank suppression and modified data transmission), program tab, and character addressing.

Prerequisites: One 3277 with keyboard must be installed on each 3272 on a model for model basis, as a diagnostic aid. That is, 3277 Model 1 on 3272 Model 1, or 3277 Model 2 on 3272 Model 2.

Each 3272 requires a control unit position on a system channel.

System/360 Model 25 Special feature on 2025; Multiplexer Channel or Selector Channel ... see 2025.

System/360 Model 30, 40, 50: Multiplexer channel (standard), or Selector Channel (special feature) ... see 2030, 2040, 2050.

System/360 Model 65, 67, 75: Selector channel of a 2860, basic multiplexer channel of a 2870, Selector Subchannels (special features) on 2870 ... see 2860, 2870.

System/360 Model 85, 195 or System/370 Model 165, 168, 195: Selector channel of a 2860, basic multiplexer channel of 2870, Selector Subchannels (special features) of 2870, block multiplexer channel of 2880 ... see 2860, 2870, 2880.

System/370 Model 115, 125: Multiplexer Channel (special feature) ... see 3115, 3125.

System/370 Model 135, 145, 155, 158: Byte multiplexer channel, block multiplexer channel, selector channel ... see 3135, 3145, 3155, 3158.

Systems 360/370 availability will be restricted unless the using system provides sufficient core to allow diagnostic programs (OLTs) to be executed. For details associated with the required additional core sizes, see the appropriate SRL (TCAM, BTAM and VTAM).

Bibliography: GA22-6822**Specify:**

(1) Voltage (AC, 1-phase, 3-wire, 60 Hz): Locking plug—#9884 for 208V, or #9886 for 230V. Non-lock plug—#9885 for 208V, or #9887 for 230V. Must be consistent with system voltage.

(2) Cables: Cables to System/360 or System/370 must be ordered. See *3270 Installation Manual—Physical Planning*, GA27-2787.

(3) System Attachment: For record purposes, identify the host processor(s) by specifying the following

Host Processor

System/360 Model 25
System/360 Model 30
System/360 Model 40
System/360 Model 50
System/360 Model 65
System/360 Model 67
System/360 Model 75
System/360 Model 85
System/360 Model 195
System/370 Model 115
System/370 Model 125
System/370 Model 135
System/370 Model 145
System/370 Model 155
System/370 Model 158
System/370 Model 165
System/370 Model 168

(4) Operator Console Use: [Mdl 2 only] For record purposes only use. #9480—if one 3277 Model 2 is to be used as a system operator console, or #9481—if no system operator console is required for the 3272.

Model Changes: Field installable.

Model Upgrade Purchase Price See price list

Special Features

Field Installation: Yes.

Device Adapter (#3250): Each permits the addition of four devices (3277s, 3284s, 3286s, 3287s, 3288-2s in any combination).

Maximum: Seven ... for a maximum of 32 attached devices.

Field Installation: Yes.

**3274 CONTROL UNIT**

Purpose: A Control unit which provides the capability of controlling up to a maximum cluster of thirty-two terminals consisting of display stations, serial matrix printers and/or line printers.

Two categories of terminal adapters are used in attaching the desired display/printer terminals (see terminal attachment list below).

The basic 3274 Control Unit allows attachment of up to eight Category A terminals. The two types of terminal adapters can be featured in various combinations to provide the maximum terminal configuration of 32 terminals (a maximum of 16 of the 32 terminals can be Category B units) and at least one 3278 Display Station with keyboard is needed for diagnostic purposes.

The 3274 communicates in half duplex mode via half or full duplex communications facilities at speeds up to 9600 bps.

ATTACHABLE TERMINALS**Category A Terminals**

3278 Model 2	Display Station
3287 Model 1 & 2	Printer
3289 Model 1 & 2	Line Printer

Category B Terminals

3277 Model 1 & 2	Display Station
3284 Model 1 & 2	Printer
3286 Model 1 & 2	Printer
3287 Model 1 & 2	Printer
3288 Model 2	Line Printer

Model 1C. For Binary Synchronous communications in half duplex mode over half duplex or duplex communications facilities with a suitably equipped System/3 Model 4, 8, 10, 12, and 15.

Highlights: The 3274 Control Unit is a new terminal control unit which can handle up to thirty-two displays, serial matrix printers and/or line printers. These terminals are grouped into two categories. The Category A terminals are a new display and printers which were developed along with the 3274 controller, while the Category B terminals were designed for attachment to the 3271 and 3272 Control Units. The 3274 Control Unit was designed to attach the Category B terminals with certain limitations. A maximum of sixteen of the thirty-two attachable terminals can be Category B terminals. Category A terminals can be driven up to a maximum of 1500 meters (4920 feet) while Category B terminals can only be driven a maximum of 610 meters (2000 feet). Both type terminals attach to their respective Terminal Adapter by the same type coaxial cable and connectors which are used between a 3271 or 3272 Control Unit and its display or printer terminals. One Feature Diskette, two System Diskettes, and one Language Diskette are shipped with each 3274.

As part of the installation procedure, a customized system diskette is generated. The generation process is accomplished by the customer keying in system configuration parameters. A unique configuration table is written on the system diskette along with the necessary control code to accomplish the functions. For example, during subsequent control unit loading or initialization of a Model 1C, BSC operation is determined by the configuration recorded on the system diskette used.

The control unit is initialized with control code as a result of Power On or by pressing the IML push button. The load occurs from the integrated diskette which was previously customized to the desired configuration. The process starts with the execution of extended tests contained on the diskette. Upon successful

conclusion of these diagnostic tests the pre-configured control code is loaded.

Communications: The 3274 Model 1C Communications with a System/3 over full or half duplex communications facilities as follows:

- System/3 Model 4 via BSCA
- System/3 Model 8 via ICA or BSCA
- System/3 Model 10 via BSCA
- System/3 Model 12 via ICA or BSCA
- System/3 Model 15 via BSCA
- System/3 Model 15D via BSCA or BSCC

Communications Facilities: The 3274 Model 1C operates in half-duplex point-to-point or multipoint mode on half-duplex or duplex facilities at transmission speeds of 2000, 2400, 4800, 7200 and 9600 bps on non-switched facilities D4, D4M, D4SB, D5, D5M, D5SB, D6, D6M, D6SB, D7M, X1M, X2M and X3M. See M2700 pages for facilities.

Modems: An external modem with its own clocking must be attached to a 3274 Model 1C with the External Modem Interface (#3701) and Communication Adapter (#6302). No external modem is required when attached locally to System/3 through BSCA/EIA Local, BSCC/EIA Local, LCA, or ICA, however (#3701) and #6302 are required.

IBM Modems Speed (bps)

3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

Switched network backup operation with Manual Answer/Manual Call is available on the 3872 Model 1, 3874 Model 1, and 3875 Model 1. For communications capabilities, product utilization and features, see M2700, M3872, M3874 and M3875

Problem Determination Procedures: Significant function has been designed into this unit to provide greater availability to the customer. This has been done through the use of problem determination and recovery procedures that are easily understood and used by the operator. See Customer Responsibility below.

CUSTOMER SETUP (CSU)

The 3274 Model 1C is designated as Customer Setup thereby offering the customer early availability and terminal relocation flexibility.

CUSTOMER RESPONSIBILITIES

The customer is responsible for:

- (1) Adequate site, system, and other vendor preparation.
- (2) Receipt at the customer's receiving dock, unpacking, and placement.
- (3) Physical Setup, connection of cables to TP Lines/modems and IBM devices, incorporating protected customer access areas, switch settings, and check-out.
- (4) Contact IBM to make cable connections of IBM CSU units to IBM non-CSU unit where customer access areas are not provided.
- (5) Relocation of the 3274, if required, to allow IBM Service access.
- (6) Notify IBM of intent to relocate and follow IBM instructions for relocation.



- (7) Connection of communication cable to the communication facility.
- (8) Performing 3274 customization in accordance with IBM supplied procedures.
 - a. For initial installation
 - b. When made necessary by changes in configuration
 - c. Updating Engineering Change level of the Control Unit diskettes (at the customer's option)
- (9) Use and follow the problem determination procedures, and fill out the trouble report prior to calling for IBM service.
- (10) Disconnecting, packing, and removal to the customer's shipping dock at the time of discontinuance. Appropriate instructions will be provided by IBM.

Prerequisites: (1) One 3278 Display Station with keyboard is needed on each 3274 as a diagnostic aid. (2) External Modem Interface (#3701) must be ordered along with Common Communications Adapter (#6302). Either an IBM or non IBM external modem, with its own clocking, must be provided (except when attached locally to System/3 through BSCA/EIA Local, BSCC/EIA Local, LCA or ICA).

Bibliography: See applicable KWIC Index listed below or specific system bibliography.

3274 Model 1C GC20-0001

Specify:

- (1) Voltage (AC, 1-phase, 3-wire, 60HZ); Locking Plug—#9890 for 120V, #9884 for 208V, #9894 for 240V. Non-Lock Plug—#9881 for 120V, #9885 for 208V, #9885 for 240V.
- (2) Power Cable Length: If standard 4.3 meter (14 feet) power cable is not desired, specify #9511 for 1.8 meters (6 feet).
- (3) Communications Cable: If the standard 6.1 meter (20 feet) communication cable is not desired, specify one of the following: #9061 for 3.0 meter (10 feet), #9062 for 9.1 meters (30 feet) or #9063 for 12.2 meters (40 feet).
- (4) System attachment: For record purposes, identify the System the 3274 attaches to or communicates with:

Processor

- System/3 Model 4
- System/3 Model 8
- System/3 Model 10
- System/3 Model 12
- System/3 Model 15

Customer Setup: Yes.

Model Changes: Not applicable

Special Features

Terminal Adapter Type A1 through A3 (#6901, #6902, and #6903). One each of these adapters can be installed. Each adapter provides for the attachment of an additional eight Category A terminals. The base control unit, which provides for attachment of eight Category A terminals, can be expanded with these three terminal adapters to a maximum configuration of thirty-two Category A terminals. These terminal adapters must be installed in sequence, making it important to order the correct adapter feature code(s).

- Terminal Adapter Type A1 (Terminals 9-16)—#6901
- Terminal Adapter Type A2 (Terminals 17-24)—#6902
- Terminal Adapter Type A3 (Terminals 25-32)—#6903

Limitation: Terminal Adapter Type A3 (#6903) is mutually exclusive with Terminal Adapter Types B3 (#7804 and B4 (#7805). **Maximum:** One of each type terminal adapter. **Prerequisite:** Terminal Adapter Type A1 is a prerequisite to installing A2 and A2 is a prerequisite to A3. **Field Installation:** Yes.

Terminal Adapter Type B1 (#7802): Permits the attachment of four Category B terminals and provides for the installation of Terminal Adapters Type B2, B3, and B4 when additional Category B terminals are desired. **Maximum:** One. **Field Installation:** Yes. **Corequisite:** Extended Function Store—16K (#3622) and Control Storage Expansion (#1801) must be installed.

Terminal Adapter Type B2 through B4 (#7803 through #7805): Each of these terminal adapters permits the attachment of four additional Category B terminals. A maximum of one each of these terminal adapters can be installed for a combined total of twelve additional or sixteen total Category B terminals attached to a control unit. These terminal adapters must be installed in sequence, making it important to order the correct adapter feature code(s).

- Terminal Adapter Type B2 (Terminals 5, 6, 7 & 8)—#7803
- Terminal Adapter Type B3 (Terminals 9, 10, 11 & 12)—#7804
- Terminal Adapter Type B4 (Terminals 13, 14, 15 & 16)—#7805

Limitation: Terminal Adapter Type B3 (#7804) and Terminal Adapter Type B4 (#7805) are mutually exclusive with Terminal Adapter Type A3 (#6903). **Maximum:** One of each type terminal adapter. **Prerequisite:** Terminal Adapter Type B1 (#7802) must be installed before these adapters can be installed. **Field Installation:** yes.

Note: Maximum number of terminals attached cannot exceed 32. Various combinations of Category A terminals and Category B terminals are possible depending on adapters selected.

Extended Function Store 16K (#3622): Provides 16,384 bytes of additional control storage. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Control Storage Expansion (#1801) must be installed with this EFS feature. **Note:** See Special Feature, Terminal Adapter Type B1 (#7802) for requirements.

External Modem Interface (#3701): Provides the appropriate cable and interface logic necessary to attach either an external IBM or non-IBM modem with its own clocking. See Specify (3) for cable length. **Specify:** (for record purposes only, no parts required) #9821 for 2000 bps, #9822 for 2400 bps, #9823 for 4800 bps, #9824 for 7200 bps, #9825 for 9600 bps line speed. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Com-



mon Communications Adapter (CCA) (#6302) must be ordered/installed with this feature.

Common Communications Adapter (#6302): Required for attachment to communication lines at speeds up to 9600 bps (BSC transmission control protocol) through either an IBM or a non-IBM modem with its own clocking. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** External Modem Interface (#3701) must be installed with this feature.

Control Storage Expansion (#1801): Provides the ability to access storage addresses above the basic level. This feature is a prerequisite to installing the Extended Function Store feature (#3622). **Maximum:** One. **Field Installation:** Yes. **Corequisite:** Terminal Adapter Type B1 (#7802) must be installed.

**3275 DISPLAY STATION**

Purpose: A single remote cathode ray tube display station. Provides controls and display of alphanumeric information from a System/3 Model 4 via the Binary Synchronous Communications Adapter, or from System/3 Model 10 or 15 via the Binary Synchronous Communications Adapter or the Local Communications Adapter or with System/3 Model 8 or Model 12 via the ICA or BSCA, or with a System/3 Model 15D via the Binary Synchronous Communications Controller (BSCC), or from a System/360 Model 25, 30, 40, 50, 65, 67 (in 65 mode), 75, 85, 195 or System/370 Model 115 through 195 via a 2701 Data Adapter Unit, 2703 Transmission Control or, except for System/360 Models 25 or 85, a 3704 or 3705 on half-duplex or duplex communication facilities using binary synchronous transmission.

Model 2: Displays 1,920 characters ... 24 lines of 80 characters each.

Highlights: Displays sixty-three 7 x 9 dot matrix characters ... 36 alphanumerics, 27 special characters, including the space. Features Data-Field Organization, which permits individual fields of data on the screen to be program-defined with various attributes such as protected or unprotected, alphanumeric or numeric, normal intensity, non-displayed, or brightened intensity, and selector light-pen detection-allowed or disallowed.

Editing Features: Typematic, cursor, tab, back-tab, protected-data, insert and delete, and extended-erase (erase to end-of-field, erase all keyboard input data, erase entire screen) are standard features for displays equipped with a keyboard.

Input Flexibility: A choice of keyboards, a selector light-pen, and a set of program function keys provide unmatched input flexibility ... see "Special Features" below.

Security Enhancement Features: A special Non-displayed Keying Mode (standard) provides for fields of data to be program-defined so that they will accept data entered from the keyboard without displaying the data on the screen. A Security Keylock (optional) prevents modification of data on the display unless the key is turned to the "On" position. An Operator Identification Card Reader (optional) is provided to enter system user identification. This enhances the (programmed) control of his access to data and audit of his actions. It may also be used to enter any sequence of characters (pre-recorded on a card) for other purposes such as transaction control, account control, and billing.

Optional features allow the attachment of a 3284 Model 3 dedicated printer, EBCDIC or ASCII keyboard, selector light-pen, audible alarm and other features ... see "Special Features" below.

Communications: The 3275 may be multidropped on the same facility with other BSC devices (System/3 Model 4, Model 6, Model 8, Model 10, Model 12, or 15, System/360 Model 20, 1130, 1800, 2715, 2770, 2780, 3271, 3275 and 3780) as tributary stations on a multipoint line with a System/360 Model 25-195 (except Model 44), or a System/370 Model 115-195 as the control station.

Communications Facilities: The 3275 operates in half-duplex multipoint mode on half-duplex facilities at transmission speeds of 1200, 2000 or 2400 bps on facilities D3, D4 or X1M via the 2701, 2703, 3704, 3705, #4640 on 3115, 3125, 3135, #2074 on System/3 Model 4, #2074/2084 on System/3 Model 10 or 15

or #4645/2074 on System/3 Model 8 or #4645/2074/2084 on System/3 Model 12 or #2094 on System/3 Model 15D using binary synchronous transmission.

The 3275 operates in half-duplex multipoint mode on duplex facilities at transmission speeds of 1200, 2000, 2400 or 4800 bps on facilities D3, D4, D5, X1M or X2M via the 2701, 2703, 3704, 3705, #4640 on 3115, 3125, 3135, #2074 on System/3 Model 4, #2074/2084 on System/3 Model 10, 12 or 15 or #2074 on System/3 Model 8, using binary synchronous transmission. Half-duplex multipoint operation at a speed of 7200 bps is available on facility D9 via the 2701, 3704, 3705, #4640 on the 3115, 3125, 3135, #2074 on System/3 Model 4, #2074/2084 on System/3 Model 10, 12, or 15 or #2074 on System/3 Model 8, or #2094 on System/3 Model 15D, using binary synchronous transmission. The 3275 operates on switched network facilities at a transmission speed of 600/1200 bps when equipped with feature #3440 using binary synchronous transmission. See M 2700 pages for facilities.

Modems: One IBM modem may be attached to a 3275, any model. **Prerequisite:** #7821 is required on the 3275 for speeds over 2400 bps on leased lines.

Modem	Speed (bps)
3872 Model 1	2400
3874 Model 1	4800
3875 Model 1	7200

Note: Switched network backup operation is available on the 3872 Model 1, 3874 and 3875. For communication capabilities, product utilization and special features, see M2700, M2701, M3705, M3872, M3874 and M3875 pages.

Prerequisites: Transmission via common carrier facility to a 2701, 2703, 3704, 3705, Integrated Communications Adapter (#4640) on 3115, 3125 on 3135, ICA (#4645 and #6202) or BSCA (#2074) on System/3 Model 8, ICA (#4645 and #6202) or BSCA (#2074/#2084) on System/3 Model 12, or BSCA (#2074/#2084) on System/3 Model 10 or 15, or #2094 on System/3 Model 15D. Requires a modem except when communicating to a System/3 Model 8 with ICA (#4645 and #4801) or EIA Local Attachment (#3601/3602) installed or a System/3 Model 12 with ICA (#4645 and #4801) or EIA Local Attachment (#3601/#3602) installed, or System/3 Model 10 or 15 with EIA Local Attachment (#3601/#3602) or Local Communications Adapter (#4765) installed, or System/3 Model 15D with EIA Local (#3603/3604) installed. See M2700 pages and M5408 or M5410 or M5412 or M5415 pages.

System/3 Model 4 allows execution of online terminal tests concurrent with a user's TP application program.

System/3 Models 8 and 10 allow execution of online terminal tests concurrent with a user's TP application program in the same program level in a disk oriented system with at least 16K bytes of main storage.

System/3 Model 12 allows execution of online terminal tests concurrent with a user's TP application program in the same program level with at least 32K bytes of main storage.

System/3 Model 15 allows execution of online terminal tests concurrent with a user's TP application program in the same partition in a system with at least 48K bytes of main storage.

For these systems, diagnostic programs will be executed only under control of the Diagnostic Control Monitor in a dedicated mode, i.e., not concurrent with user program execution or residence.



Bibliography: See KWIK Index G320-1621 or specific system bibliography.

Specify:

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug.
- (2) Cables: Cable to attach Data Set should be ordered. Refer to *3270 Installation Manual—Physical Planning, GA27-2787*.
- (3) System Attachment: For record purposes identify the host processor(s) by specifying the following

Processor

System/3 Model 4
System/3 Model 8
System/3 Model 10
System/3 Model 12
System/3 Model 15

- (4) Transmission Code: Specify one; #9761—for EBCDIC Transmission Code (available at time of manufacture only) ... utilizes 8-bit EBCDIC code over the transmission facilities ... used in conjunction with EBCDIC Character Set (#9089). #9762—for ASCII Transmission Code (available at time of manufacture only) ... utilizes 8-bit ASCII code over the transmission facilities ... used in conjunction with ASCII Character Set (A) (#9091) or (B) (#9092).
- (5) Character Set: Specify one of the following;
 - #9089 For EBCDIC Character Set (available at time of manufacture only) ... provides the 64 characters described on the EBCDIC typewriter keyboard. **Prerequisite:** EBCDIC Transmission Code (#9761).
 - #9091 For ASCII Character Set (A) (available at time of manufacture only) ... provides the 64 ASCII characters but substitutes the Logical OR (!) and Logical NOT (-) for the exclamation mark (!) and circumflex (^). **Prerequisite:** ASCII Transmission Code (#9762).
 - #9092 For ASCII Character Set (B) (available at time of manufacture only) ... provides the standard 64 ASCII character set. **Prerequisite:** ASCII Transmission Code (#9762).

Accessories: LOCKS AND KEYS: The 3275 with the Security Keylock (#6340) special feature is shipped with two keys. Additional keys may be purchased only from IBM. (Vendor will supply additional keys only to original purchaser.)

Model Changes: Field Installable.

Special Features

Audible Alarm (#1090): An alarm, sounded under program control, to alert the operator to a special condition. This alarm, during keyboard operation, is sounded when a character is entered into the next to last position on the screen. **Maximum:** One. **Field Installable:** Yes.

Dial (#3440): [Plant installation only] Provides the capability of operating over the public switched telephone network at speeds of 600/1200 bps.

Operator Identification Card Reader (#4600): Provides the capability of reading a Mr size, 2-1/8" x 3-3/8" (credit card size), plastic card with a magnetic stripe on the back. This card can be encoded with up to 40 numeric characters, including control characters.

The feature provides the ability to read an operator identification card to allow identification of the display operator, thus enhancing system data security capability.

The card reader can read, under program control, the magnetically encoded information from the operator identification card on the ABA standard magnetic striped credit card. This allows the feature to be used in both banking and operator identification applications. The same card that is read on the 2730 can be read by this feature.

For complete information on the availability of magnetically striped and encoded identification and credit cards, see the *IRD Sales Manual*. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Any Keyboard.

Keyboard (#4630 - 4636).

#4630 66 key EBCDIC Typewriter Keyboard, typewriter-like layout, movable, with 45 alphameric keys and 21 control keys. **Prerequisite:** EBCDIC Character Set (#9089).

#4631 66 key EBCDIC Data Entry Keyboard, movable, with 36 alphameric keys and 30 control keys. **Prerequisite:** EBCDIC Character Set (#9089).

#4632 78 key Operator Console Keyboard, operator-console layout, movable, with 45 alphameric keys, 21 control keys, and 12 program function keys. **Prerequisite:** EBCDIC Character Set (#9089).

#4633 78 EBCDIC Typewriter Keyboard, 66 key EBCDIC layout with 12 additional program function keys, movable. **Prerequisite:** EBCDIC Character Set (#9089).

#4634 66 key ASCII Keyboard, ASCII typewriter layout, movable, with 45 alphameric keys and 21 control keys. **Prerequisite:** ASCII Character Set (A) or (B) (#9091 or #9092).

#4635 78 key ASCII Keyboard, 66 key ASCII typewriter layout, with 12 additional function keys, movable. **Prerequisite:** ASCII Character Set (A) or (B) (#9091 or #9092).

#4636 66 key EBCDIC Data Entry Keyboard, keypunch layout, movable, with 36 alphameric keys and 30 control keys. This is the recommended keyboard for data entry, including Video 370. **Prerequisite:** EBCDIC Character Set (#9089).

Maximum: One of the above. **Field Installable:** Yes.

Keyboard Numeric Lock (#4690): Provides the ability to lock the keyboard, if a non-numeric key [other than 0-9, minus (-), period (.) or dup] is depressed in a predefined numeric-only field. **Maximum:** One. **Field Installable:** Yes.

Line Adapter (#5500): Provides a modem capable of operating

at a speed of 1200 bps on the leased telephone network, or at speeds of 600/1200 bps on the switched telephone network via a similiarly equipped System/3 CPU, 2701 or 3705. **Field Installable:** Yes. **Prerequisites:** Dial (#3440) on the switched network ... **Transmission Speed (#7820)** on the leased network.

Line Adapter with Auto Answer (#5501): Provides a modem with automatic answering for use with the switched telephone network at speeds of 600/1200 bps via a similiarly equipped System/3 CPU, 2701 or 3705. **Field Installable:** Yes. **Prerequisite:** Dial (#3440).

Printer Adapter (#5550): To attach a 3284 Printer Model 3. Provides the controls to print out the contents of the 3275 buffer. Used with the basic 3275. **Maximum:** One. **Field Installable:** Yes.

Security Keylock (#6340): A lock and key which prevents modification and display of data on the display when in the "off" position. **Maximum:** One. **Field Installable:** Yes.

Selector Light-Pen (#6350): A hand-held, pen-like device that permits the operator to select fields of data from a display for computer input. **Maximum:** One. **Field Installable:** Yes.

Transmission Speed (#7820, 7821): #7820—for transmitting over common carrier facilities at 1200 bps. Clocking is provided by the 3275. #7821—for transmitting at speeds of 4800 or 7200 bps. Clocking provided by modem. **Maximum:** One **Field Installable:** Yes.



3276 CONTROL UNIT DISPLAY STATION

Purpose: An enhanced, cathode-ray tube (CR) display station used for displaying alphanumeric data, and for entering data into, and retrieving data from a System/3. The 3276 optionally provides control and multiplexing capabilities to support up to seven 3278 Display Stations, 3287 Printers, or 3289 Line Printers, allowing a maximum cluster size of eight displays or printers including the 3276's own display. A keyboard, or a selector light-pen, permit an operator to display and manipulate data on the screen in a flexible and efficient manner. The 3276 meets both general and unique display requirements with its set of basic and optional features.

The 3276 communicates with System/3 in half duplex mode via half or full duplex communications facilities at speeds up to 7200 bps.

Model 2. Displays up to 1920 characters ... 24 lines of 80 characters each. Can attach up to seven 3278 Model 2s 3287s (any model), or 3289s (any model) in any combination.

Highlights: Displays each character within a 7 x 14 character matrix. The basic 26 character upper case letters are presented in a 7 x 9 matrix. There is a 94 character set; 632 alphanumeric and 32 special character, not including the Space and Null characters. The display character set may be restricted to the upper case characters by the monospace switch. Uses 3270 Field Formatting capability which permits individual fields of data on the screen to be program defined with various attributes such as protected/unprotected, alphanumeric, normal/highlighted intensity, displayable/non-displayable, and selector light-pen detection allowed/disallowed.

The operator may initiate a local display-to-printer copy function (i.e., without host intervention) from the keyboard of a 3276 or 3278 attached to a 3276. The printer designation is controlled by a configuration default matrix which is fixed by the relative port positions of displays and printers attached to the 3276. Other printers may be accessed using the IDENT key.

Devices attached to the 3276 are assigned port positions 1 through 8. Displays are authorized to print only to printers which are attached to higher numbered ports. If the IDENT key is not used, a PRINT operation from a given display will cause printing to take place at the first printer whose port position is higher than the display. The operator may use the IDENT key to print to any printer. (The host can perform copy in a manner compatible with existing 3271/3272 support.

Operator Factors: The 3276 has an anti-glare screen. Indicators are displayed on the bottom row of the screen, outside the data display area, and provide useful operator factors. Host display of data on the screen is accomplished without refresh interrupt (i.e., no blinking). The keyboard which is low in profile provides a palm rest area and has separators to help prevent accidental striking of control keys. The operator may select one of several cursor modes.

Cluster Capability: Up to seven 3278s or 3287s or 3289s may be attached. The basic 3276 provides a display and a port for one device, a 3278, a 3287 or a 3289. Up to three Device Adapters, each controlling up to two devices, can be attached to the 3276. The 3276 allows the attachment of seven additional displays and/or printers for a maximum cluster size of eight including its own display ... See "Special Features" below.

Editing Functions: Cursor move, tab, home key, back tab, insert, delete, extended erase (erase to end-of-field, erase all keyboard input data, and erase entire screen) and cursor

select keys are all basic. All alphanumeric, special symbol, and cursor move keys have typamatic capability. Double speed cursor typamatic is attained with a simultaneous depressing of the ALT key and a horizontal cursor positioning key.

Input Flexibility) A choice of keyboard or the Selector Light-Pen provide input flexibility ... See "Special Features" below. Fields of data can be selected by positioning the cursor and pushing the cursor select key, instead of using the Selector Light-Pen. Twelve Program Function (PF) keys are basic with all typewriter keyboards.

Security Functions A special non-displayed input mode provides for fields of data to be program-defined so that they will accept data entered from the keyboard without displaying the data on the screen. A security Keylock (optional) prevents modification or display of data in the display buffer unless the key is turned to the "on" position. An optional operator identification card reader can also be attached. These capabilities allow customer-supplied security program routines and procedures, to control access to data and audit of actions. An Address Keylock (optional) controls access to the address switches.

Communications: The 3276 Model 2 communicates with System/3 over full or half duplex communications facilities as follows:

- System/3 Model 4 via BSCA
- System/3 Model 8 via ICA or BSCA
- System/3 Model 10 via BSCA
- System/3 Model 12 via ICA or BSCA
- System/3 Model 15 via BSCA
- System/3 Model 15D via BSCA or BSCC

Communications Facilities: The 3276 operates in data half-duplex point-to-point or multipoint mode on half-duplex or duplex facilities at transmission speeds of 1200, 2000, 2400 4800, and 7200 bps on non-switched facilities D3, D3M, D3SB, D4, D4M, D4SB, D5, D5M, D5SB, D6, D6M, D6SB, X1M, and X2M.

Modems: A 1200 bps Integrated modem feature or an external IBM modem may be attached to the 3276. External modems require External Modem Interface (#3701).

Modem	Speed (bps)
3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

No external modem is required when attached locally to System/3 through BSCA/EIA Local, BSCC/EIA Local, LCA, or ICA; however, External Modem Interface (#3701) is required.

Switched network backup operation, with Manual Call and Manual or Auto Answer, is available on the 3872 Model 1, 3874 Model 1 and 3875 Model 1. For communications capabilities, product utilization and special features, see M2700, M3872, M3874, and M3875 pages.

Problem Determination Procedures

Significant function has been designed into this unit to provide greater availability to the customer. This has been done through the use of problem determination and recovery procedures that are easily understood and used by the operator. The procedures are provided by the Problem Determination Guide manual that will be stored under the keyboard palm rest. See "Customer Responsibility" below.

**Customer Setup**

The 3276 is designated as Customer Setup thereby offering the customer early availability and terminal relocation flexibility.

Customer Responsibility

The customer is responsible for:

- Adequate site, system and other vendor preparation.
- Receipt at customer's receiving dock, unpacking and placement of 3276.
- Physical setup, connection of cables to TP lines/modems and IBM devices incorporating protected customer access areas, switch settings, and check out.
- Notify IBM of intent to relocate and follow IBM instructions for relocation.
- Use and follow the problem determination procedures and fill out trouble report prior to calling for IBM service.
- Disconnecting, packing and removal to the customer's shipping dock at the time of discontinuance appropriate instructions will be provided by IBM.

Prerequisites: Each 3276 requires a modem (except as indicated above under Modems): A keyboard must be installed on each 3276.

Bibliography: See KWIC Index, G320-1621 or specific system bibliography.

Specify:

- (1) Voltage (120V AC, 1-phase, 3-wire 60HZ): #9890 for locking plugs, or #9891 for non-lock plug. If standard 2.8 meter (9 foot) power cable is not desired, specify: #9511 for 1.8 meter (6 foot) cable, #9512 for 3.7 meter (12 foot) cable, or #9513 for 4.5 meter (15 foot) cable.

- (2) Communication cable:

A 6.1 meter (20 foot) communication cable is provided as standard for attachment to standalone modem, or the communication facility when integrated modem is used. If standard 6.1 meter communication cable is not desired, specify: #9061 for 3.0 meter (10 foot) cable, #9062 for 9.1 meter (30 foot) cable or #9063 for 12.2 meter (40 foot) cable.

- (3) Character Set: (Specify one)

#9082 For EBCDIC Character Set—used in conjunction with 75 Key Typewriter Keyboard (#4621) or Data Entry Keyboard (#4622 or #4623) or 87-Key EBCDIC Typewriter Keyboard (#4627).

#9084 For ASCII Character Set (B)—used in conjunction with 75-Key ASCII Typewriter Keyboard #4624 or 87-Key ASCII Typewriter Keyboard (#4628).

- (4) System Attachment: For record purposes, identify the host processor(s) by specifying the following

Processor

System/3 Model 4
System/3 Model 8
System/3 Model 10
System/3 Model 12
System/3 Model 15

Special Features

Address Keylock (#1009): Controls access to the unit address switches which are located in the Operator Panel Drawer. **Maximum:** One. **Field Installation:** Yes.

Audible Alarm (#1090): An alarm, sounded under program control, to alert the operator to a special condition. This alarm, during keyboard operation, is also sounded when a character is entered into the next-to-last position on the screen. The operator may adjust the volume of the tone. **Maximum:** One. **Field Installation:** Yes.

Terminal Adapters (#3255, #3256, #3257)

#3255 Terminal Adapter No. 1 enables attachment of two devices (3278s, 3287s, and/or 3289s). **Maximum:** One.

#3256 Terminal Adapter No. 2 enables attachment of two devices (3278s, 3287s, and/or 3289s). **Prerequisite:** Terminal Adapter No. 1 (#3255). **Maximum:** One.

#3257 Terminal Adapter No. 3 enables attachment of two devices (3278s, 3287s, and/or 3289s). **Prerequisite:** Terminal Adapter No. 2 (#3256). **Maximum:** One.

Field Installation: Yes. *Note:* The 3276 provides a display and a port for one device, a 3278 a 3287, or a 3289. The 3276 with the three Terminal Adapters (#3255, #3256, #3257) thus allows a maximum cluster size of eight displays or printers.

Keyboard (one should be ordered for each 3276)

#4621 75 Key Typewriter Keyboard, typewriter—like layout, movable, with 49 data keys and 26 control keys. Twelve program function keys are included in the top row of data keys through use of an alternate shift key. **Prerequisite:** EBCDIC Character Set (#9082).

#4622 75 Key Data Entry Keyboard movable, with 35 data keys, 10 program function keys and 30 control keys. **Prerequisite:** EBCDIC Character Set (#9082).

#4623 75 Key Data Entry Keyboard, keypunch layout, movable, with 35 data keys, 10 program function keys and 30 control keys. This is the recommended keyboard for high volume data entry. **Prerequisite:** EBCDIC Character Set (#9082).

#4624 75 Key ASCII Typewriter Keyboard, ASCII typewriter layout, movable, with 49 data keys and 26 control keys. Twelve program function keys are included in the top row of the data keys through use of an alternate shift key. **Prerequisite:** ASCII Character Set (B) (#9084).

#4627 87 Key EBCDIC Typewriter Keyboard, typewriter-like layout, movable, with 49 alphameric data keys, 26 control keys, and 12 program function keys (24 total P.F. keys). Twelve of the program function keys are included in the top row of data keys through the use of an alternate shift key. **Prerequisite:** EBCDIC Character Set (#9082).



#4628 87 Key ASCII Typewriter Keyboard, ASCII typewriter-like layout, movable, with 49 alphameric data keys, 26 control keys, and 12 program function keys (24 total P.F. keys). Twelve of the program function keys are included in the top row of data keys and are available through the use of an alternate shift key. **Prerequisite:** ASCII Character Set (B) (#9084).

Maximum: One of the above. **Field Installation:** Yes. The keyboard is set up by the customer. **Specify:** If standard 91 centimeter (3 foot) keyboard cable is not desired, specify #9399 for 182 centimeter (6 foot) cable. **Limitation:** Keyboards used on 3275 and 3277 machines are not interchangeable with keyboards used on 3276/3278 machines.

Communications Feature with Business Machine Clock (#6301): Required for attachment to communications facilities through the 1200 bps Integrated Modem, or the External Modem Interface (#3701) at 1200 bps to any external modem that does not provide its own clocking. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be ordered with #6302.

Communications Feature without Business Machine Clock (#6302): Required for attachment to communications facilities, at speeds up to 7200 bps using BSC, through the External Modem Interface (#3701) to any external modem that provides its own clocking. **Specify:** (for record purposes only, no parts required) #9821 for 2000 bps, #9822 for 2400 bps, #9823 for 4800 bps, #9824 for 7200 bps. **Maximum:** One. **Field Installation:** Yes. **Limitation:** Cannot be ordered with #6301.

External Modem Interface (#3701): Provides an EIA/CCIT interface for attachment of an IBM or other external modem. **Specify:** #9491 for operation on non-switched communication facilities. **Prerequisite:** Communication Feature with or without Business Machine Clock (#6301 or #6302). **Maximum:** One. **Field Installation:** Yes. **Limitation:** Cannot be ordered with #5500.

1200 bps Integrated Modem, Non-switched (#5500): Provides an integrated modem at speeds of 1200/600 bps for operation over non-switched communication facilities. No external modem is required. **Specify:** #9651 for use with 4-wire facility or #9652 for use with 2-wire facility. **Maximum:** One. **Prerequisite:** Communication Feature with Business Machine Clock (#6301). **Field Installation:** Yes. **Limitation:** Cannot be ordered with #3701.

Keyboard Numeric Lock (#4690): Provides a Data Entry Keyboard (#4622 or #4623) with the ability to lock the keyboard, if a non-numeric key [other than 0-9, minus (-), decimal sign, or dup] is depressed in a pre-defined numeric-only field. **Prerequisite:** Data Entry Keyboard (#4622 or #4623). **Maximum:** One. **Field Installation:** Yes.

Security Keylock (#6340): A lock and key which prevents modification or display of data in the display terminal when in the "off" position. **Maximum:** One. **Field Installation:** Yes.

Selector Light-Pen (#6350): A hand-held, pen-like device which permits the operator to select fields of data from a display for input to the host system. The Selector Light-Pen, while not being used, can be placed in a recess of the keyboard, which is used for user's incidental items. **Maximum:** One. **Field Installation:** Yes.

Magnetic Reader Control (#4999): Provides the capability of attaching a Magnetic Slot Reader. **Maximum:** One. **Field Installation:** Yes.

Accessories: The following items are available on a purchase only basis.

Magnetic Slot Reader (Part #4123500): A free standing Magnetic Slot Reader (MSR) that reads encoded information from a magnetic stripe. It attaches by a 1.5 meter cable through the Magnetic Reader Control (#4999). The MSR has 3 lights and a buzzer which provide feedback to the user on the status of the read data.

The MSR accommodates a wide range (height and length) of magnetic striped plastic cards such as: ID badges, security operator identification cards, etc. These cards can be encoded with Numeric only up to 40 characters at 75 bits per inch, or up to 65 characters at 127 bits per inch.

Note: Magnetic cards coded with the Alternate End of Message character (hexidecimal "C") cannot be read by this reader. **Maximum:** One. **Limitation:** Valid for numeric only data. **Prerequisite:** Magnetic Reader Control (#4999).

Locks and Keys: The 3276 with the Security Keylock (#6340) special feature is shipped with two keys. Additional keys may be purchased only from IBM. (Vendor will supply additional keys only to original purchaser.)



3277 DISPLAY STATION

Purpose: A high-performance cathode-ray tube used in clusters with the 3271, 3272, or 3274 Control Unit or local Display Adapter (System/3 Model 8 or 12) or Display Adapter (System/3 Model 15), or as local work station or operator display on a System/3 Model 4, for displaying alphameric data, and for entering data into and retrieving data from a System/360, System/370, System/3, or 3790 Communication System. Used as the operator display console on System/3 Model 15. A keyboard or light-pen or both permit an operator to display and manipulate data on the screen in a highly flexible and efficient manner. With its comprehensive and powerful set of standard and optional features, the 3277 meets both general-purpose and unique display requirements.

Model 1: To display up to 480 characters ... 12 lines of 40 characters each. For use with the 3271 Model 1, or 2 ... 3272 Model 1 or 2 ... 3274 ... Local Display Adapter (#4702 on System/3 Model 8 or 12) ... Display Adapter (#4601 on System/3 Model 15) ... System/3 Model 4 as local work station or operator display. For use with 3790, see below.

Model 2: To display up to 1920 characters ... 24 lines of 80 characters each. For use with 3271 Model 2 ... 3272 Model 2 ... 3274 ... or Local Display Adapter (#4702 and #4705 on System/3 Model 8 or 12) ... Display Adapter (#4601 on System/3 Model 15) ... System/3 Model 4 as local work station (#4705 on 5404). For use with System/3 see below.

Note: 3277 Model 1 and 2 displays may be intermixed on a 3271 Model 2, 3272 Model 2, or 3274. In this configuration, each 3277 Model 1 will display 480 characters supplied by the CPU to the 1,920 character buffer in the 3271 or 3272 or 3274. 3277 Model 1s and 2s may not be intermixed on a 3271 Model 1, 3272 Model 1, or 3791.

Model Changes: Available at time of manufacture only.

Highlights: Displays sixty-three 7 x 9 dot-matrix characters ... 36 alphamerics, 27 special characters, including the space. Features Data-Field Organization which permits individual fields of data on the screen to be program-defined with various attributes such as protected or unprotected, alphameric or numeric, normal intensity, non-displayed, or brightened intensity, and selector light-pen detection-allowed or disallowed.

Editing Features: Typamatic cursor, tab, back-tab, protected-data, insert and delete, and extended-erase (erase to end-of-field, erase all keyboard input data, erase entire screen) are standard features for displays equipped with a keyboard.

Input Flexibility: A choice of keyboards, a selector light-pen, and a set of program function keys provide unmatched input flexibility ... see "Special Features" below.

Output Flexibility: Information on the screen can be directed to another display or hard copy device under program control.

Security Enhancement Features: A special Non-displayed Keying Mode (standard) provides for fields of data to be program-defined so that they will accept data entered from the keyboard without displaying the data on the screen. A Security Keylock (optional) prevents modification of data on the display unless the key is turned to the "on" position. An Operator Identification Card Reader (optional) is provided to enter system user identification. This enhances the (programmed) control of his access to data and audit of his actions. It may also be used to enter any sequence of characters (pre-recorded on a card) for other purposes such as transaction control, account control, and billing.

For Operator Display on System/3 Model 4: A 3277 Model 1 (without keyboard) is required on the System/3 Model 4. It functions as the operator display for the Communications Control Program (CCP). A 3271, 3272, or 3274 is not required. For voltage, specify #9881. No cable order is required.

For Local Work Stations on System/3 Model 4: Up to five 3277s (Models 1 and 2 intermixed) can be directly attached to the 5404 Processing Unit. A 3271 or 3272 or 3274 Control Unit is not required. A cable is required. All 3277 "Special Features" apply with the exception of ASCII keyboards and character sets. Specify #9089 for EBCDIC Character Set. See "Specify" below for voltage and cable ordering information.

For the Local Display Adapter on System/3 Model 8 or Model 12: Up to twelve 3277s (Models 1 and 2 intermixed) can be directly attached to the Local Display Adapter (#4702) with appropriate subfeatures on the 5408 or 5412. This maximum is reduced by one for each 3284 (Model 1 or 2), 3286 (Model 1 or 2), 3287 (Model 1 or 2) or 3288 (Model 2) Printer that is attached. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. All 3277 "Special Features" apply with the exception of ASCII keyboards and character sets. Specify #9089 for EBCDIC Character Set. See "Specify" below for voltage and cable ordering information.

For Operator Console on System/3 Model 15: A 3277 Model 1 is required on the System/3 Model 15. It functions as an operator console and must be equipped with 78 key Operator Console Keyboard (#4632). No other special features are supported on the 3277. A 3271, 3272, or 3274 is not required when the 3277 Model 1 is directly attached to a 5415. For voltage, specify #9881. For character set, specify #9089. Specify #9590 for required CE servicing documentation. No cable order is required.

For Display Adapter on System/3 Model 15: Up to thirty 3277s (Models 1 and 2 intermixed) can be directly attached to the Display Adapter (#4601/#4602) on the 5415. This maximum is reduced by one for each 3284 (Model 1 or 2), 3286 (Model 1 or 2), 3287 (Model 1 or 2), or 3288 (Model 2) Printer that is attached. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. All 3277 "Special Features" apply with the exception of ASCII keyboards and character sets. Specify #9089 for EBCDIC Character Set. See "Specify" below for voltage and cable ordering information.

Maximum: Up to thirty-two 3277s can be attached to a 3271 or 3272. Up to sixteen 3277s can be attached to a 3274. The maximum is reduced by one on a 3271 or a 3272 for each 3284 - 1, 2, or 3286 - 1, 2 or 3287, or 3288-2 Printer attached. The maximum is reduced by one on a 3274 for each 3284 - 1, 2, 3286 -1, 2, 3287, or 3288-2 Printer attached through Terminal Adapter 7802 through 7805. See 3271, 3272 or 3274.

Prerequisites: For Model 1: A 3271 Model 1 or 2, 3272 Model 1 or 2, or 3274 with appropriate Device Adapters (#3250) ... see 3271, 3272, or 3274.

For Model 2: A 3271 Model 2 or 3272 Model 2 with appropriate Device Adapters (#3250) ... see 3271, 3272, or 3274.

Bibliography: See KWIK Index G320-1621 or specific system bibliography.

**Specify:**

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug.
- (2) Cables: See Accessories for 3277 cable ordering instructions. For cable specifications, see *Installation Manual—Physical Planning*, GC22-7004 or 3270 *Installation Manual—Physical Planning*, GA27-2787.
- (3) Character Set: Specify one of the following:
- #9089 For EBCDIC Character Set (available at time of manufacture only) ... provides the 64 characters described on the EBCDIC typewriter keyboard. **Prerequisite:** If used with the 3271, EBCDIC Transmission Code (#9761) is a prerequisite on the 3271.
- #9091 For ASCII Character Set (A) (available at time of manufacture only) ... provides the 64 ASCII characters but substitutes the Logical OR (|) and Logical NOT (~) for the exclamation mark (!) and circumflex (^). **Prerequisite:** If used with the 3271, ASCII Transmission Code (#9762) is a prerequisite on the 3271.
- #9092 For ASCII Character Set (B) (available at time of manufacture only) ... provides the standard 64 ASCII characters. **Prerequisite:** If used with the 3271, ASCII Transmission Code (#9762) is a prerequisite on the 3271.
- (4) Console Use with System/3 Model 15 (Model 1 only). #9590 for System/3 Model 15 console use.

Accessories:

Locks and Keys: The 3277 with the Security Keylock (#6340) special feature is shipped with two keys. Additional keys may be purchased only from IBM. (Vendor will supply additional keys only to original purchaser.)

3277 Key (#2577741)**Cables**

Cables and/or associated parts to attach the subject machines to the 3271/3272/3274 Control Units, the Local Display Adapter (#4702) on System/3 Model 8 and Model 12, or the Display Adaptor (#4601) on System/3 Model 15 or directly to the System/3 Model 4, may be purchased from IBM or from a customer selected source. For the proper identification, installation, and application of the subject cables and parts, see 3270 *Installation Manual—Physical Planning*, GA27-2787 and *Coaxial Cable and Accessories Manual*, GA27-2805. The customer is responsible for installation and maintenance of these cables and their associated parts.

Assem. #2577672 Cable Assembly Indoor
Bulk #0323921 Coax Wire (Note 1)
Part #1836418 Connector Kit (Note 1)
Assem. #1833108 Cable Assembly Outdoor
Bulk #5252750 Coax Wire (Note 2)
Part #1836419 Connector Kit (Note 2)

Part #2621414 Modification Kit (Note 3)
Part #1833106 Station Protector Attachment Kit (Note 5)
Part #5252643 Adapter (Note 7)
Part #1830818 Station Protector Kit, Gas (Note 4)
Part #5252899 Station Protector Element, Gas (Note 6)

Note 1: Coax wire and one connector kit (includes 2 connectors 1836444) required for each indoor cable assembly.

Note 2: Coax wire and one connector kit (includes 2 connectors 1836447) required for each outdoor assembly.

Note 3: Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.

Note 4: Must be used with outdoor cable assembly when installed above ground. One kit required for each cable assembly.

Note 5: Used to attach outdoor cable to station protector. One kit required for each cable assembly.

Note 6: Replacement station protector elements.

Note 7: Used to join two 2577672 or two 1833108 cable assemblies together.

Special Features

Audible Alarm (#1090): An alarm, sounded under program control, to alert the operator to a special condition. This alarm during keyboard operation, is sounded when a character is entered into the next to last position on the screen. **Maximum:** One. **Field Installable:** Yes.

Operator Identification Card Reader (#4600): Provides the capability of reading Mr Size 2-1/8" x 3-3/8" (credit card size), plastic card with a magnetic stripe on the back. This card can be encoded with up to 40 numeric characters, including control characters.

The feature provides the ability to read an operator identification card to allow identification of the display operator, thus enhancing system data security capability.

Prerequisite: Any Keyboard.

Keyboard (#4630-#4636).

#4630 66 key EBCDIC Typewriter Keyboard, typewriter-like layout, movable, with 45 alphameric keys and 21 control keys. **Prerequisite:** EBCDIC Character Set (#9089).

#4631 66 key EBCDIC Data Entry Keyboard, movable, with 36 alphameric keys and 30 control keys. **Prerequisite:** EBCDIC Character Set (#9089).

#4632 78 key Operator Console Keyboard, operator-console layout, movable, with 45 alphameric keys, 21 control keys, and 12 program keys. **Prerequisite:** EBCDIC Character Set (#9089).

#4633 78 key EBCDIC Typewriter Keyboard, 66 key EBCDIC typewriter layout with 12 additional program function keys, movable. **Prerequisite:** EBCDIC Character Set (#9089).

#4634 66 key ASCII Typewriter Keyboard, ASCII typewriter layout, movable, with 45 alphameric keys and 21 control keys. **Prerequisite:** ASCII Character Set (A) (#9091) or (B) (#9092).

#4635 78 key ASCII Typewriter Keyboard, 66 key ASCII typewriter layout with 12 additional function keys, movable.



Prerequisite: ASCII Character Set (A) (#9091) or (B) (#9092).

#4636) 66 key EBCDIC Data Entry Keyboard, keypunch layout, movable, with 36 alphameric keys and 30 control keys. This is the recommended keyboard for Data Entry including Video 370.

Prerequisite: EBCDIC Character Set (#9089).

Maximum: One of the above. **Field Installable:** Yes.

Keyboard Numeric Lock (#4690): Provides the ability to lock the keyboard if a non-numeric key [other than 0-9, minus (-), period (.), or dup] is depressed in a predefined numeric-only field. **Maximum:** One. **Field Installable:** Yes.

Security Keylock (#6340): A lock and key which prevents modification and display of data on the display when in the "off" position. **Maximum:** One. **Field Installable:** Yes.

Selector Light-Pen (#6350): A hand-held, pen-like device that permits the operator to select fields of data from a display for computer input. **Maximum:** One. **Field Installable:** Yes.



3278 DISPLAY STATION

Purpose: An enhanced cathode-ray tube (CRT) display station used in clusters with the 3274 Control Unit or the 3276 Control Unit Display Station for displaying alphameric data, and for entering data into and retrieving data from a System 3. A Keyboard, Selector Light-Pen or both permit an operator to display and manipulate data on the screen in a flexible and efficient manner. With its set of basic and optional features, the 3278 meets both general-purpose and unique display requirements.

Model 2. For use with 3274 or 3276 to display up to 1920 characters ... 24 lines of 80 characters each.

Highlights: Displays each character within a 7 x 14 character matrix. The basic 26 character upper case letters are presented in a 7 x 9 matrix. There is a 94-character set; 26 upper case alphabetic, 26 lower case alphabetic, 10 numeric, and 32 special characters. A monospace switch is used for 3277 compatibility. Uses 3270 field formatting which permits individual fields of data on the screen to be program defined with various attributes such as protected/unprotected, alphameric, normal/highlighted intensity, displayable/non-displayable, and Selector Light-Pen detection allowed/disallowed.

Operator Factors: The 3278 has an anti-glare screen. Indicators are displayed on the bottom row of the screen, outside the data display area, and provide useful operator factors. Host display of data on the screen is accomplished without refresh interrupt (i.e., no blinking). The keyboard which is low in profile provides a palm rest area and has separators to help prevent accidental striking of control keys. The operator may select one of several cursor modes.

Editing Function: Cursor move, tab, home key, back tab, insert, delete, extended erase (erase to end-of-field, erase all keyboard input data, and erase entire screen) and cursor select keys are all basic for displays equipped with a keyboard. All alphameric, special symbol, and cursor move keys have typamatic capability. Double speed cursor typamatic is attained with a simultaneous depressing of the ALT key and a horizontal cursor positioning key.

Input Flexibility: A choice of keyboards or the Selector Light-Pen provide input flexibility ... See "Special Features" below. Fields of data can be selected by positioning the cursor and pushing the cursor select key, instead of using the Selector Light-Pen. Twelve Program Function (PF) keys are basic with all typewriter keyboards.

Security Functions A special non-displayed input mode provides for fields of data to be program-defined so that they will accept data entered from the keyboard without displaying the data on the screen. A Security Keylock (optional) prevents modification or display of data in the display buffer unless the key is turned to the "on" position. An optional operator identification card reader can also be attached. These capabilities allow customer-supplied security program routines and procedures to control access to data and audit of actions.

Problem Determination Procedures

Significant function has been designed into this unit to provide greater availability to the customer. This increased availability has been achieved through the use of problem determination and recovery procedures that are easily understood and used by the operator. The procedures are provided by the *Problem Determination Guide* manual that will be stored under the keyboard palm rest. See "Customer Responsibility" below.

Customer Setup (CSU)

The 3278 Model 2 is designated as Customer Setup, thereby offering the customer early availability and terminal relocation flexibility.

Customer Responsibility

The customer is responsible for:

- Adequate site, system and other vendor preparation.
- Receipt at customer's receiving dock, unpacking and placement of 3278.
- Physical setup, connection of cables in protected customer access areas, switch settings, and check out.
- Contact Customer Engineering to make cable connections of IBM CSU units to IBM non-CSU units where customer access areas are not provided.
- Notify IBM of intent to relocate and follow IBM instructions for relocation.
- Use and follow the problem determination procedures and fill out trouble report prior to calling for IBM service.
- Disconnecting, packing and removal to the customer's shipping dock at the time of discontinuance appropriate instructions will be provided by IBM.

Prerequisites: Each 3278 requires a 3274 or 3276 with appropriate Terminal Adapters ... See 3274 or 3276

Bibliography: See KWIC Index, G320-1621 or specific system bibliography.

Specify:

- (1) Voltage (120V AC, 1-phase, 3-wire 60HZ): #9890 for locking plugs, or #9891 for non-locking plug. If standard 2.8 meter (9 foot) power cable is not desired, specify: #9511 for 1.8 meter (6 foot) cable, #9512 for 3.7 meter (12 foot) cable, or #9513 for 4.5 meter (15 foot) cable.
- (2) Cables: Cables and/or associated parts may be purchased from IBM or from a customer selected source. For the proper identification, installation, and application of the subject cables and parts, see *3270 Installation Manual—Physical Planning*, GA27-2787 and *Coaxial Cable and Accessories Manual* GA27-2805. The customer is responsible for installation and maintenance of these cables and their associated parts.



Assm. #	2577672	Cable Assembly Indoor
Bulk #	0323921	Coax Wire (Note 1)
Part #	1836418	Connector Kit (Note 1)
Assm. #	1833108	Cable Assembly Outdoor
Bulk #	5252750	Coax Wire (Note 2)
Part #	1836419	Connector Kit (Note 2)
Part #	2621414	Modification Kit (Note 3)
Part #	1833106	Station Protector Attachment Kit (Note 5)
Part #	5252643	Adapter (Note 7)
Part #	1830818	Station Protector Kit, Gas (Note 4)
Part #	5252899	Station Protector Element, Gas (Note 6)

- Note 1:** Coax wire and one connector kit (includes 2 connectors part #1836444) required for each indoor cable assembly.
- Note 2:** Coax wire and one connector kit (includes 2 connectors part #1836447) required for each outdoor cable assembly.
- Note 3:** Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.
- Note 4:** Must be used with outdoor cable assembly when installed outdoors (either above or below ground level. One kit required for each cable assembly.
- Note 5:** Used to attach outdoor cable to station protector. One kit required for each cable assembly.
- Note 6:** Replacement station protector elements.
- Note 7:** Used to join two part #2577672 or two part #1833108 cable assemblies together.

(3) Character Set: (Specify one.)

#9082 for EBCDIC Character Set—used in conjunction with 75 Key Typewriter Keyboard (#4621) or Data Entry Keyboard (#4622 or #4623) or 87 Key EBCDIC Typewriter Keyboard (#4627).

#9084 for ASCII Character Set (B)—used in conjunction with 75 Key ASCII Typewriter Keyboard #4624 or 87 Key ASCII Typewriter Keyboard (#4628).

(4) System attachment: For record purposes identify the 3274 or 3276 to which this 3278 will attach.

- 3274 Model 1C Specify #9551
- 3276 Model 2 Specify #9552

Limitation: A 3278 must specify the same Character Set as used on the 3274 or 3276 to which it is attached.

Prices: See Price List.

Special Features

Audible Alarm (#1090): An alarm, sounded under program control, to alert the operator to a special condition. This alarm, during keyboard operation, is also sounded when a character is entered into the next-to-last position on the screen. The operator may adjust the volume of the tone. **Maximum:** One. **Field Installation:** Yes.

Keyboard

#4621 75 Key Typewriter Keyboard, typewriter-like layout, movable, with 49 data keys and 26 control keys. Twelve program function keys are included in the top row of data keys through use of an alternate shift key. **Prerequisite:** EBCDIC Character Set (#9082).

#4622 75 Key Data Entry Keyboard, movable, with 35 data keys, 10 program function keys and 30 control keys. **Prerequisite:**

EBCDIC Character Set (#9082).

#4623 75 Key Data Entry Keyboard, keypunch layout, movable, with 35 data keys, 10 program function keys and 30 control keys. This is the recommended keyboard for Data Entry. **Prerequisite:** EBCDIC Character Set (#9082).

#4624 75 Key ASCII Typewriter Keyboard, ASCII typewriter layout, movable, with 49 data keys and 26 control keys. Twelve program function keys are included in the top row of the data keys through use of an alternate shift key. **Prerequisite:** ASCII Character Set (B) (#9084).

#4627 87 Key EBCDIC Typewriter Keyboard, typewriter-like layout, movable, with 49 alphameric data keys, 26 control keys, and 12 program function keys (24 total P.F. keys). Twelve of the program function keys are included in the top row of data keys through the use of an alternate shift key. **Prerequisite:** EBCDIC Character Set (#9082).

#4628 87 Key ASCII Typewriter Keyboard, ASCII typewriter-like layout, movable, with 49 alphameric data keys, 26 control keys, and 12 program function keys (24 total P.F. keys). Twelve of the program function keys are included in the top row of data keys and are available through the use of an alternate shift key. **Prerequisite:** ASCII Character Set (B) (#9084).

Maximum: One of the above. **Field Installation:** Yes. The keyboard is set up by the customer. **Specify:** If standard 91 centimeter (3 foot) keyboard cable is not desired, specify #9399 for 182 centimeter (6 foot) cable. **Limitation:** Keyboards used on 3275 and 3277 machines are not interchangeable with keyboards used on 3276/3278 machines.

Keyboard Numeric Lock (#4690): Provides a Data Entry Keyboard (#4622 or #4623) with the ability to lock the keyboard, if a non-numeric key [other than 0-9, minus (-), decimal sign, or dup] is depressed in a pre-defined numeric-only field. **Prerequisite:** Data Entry Keyboard (#4622 or #4623). **Maximum:** One. **Field Installation:** Yes.

Security Keylock (#6340): A lock and key which prevents modification or display of data in the display terminal when in the "off" position. **Maximum:** One. **Field Installation:** Yes.

Selector Light-Pen (#6350): A hand-held, pen-like device which permits the operator to select fields of data from a display for input to the host system. The Selector Light-Pen, while not being used, can be placed in a recess of the keyboard, which is used for user's incidental items. **Maximum:** One. **Field Installation:** Yes.

Switch Control Unit (#1720): Permits switching operational control of the display station between two different 3274 or 3276 control units. **Maximum:** One. **Field Installation:** Yes. **Customer Setup:** Yes.

Magnetic Reader Control (#4999): Provides the capability of attaching a Magnetic Slot Reader. **Maximum:** One. **Field Installation:** Yes.

Accessories: The following items are available on a purchase only basis. Order the part number indicated below at price listed in the Machines Price List.

Magnetic Slot Reader (Part #4123500): A free standing Magnetic Slot Reader (MSR) that reads encoded information from a magnetic stripe. It attaches by a 1.5 meter cable through the Magnetic Reader Control (#4999). The MSR has 3 lights and a buzzer which provide feedback to the user on the status of the read data.



The MSR accommodates a wide range (height and length) of magnetic striped plastic cards such as: ID badges, security operator identification cards, etc. These cards can be encoded with Numeric only up to 40 characters at 75 bits per inch, or up to 65 characters at 127 bits per inch.

Note: Magnetic cards coded with the Alternate End of Message character (hexidecimal "C") cannot be read by this reader.

Maximum: One. **Limitation:** Valid for numeric only data.

Prerequisite: Magnetic Reader Control (#4999).

Locks and Keys: The 3278 with the Security Keylock (#6340) special feature is shipped with two keys. Additional keys may be purchased only from IBM. (Vendor will supply additional keys only to original purchase.)

**3284 PRINTER**

Purpose: Provides hard copy output at a speed of 40 cps.

Model 1: Provides storage of 480 characters and attaches to: 3271 Model 1 or 2... 3272 Model 1 or 2...3274...Local Display Adapter (#4702 on System/3 Model 8 or 12) ... Display Adapter (#4601 on System/3 Model 15) ... 3284 Attachment (#7901 on System/3 Model 15) ... System/3 Model 4 as local work station. For use with System/3, see below.

Model 2: Provides storage of 1,920 characters and attaches to: either a 3271 Model 2, or a 3272 Model 2...3274...Local Display Adapter (#4702 and #4705 on System/3 Model 8 or 12) ... Display Adapter (#4601 on System/3 Model 15) ... System/3 Model 4 as local work station (#4705 on 5404). For use with System/3, see below.

Model 3: Attaches to and uses the storage buffer of a 3275 Display Station Model 1, 2, or 3. Also attaches to and uses the storage buffer of a 5275 Direct Numerical Control Station.

Highlights: Provides a hard copy output at a speed of 40 cps, using the EBCDIC character set ... for ASCII character sets, see "Specify" below. Model 1 and 2 may print from the CPU or the contents of a 3277 Display Station or 3284 or 3286/3287 printer buffer via the 3271, 3272, or 3274 Control Unit. Model 3 prints the contents of the buffers of the 3275 Display Station or the 5275 Direct Numerical Control Station.

The unit has a pin feed platen which permits the feeding of marginally punched continuous forms paper. 120, 126 or 132 print positions may be specified ... see "Specify." Line spacing is 6 lines/inch. Matrix characters are formed by 7 vertical wires printing dots in up to 4 of 7 possible horizontal positions. Use of the underscore in conjunction with another character will overprint the lowest dot in that character and is not recommended. Refer to SRL GA24-3488 for forms design considerations and limitations. Up to 6-part forms can be printed with a maximum thickness of .018" (for optimum feeding and stacking, no more than 3 parts are recommended). Forms lengths can be 3" to 14" in increments of 1/6". Card stock continuous forms are not recommended.

For Local Work Station on System/3 Model 4: 3284 Printers (Models 1 and 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3286 Printers (Models 1 and 2) and 3287 Printers (Models 1 and 2) and 3288 Line Printers (Model 2) for a maximum of 5 devices attached to the 5404. Specify #9089 for EBCDIC Character Set. A 3271, 3272, or 3274 Control Unit is not required. A cable order is required. See "Specify" below for voltage and cable ordering information.

For Local Display Adapter on System/3 Model 8 or Model 12: 3284 Printers (Models 1 and 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3286 Printers (Models 1 and 2) and 3287 Printers (Models 1 and 2) and 3288 Printers (Model 2) for a maximum of twelve devices attached via the Local Display Adapter (#4702) and its subfeatures on the 5408 or 5412. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. Specify #9089 for EBCDIC Character Set. Not compatible with ACSII Character Sets. See "Specify" below for voltage and cable ordering information.

For Console Use with System/3 Model 15: A 3284 Model 1 is optional and is primarily used to provide console message logging. For Voltage, specify #9881 ... For Character Set, specify #9089 ... For Pin Feed Platen, specify as shown below. No cable order is required. **Prerequisite:** 3284 Attachment (#7901) on the 5415.

For Display Adapter on System/3 Model 15: 3284 Printers (Models 1 and 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3286 Printers (Models 1 and 2) and 3287 Printers (Models 1 and 2) and 3288 Printers (Model 2) for a maximum of 30 devices attached via the Display Adapter (#4601/#4602) on the 5415. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. Specify #9089 for EBCDIC Character Set. Not compatible with ACSII Character Set. See "Specify" below for voltage and cable ordering information.

Prerequisites:

Model 1: A 3271 Model 1 or 2, a 3272 Model 1 or 2, 3274, or #7901 on a 5415.

Model 2: A 3271 Model 2, a 3272 Model 2, or 3274.

Model 3: A 3275 Model 1, 2 or 3 with Printer Adapter (#5550) or a 5275 with Printer Adapter (#5555).

Supplies: A black ribbon, Part No. 1136970 or equivalent, is required.

Bibliography: System/360/370—GA22-6822, 3270—GA24-3089

Specify:

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug.
- (2) Pin Feed Platen: #9162 for 126 print positions (13-1/8" hole-to-hole), or #9167 for 120 print positions (12-1/2" hole-to-hole), or #9168 for 132 print positions (13-7/8" hole-to-hole). *Note:* Do not order #9167 or #9168 unless paper is available in your area.
- (3) Character Set: Specify one of the following:
 - #9089—for EBCDIC Character Set (available at time of manufacture only) ... provides the 64 ASCII characters described on the EBCDIC typewriter keyboard. #9089 required if used with the 3275 Model 3. **Prerequisite:** If used with the 3271, EBCDIC Transmission Code (#9761) required on the 3271.
 - #9091—for ASCII Character Set (A) (available at time of manufacture only) ... provides the 64 ASCII characters but substitutes the Logical OR (|) and Logical NOT (-) in place of the exclamation mark(!) and circumflex (^). **Prerequisite:** If used with the 3271, ASCII Transmission Code (#9762) is required on the 3271.
 - #9092—for ASCII Character Set (B) (available at time of manufacture only) ... provides the standard 64 ASCII characters. **Prerequisite:** If used with the 3271, ASCII Transmission Code (#9762) is required on the 3271.
- (4) Cables: See Accessories for 3284-1, -2 cable ordering instructions. For cable specifications, see *System/370 Installation Manual—Physical Planning*, GC22-7004 or *3270 Installation Manual—Physical Planning*, GA27-2787.

Model Changes: Model changes between model 1 and model 2 are field installable. Model 3 is field installable on the 3275 or 5275 but is not interchangeable with a model 1 or model 2.

Accessories:**Forms Stand**

Permits placement of continuous forms on the stand above floor level and provides for forms stacking after printing. This accessory is a two shelf forms stand.

TYPE FEATURE NO.

3284 4450

Cables

Cables and/or associated parts to attach the subject machines to the 3271/3272/3274 Control Units, the Local Display Adapter (#4702) on System/3 Model 8 and Model 12, or the Display Adaptor (#4601) on System/3 Model 15 or directly to the System/3 Model 4, may be purchased from IBM or from a customer selected source. For the proper identification, installation, and application of the subject cables and parts, see *3270 Installation Manual—Physical Planning*, GA27-2787 and *Coaxial Cable and Accessories Manual*, GA27-2805. The customer is responsible for installation and maintenance of these cables and their associated parts.

Assem. #2577672 Cable Assembly Indoor

Bulk #0323921 Coax Wire (Note 1)

Part #1836418 Connector Kit (Note 1)

Assem. #1833108 Cable Assembly Outdoor

Bulk #5252750 Coax Wire (Note 2)

Part #1836419 Connector Kit (Note 2)

Part #2621414 Modification Kit (Note 3)

Part #1833106 Station Protector Attachment Kit (Note 5)

Part #5252643 Adapter (Note 7)

Part #1830818 Station Protector Kit, Gas (Note 4)

Part #5252899 Station Protector Element, Gas (Note 6)

Note 1: Coax wire and one connector kit (includes 2 connectors 1836444) required for each indoor cable assembly.

Note 2: Coax wire and one connector kit (includes 2 connectors 1836447) required for each outdoor assembly.

Note 3: Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.

Note 4: Must be used with outdoor cable assembly when installed above ground. One kit required for each cable assembly.

Note 5: Used to attach outdoor cable to station protector. One kit required for each cable assembly.

Note 6: Replacement station protector elements.

Note 7: Used to join two 2577672 or two 1833108 cable assemblies together.

**3286 PRINTER**

Purpose: Provides hard copy output at a speed of 66 cps.

Model 1: Provides storage of 480 characters and attaches to: 3271 Model 1 or 2...3272 Model 1 or 2...3274...Local Display Adaptor (#4702 on System/3 Model 8 or 12)... Display Adapter (#4601 on System/3 Model 15)... System/3 Model 4 as local work station. For use with System/3, see below.

Model 2: Provides storage of 1,920 characters and attaches to: Either 3271 Model 2 or a 3272 Model 2...3274...Local Display Adapter (#4702 and #4705 on System/3 Model 8 or 12)... Display Adapter (#4601 on System/3 Model 15)... System/3 Model 4 as local work station (#4705 on 5404). For use with System/3, see below.

Model 3. Attaches to and uses the storage buffer of a 3735 Programmable Buffered Terminal Model 1.

Highlights: Provides controls, storage and hard copy output at a speed of 66 cps, using the EBCDIC character set ... for ASCII character sets, see "Specify" below. The unit may print from a CPU or the contents of a 3277 Display Station or a 3284, 3286, or 3287 printer buffer via the 3271, 3272, or 3274 Control Unit. When attached to a 3735, the 3286 Model 3 prints under 3735 Program Control.

The unit has a pin feed platen which permits the feeding of marginally punched continuous forms paper. 120, 126 or 132 print positions may be specified ... see "Specify." Line spacing is 6 lines/inch. Matrix characters are formed by 7 vertical wires printing dots in up to 4 of 7 possible horizontal positions. Use of the underscore in conjunction with another character will overprint the lowest dot in that character and is not recommended. Refer to SRL GA24-3488 for forms design considerations and limitations. Up to 6-part forms can be printed with a maximum thickness of .018" (for optimum feeding and stacking, no more than 3 parts are recommended). Forms lengths can be 3" to 14" in increments of 1/6". Card stock continuous forms are not recommended.

For Local Work Station on System/3 Model 4: 3286 Printers (Models 1 and 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3284 Printers (Models 1 and 2) and 3287 Printers (Models 1 and 2) and 3288 Line Printers (Model 2) for a maximum of 5 devices attached to the 5404. Specify #9089 for EBCDIC Character Set. A 3271, 3272, or 3274 Control Unit is not required. A cable order is required. See "Specify" below for voltage and cable ordering information.

For Local Display Adapter on System/3 Model 8 or Model 12: 3286 Printers (Models 1 and 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3284 Printers (Models 1 and 2) and 3287 Printers (Models 1 and 2) and 3288 Printers (Model 2) for a maximum of twelve devices attached via the Local Display Adapter (#4702) and its subfeatures on the 5408 or 5412. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. Specify #9089 for EBCDIC Character Set. Not compatible with ASCII Character Sets. See "Specify" below for voltage and cable ordering information.

For Display Adapter on System/3 Model 15: 3286 Printers (Models 1 and 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3284 Printers (Models 1 and 2) and 3287 Printer (Models 1 and 2) and 3288 Printers (Model 2) for a maximum of 30 devices attached via the Display Adapter (#4601/#4602) on the 5415. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. Specify #9089 for EBCDIC Character Set. Not compatible with ASCII Character

Sets. See "Specify" below for voltage and cable ordering information.

Prerequisites:

Model 1: a 3271 Model 1 or 2 or a 3272 Model 1 or 2 or a 3274.

Model 2: a 3271 Model 2 or a 3272 Model 2 or a 3274.

Model 3: a 3735 Model 1 with #7880 installed.

Supplies: A black ribbon, Part No. 1136970 or equivalent, is required.

Bibliography: *System/360/370*, GA22-6822, 3720, GA24-3089.

Specify:

(1) Voltage (115V AC, 1-phase, 3-wire, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug.

(2) Pin Feed Platen: #9162 for 126 print positions (13-1/8" hole-to-hole), or #9167 for 120 print positions (12-1/2" hole-to-hole), or #9168 for 132 print positions (13-7/8" hole-to-hole). *Note:* Do not order #9167 or #9168 unless paper is available in your area.

(3) Character Set: Specify one of the following:

#9089 For EBCDIC Character Set ... provides the 64 characters described on the EBCDIC typewriter keyboard. **Prerequisites:** If used with the 3271, EBCDIC Transmission Code (#9761) is required on the 3271. If used with the 3735, EBCDIC Transmission Code (#9761) is required on the 3735.

#9091 For ASCII Character Set (A) ... provides the 64 ASCII characters but substitutes the Logical OR (|) and Logical NOT (¬) in place of the exclamation mark (!) and circumflex (^). **Prerequisites:** If used with the 3271, ASCII Transmission Code (#9762) is required on the 3271.

#9092 For ASCII Character Set (B) ... provides the standard 64 ASCII characters. **Prerequisites:** If used with the 3271, ASCII Transmission Code (#9762) is required on the 3271. If used with the 3735, ASCII Transmission Code (#9762) is required on the 3735.

(4) Cables: See Accessories for 3286 cable ordering instructions. For cable specifications, see *System/370 Installation Manual—Physical Planning*, GC22-7004 or *3270 Installation Manual—Physical Planning*, GA27-2787.

Model Changes: Model changes between model 1 and model 2 are field installable ... model 3 is not interchangeable with model 1 or model 2.

**Accessories:****Forms Stand**

Permits placement of continuous forms on the stand above floor level and provides for forms stacking after printing. This accessory is a two shelf forms stand.

TYPE FEATURE NO.

3286 4450

Cables

Cables and/or associated parts to attach the subject machines to the 3271/3272/3274 Control Units, the Local Display Adapter (#4702) on System/3 Model 8 and Model 12, or the Display Adaptor (#4601) on System/3 Model 15 or directly to the System/3 Model 4, may be purchased from IBM or from a customer selected source. For the proper identification, installation, and application of the subject cables and parts, see *3270 Installation Manual—Physical Planning*, GA27-2787 and *Coaxial Cable and Accessories Manual*, GA27-2805. The customer is responsible for installation and maintenance of these cables and their associated parts.

Assem. #2577672 Cable Assembly Indoor

Bulk #0323921 Coax Wire (Note 1)

Part #1836418 Connector Kit (Note 1)

Assem. #1833108 Cable Assembly Outdoor

Bulk #5252750 Coax Wire (Note 2)

Part #1836419 Connector Kit (Note 2)

Part #2621414 Modification Kit (Note 3)

Part #1833106 Station Protector Attachment Kit (Note 5)

Part #5252643 Adapter (Note 7)

Part #1830818 Station Protector Kit, Gas (Note 4)

Part #5252899 Station Protector Element, Gas (Note 6)

Note 1: Coax wire and one connector kit (includes 2 connectors 1836444) required for each indoor cable assembly.

Note 2: Coax wire and one connector kit (includes 2 connectors 1836447) required for each outdoor assembly.

Note 3: Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.

Note 4: Must be used with outdoor cable assembly when installed above ground. One kit required for each cable assembly.

Note 5: Used to attach outdoor cable to station protector. One kit required for each cable assembly.

Note 6: Replacement station protector elements.

Note 7: Used to join two 2577672 or two 1833108 cable assemblies together.



3287 PRINTER

Purpose: Provides hard copy output. The 3287 Models 1 and 2 attach to a 3271 Control Unit Model 1 or 2, or a 3272 Control Unit Model 1 or 2, or a 3274 Control Unit Model 1C, or a 3276 Control Unit Display Model 2, or a System/3 Models 4, 8, 12, or 15 or as an optional console printer on System/3 Model 15.

Model 1: 80 cps maximum bi-directional printer.

Model 2: 120 cps maximum bi-directional printer.

Note: Actual printer throughput is dependent upon operational and system characteristics. Factors such as controller configuration and line transmission speed, output format, and programming application processing must all be considered in determining actual throughput.

Model Changes: Field installable.

Highlights: The 3287 consists of control functions, printer and indicator lights in one integrally designed desk-top unit. Special Features are available which permit tailoring of the printer to the user's requirements.

Where the 3287 replaces a 3284 or 3286 Printer the Variable Width Forms Tractor (Special Feature) is used in lieu of the Pin Feed Platen or Forms Tractor RPQ WD 4031. In addition, Friction Feed Paper Handling is available as a Specify Feature.

Control Functions: Provides the control for all online operations. This unit requires the 3271/3272 Attachment (#8330) for receiving data from a 3271/3272 Control Unit, or a 3274 Control Unit, (with Terminal Adapter B), or a System/3. The 3274/3276 Attachment (#8331) is used for receiving data from a 3274 Control Unit (with Terminal Adapter Type A), or a 3276 Control Unit Display Station.

Printer: Maximum printer throughput is obtained with bi-directional serial matrix printing and indexing without unnecessary print head movement. The printer dot matrix is 4 of 7 wide by 8 high giving high legibility with character spacing at 10 to the inch. Line spacing is 6 and 8 lines to the inch. Up to 132 characters can be printed in a line. Up to 6 part forms (total thickness—0.018"/0.457mm) may be used. For any multi-part or pre-printed continuous forms the Variable Width Forms Tractor (#8700) is recommended. Five and six part continuous forms should be tried on an individual basis for acceptable feeding, registration, and print quality.

The Friction Feed Paper Handling (#9180) is recommended, for use with non-preprinted single part roll or fan-fold paper, with a minimum width of 8"/203mm, when the Variable Width Forms Tractor (#8700) is not used. Maximum overall forms width is 14-7/8"/378mm; card stock forms are not recommended. (See *Form Design Printers Reference Guide*, GA24-3488 for form specifications and limitations.)

Audible Alarm, Mono-Dual case, Single/Double line spacing, and Maximum Print Position are standard functions. Dual Case is not supported for ASCII when using 3271/3272 Attachment (8330) Mono/Dual switch is inoperative when the 3287 is copying from a display.

Problem Determination Procedures

Significant function has been designed into this unit to provide greater availability to the customer. This has been done through the use of problem determination and recovery routines and procedures that can be understood and used by the operator. See Customer Responsibilities below.

Customer Setup (CSU)

The 3287 Models 1 and 2 are designated as Customer Setup, thereby offering the customer early availability and terminal relocation flexibility.

For additional information on CSU refer to the GI Section 2.

Customer Responsibilities

The customer is responsible for:

- Adequate site, system and other vendor preparation.
- Receipt at the customer's receiving dock, unpacking, and placement of the 3287.
- Physical setup, connection of cables, switch settings, and checkout.
- Contacting _____ to make cable connections of IBM CSU units to IBM non-CSU units where customer access areas are not provided.
- Notifying IBM of intent to relocate and following IBM instructions for relocation.
- Using and following the problem determination procedures and fill out trouble report prior to calling for IBM service.
- Disconnecting, packing and removal to the customer shipping dock at the time of discontinuance. Appropriate instructions will be provided by IBM.
- Providing a desk or table top to support the 3287.

Prerequisites:

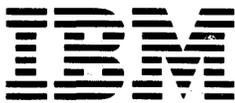
Attachment	Attachment Feature on 3287	Device Adapter on Control Unit
3271/3272	FC#8330	Available port or added FC#3250
3274	FC#8331 or FC#8330	Type A or B Adapter (See M3274 Sales Pages)
3276	FC#8331	Available port or added FC#3255, FC#3256, FC#3257

For Direct Local Attachment to a System/3: (via FC#8330 on the 3287 and available device interface on System/3 CPU)

System/3 Model 4	5404 Processing Unit
System/3 Model 8	FC#4701/4702 on 5408 Processing Unit
System/3 Model 12	FC#4701/4702 on 5412 Processing Unit
System/3 Model 15	FC#4601 on 5415 Processing Unit
For console use with System/3 Model 15	FC#8330 is required on 3287 FC#7901 is required on 5415

Bibliography: See KWIC Index GA20-1621 or specific system bibliography.

Supplies: A black ribbon, IBM Part No. 1136653 or equivalent, is required.



Specify Features (For details see Specify Descriptions):

3287 Attached to:
 S/3
 3271/72 3274 3276 DA/LDA
 (Note 1) Console

		3271/72	3274	3276	S/3 DA/LDA Console
(1) Plugs					
Locking Plug	#9890	X	X	X	X
Non-locking Plug	#9891	X	X	X	XX
(2) Power Cord					
6 foot (1.8m)	#9511	X	X	X	X
9 foot (2.8m)	Default	X	X	X	XX
12 foot (3.7m)	#9512	X	X	X	X
15 foot (4.5m)	#9513	X	X	X	X
(3) Cables					
See Specify Descriptions		X	X	X	X
(4) Character Set					
EBCDIC	#9082	X	X	X	X
ASCII (B)	#9084	X	X	X	
(5) Variable Width Forms Tractor-Covers	#9850	X	X	X	X
(6) Variable Width Forms Tractor—Paper Handling	#9185	X	X	X	X
(7) Friction Feed Paper Handling	#9180	X	X	X	X
(8) Page Length Control	#9550	X	X	X	X
(9) X Print Error Indication	#9488	X	X	X	X
(10) Character Print Operation					
480 Characters	#9520	X	X		X
1920 Characters	#9522	X	X	X	X
(11) Blower	#9030	X	X	X	X

Note 1: For Terminal Adapter Type B on 3274, select from specify, #9520 and #9522. For Terminal Adapter Type A, #9520 is not required.

Specify

- (1) Plugs (Voltage 120V AC, 1-phase 3 wire 60 Hz): #9890 for locking plug, or #9891 for non-locking plug.
- (2) Power Cord:
If standard 9 foot (2.8m) Power Cord is not desired, specify: #9511 for 6 foot (1.8m) Power Cord, #9512 for 12 foot (3.7m) Power Cord, or #9513 for 15 foot (4.5m) Power Cord.
- (3) Cables: See Accessories, Page M3287.3 for 3287 Models 1 and 2 ordering instructions. See *Installation Manual—Physical Planning, GA27-2787*, for cable details. A separate cable order is not required when attaching to System/3 Model 15 via FC#7901 on the 5415.

- (4) Character Set:
Specify one of the following:
#9082 For EBCDIC Character Set.
#9084 For ASCII (B) Character Set. (Not for System/3 LDA/DA or as console printer)
Note: The Character Set specified [EBCDIC or ASCII (B)] must be the same as the transmission code/character set used on the control unit to which it is attached.
- (5) Variable Width Forms Tractor—Covers (#9850): Specify if Variable Width Forms Tractors (#8700) is ordered.
- (6) Variable Width Forms Tractor— Paper Handling (#9185): Specify if Variable Width Forms Tractor (#8700) is ordered and there is a requirement to handle forms with an overall width from 3 to 8 inches (76.2 to 203.2mm). **Prerequisite:** Variable Width Forms Tractor (#8000).
- (7) Friction Feed Paper Handling (#9180):
Must be ordered on all machines without the Variable Width Forms Tractor Covers (#9850). A Customer using the Variable Width Forms Tractors has the option of ordering Specify Feature #9180 at no additional charge once per machine, for friction feeding of single part non-preprinted continuous roll and fan fold paper with a minimum width of 8"/203mm. Included in Specify Feature (#9180) is a paper tear bar for tearing continuous forms approximately 2 1/2"/64mm from the last line printed. Specify Feature #9180 is used interchangeably with the Variable Width Forms Tractor and is attached and removed by the customer. This specific feature is designated as Customer Setup.
- (8) Page Length Control (#9550): Allows customer insertion of Forms Feed (FF) Character (HEX OC) into the data stream. Upon detection of the FF character, the printer will skip to the first print line of the next form. The form length is entered into two decade switches on the 3287 by the operator and is variable from 00 to 99. (The programming implementation of this feature is the customer's responsibility). **Prerequisite:** Variable Width Forms Tractor (#8700).
- (9) X Print Error Indication (#9488): To indicate an error an X is printed on the print line immediately below the last line normally printed.
- (10) Character Print Operation:
With 3271/3272 Attachment (#8330) specify one of the following:
#9520 (480 character print operation) for use with a 3271 Control Unit Model 1, or a 3272 Control Unit Model 1 or a 3274 Control Unit Model 1C (Adapter Type B), or a System/3 Model 4, 8, 12 or 15. *Note:* #9520 (480-character print operation) can also be specified for use with a 3271 Control Unit Model 2, or a 3272 Control Unit Model 2. #9520 is required for console printer on System/3 Model 15.
#9522 (1,920 character print operation) for use with a 3271 Control Unit Model 2, a 3272 Control Unit Model 2, or a 3274 Control Unit Model 1C (Adapter Type B), or a System/3 Model 4, 8, 12 or 15.
With 3274/3276 Attachment (#8331) specify the following:



#9522 (1920 character print operation) for use with a 3276 Control Unit Display Station Model 2, or a 3278 Display Station Model 2 attached to a 3274 Control Unit (Adapter Type A).

- (11) Blower (#9030): Must be specified only for 3287 Model 1 to be used in an environment above 90°F (32.2°C) ambient temperature [specification limits up to 104°F (40.5°C)]. Available at original manufacture only.
- (12) System Attachment: Identify the attaching Control Unit or natively attached Host Processor by specifying the following

Control Unit/natively attached

Host Processor

- 3271
- 3272
- 3274 Model 1C
- 3276 Model 2
- System/3 Model 4
- System/3 Model 8
- System/3 Model 12
- System/3 Model 15

Special Features (For details see Special Feature Descriptions):

		3287 Attached to:				
		3271/72		3274	3276	S/3Syste DA/LDAC
3271/3272 Attach	#8330	X	X			XX
3274/3276 Attach	#8331		X	X		
Variable Width Forms Tractor	#8700	X	X	X	X	XX

Special Feature Descriptions:

3271/3272 Attachment (#8330): Provides one interface for attachment of a 3287 Model 1 or 2 to a 3271 Control Unit Model 1 or 2, a 3272 Control Unit Model 1 or 2, or a 3274 Control Unit Model 1C, or a System/3 Model 4, 8, 12 or 15. Provides the buffer storage required for print operation. **Maximum:** One. **Field Installation:** Yes. **Customer Setup:** No. **Limitation:** Cannot be installed with 3274/3276 Attachment (#8331). **Prerequisite:** For 3270 System ... An available port or added FC#3250 on a 3271 Model 1, 2, or 3272 Model 1, 2 ... See M3271 or M3272. For 3274 Control Unit ... An available port (Type B) or added Type B Adapter ... See M3274. For System/3 Model 4, 8, 12 or 15 ... See M5404, M5408, M5412, or M5415 ... An available device interface on the System/3 CPU. For console printer on System/3 Model 15, FC#7901 is required on 5415.

3274/3276 Attachment (#8331): Provides one interface for attachment of a 3287 Model 1 or 2 to a 3274 Control Unit Model 1C or to a 3276 Control Unit Display Station Model 2. Provides buffer storage required for print operation. Included in this feature is Buffer Reprint support. **Maximum:** One. **Field Installation:** Yes. **Customer Setup:** No. **Limitation:** Cannot be installed with 3271/3272 Attachment (#8330). **Prerequisite:** An available port or added FC#3255, FC#3256, FC#3257 or a 3276, or an available port (Type A) or added Type A Adapter on a 3274.

Variable Width Forms Tractor (#8700): A forms feeding device for continuous margin punched forms. Overall forms width from 3 to 15 inches (76.2 to 381.0 mm) can be fed. **Prerequisites:** Variable Width Forms Tractor-Covers (#9850)

and Variable Width Forms Tractor-Paper Handling (#9185) where there is a requirement to handle forms with an overall width from 3 to 8 inches (76.2 to 203.2 mm). **maximum:** One. **Field Installation:** Yes. **Customer Setup:** No.

Accessories

Forms Stand Permits placement of continuous forms on the stand above floor level and provides for stacking after printing. This accessory is a two shelf forms stand.

Type

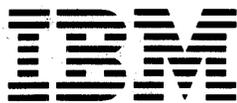
3287

Cables:

Cables and/or associated parts may be purchased from IBM or from a customer selected source. For the proper identification, installation, and application of the subject cables and parts, see 3270 *Installation Manual—Physical Planning*, GA27-2787 and *Coaxial Cable and Accessories Manual*, GA27-2805. The customer is responsible for installation and maintenance of these cables and their associated parts.

Assm. # 2577672	Cable Assembly Indoor
Bulk # 0323921	Coax Wire (Note 1)
Part # 1836418	Connector Kit (Note 1)
Assm. # 1833108	Cable Assembly Outdoor
Bulk # 5252750	Coax Wire (Note 2)
Part # 1836419	Connector Kit (Note 2)
Part # 2621414	Modification Kit (Note 3)
Part # 1833106	Station Protector Attachment Kit (Note 5)
Part # 5252643	Adapter (Note 7)
Part # 1830818	Station Protector Kit, Gas (Note 4)
Part # 5252899	Station Protector Element, Gas (Note 6)

- Note 1:** Coax wire and one connector kit (includes 2 connectors part #1836444) required for each indoor cable assembly.
- Note 2:** Coax wire and one connector kit (includes 2 connectors part #1836447) required for each outdoor cable assembly.
- Note 3:** Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.
- Note 4:** Must be used with outdoor cable assembly when installed outdoors (either above or below ground level). One kit required for each cable assembly.
- Note 5:** Used to attach outdoor cable to station protector. One kit required for each cable assembly.
- Note 6:** Replacement station protector elements.
- Note 7:** Used to join two part #2577672 or two part #1833108 cable assemblies together.

**3288 LINE PRINTER (Model 2)**

Purpose: Provides hard copy output at speeds up to 120 LPM.

Highlights: Provides hard copy output at a speed of up to 120 LPM using EBCDIC or ASCII 64 character sets... see "Specify" below. May print from the CPU or the contents of a 3277 Display Station. Attaches to: 3271 Model 2 or 3272 Model 2...3274...Local Display Adapter (#4702 and #4705 on System/3 Model 8 or 12)... Display Adapter (#4601 on System/3 Model 15)... System/3 Model 4 as local work station (#4705 on 5404). For use with System/3, see below.

Prints 10 characters per inch, 132 characters or positions per line at 6 lines per inch on continuous fan-fold paper. The paper handling mechanism is adjustable to accept paper from widths of 3.5" (8.9 cm) to 15.0" (38.10 cm). Paper up to 6 parts plus carbon (maximum total thickness is .020" or .50 mm) can be accommodated. Forms jam detection is provided. Use of card stock forms is not recommended.

Notes: (1) The 3288 Line Printer is recommended for use in a machine room environment due to its higher noise level while printing ... (2) The 3288 is supported by programming as a 3286 Printer Model 2.

For Local Work Station on System/3 Model 4: 3288 Line Printers (Model 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3284 Printers (Models 1 and 2) and 3286 Printers (Models 1 and 2) and 3287 Printers (Models 1 and 2) for a maximum of 5 devices attached to the 5404. Specify #9089 for EBCDIC Character Set. A 3271, 3272, or 3274 Control Unit is not required. A cable order is required. See "Specify" below for voltage and cable ordering information.

For Local Display Adapter on System/3 Model 8 or 12: 3288 Line Printers (model 2) may be intermixed with 3277 Display Stations (Models 1 and 2), 3284 Printers (Models 1 and 2), 3286 Printers (Model 1 and 2) and 3287 Printers (Models 1 and 2), for a maximum of twelve devices attached via the Local Display Adapter (#4702) and its subfeatures on the 5408 and 5412. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. Specify #9089 for EBCDIC Character Set. See "Specify" below for voltage and cable ordering information.

For Display Adapter on System/3 Model 15: The 3288 Printer (Model 2) may be intermixed with 3277 Display Stations (Models 1 and 2) and 3284 Printers (Models 1 and 2) and 3286 Printers (Models 1 and 2), or 3287 Printers (Models 1 and 2) for a maximum of 30 devices attached via the Display Adapter (#4601/#4602) on the 5415. A 3271, 3272, or 3274 Control Unit is not required. A cable is required. Specify #9089 for EBCDIC Character Set. Not compatible with ASCII Character Sets. See "Specify" below for voltage and cable ordering information.

Prerequisite: A 3271 Control Unit Model 2, a 3272 or a 3274 Control Unit Model 2.

Supplies: A black ribbon, Part No. 1136634 or equivalent, is required.

Bibliography: See KWIC Index G320-1621 or specific system bibliography.

Specify:

- (1) Voltage (115V AC, 1-phase, 3-wire, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug.
- (2) Character Set: Specify one of the following:
 - #9089 For EBCDIC Character Set (available at time of manufacture only) ... provides the 64 characters described on the EBCDIC Typewriter Keyboard. **Prerequisite:** If used with the 3271 Model 2, EBCDIC Transmission Code (#9761) is required on the 3271 Model 2.
 - #9091 For ASCII Character Set (A) (available at time of manufacture only) ... provides the 64 ASCII characters but substitutes the Logical OR (|) and Logical NOT (-) in place of the exclamation mark (!) and circumflex (^). **Prerequisite:** If used with the 3271 Model 2, ASCII Transmission Code (#9762) is required on the 3271 Model 2.
 - #9092 For ASCII Character Set (B) (available at time of manufacture only) ... provides the standard 64 ASCII characters. **Prerequisite:** If used with the 3271 Model 2, ASCII Transmission Code (#9762) is required on the 3271 Model 2.
- (3) X Print Error Indication: #9944...to indicate an error an X is printed on the print line immediately below the last line normally printed.
- (4) Vertical Forms Control: Specify #9850...allows customer insertion of a Forms Feed Character (Hex OC) into his data stream. Upon detection of the FF character, the printer will skip to the first print line of the next form. The form length is entered into two decade switches by the operator and is variable from 00 to 99. (The implementation of this feature is the customer's responsibility.)
- (5) Cables: See 3288 cable ordering instructions. For cable specifications see *System/370 Installation Manual—Physical Planning*, GC22-7004 or *System/370 Installation Manual—Physical Planning*, GA27-2787.

Accessories:**Forms Stand**

Permits placement of continuous forms on the stand above floor level and provides for forms stacking after printing. This accessory is a two shelf forms stand.

TYPE

3288

Cables

Cables and/or associated parts to attach the subject machines to the 3271/3272/3274 Control Units, the Local Display Adapter (#4702) on System/3 Model 8 and Model 12, or the Display Adaptor (#4601) on System/3 Model 15 or directly to the System/3 Model 4, may be purchased from IBM or from a customer selected source. For the proper identification, installa-



tion, and application of the subject cables and parts, see 3270 *Installation Manual—Physical Planning*, GA27-2787 and *Coaxial Cable and Accessories Manual*, GA27-2805. The customer is responsible for installation and maintenance of these cables and their associated parts.

Assem. #2577672 Cable Assembly Indoor
Bulk #0323921 Coax Wire (Note 1)
Part #1836418 Connector Kit (Note 1)
Assem. #1833108 Cable Assembly Outdoor
Bulk #5252750 Coax Wire (Note 2)
Part #1836419 Connector Kit (Note 2)
Part #2621414 Modification Kit (Note 3)
Part #1833106 Station Protector Attachment Kit (Note 5)
Part #5252643 Adapter (Note 7)
Part #1830818 Station Protector Kit, Gas (Note 4)
Part #5252899 Station Protector Element, Gas (Note 6)

- Note 1:* Coax wire and one connector kit (includes 2 connectors 1836444) required for each indoor cable assembly.
- Note 2:* Coax wire and one connector kit (includes 2 connectors 1836447) required for each outdoor assembly.
- Note 3:* Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.
- Note 4:* Must be used with outdoor cable assembly when installed above ground. One kit required for each cable assembly.
- Note 5:* Used to attach outdoor cable to station protector. One kit required for each cable assembly.
- Note 6:* Replacement station protector elements.
- Note 7:* Used to join two 2577672 or two 1833108 cable assemblies together.



3289 LINE PRINTER MODELS 1 AND 2

Purpose: A line printer for attachment to a 3274 Control Unit or a 3276 Control Unit Display Station.

Highlights: Line printing is from characters engraved on a revolving metal belt. The 3289 models operate at the following speeds:

	Maximum Lines Per Minute*	Character Set
Model 1	155	48
	120	64
	80	94
Model 2	400	48
	300	64
	230	94

*Actual printer throughput is dependent on operational and system characteristics. Maximum print speed may be degraded by such factors as communication line speed, control unit load, and application program.

Model Changes: Not field installable.

Included is one interchangeable print belt (48-, 64-, and 94-character set)—see "Specify." A variable width forms tractor for feeding of marginally punched continuous forms (one to six parts) up to 15" overall width is provided. The following functions are basic: paper jam detection; front forms loading; vertical forms control; vertical/horizontal format control; end of forms detection; single/double vertical spacing; 132 print positions; character spacing of 10 per inch; line spacing of 6 or 8 lines per inch; 4016 byte buffer; standard color accent panel will be pebble gray; any other colors are via RPQ only.

Limitations: Refer to *Form Design Printers Reference Guide*, GA24-3488 for forms design considerations. Printed output is not supported for optical character reading.

Prerequisite: A 3274 Control Unit with appropriate adapter or a 3276 Control Unit Display Station.

Problem Determination Procedure

Significant function has been designed into this unit to provide greater availability to the customer. This has been done through the use of problem determination and recovery routines and procedures that are easily understood and used by the operator. See "Customer Responsibility" below.

Customer Setup (CSU)

The 3289 Model 1 and 2 are designated as Customer Setup thereby offering the customer early availability and terminal relocation flexibility.

For additional information on CSU refer to the GI Section 2.

Customer Responsibilities

The following are customer responsibilities:

- Adequate site, system and other vendor preparation.
- Receipt at the customer's receiving dock, unpacking, and placement of the 3289.
- Physical setup, connection of cables, switch settings, and check out.
- Notify IBM of intent to relocate and follow IBM instructions for relocation.

- Use and follow the problem determination procedures and fill out trouble report prior to calling IBM for service.
- Disconnecting, packing and removal to the customer's shipping dock at the time of discontinuance appropriate instruction will be provided by IBM.

Supplies: Black ribbons, IBM Part No. 1136634 or equivalent for Model 1 or IBM Part No. 1136670 or equivalent for Model 2 is required.

Bibliography: See KWIC Index G320-1621 or specific system bibliography.

Specify:

- (1) Voltage (120 AC, 1-phase, 3-wire, 60Hz): #9890 for locking plug or #9891 for non-locking plug;
- (2) Power Cord: If standard 9 foot (2.8m) Power Cord is not desired, specify: #9511 for 6 foot (1.8m) Power Cord, #9512 for 12 foot (3.7m) Power Cord, or #9513 for 15 foot (4.6m) Power Cord.
- (3) Print Belt Character Set: Specify one. Available at time of manufacture only. See Print Belt, additional, below:
 - #9490 48-Character Set EBCDIC
 - #9491 64-Character Set EBCDIC
 - #9492 94-Character Set EBCDIC
 - #9493 48-Character Set ASCII (B)
 - #9494 64-Character Set ASCII (B)
 - #9495 94-Character Set ASCII (B)
 (Code must be the same as that specified for the control unit.)
- (4) Cabling: Customer is responsible for procurement, maintenance, and installation of coaxial signal cable. See below. See *3270 Installation Manual—Physical Planning*, GA27-2787, for cable details.
- (5) Print Error Indication: An error graphic X is printed online immediately below the last print line for that data buffer when the printer is used in 3270 data stream mode. Specify 9488.
- (6) Character Print Operation: To specify the printer buffer size when the printer is used in 3270 data stream mode. 9522 (1920-character print) For use with a program which assumes the buffer size is 1920 bytes.
- (7) System Attachment: Identify the attaching control unit by specifying the following

Control Unit

- 3274-1C
- 3276-2



Special Feature

Audible Alarm (#1090): Sounds an alarm that alerts the operator of conditions that require manual intervention. The operator can set loudness level and duration (short or continuous). **Field Installable:** Yes. **Customer Setup:** No.

Accessories:

The following items are available on a purchase only basis. For shipment with machine order part # the feature # is indicated below.

Print Belt, additional—Permits the customer to obtain more than one character set print belt.

- #5821 48-Character EBCDIC
- #5822 64-Character EBCDIC
- #5823 94-Character EBCDIC
- #5811 48-Character ASCII (B)
- #5812 64-Character ASCII (B)
- #5813 94-Character ASCII (B)

Cables

Assm. #	2577672	Cable Assembly Indoor
Bulk #	0323921	Coax Wire (Note 1)
Part #	1836418	Connector Kit (Note 1)
Assm. #	1833108	Cable Assembly Outdoor
Bulk #	5252750	Coax Wire (Note 2)
Part #	1836419	Connector Kit (Note 2)
Part #	2621414	Modification Kit (Note 3)
Part #	1833106	Station Protector Attachment Kit (Note 5)
Part #	5252643	Adapter (Note 7)
Part #	1830818	Station Protector Kit, Gas (Note 4)
Part #	5252899	Station Protector Element, Gas (Note 6)

Note 1: Coax wire and one connector kit (includes 2 connectors part #5214874) required for each indoor cable assembly.

(Note 7): Coax wire and one connector kit (includes 2 connectors part #5252758) required for each outdoor cable assembly.

Note 3: Customers replacing 2260 Display Stations may utilize the existing installed cables by use of this modification kit. One kit required for each cable.

Note 4: Must be used with outdoor cable assembly when installed outdoors (either above or below ground level. One kit is required for each cable assembly.

Note 5: Used to attach outdoor cable to station protector. One kit required for each cable assembly.

Note 7: Used to joint two part #2577672 or two part #1833108 cable assemblies together.



3340 DIRECT ACCESS STORAGE FACILITY

Purpose: Multiple capacity, high-speed, direct access storage for attachment to a System/3 Model 12 or System/3 Model 15 with B, C, or D Model Processing Unit, System/7 with E Model Processing Unit.

Model A2: Two disk storage drives and associated control for attachment to a System/3 Model 15, with B, C, or D Model Processing Unit via native attachment, or a System/7 equipped with a 5988-T01, 3340 attachment module. It provides logic and power for the attachment of up to three 3340 Model B units.

Model B1: Contains one disk storage drive.

Configurations:

System/7: Up to three can be attached to a 3340 Model A2 to provide a 3, 4 or 5 drive configuration. Can be combined with Models A2 and B2 for 5,6 or 7 drive configuration.

System/3 Model 15 with B, C, or D Model Processor: One can be attached to a 3340 Model A2 to provide a 3 drive configuration.

Model B2: Contains two disk storage drives.

Configurations:

System/7: Up to three can be attached to a 3340 Model A2 for a 4, 6, or 8 drive configuration. Can be combined with Models A2 and B1 for a 5, 6 or 7 drive configuration.

System/3 Model 15 with B, C, or D Model Processor: One can be attached to a 3340 Model A2 to provide a 4 drive configuration.

Model C: Contains two disk storage drives.

Prices: See Price List

Configuration:

System/3 Model 12—one can be attached directly to the 5412 to provide a two-drive configuration.

Model Changes: Available at time of manufacture only.

Highlights: Each 3340 contains an air filtration system and the load/unload mechanism for the 3348 Data Module. It features low cost, multiple capacity, fast access and high data rate ... two drives (C2 only) attach to a System/3 Model 12 ... up to 4 drives attach to a System/3 Model 15 B, C, or D ..., up to 8 drives attach to a System/7.

The 3340 introduces a new design in which a sealed cartridge (3348 Data Module) contains the disks, access arms, read/write heads and spindle. Multiple capacity options on each drive become possible due to the modularity provided by this unique design. In addition, the 3348 Model 70F contains fixed heads which provide low cost, fixed head capability for the 3340 user. The user may place selected components of IBM software as well as his own programs in the fixed head area to increase device performance. The 3348 Model 70F requires the Fixed Head Feature (#4301) on the 3340. See "Special Features." The 3348 Model 70F is not available on the System/3 Model 12 or Model 15.

3348 Cylinder Concepts

	Mdl 35 on System/7 (34.9MB)	Mdl 70 or 70F on System/7 (69.8MB)	Mdl 70 on System/3-12 or 15 (41.0MB)
Bytes per Track	8,368	8,368	12,288
Tracks per Cylinder	12	12	20
Cylinders per Data Module	348	696	210*
Bytes per Cylinder	100,416	100,416	245,760

*Note: For the Model 12 or 15, these are "logical" cylinders rather than physical cylinders. For capacities on the System/7 see System/7 under 3348.

Data Rate: 885,000 bytes per second. See GA09-1004 for Data Rate on System/7.

Access Time: For the 3348 Model 35 and 70, the average seek time is 25 ms with a minimum of 10 ms and a maximum of 50 ms. For the Model 70F, the average seek time is 0ms for cylinders 1 through 5 while all other cylinders retain the above seek timing. Rotation time is 20.2 ms and latency is 10.1 ms, the same as for the 3348 Models 35 and 70.

Autoloading: Data Modules are automatically loaded after the Data Module is placed in the drive, the drive cover is closed and a switch is turned on. The Data Module is a sealed unit and requires no cover removal. Start up time is less than 20 seconds.

Read Only: A switch is provided on every 3340 drive. This switch is activated by inserting a latch in the Data Module. When the latch is not inserted, the Data Module is protected from being written upon or erased.

Data Modules: Each drive requires a Data Module to operate. These must be ordered separately ... see 3348.

3348 Data Module Model 35 provides 34,944,768 bytes of main data storage plus 9,830,400 bytes for program support on System/3 Model 12 and Model 15.

3348 Data Module Model 70 provides 41,041,920 bytes of main data storage plus 9,830,400 bytes for program support on System/3 Model 12 and Model 15.

3348 Data Module Model 70F provides 69,889,536 bytes of storage of which 502,080 are accessible by fixed heads.

Only the 3348 Data Module Model 70 is available on System/3 Model 12 and Model 15.

Either the Model 35 or the Model 70 may operate on any drive and they are interchangeable between drives, including drives with the Fixed head feature (#4301 or #4302) installed. The Model 70F, however, requires the Fixed head feature (#4301 or #4302) on the drive.

Data written on a data module by System/3 cannot be retrieved by System/370, and vice versa.

Prerequisites: A 3340 facility requires—a 3340 Model A2 (except System/3 Model 12, which supports only 3340 Model C2) ... a System/3 Model 15 with a B, C, or D Model Processor, System/7 with a 5998-T01 Module ... each 3340 drive requires a 3348 Data Module.

Maximum:

- System/3 Model 12—two 3340 drives (C2)
- System/3 Model 15B, 15C, or 15D—four 3340 drives
- System/7 Model E—eight 3340 drives

Bibliography: GA22-6822



Specify:

- (1) Voltage (AC, 3-phase, 4-wire, 60 cycle): #9903 for 208V, or #9905 for 230V ... must be consistent with system voltage.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (3) System Attachment: Specify #9589 for Attachment of Model A2 to System/3 Model 15. Specify #9589 must also be used for a Model B1 or B2 attached to the 3340 A2 to provide a 3 or 4 drive system.

Attachment	Specify #
System/3 Model 15	9589
System/7 Model E	9590

The following must be specified for a 3340 Model C2.

Attachment	Specify #
System/3 Model 12	#9600

- (4) For conversion of a 5415A Model CPU to a 5415B, 5415C, or 5415D Model CPU, the MES must indicate deletion of Feature #9400, and if a second 5444 is installed, deletion of #9401 or #9402.

†Special Features

Fixed Head Feature (#4301, 4302). #4301 For model A2 or B2 ... #4302 For model B1. To operate the 3348 Model 70F on the 3340. The Fixed Head Feature is available on System/7. Attachment is via the 5998-TO1 on the System/7. See appropriate machines for additional requirements. **Limitations:** Not available on 3340s attached to System/3 Model 12 or 15. **Field Installation:** Yes.



3344 DIRECT ACCESS STORAGE

Purpose: Dual drive, large capacity, direct access storage for attachment via a 3340 Model A2 to a System/3 Model 150.

Model B2: Two-drive disk storage unit which attaches to a 3340 Model A2. On System/3 Model 15D, one 3344 B2 can be attached to a 3340 A2 to make a four-drive system.

Highlights: The 3344 features a large capacity, fixed storage medium. Each 3344 has two drives and requires eight logical device addresses. On System/3 Model 150 each drive is approximately equivalent to four logical 3348 Model 70s—each logical volume features a larger main data area, and a smaller area reserved for simulation, than on a 3348 data module.

Cylinder concept-System/3 Model 15D: Each drive has 828 logical cylinders with 20 tracks per cylinder. Maximum track capacity is 12,288 bytes providing up to 245,760 bytes per logical cylinder. Maximum drive capacity is 203,489,280 bytes. Data Rate—885,000 bytes per second.

Access Time: Average seek time is 25 ms with a minimum of 10 ms and a maximum of 50 ms. Rotation time is 20.2 ms and latency is 10.1 ms.

Read Only: A two position switch is provided for each drive. When the switch is in the "read only" position, the drive is protected from being written upon or erased.

Data Recovery (Plant Only): Should data in the field prove unrecoverable, data recovery assistance at the plant of manufacture will be provided.

Alternate Tracks: As used on System/3 Model 15D, there are 160 alternate tracks per drive (40 per logical volume). The 3344 will be shipped from the plant with not more than 5 flagged tracks per drive. Therefore, a minimum of 155 alternate tracks per drive are available for customer use.

Prerequisites: For use with System/3-15D, a 5415D with specify #9781 and #9784, and a 3340 Model A2, are required.

Data written by System/3 cannot be retrieved by System/370. Data written by System/370 cannot be retrieved by System/3 using SCP support.

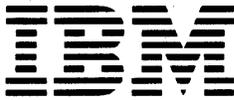
Limitations: Data written by System/3 cannot be retrieved by System/370. Data written by System/370 cannot be retrieved by System/3 using SCP support.

Prices: See Price List

Bibliography: System/3: GC20-8080

SPECIFY:

- (1) Voltage (AC, 3-phase, 4-wire, 60 Hz): #9903 for 208V, or #9905 for 230V ... must be consistent with that of the unit to which the 3344 is attached.
- (2) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (3) System Attachment: Specify #9589 for attachment to System/3 Model 15D.



3348 DATA MODULE

Purpose: A new generation, removable and interchangeable Data Module for the 3340 Disk Drive family.

Data Module is placed in drive, cover is closed and a switch is turned on. Start-up time is less than 20 seconds.

Flag-Free: Data Modules are shipped from the plant flag-free. If within 90 days after receipt the customer is required to assign an alternate track (using DOS/VS System utilities), he may return the Data Module to IBM and it will be repaired at no cost to the customer.

Capacity Upgrade (Plant Only): The model 35 may be capacity upgraded to a model 70. Data Modules must be returned to the plant of manufacture for the upgrade service. Downgrading is not available. Recorded data will not be recoverable. Upgrade of either the model 35 or 70 to the model 70F is available at time of manufacture only.

Models: Three are available in two different capacities:

3348 Model 35	34,944,768 bytes
3348 Model 70	69,889,536 bytes on System/370 and 41,041,920 bytes of main data storage plus 9,830,400 bytes for program support on System/3 Model 12 and Model 15.
3348 Model 70F	69,889,536 bytes of which 502,080 are accessible by fixed heads.

Dimensions:	Model 35	Model 70	Model 70F
Height	8"	8"	8"
Width	16"	16"	16"
Maximum Length	18"	18"	18"
Shipping Weight (lbs)	21	23	24

Covers are sealed at the plant and are unbreakable and nonflammable. A large handle is provided for ease of installation, removal and transportation. The Data Module has an aperture that is opened (or closed) automatically by the drive during loading (or unloading). The Data module is then connected to the drive for power and communications.

A CE cylinder is assigned to facilitate maintenance of the 3340.

Data Recovery (Plant Only): Should data in the field, for any reason, prove unrecoverable, a method for data recovery assistance at the plant of manufacture will be provided.

Initialization: The Data Module will be initialized at the plant. Home addresses and record zero will be written for each track.

3348 Data Module Repair Service (Plant Only)

Replace one or more defective disks (including servo disk) and/or heads, clean and lubricate, and retest to new Data Module performance specifications:

System/7 Capacities	Capacity by Model (MB)		
Mode of Recording	35	70	70F
5022 Emulation	29.4	58.9	58.9
Native Max Record Length			
7,294 bytes	30.4	60.9	60.9
Native Optimum Record Length			
4,100 bytes	34.2	68.4	68.4

System/3 Model 12 and Model 15 use only the 3348 Model 70.

Highlights

Data Module Concept: The 3348 Data Module utilizes a new concept in removable direct access storage devices. The Data Module, within a sealed cartridge, contains the disks, the spindle, the read/write heads and the access arms. The access arms and heads are not part of the drive as in previous disk pack/disk drive interfaces. The sealed module design protects the disk surfaces by reducing outside contamination. Multiple capacity options on each drive become possible due to the modularity provided by this unique design. In addition, the Model 70F contains fixed heads which provide low cost, fixed head capability for the 3340 user. The user may place selected components of IBM software as well as his own programs in the fixed head area to increase device performance. The 3348 Model 70F requires that the Fixed Head Feature (#4301) be installed on the 3340.

Removable: Can be installed and removed from the 3340 by the operator.

Interchangeable: The Model 35 or the Model 70 may operate on any drive and are interchangeable between drives, including those with the Fixed Head Feature (#4301) installed. The Model 70F, however, requires that #4301 or #4302 be installed on the drive. System/3, Model 12 and Model 15 use only the 3348 Model 70.

Auto-loading: Data Modules are automatically loaded after the

Model 35 Model 70 Model 70F

Repair Service	*	*	*
* Repair prices will be made available at time of first customer shipment.			

If in addition to normal repair service a new cover is required, there will be an additional charge.



**3410 MAGNETIC TAPE UNIT
3411 MAGNETIC TAPE UNIT AND CONTROL**

Purpose: Magnetic tape units and controls for a System/3 Models 8/10/12/15 the 3410 Model 001 can be used with a 3881 Optical Mark Reader Model 002 or a 3886 Optical Character Reader Model 002.

Models:

Data rates in 8-bit bytes per second (1600 bpi).

	3410	3411
Model 001	20,000	20,000
Model 002	40,000	40,000
Model 003	80,000	80,000

Highlights:

The 3410 is a single tape unit controlled by a 3411. The 3411 is a single channel control unit with one tape drive.

- Efficient, compact space saving design.
- Dual Density feature ... allows processing of data recorded at 1600 bpi PE or 800 bpi NRZI.
- Seven Track feature ... tape written in seven track format compatible with tapes written at 200, 556, 800 bpi by 729/7330/7335 and 2401/2402/2403/2404/2415/3420 tape drives equipped with 7 track read/write heads.
- Radial attachment of tape units permits limited offline maintenance.
- Simplified tape threading path.

Checking: During write operations, both parity and signal amplitude are checked. (When used with a 3881 Optical Mark Reader, both are checked in 800 bpi NRZI ... signal amplitudes only in 1600 bpi). During read operations, parity is checked.

Error Correction: In 1600 bpi PE recording format single track error correction in flight takes place. For 9-track, 800 bpi NRZI, track in error (T.I.E.) is provided. (Not applicable when used with a 3881 Optical Mark Reader.)

Functions: The following table indicates feature numbers for corresponding functions:

Subsystem Function	Feature Name	3411 Control Unit	3410* Tape Unit (includes tape unit on 3411)
1600 bpi 9-track only	Single Density	Standard	#3211
1600 bpi PE/800 bpi NRZI 9-track	Dual Density	#9150	#3211 or #3221
1600 bpi PE/200-556-800 bpi NRZI 7-track	Seven Track	#9160	#3211 or #6550

* Tape units must all be the same model as 3411.

Characteristics	Model 001	Model 002	Model 003
Data Rate (kb/sec)			
at 1600 bpi (P.E.)	20	40	80
at 800 bpi (NRZI)	10	20	40
at 556 bpi	6.9	13.9	27.8
at 200 bpi	2.5	5.0	10.0
Recording Density (bpi)	1600/800/556/200—all models		
Tape Speed (ips)	12.5	25	50
Nominal IBG (inch)			
- 9 Track	.6	.6	.6
- 7 Track	.75	.75	.75
Nominal IBG Time (ms)			
- 9 Track	48	24	12
- 7 Track	60	30	15
Nominal Read/Write			
Access Time (ms)	15	12	6
Rewind Time Full Reel (min)	3	3	2

Maximums:

Interconnected 3410's and 3411's must be of the same model ... models cannot be intermixed. The maximum number of tape units (3410's) per 3411 are:

- Model 001 Up to three 3410 Model 001's ... a total of 4 drives.
- Model 002 Up to three 3410 Model 002's ... a total of 4 drives.
- Model 003 Up to three 3410 Model 003's ... a total of 4 drives.

Limitation: A maximum of 4 tape drives (any model) can be attached to a System/3 Model 8/10/12/15. A maximum of one 3410 Model 001 can be attached to the 3881 or 3886.

Prerequisites: Each 3411 requires the following:

For System/3 Model 10/15—a 3411 Magnetic Tape Attachment (#7951) on the 5410 or 5415 and System/3 Model 8/10/12/15 Attachment (#7003) on the 3411 ... see "Special Features."

For System/3 Mdl 8—A 3411 Magnetic Tape Attachment (#7960) on the 5408 and System/3 Model 8/10/12/15 Attachment (#7003) on the 3411 ... see "Special Features."

For System/3 Mdl 12—a Basic Attachment Feature (#4701) and a 3411 Magnetic Tape Attachment (#7960) on the 5412 and System/3 Model 8/10/12/15 attachment (#7003) on the 3411 ... see "Special Features."

Each 3410 requires an appropriate model of the 3411, except when a 3410 Model 001 is attached to a 3881 or 3886.

Magnetic Tape:

The following tapes and reels can be used: IBM Series 500, IBM Heavy Duty, IBM Dynexcel, or competitive formulations which meet the tape and reel criteria in Tape Specifications, GA32-0006.

Note: IBM tapes other than those above do not provide adequate reliability and should not be used.

Bibliography: System/3—GC20-8080, 3881—GA21-9127. Also IBM 3410/3411 Component Summary, GA32-0015.

Metering: 3410 (all Models)—I/O Unit (online) ... 3410 Model 001 when used with a 3881 Model 2—I/O Unit (offline). 3411—Assignable Unit.

Model Changes: Field installable.

**Specify:**

- (1) Voltage (AC, 1-phase, 3-wire, 60 cycle): #9902 for 208V, or #9904 for 230V. If used with a 3881 Optical Mark Reader or a 3886 Optical Character Reader, voltage must be consistent.
- (2) Dual Density, Control (3411 only): #9150. Permits attachment of 3410's equipped with Dual Density, Tape Unit (#3221) and installation of Dual Density, Tape Unit (#3221) on the 3411 itself. 3410's equipped with Single Density, Tape Unit (#3211) can also be attached. **Limitation:** Cannot be installed on same 3411 with Seven Track, Control (#9160). **Field Installation:** Yes.
- (3) Seven Track, Control (3411 only): #9160. Permits attachment of 3410's equipped with Seven Track, Tape Unit (#6550) and installation of Seven Track, Tape Unit (#6550) on the 3411 itself. 3410's equipped with Single Density, Tape Unit (#3211) can also be attached. #9160 includes the translator function which, when used causes 8-bit bytes from the I/O interface to be written on tape as 6-bit BCD characters and 6-bit characters read from tape to be translated into their EBCDIC equivalents. The Data Conversion function, also included, allows reading and writing of 8-bit bytes on 7-track tape by converting 4 tape characters to three storage bytes and vice versa. **Limitation:** Cannot be installed with Dual Density, Control (#9150). **Field Installation:** Yes.
- (4) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- (5) Tape Reels: If any color other than gray is desired, specify #9051 for red, #9053 for blue, or #9054 for white.
- (6) Density Formats: The 3410/3411 subsystem can operate in three density formats ... 1600 bpi PE, single density ... or 1600/800 bpi, dual density ... or 200/556/800 bpi, seven track. With the exception of single density, which is standard on the control unit of the 3411, a feature number for the format desired must be specified for each tape unit and the control unit ... see "Special Features" for limitations. Dual Density, Control (#9150) is required on the 3411 for Dual Density, Tape Unit (#3221) on the 3411 and attached 3410's ... see specify (2) above. Seven Track, Control (#9160) is required on the 3411 for Seven Track, Tape Unit (#6550) on the 3411 and attached 3410's ... see specify (3) above.
- (7) System Attachments: System/3 Model 8/10/12/15 Attachment (#7003) is required for attachment to a System/3 Model 8, 10, 12 or 15.
- (8) Language Group: #2927 for English.

Special Features:

Single Density, Tape Unit (#3211): (3410, 3411—any Model) Permits the 3410 or the tape unit on a 3411 to operate at 1600 bpi PE only. **Limitation:** Cannot be installed with Dual Density, Tape Unit (#3221) or Seven Track, Tape Unit (#6550). **Field Installation:** Yes. **Prerequisite:** If installed on the 3886 Optical Character Reader, Single Density Tape Adapter (#6490) on the 3886.

Dual Density, Tape Unit (#3221): (3410, 3411—any Model) Permits the 3410, or the tape unit on a 3411 Model 001, 002 or

003 to operate at 800 bpi as well as 1600 bpi. **Limitation:** Cannot be installed with Single Density, Tape Unit (#3211) or Seven Track, Tape Unit (#6550). **Field Installation:** Yes. **Prerequisite:** Dual Density, Control (#9150) on the 3411 ... see "Specify," or Dual Density (#3550) on the 3881 Optical Mark Reader, or Dual Density Tape Adapter (#6485) on the 3886 Optical Character Reader.

Seven Track, Tape Unit (#6550): (3410, 3411—any model) Permits the 3410 or the tape unit on the 3411 to operate at 200, 556 or 800 bpi NRZI in the seven track format compatible with 729 7330, 7335 and 2401, 2402, 2403, 2404, 2415, 3420 tape units equipped with seven-track read/write heads. Tape units with this feature will only read or write 7-track tape. **Limitation:** Cannot be installed with Single Density, Tape Unit (#3211), or Dual Density, Tape Unit (#3221). **Field Installation:** Yes. **Prerequisite:** Seven Track, Control (#9160) on the 3411.

System/3 Mdl 8/10/12/15 Attachment (#7003): (3411 Model 001, 002, 003) To attach the 3411 with up to three 3410's to a System/3 Model 8, 10, 12 or 15. **Limitation:** Cannot be installed with System/360/370 Attachment (#7360) or System/370 Model 115/125 Attachment (#7361). **Field Installation:** Yes. **Prerequisite:** 3411 Magnetic Tape Attachment (#7960) on the 5408 and 5412 or 3411 Magnetic Tape Attachment (#7951) on the 5410 and 5415.



3601 FINANCE COMMUNICATION CONTROLLER

Purpose: A programmable controller for attachment of 3600 Finance Communication System Terminals to S/370 and S/3 Model 15 processors.

Attachment to S/370 is via a 3704/3705 Communications Controller using SDLC transmission over various common carrier or user-owned facilities.

Attachment to S/3 Model 15 is via Binary Synchronous Communications (BSC)— see 3601/3602 RPQ 8K0598 and 5415 RPQ S40156.

Model 2A A programmable controller with a diskette drive which accommodates one-sided removable diskettes, a maximum of three loops, and a maximum of 88K bytes of user programmable storage.

Remote terminal attachments* are available.

Model 2B A programmable controller with a diskette drive which accommodates one or two-sided removable diskettes, a maximum of three loops, and a maximum of 88K bytes of user programmable storage.

Remote terminal attachments* are available.

Model 3A A programmable controller with a diskette drive which accommodates one-sided removable diskettes, diskette drive, a maximum of six loops and a maximum of 88K bytes of user programmable storage.

Remote terminal attachments* are available.

Model 3B A programmable controller with a diskette drive which accommodates one or two-sided removable diskettes, a maximum of six loops and a maximum of 88K bytes of user programmable storage.

Remote terminal attachments* are available.

* Remote terminal attachments can be achieved on the total number of loops indicated by one or a combination of the following, as applicable.

Device or Feature	Device or Feat. #	3601			
		2A	2B	3A	3B
1200 bps Loop		—	—	5	5
Integrated Modem	#8001			5	5
Term. Attach Unit	3603-1	3	3	6	6
EIA Interface	RPQ	2	2	5	5

Highlights: Controls all the functions of 3600 Finance Communications System terminals. Controls data transmission between those terminals and the central processing site. Four SDLC Communications features are available one of which is required for transmission to and from the Host. An SDLC Communications feature at speeds from 1200 bps to 4800 bps or an SDLC Communications (model 1, 3A or 3B) feature at speeds from 1200 bps to 9600 bps can be selected. Besides Host link speed differences the SDLC feature to 9600 bps allows a maximum controller aggregate baud rate of 12,000 bps for the loops independent of the host link speed...see "Communications Features."

For Binary Synchronous Communications (BSC) see RPQ 8K0598.

Models 2A, 2B, 3A and 3B—contains approximately 24K bytes of programmable storage. Four additional increments of 16K bytes of programmable storage (for a total of 88K) are available. The amount of programmable storage available for application

programming depends upon the attached terminal configuration and user environment...see "Additional Storage Feature (#1006)."

Models 2A and 3A house a direct access diskette drive with a one-sided removable diskette which provides permanent storage for control and user programs, plus temporary and permanent storage for user data (sequential logging, random retrieval of data records, etc.).

Models 2B and 3B—houses a direct access diskette drive with a two-sided removable diskette which provides permanent storage for control and user programs, plus temporary and permanent storage for user data (sequential logging, random retrieval of data records, etc.).

All 3600 System terminals are attached by loops which operate at speeds of 1200, 2400 or 4800 bps for locally attached terminals and at 1200 bps for remotely attached terminals. The base unit provides one loop. Two additional loops are available on models 2A and 2B while five additional loops are available on models 3A and 3B. 1200 bps loops integrated modems are available on models 3A and 3B only...see "Special Features." *Note:* Only one 4800 bps loop per 3601 may be specified for System/3 Host attachment configurations.

Communication between the controller and the 3704/3705 may be either through an integrated 1200 bps modem or through an external modem with EIA Interface (#3701), or via the local attachment feature of the 3704/3705. See "Modems" and "Special Features" below. Each 3601 operates in half-duplex mode. Duplex communication line operations are possible with multiple 3601's attached to the line...one 3601 transmitting while the other receives.

For attachment to S/3 Model 15 see 3601/3602 RPQ 8K0598 and 5415 RPQ S40156.

Can be programmed to operate independently when the CPU is unavailable. Capable of controlling all terminal functions, executing arithmetic, and capturing data from the terminals for later transmission to the CPU. A keylock is provided for the removable diskette. One key is provided.

Transmission: The 3601 operates over common carrier-provided or equivalent customer-owned communications facilities. For information concerning these facilities, see the M 2700 pages.

Modems: External modems operating at up to 4800 bps may be attached when used with SDLC Feature #6301 or #6302. Speeds up to 9600 bps may be achieved with SDLC Feature #4501 or #4502.

Modem	Speed (bps)	Facility
3872	2400	Non-switched voice grade lines
3874	4800	Non-switched voice grade lines
3875	7200	Non-switched voice grade lines
*	9600	Non-switched voice grade lines
*	9600	Non-switched digital data svc.

* No IBM Modem available.

Prerequisite: Communications with a S/370 with virtual storage capability via a 3704 or 3705 Communications Controller equipped with appropriate features.

Bibliography: GC20-0370 *IBM S/370 Bibliography* and GC27-



0001 IBM 3600 Finance Communication System, System Summary.

Specify:

(1) Voltage (115 V AC, 1-phase, 60 Hz). #9880 for locking plug, or #9881 for non-lock plug. Field Installation: Not recommended.

(2) Controller Designation: Media distribution of Controller Data. Specify #9491 to identify the initial 3601 ordered for use with a host system location, or specify #9492 to identify additional 3601s per host system.

Note: customers using the 3600 program preparation service may chose not to receive the controller data separately. In this case, #9492 should also be specified for the initial 3601.

If #9491 is specified for the 3601, specify: #9494 if there is no 3614 with a first position designator attached to any 3601 on the same host system, or #9495 if there is a 3614 with a first position designator and #9001 attached to any 3601 on the same host system. See 3614 Host Attachment Designation under "Specify" for the 3614.

If #9491 is specified, select the specify number of the desired media.

- #9412 9/800 Magnetic Tape
#9413 9/1600 Magnetic Tape
#9414 9/6250 Magnetic Tape

If magnetic tape is not available on designated CPU, then select one of the following media. [DOS/VS users only]

- #9431 80-Column Cards
#9432 96-Column Cards

If card or tape inputs are not available at the host location, contact your Industry Support Center for guidance.

When feature #9491 is specified, additional shipping information is required.

Supplement Spec is to be entered exactly as follows to indicate shipping address of the HOST SYSTEM LOCATION.

- Line 1 IBM PROGRAMMING SUPPORT REPRESENTATIVE (PSR)
Line 2 C/O (Name of Customer)
Line 3 Street Address (or P.O. Box)
Line 4 City, State, Zip

This is the address to which controller data tapes will be automatically shipped (1) after the first controller is ordered and (2) whenever controller data is updated by an EC.

(3) Cables: See Accessories for ordering instructions. Also see Installation Manual—Physical Planning, GA27-2766.

(4) If ordering a 3614 with 1st position designator (see Host Attachment Designation under "Specify" for the 3614) to be added to any existing 3601, an MES order transaction should be used against the initial 3601 (specify code #9491 with #9494) requesting to delete #9494 and add #9455 for the initial 3601.

Refer to 677-28 for further explanation of these specify codes and their use when (1) ordering a loop-attached 3614 in a network where no 3614s are previously attached, and (2) field installation of feature #9001 on a loop-attached system.

If all installed or on order 3614s for loop attachment to the 3601 are removed or cancelled, an order transaction should be used against the initial 3601 (specify code #9491 with #9495) to delete #9495 and add #9494.

Model Changes: Model 2A can be changed to Model 2B, 3A or 3B. Model 2B to Model 3B. Model 3A to Model 3B. Field Installation: Yes...Model 2A to 2B, 2A to 3B, or 3A to 3B requires replacement of the diskette storage device. Adequate provision must be made for retaining data contained on the diskette by having the user remove it prior to the start of any conversion.

Customer price quotations and customer order acknowledgment letters for purchase must state: "Installation of this model change involves removal of parts which become the property of IBM."

Special Features

Additional Storage Feature (#1006). [Models 2A, 2B, 3A and 3B only] Provides an additional 16,384 bytes of control storage for device arrangement or an additional 16,384 bytes of user programmable storage. Specify: #9591 for Control Storage for Device Attachment. Any combination of device types; 3603, 3604, 3606, 3608, 3610, 3611, 3612, 3614, and/or 3618 may be attached. Some combinations of device types can be accommodated by the basic machine and some combinations will require an optional 16,384 bytes of control storage provided by the use of feature #1006. To determine if #1006 is required, refer to the Device Attachment Table "C" below. Calculate the sum of the attachment factors for the combination of devices or function required. Add the attachment factor one time only for each device type. If the attachment factor sum is 10 or less, feature #1006 (Specify #9591) is not required. If the attachment factor sum is greater than 10, feature #1006 (Specify #9591) is required. An attachment factor greater than 22 is not allowed.

Device Attachment Table C

Table with 2 columns: Device Type or Feature, Attachment Factor. Rows include 3603 or 3604 (0), Mag. Strip Encoder-Reader (#4905/4906) (0.7), 3606 (3.0), 3608 (5.8), 3610, 3611 and/or 3612 (2.6).



3614 [without controller data encryption support]	1.2
3614 [with support for the Alternate Encryption Technique (AET) only]	2.2
3614 [with support for the Data Encryption Standard (DES) only]	2.7
3614 [with support for both DES and AET]	3.7
3618	3.0
SDLC to 9600 bps (#4501 or #4502)	0.7
Data Sequencing	1.6
Set Diskette	0.9
Storage Expansion	1.0
Instruction Enhancements	1.7
Priority Dispatching (LCHAP) only	0.6
Translate Instruction (LTRT) only	1.5
LCHAP and LTRT together	1.8

Note: Any 3610, 3611 and 3612 combination constitutes one device type. The Magnetic Stripe Reader (#4901 or #4902) need not be considered in computing the attachment factor. If both a 3606 and 3608 are used, do not include the 3606 attachment factor.

Note: A single 3614 may have either DES or AET, but not both.

Note: A description of non-“Specify,” non-“Feature,” non-“Machine” Attachment Factor functions is given later in this section.

Maximum: For #1006 with #9591 specified—One. **Field Installation:** Yes.

Specify: #9592 for User Programmable Storage. Additional Storage Feature (#1006) provides additional 16,384 bytes of user programmable storage. **Maximum:** For #1006 with #9592 specified and without #6501—Two. For #1006 with #9592 specified and with #6501—Four. **Prerequisite:** If more than two Additional Storage Features (#1006 with specify #9592) are ordered the Storage Expansion Feature (#6501) is required. **Field Installation:** Yes.

EIA Interface (#3701): Provides the appropriate cables and interface logic necessary to attach an external IBM modem for communications to the System/3 or host processor through the 3704/3705 or for local attachment to the System/3 or 3704/3705 without requiring modems. Non-IBM modems may be attached to subject to the multiple Suppliers System Policy. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** SDLC Communications Feature with Clocking (#6301 or #4501) or SDLC Communications Feature without Clocking (#6302 or #4502). **Limitation:** Cannot be installed with a 1200 bps Integrated Modem (#5500).

Loop Feature, Additional (#4735): Provides the ability to attach additional 3600 Finance Communication System terminals. **Maximum:** Two per models 2A and 2B. Five per models 3A and 3B. **Field Installation:** Yes. **Prerequisite:** For each loop with any remotely attached terminals. 1200 bps Loop Integrated Modem (#8001 or #8002) on a terminal or a 3603 is required. **Limitation:** A maximum of two loops (including the provided local loop) operating at 4800 bps, per 3601 are allowed when one of the SDLC communication features (#4501 or #4502) are specified. Loop Integrated Modem (#8001) cannot be installed on models 2A and 2B. *Note:* The sum of speeds of all loops in bits per second (bps) plus the speed of the SDLC link (#6301 or #6302) in bps cannot exceed 12,000 bps. When SDLC feature (#4501 or #4502) is installed, the sum of all loops cannot exceed 12,000 bps (do not use the host link speed).

1200 bps Integrated Modem (#5500): An integrated modem

for operation at 1200 bps over non-switched half-duplex or duplex voice grade lines for communication to the CPU through the 3704 or 3705...or to an appropriately featured S/3 Model 15 communication adapter— see 5415 RPO S40156. **Specify:** #9651 for 4-wire strapping, or #9652 for 2-wire strapping. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** SDLC Communications Feature with Clocking (#4501 or #6301). **Limitation:** Cannot be installed with EIA Interface (#3701).

Communications Features: Each 3601 must be equipped with one of the following SDLC features and either the EIA Interface (#3701) or the 1200 bps Integrated Modem (#5500) for communication with the host processor.

SDLC Communications Feature with Business Machines Clocking (#4501): [Model 3A or 3B only] Required for attachment to communication lines through the 1200 bps Integrated Modem (#5500) or any external modem which does not have internal clocking. The SDLC link speed of this feature need not be included when calculating the sum of loop speeds not to exceed the controller aggregate baud rate of 12,000 bps. **Maximum:** One. **Limitations:** Cannot be installed with #6301, 6302 or 4502. **Field Installation:** Yes.

SDLC Communications Feature without Business Machine Clocking (#4502): [Model 3A or 3B only] Required for attachment to communication lines through an external modem which does not have internal clocking at speeds up to 9600 bps. The SDLC link speed of this feature need not be included when calculating the sum of the loop speeds not to exceed the controller aggregate baud rate of 12,000 bps. **Maximum:** One. **Limitation:** Cannot be installed with #6301, 6302 or 4501. **Field Installation:** Yes. **Prerequisite:** EIA Interface (#3701).

SDLC Communications Feature with Business Machine Clocking (#6301): Required for attachment to communication lines through the 1200 bps Integrated Modem (#5500) or any external modem which does not have internal clocking, or for local attachment to the 3704/3705. **Maximum:** One. **Limitation:** Cannot be installed with #6302, 4501 or 4502. **Field Installation:** Yes.

SDLC Communications Feature without Business Machine Clocking (#6302): Required for attachment to communications lines through an external modem which does have internal clocking at speeds up to 4800 bps. **Maximum:** One. **Limitation:** Cannot be installed with #6301, 4501 or 4502. **Field Installation:** Yes. **Prerequisite:** EIA Interface (#3701).

Storage Expansion Feature (#6501): [Models 2A, 2B, 3A and 3B only] Provides capability of expanding user programmable storage beyond 56K bytes. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** This feature (#6501) is required when more than two Additional Storage Features (#1006 with specify #9592) are ordered.

1200 bps Loop Integrated Modem (#8001): [Model 3A or 3B only] An integrated modem for transmission to remotely located 3600 Finance Communication System terminals. Operates at 1200 bps over non-switched normal quality voice grade lines.

Note: Several remote loop configuration variations can be realized; e.g., see the IBM 3600 FCS Configurator, GA27-2762. However, regardless of configuration, the interconnecting common carrier facilities are always point-to-point circuits; either 2-wire half-duplex or 4-wire duplex. The common carrier does not tariff 3600 “remote loops.” The customer should be referred to the configurator or information in the M 2700 pages for definition of the tariffed elements of the remote loop. **Maximum:** One per Additional Loop Feature (#4735). **Field Installation:** Yes.



Prerequisite: Additional Loop Feature (#4735). Each remote location must have either a 3604 Keyboard Display Model 2, 3 or 4 equipped with a 1200 bps Loop Integrated Modem (#8001 or #8002), a 3614 Consumer Transaction Facility with a 1200 bps Loop Integrated Modem (#8001) or a 3603 as the first attached remote unit in each physical (geographic) location.

Accessories: See accessories at the end of this Machine Type.

Attachment Factor Functions

Data Sequencing: Allows user applications to sequence, in storage, a block of data items or to collate, in storage, data items from two separate blocks into a third block, according to a parameter list.

Set Diskette: Allows user applications to reset the temporary files, to specify the type of start-up (i.e., warm or cold) to be performed on the next load, and/or to initiate a load of the controller.

Instruction Enhancements: Provides the user application with the following new instructions:

Bit Manipulating—Test and Branch (LIFON, LIFOFF): provide a test, set and branch function in a single instruction. This reduces the 3600 AP processing and memory requirements when processing single bits.

Logical Compare Data Immediate (CCDI) Compares immediate data to data in a specified field.

Move Data Immediate (MVDI) Moves immediate data to a specified field.

Load Data Immediate (LDDI) Loads immediate data into specified register.

SCALE formats an input string of characters into a conveniently processable numerical format. When used in processing monetary input, functions such as the removal of the monetary symbol, commas, and periods from the input data

are automatically done. In the event that cents were not in the input data, zero padding is optionally provided. SCALE should significantly reduce the number of instructions required to process monetary input.

Segment Indexing (SETX, TESTX, SETXREG) Provides an alternate method of referencing data within a segment. Only fixed operands of 3600 instruction may be indexed. This function can be used to reduce the number of SETFPL instructions executed by the AP, thereby enhancing performance and reducing AP size. This function also provides a pseudo DSECT facility, thereby enabling an AP to more readily reference (1) variably displaced data within segments and/or (2) data beyond 4K bytes from the beginning of a segment.

Branch on Index (BRANX) Provides an index increment, compare and branch function in a single instruction. This instruction is used to control the number of times a series of AP instructions will be executed. Since the instruction algebraically increments a register, BRANX can be used in conjunction with the Segment Indexing facility to simplify the processing of tables.

Execute (LEXEC) Provides a function similar to the S/370 EXECUTE instruction. The amount of data logically OR'ed into the target instruction may be 2, 4, or 6 bytes.

Priority Dispatching Provides the ability to specify the order in which 3601/3602 workstations are dispatched. This function consists of the LCHAP instruction which activates or deactivates the dispatching priority specified in the table(s) generated by the PRIDSP macro.

Translate The LTRT instruction processes an input data stream against user specifiable translate table(s) to generate a translated output data stream. The LTRTBEG, LTRTENT and LTRTGEN instructions assist the user application programmer in specifying the translate table(s).

3600 ACCESSORIES

CABLES (3600)

Cables to attach 3600 units may be purchased from IBM or a customer-selected source ... see *Physical Planning Manual* GA27-2766 for cable and connector specifications. The customer is responsible for installation and maintenance of these cables. Assembled cables may be purchased from IBM at the prices shown below.

Item No.	Description	Maximum Length
ASSM 1563155	Loop Cable Assembly	609.6m(2000')
ASSM 1741656	Cable Assy (joining 2 telephone lines)	N/A
ASSM 1745348	Cable Assy (3603 to Loop Terminal Box)	7.62m(25')
ASSM 1745372	Cable Assy (Loop Repeater to Loop Terminal Box)	7.62m(25')
ASSM 1745349	Cable Assy (DDA to 3603)	7.62m(25')
ASSM 1745350	Cable Assy (3603 to Leased Lines)	7.62m(25')
BULK 5252769	Bulk Cable (2 Conductor)	N/A
BULK 5252913	Bulk Cable (4 Conductor)	N/A
PART 1561344	Strain Relief	
PART 1745363	Connector Assembly (3603)	
PART 5252765	Male Plug	
PART 5252766	Female Plug	
PART 5420242	Mini-Ty (used with 1745363)	

LOCKS AND KEYS



3601: The 3601 is shipped with two keys. Additional keys may be purchased from IBM.

3610, 3612: The 3610 mdl 2 and 3612 mdl 2 with the Journal Takeup with Locked Cover (#4651) special feature are shipped with two keys. Additional keys may be purchased from IBM.

3610 mdl 4: The 3610 mdl 4 is shipped with two keys. Additional keys may be purchased from IBM.

FORMS STAND

Permits placement of continuous forms (out of carton) on stand above floor level and provides for stacking after printing. This accessory is a two-shelf forms stand.

Permits feeding of continuous forms from the carton and provides for forms stacking after printing. This accessory is a one-shelf forms stand.

For 3610, 3612, 3618 #4450

LOOP REPEATER (P/N 440002) (3600 System)

Plugs into the Loop cable and redrives all signals being transmitted in a 3600 Finance Communication System. Each Loop Repeater contains Loop redriving capabilities which allow for the extension of the Loop cable length by 2000 feet. Loop Repeaters may be employed on a Loop to extend its overall length to a maximum of 20,000 cable-feet. The unit can be physically mounted on a wall in an out-of-the-way location.

Prerequisite: An operating 3600 System Local Loop or Remote Subloop.

Bibliography: GC22-0005

Customer Responsibilities: The customer may be advised that: (1) The customer is responsible for making certain that the use of the equipment complies with all Federal, State, and Local Laws, Regulations, and Ordinances ... (2) The customer is responsible for price quotations, installation and cost (initial and recurring) of common carrier equipment and service ... (3) The customer is responsible for the set-up of the unit ... (4) The customer will determine the failing unit (see "Maintenance" below) ... (5) the customer is responsible for determining the required number of spares.

Physical Planning and Set-up: Physical planning and set-up is the responsibility of the customer. Attachment to the Loop cable is provided by ordering External Signal Cable Assembly (IBM P/N 174372), or equivalent ... see *IBM 3600 Finance Communication System Installation Manual—Physical Planning GA27-2766*.

Spares: The customer may wish to replace a failing unit with a spare and must be advised to purchase sufficient spare units for such use. The number of spare units recommended is dependent upon the number of units the customer has installed, application requirements, physical locations and layouts. However, the minimum number of spare units recommended is shown in the following table:

Number of Loop Repeaters Installed	Number of Minimum Spares Recommended	Number of Loop Repeaters Installed	Minimum Number of Spares Recommended
100	2	2500	12
200	2	3000	14
300	3	3500	16
500	4	4000	18
1000	6	4500	19
1500	9	5000	21
2000	10		

Warranty: Service is available at the designated Center during the 90 day warranty period, which commences 30 days following date of shipment from the plant of manufacture (Raleigh). It shall be the customer's responsibility to set up the equipment. It shall be the customer's responsibility to determine the failing unit and remove it from the Loop, and if the unit is still under warranty, to pack it in the designated shipping container and ship it prepaid to the designated Center. IBM will return the serviced unit, shipping charges prepaid. There is no regularly scheduled preventative maintenance recommended by IBM on these units.

Maintenance agreements are not available.

Machine Part No.

Loop Repeater	3601	4400002
Loop Repeater	3602	4400002

Miscellaneous

Accessories for 3600 System equipment may be purchased from IBM or a customer selected source.



Part Number Description

3603	111262	Fuse (.4 Slow Blow)
	1176668	Fuse (1.5A Flow Blow)
3604 Keytop Labels		
	Mdls 1, 2, 3, 4	
	1561332	Blank Base for Customization
	1562333	Clear Protective Overlay
	1561341	Preprinted (Group 1)
	1561342	Preprinted (Group 2)
3604 Overlays		
	Models 5, 6	
	4942506	White Background 45 Key
	4942515	Blue Insert 15 Key
	4943749	Clear Protective Cover 45 Key
3606/3608		
	1652103	Fuse Holder Assembly
	1702817	Display Filter - Standard
	1702847	Keyboard Overlay - Standard
	1702848	Keyboard Overlay - Blank except for Numerics
	1702849	Keyboard Overlay - Protective Cover
	1702904	Display Filter - Blank Red
3603		
	1745353	Jumper Assembly (Signal Attenuation)
	5929886	Wall Plate Assembly



3602 FINANCE COMMUNICATION CONTROLLER

Purpose: A programmable controller for attachment of 3600 Finance Communication System Terminals to S/370 and S/3 Model 15 processors.

Attachment to S/370 is via a 3704/3705 Communications Controller using SDLC transmission over various common carrier or user-owned facilities.

Attachment to S/3 Model 15 is via Binary Synchronous Communications (BSC)— see 3601/3602 RPO 8K0598 and 5415 RPO S40156.

Model 1A: A large-file programmable controller with a 5.2 meg disk, a drive which accommodates one or two-sided removable diskettes, 16K increments of storage, and a maximum loop capacity of eight of which seven can be remote.

Model 1B: A large-file programmable controller with a 9.3 meg disk, a drive which accommodates one or two-sided removable diskettes, 16K increments of storage, and a maximum loop capability of eight, of which seven can be remote.

Highlights: Controls all the functions of 3600 Finance Communication System terminals. Controls data transmission between those terminals and the central processing site. Four SDLC Communication features are available one of which is required for transmission to the Host. An SDLC Communications feature at speeds from 1200 bps to 4800 bps or an SDLC Communications feature at speeds from 1200 bps to 9600 bps can be selected. Besides Host link speed differences the SDLC feature to 9600 bps allows a maximum controller aggregate baud rate of 12,000 bps for the loops independent of the Host link speed...see "Communications Features." For Binary Synchronous Communications (BSC) see RPO 8K0598.

Contains approximately 24K bytes of programmable storage. Six more increments of 16K bytes of programmable storage (for a total of 120K) are available. The amount of programmable storage available for application programming depends upon the attached terminal configuration and user environment...see Additional Storage Feature (#1006).

Houses a direct access diskette drive with two-sided removable diskette which provides permanent storage for control and user programs, plus temporary and permanent storage for user data (sequential logging, random retrieval of data records, etc.).

Houses a disk storage device for storage of user data. This storage device is not removable except by service personnel. Includes a fixed head feature which will provide 8 additional heads with access to disk data on 8 tracks...see Additional Disk Heads Feature (1010, 1011).

All 3600 System terminals are attached by loops which operate at speeds of 1200, 2400 or 4800 bps for locally attached terminals and at 1200 bps for remotely attached terminals. The base unit provides one loop. Seven additional loops are available. Integrated modems are available on both models...see "Special Features." *Note:* Only one 4800 bps loop per 3602 may be specified for System/3 Host attachment.

Communication between the controller and the 3704/3705 may be either through an integrated 1200 bps modem through an external modem with EIA Interface (#3701), or via the local attachment feature of the 3704/3705. See "Modems" and "Special Features" below. Each 3602 operates in half-duplex mode. Duplex communication line operations are possible with

multiple 3601/3602s attached to the line...one 3602 transmitting while the other receives.

For attachment to S/3 Model 15 see 3601/3602 RPO 8K0598 and 5415 RPO S40156.

Can be programmed to operate independently when the CPU is unavailable. Capable of controlling all terminal functions, executing arithmetic, and capturing data from the terminals for later transmission to the CPU.

Transmission: The 3602 operates over common carrier-provided or equivalent customer-owned communications facilities. For information concerning these facilities, see the M 27.00 pages.

Modems: External modems operating at up to 4800 bps may be attached when used with SDLC Feature #6301 or #6302. Speeds up to 9600 bps may be achieved with SDLC Feature (#4501 or 4502).

Modem	Speed (bps)	Facility
3872	2400	Non-switched voice grade lines
3874	4800	Non-switched voice grade lines
3875	7200	Non-switched voice grade lines
*	9600	Non-switched voice grade lines
*	9600	Non-switched voice grade lines

* No standard IBM Modem available.

Prerequisite: Communications with a S/370 with virtual storage capability via a 3704 or 3705 Communications Controller equipped with appropriate features. For BSC communication with a S/3 Model 15...see 3601/3602 RPO 8K0598 and 5415 RPO S40156.

Bibliography: GC20-0370 for S/370, and GC27-0001 for IBM 3600 Finance Communication System, System Summary.

Specify:

(1) Voltage (AC, 1-phase, 60 Hz): Locking Plug—#9880 for 115V, #9884 for 208V, #9886 for 230V. Non-lock Plug—#9881 for 115V, #9885 for 208 V, #9887 for 230V. **Field Installation:** Not recommended.

(2) Controller Designation: Media distribution of Controller Data. Specify #9491 to identify the initial 3602 ordered for use with a host system location, or specify #9492 to identify additional 3602s per host system.

If #9491 is specified for the 3602, specify: #9494 if there is no 3614 with a first position designator attached to any 3602



on the same host system, or #9495 if there is a 3614 with a first position designator and #9001 attached to any 3602 on the same host system. See 3614 Host Attachment Designation under "Specify" for the 3614.

If #9491 is specified, select the specify number of the desired media.

- #9412 9/800 Magnetic Tape
- #9413 9/1600 Magnetic Tape
- #9414 9/6250 Magnetic Tape

If magnetic tape is not available on designated CPU, then select one of the following media. [DOS/VS users only]

- #9431 80-Column Cards
- #9432 96-Column Cards

Refer to letter 677-28 for further information of these specify codes and their use when (1) ordering a loop attached 3614 in a network where no 3614's are previously attached, and (2) field installation of feature #9001 on a loop attached 3614.

Model Changes: Model 1A can be changed to Model 1B. This upgrade requires replacement of the disk storage (not diskette) device. Adequate provision must be made for retaining data contained on disk storage and elimination of user proprietary information. **Limitation:** Field installation of the additional disk heads for Model 1B (#1011) concurrently with a model change from Model 1A to Model 1B requires the submission of an RPQ.

Customer price quotations and customer order acknowledgment letters for purchase MESs must state: "Installation of this model change involves removal of parts which become the property of IBM."

Special Features

Additional Storage Feature (#1006): Provides an additional 16,384 bytes of control storage for device attachment or an additional 16,384 bytes of programmable storage. **Specify:** #9591 for Control Storage for Device Attachment. Any combination of device types: 3603, 3604, 3606, 3608, 3610, 3611, 3612, 3614 and/or 3618 may be attached. Some combinations of device types can be accommodated by the basic machine and some combinations will require an optional 16,384 bytes of control storage provided by the use of feature #1006. To determine if #1006 is required, refer to the Device Attachment Table below. Calculate the sum of the attachment factors for the combination of devices or function required. Add the attachment factor one time only for each device type. If the attachment factor sum is 10 or less, feature #1006 (Specify #9591) is not required. If the attachment factor sum is greater than 10, feature #1006 (Specify #9591) is required. An attachment factor greater than 22 is not allowed.

Device Attachment Table

Device Type or Feature	Attachment Factor
3603 or 3604	0.0
Mag. Strip Encoder-Reader (#4905/4906)	0.7
3606	3.0
3608	5.8
3610, 3611 and/or 3612	2.6
3614 [without controller data support]	1.2
3614 [with support for the 3614 Alternate Encryption Technique (AET) only]	2.2
3614 [with support for the Data Encryption Standard (DES) only]	2.7
3614 [with support for both DES and AET]	3.7
3618	3.0
SDLC to 9600 bps	0.7
Disk File (5.2 or 9.3 meg)	10.0
Data Sequencing	1.6
Set Diskette	0.9
Storage Expansion	1.0
Instruction Enhancement Package	1.7
Priority Dispatching (LCHAP) only	0.6
Translate Instruction (LTRT) only	1.5
LCHAP and LTRT together	1.8

Note: A single 3614 may have either DES or AET, but not both.

Note: Any 3610, 3611 and 3612 combination constitutes one device type. The Magnetic Stripe Reader (#4901) need not be considered in computing the attachment factor. If both a 3606 and 3608 are used, do not include the 3606 attachment factor.

Note: A description of non-"Specify," non-"Feature," non-"Machine" Attachment Factor functions is given later in this section.



Maximum: For #1006 with #9591 specified—One. **Field Installation:** Yes.

Specify: #9592 for User Programmable Storage. Additional Storage Feature (#1006) provides an additional 16,384 bytes of user programmable storage. **Maximum:** For #1006 with #9592 specified and without #6501—two. For #1006 with #9592 specified and with #6501—Six. **Prerequisite:** If more than two Additional Storage Features (#1006 with specify #9592) are ordered the Storage Expansion Feature (#6501) is required. **Field Installation:** Yes.

Additional Disk Heads (#1010, 1011): [#1010 for Model 1A...#1011 for Model 1B] Provides additional disk heads (8) for the disk file as specified by model type selected. **Maximum:** One. **Field Installation:** Not recommended.

EIA Interface (#3701): Provides the appropriate cables and interface logic necessary to attach an external IBM modem for communications to the System/3 or host processor through the 3704/3705 or for local attachment to the System/3 or 3704/3705 without requiring modems. Non-IBM modems may be attached subject to the Multiple Suppliers System Policy. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** SDLC Communications Feature with Clocking (#6301 or #4501) or SDLC Communications Feature without Clocking (#6302 or #4502). **Limitation:** Cannot be installed with a 1200 bps Integrated Modem (#5500).

Loop Feature, Add'l (#4735): Provides the ability to attach additional 3600 Finance Communication System terminals. **Maximum:** Seven. **Field Installation:** Yes. **Prerequisite:** For each loop with any remotely attached terminals, a 1200 bps Loop Integrated Modem (#8001 or #8002) or a 3603 is required. **Limitation:** Only one loop (including the provided local loop) operating at 4800 bps, per 3602 is allowed unless SDLC Features (#4501 or #4502) are used.

Note: The sum of the speeds of all loops in bits per second (bps) plus the speed of the SDLC link (#6301 or #6302) in bps cannot exceed 12,000 bps. When SDLC Feature (#4501 or #4502) is installed only the sum of the loops cannot exceed 12,000 bps.

1200 bps Integrated Modem (#5500): An integrated modem for operation at 1200 bps over non-switched half-duplex or duplex voice grade lines for communication to the CPU through the 3704 or 3705...or to an appropriately featured S/3 Model 15 communications adapter— see 5415 RPQ S40156. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** SDLC Communications Feature with Clocking (#6301 or #4501). **Limitation:** Cannot be installed with EIA Interface (#3701).

Communications Features: Each 3602 must be equipped with one of the following SDLC features and either the EIA Interface (#3701) or the 1200 bps Integrated Modem (#5500) for communication with the host processor.

SDLC Communications Feature with Business Machine Clocking (#4501): Required for attachment to communication lines through the 1200 bps Integrated Modem (#5500) or any external modem which does not have internal clocking. The SDLC link speed of this feature need not be included when calculating the sum of the loop speeds not to exceed the controller aggregate baud rate of 12,000 bps. **Maximum:** One. **Limitation:** Cannot be installed with #6301, 6302 or 4502. **Field Installation:** Yes.

SDLC Communications Feature without Business Machine Clocking (#4502): Required for attachment to communication

lines through an external modem which does have internal clocking at speeds up to 9600 bps. The SDLC link speed of this feature need not be included when calculating the sum of the loop speeds not to exceed the controller aggregate baud rate of 12,000 bps. **Maximum:** One. **Limitation:** Cannot be installed with #6301, 6302 or 4501. **Field Installation:** Yes. **Prerequisite:** EIA Interface (#3701).

SDLC Communications Feature with Business Machine Clocking (#6301): Required for attachment to communication lines through the 1200 bps Integrated Modem (#5500) or any external modem which does not have internal clocking, or for local attachment to the 3704/3705. **Maximum:** One. **Limitation:** Cannot be installed with #6302, 4501 or 4502. **Field Installation:** Yes.

SDLC Communications Feature without Business Machine Clocking (#6302): Required for attachment to communication lines through an external modem which does have internal clocking at speeds up to 4800 bps. **Maximum:** One. **Limitation:** Cannot be installed with #6301, 4501 or 4502. **Field Installation:** Yes. **Prerequisite:** EIA Interface (#3701).

Storage Expansion Feature (#6501): Provides capability of expanding user programmable storage beyond 56K bytes. **Maximum:** One. **Field Installation:** Yes. This feature (#6501) is required when more than two additional Storage Features (#1006 with specify #9592) are ordered.

1200 bps Loop Integrated Modem (#8001): An integrated modem for transmission to remotely located 3600 Finance Communication System terminals. Operates at 1200 bps over non-switched normal quality voice grade lines. *Note:* Several remote loop configuration variations can be realized; e.g., see the *IBM 3600 FCS Configurator*, GA27-2762. However, facilities are always point-to-point circuits; either 2-wire half-duplex or 4-wire duplex. The common carrier does not tariff 3600 "remote loops." The customer should be referred to the configurator or information in the M2700 pages for definition of the tariffed elements of the remote loop. **Maximum:** One per Additional Loop Feature (#4735). **Field Installation:** Yes. **Prerequisite:** Additional Loop Feature (#4735). Each remote location must have either a 3604 Keyboard Display Model 2, 3 or 4 equipped with a 1200 bps Loop Integrated Modem (#8001 or #8002), a 3614 Consumer Transaction Facility with a 1200 bps Loop Integrated Modem (#8001), or a 3603 as the first attached remote unit in each physical (geographic) location.

Accessories: See Accessories at end of Machine Type 3601.

Attachment Factor Functions

Data Sequencing: Allows user applications to sequence, in storage, a block of data items or to collate, in storage, data items from two separate blocks into a third block, according to a parameter list.

Set Diskette: Allows user applications to reset the temporary files, to specify the type of start-up (i.e., warm or cold) to be performed on the next load, and/or to initiate a load of the controller.

Instruction Enhancements: Provides the user application with the following new instructions:

Bit Manipulating—Test and Branch (LIFON, LIFOFF): Provide a test, set and branch function in a single instruction. This reduces the 3600 AP processing and memory requirements when processing single bits.

Logical Compare Data Immediate (CCDI): Compares immediate data to data in a specified field.



Move Data Immediate (MVDI): Moves immediate data to a specified field.

Load Data Immediate (LDDI): Loads immediate data into specified register.

SCALE Formats an input string of characters into a conveniently processable numerical format. When used in processing monetary input, functions such as the removal of the monetary symbol, commas, and periods from the input data are automatically done. In the event that cents were not in the input data, zero padding is optionally provided. SCALE should significantly reduce the number of instructions required to process monetary input.

Segment Indexing (SETX, TESTX, SETXREG): Provides an alternate method of referencing data within a segment. Only fixed operands of 3600 instruction may be indexed. This function can be used to reduce the number of SETFPL instructions executed by the AP, thereby enhancing performance and reducing AP size. This function also provides a pseudo DSECT facility, thereby enabling an AP to more readily reference (1) variably displaced data within segments and/or (2) data beyond 4K bytes from the beginning of a segment.

Branch on Index (BRANX): Provides an index increment, compare and branch function in a single instruction. This instruction is used to control the number of times a series of AP instructions will be executed. Since the instruction algebraically increments a register, BRANX can be used in conjunction with the Segment Indexing facility to simplify the processing of tables.

Execute (LEXEC): Provides a function similar to the S/370 EXECUTE instruction. The amount of data logically OR'ed into the target instruction may be 2, 4, or 6 bytes.

Priority Dispatching: Provides the ability to specify the order in which 3601/3602 workstations are dispatched. This function consists of the LCHAP instruction which activates or deactivates the dispatching priority specified in the table(s) generated by the PRIDSP macro.

Translate: The LTRT instruction processes an input data stream against user specifiable translate table(s) to generate a translated output data stream. The LTRTBEG, LTRTENT and LTRTGEN instructions assist the user application programmer in specifying the translate table(s).



3603 TERMINAL ATTACHMENT UNIT

Purpose: Attaches all 3600 System Controllers and terminals to the communication facilities. The 3603 enables remote subloop operation by connecting the controller loop feature to the communication facilities which connect to a remote 3603 with the subloop of terminals.

Model 1 Provides 1200 bps integrated circuitry for attachment to communication facilities and has switched network backup capability for use if the non-switched communication line fails.

Model 2 Provides an EIA RS232C interface to an external asynchronous modem (1200, 2400 bps).

Model Changes: Available at time of manufacture only.

Highlights: Can be physically installed on a wall ... has self test facilities to establish valid operation of the 3603 on a local loop exclusive of the non-switched network.

PREREQUISITES:

The 3603 mdl 2 with Clocking (#6352) requires a synchronous modem that accepts transmit signal element timing from the 3600 System equipment.

A 3601 or 3602 with an Additional Loop Feature (#4735) is required for each remote loop that is attached with a 3603.

As an alternate to a 3603, a 1200 BPS Loop Integrated Modem (#8001) in the 3601 or 3602 may be used. (#8001) in the 3601 or 3602 may be used.

Note: The loop is unidirectional. Therefore, if there is only one 3603 attached, there must be a four-wire duplex communication channel interconnecting the 3601/3602 and the 3603. If there is more than one 3603 location attached to a single loop, there must be a two-wire line linking all the 3603s in the loop, plus a two-wire line from the 3601/3602 to the first 3603 and from the last 3603 to the 3601/3602. The 3603 attaches to normal quality voice grade lines. When using a 3603 on a loop it is recommended that a 3603 be used at the 3601/3602 to maximize backup capabilities.

Bibliography: IBM Financial Services Terminals: Complementing the *IBM 3600 Finance Communication System*, GC27-0002.

Customer Responsibilities: The customer must be advised that: [1] He is responsible to make certain that the use of the equipment complies with all Federal, State, and Local Laws, Regulations, and Ordinances...[2] He is responsible for price quotations, installation and cost (initial and recurring) of common carrier equipment and service...[3] He is responsible for set up of the unit...[4] The customer will determine the failing unit (see "Maintenance" below)...[5] He is responsible to determine required spares...[6] Purchaser agrees that IBM is relieved of responsibility for all claims including, but not limited to, loss of funds contained in, dispensed by or associated with the 3603.

The customer is also responsible for the provision of a telephone local loop conditioned for data above 300 bps, and for a CDT Data Access Arrangement in order to use the Switched Network Backup Function. A cable is available from IBM for a fee, for the DAA attachment. A similar cable is available, also for a fee, to connect the 3603 to the non-switched line connector. Installation of the cable is also a customer responsibility.

The *IBM 3600 Finance Communication System Installation Manual—Physical Planning* GA27-2766, and the *IBM 3600 Finance Communication System Financial Services*

Terminal—Terminal Installation Guide GA27-2796, should be ordered for each customer installation.

Spares: The customer may wish to replace a failing 3603 with a spare and must be advised to purchase sufficient spare unit for such use. The number of spare units recommended is dependent upon the number of units the customer has installed, his applications requirements, physical locations, and layouts. However, the minimum number of spare units recommended is shown in the following table:

Number of 3603s installed	Minimum Number of Spares Recommended	
	Model 1	Model 2
100	23	
200	34	
300	46	
500	68	
1000	1014	
1500	1419	
2000	1724	
2500	2028	
3000	2333	
3500	2738	
4000	3042	
4500	3347	
5000	3651	

Maintenance: Maintenance of the 3603 will normally be at a designated IBM Repair Center. All maintenance, parts replacement, adjustments, and repair shall normally be performed at the designated IBM Repair Center. It shall be the customer's responsibility to set up the equipment and to determine when remedial maintenance is required. When remedial maintenance is required, it shall be the customer's responsibility to determine the failing unit, pack the unit in the designated shipping container and ship it prepaid to the designated IBM Repair Center. IBM will pay the transportation charges for return of the repaired unit. There is no regularly scheduled preventive maintenance recommended by IBM on these units.

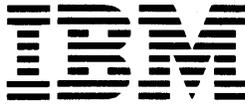
The repair service is available under an IBM Repair Center Maintenance Supplement to the IBM Maintenance Agreement or on a time and material basis.

Customers with machines not under an IBM Maintenance Agreement have the option to ship the machines to the designated IBM Repair Center for repair under the IBM Machine Repair Authorization Form, G120-2165, in which case repair will be made (if the machine is repairable). Alternatively, upon request, IBM will provide, for a minimum charge, an estimate of repair charges. This charge covers handling, inspection, cleaning, adjustments, testing, and estimating of repair charges.

IBM Repair Center Service: The 3603 is eligible for maintenance coverage immediately following expiration of the service and parts warranty at the monthly charge shown under MMMC in Price List.

If maintenance coverage is not contracted for immediately following expiration of any service and parts warranty and the customer now wants maintenance coverage, he may ship the machine(s) to the designated IBM Repair Center for an inspection.

If, on the basis of an inspection, the repair center concludes that a machine is not repairable, no further work will be performed and the machine will be returned to the customer without charge.



In all other cases, a minimum charge per machine to cover handling, inspection, cleaning, adjustments, and testing will be applied. In addition, all parts needed will be billed at IBM's prevailing parts prices and the additional time required for repairs will be billed at IBM's applicable service rates. The machine will then be eligible for maintenance coverage.

Central Facility Maintenance: IBM will accept requests for special contracts for central facility maintenance (see General Information; section 9). Under this offering, service will be performed at a repair facility located on customer premises. The customer will continue to be required to determine the failing unit and to transport it to and from the facility.

SPECIAL FEATURES

CLOCKING (#6352). (Model 2 only) Provides Transmit Signal Element Timing to synchronous modems (1200, 2400 bps).
Field Installation: Not recommended.

SPECIFY:

(1) Voltage (115 V AC, 1-phase, 60 Hz): #9901.

(2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.

Accessories: See Accessories at the end of Machine Type 3601.



3604 KEYBOARD DISPLAY Model 1

Purpose: A combination keyboard and gas-panel terminal for input and output in interactive banking applications.

The 3604 Model 1 displays 240 characters—six rows of 40 characters. May have numeric and function keys.

Model Changes: Available at time of manufacture only.

Highlights: The 3604 displays up to 153 different characters under programmed control of a 3601 or 3602 Finance Communication Controller.

Has a variety of keyboards to meet input requirements...see "Special Features."

Can be equipped to read a magnetic stripe on either a plastic card or a passbook and/or encode a magnetic stripe on a passbook.

May be either locally or remotely attached to the 3601 or 3602.

Prerequisites:

- (1) An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with 3614 since the 3614 will often be operating when the 3604 Model 2, 3 or 4 is not.
- (2) One keyboard type must be selected to complete the order...see "Keyboards" under "Special Features."

Bibliography: GC20-0370.

Specify:

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not recommended.
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories.
- (3) Numeric Engraving: For bottom row of engraved numeric keypad (from left to right)—#9481 for zero, double-zero, triple-zero, #9482 for zero, double-zero, decimal point; or #9483 for zero, triple-zero, decimal point. See "Special Features." **Field Installation:** Not recommended.
- (4) Function/Transaction Key Configuration: For the Function/Transaction keyboard to the right of the engraved numeric section—#9181 if all individual keys, or #9182 if 3 bottom keys in leftmost column are to be replaced by a single raised "Motorbar" key. See "Special Features." **Field Installation:** Not recommended.

Special Features

Keyboards: All keyboards will have a combination of pre-engraved and non-engraved keytops. Each 3604 will be provided with 3 sets of self-adhesive keytop labels. One set will be pre-printed with commonly-used function nomenclature and will have a protective plastic coating applied. Also, set of blank labels plus a set of clear plastic overlays for the blank labels will be provided so that the user may create his own labels.

Each keyboard will have an engraved numeric keyboard consisting of 15 keys arranged in three columns of five rows. The bottom row of this section will be engraved as specified...see item [3] under "Specify." The next three rows will be engraved with the digits 1 thru 9. The top row will contain three non-engraved function/transaction keys. All keyboards will also contain at least one function/transaction keypad consisting on non-engraved keys arranged in some number of columns which are 5 keys high.

Numeric Keyboard (#4661): A three-column function/ transaction keypad to the right of an engraved numeric keypad. See items [3] and [4] under "Specify." **Maximum:** One. **Limitation:** Cannot be installed with Keyboard (#4663). **Field Installation:** Not recommended.

Expanded Numeric Keyboard (#4663): Same as #4661 plus an additional three-column function/transaction keypad to the left of the engraved numeric keyboard. See items [3] and [4] under "Specify." **Maximum:** One. **Limitation:** Cannot be installed with Keyboard (#4661). **Field Installation:** Not recommended.

Magnetic Stripe Capability: The 3604 can be equipped with a Magnetic Stripe Reader or a Magnetic Stripe Encoder/Reader which mounts on top of the 3604. To use these features an operator manually passes a magnetic striped plastic identification card or credit card (for reading), or a passbook with a magnetic stripe label attached (for reading or encoding), through the slot. The 3604 encoding is a unique format at 210 bits per inch. Standard ABA encoding is at 75 bits per inch; therefore, credit cards cannot be encoded to ABA specifications, and this must be used as "read-only" documents. The 3604 is capable of reading either the standard ABA format or the 3604 passbook format.

Magnetic Stripe Reader (#4901): Has read capability only. **Maximum:** One. **Limitation:** Cannot be installed with Magnetic Stripe Encoder Reader (#4905). **Field Installation:** Yes.

Magnetic Stripe Encoder-Reader (#4905): Has encode and read capability. **Maximum:** One. **Limitation:** Cannot be installed with Magnetic Stripe Reader (#4901). **Field Installation:** Yes. **Prerequisite:** Depending upon the configuration, the Additional Storage Feature (#1005 or #1006) may be required on the 3601 or 3602...see M3601 or M3602 pages.

Note: Effective July 1, 1977, orders for the 3604 Model 1 will be accepted by IBM on a purchase only basis.

Accessories: See Accessories at the end of Machine Type 3601.

**3604 KEYBOARD DISPLAY Models 2, 3 and 4**

Purpose: A combination keyboard and gas-panel display terminal, for input and output in interactive banking applications, with a variety of screen sizes.

Model 2 Displays 240 characters—six rows of 40 characters. May have alphanumeric, numeric and function keys. May have an integrated modem.

Model 3 Displays 480 characters—12 rows of 40 characters. May have numeric, alphanumeric and function keys. May have an integrated modem.

Model 4 Displays 1024 characters—16 rows of 64 characters. May have numeric, alphanumeric and function keys. May have an integrated modem.

Model Changes: Available at time of manufacture only.

Highlights: The 3604 displays up to 153 different characters under programmed control of a 3601 or 3602 Finance Communication Controller.

Has a variety of keyboards to meet input requirements...see "Special Features."

Can be equipped to read a magnetic stripe on either a plastic card or a passbook and/or encode a magnetic stripe on a passbook.

May be either locally or remotely attached to a 3601 or 3602.

Prerequisites:

(1) An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and a 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 Model 2, 3 or 4 is not.

(2) One keyboard type must be selected to complete the order...see "Keyboards" under "Special Features."

Bibliography: GC20-0370.

Specify:

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not recommended.
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.
- (3) Numeric Engraving: For bottom row of engraved numeric keypad (from left to right)—#9481 for zero, double-zero, triple-zero; #9482 for zero, double-zero, decimal point; or #9483 for zero, triple-zero, decimal point. See "Special Features."

tures." **Field Installation:** Not recommended.

- (4) Function/Transaction Key Configuration: For the Function/Transaction keyboard to the right of the engraved numeric section—#9181 if all individual keys, or #9182 if 3 bottom keys in leftmost column are to be replaced by a single raised "Motorbar" key. See "Special Features." **Field Installation:** Not recommended. *Note:* Motorbar key is available on Numeric Keyboard (#4771), Expanded Numeric Keyboard (#4773), or Expanded Alphanumeric Keyboard (#4774). It is not available with Alphanumeric Keyboard (#4772), therefore no Specify Feature if #4772 is selected.

Special Features

Keyboards: All keyboards will have a combination of pre-engraved and non-engraved keytops. Each 3604 will be provided with 3 sets of self-adhesive keytop labels. One set will be preprinted with commonly-used function nomenclature and will have a protective plastic coating applied. Also, set a blank label will be provided so that the user may create his own labels.

Each keyboard will have an engraved numeric keypad consisting of 15 keys arranged in three columns of five rows. The bottom row of this section will be engraved as specified...see item [3] under "Specify." The next three rows will be engraved with the digits 1 through 9. The top row will contain three non-engraved function/transaction keys. All keyboards will also contain at least one function/transaction keypad consisting on non-engraved keys arranged in some number of columns which are 5 keys high.

Numeric Keyboard (#4771): A three-column function/transaction keypad to the right of an engraved numeric keypad. See items [3] and [4] under "Specify." **Maximum:** One on Model 2, 3 or 4. **Limitation:** Cannot be installed with Keyboard (#4772, 4773, 4774). **Field Installation:** Not recommended.

Alphanumeric Keyboard (#4772): An alphanumeric section pre-engraved as a typewriter keyboard to the left on an engraved numeric keyboard plus a one-column function/transaction keypad to the right of the engraved numeric keypad. See item [3] under "Specify." **Maximum:** One on Model 2, 3 or 4. **Limitation:** Cannot be installed with Keyboard (#4771, 4773, 3774). **Field Installation:** Not recommended.

Expanded Numeric Keyboard (#4773): Same as #4771 plus an additional three-column function/transaction keypad to the left of the engraved numeric keypad. See items [3] and [4] under "Specify." **Maximum:** One on Model 2, 3 or 4. **Limitation:** Cannot be installed with Keyboard (#4771, 4772, 4774). **Field Installation:** Not recommended.

Expanded Alphanumeric Keyboard (#4774): Same as #4772 except that function/transaction keyboard is five columns wide. See items [3] and [4] under "Specify." **Maximum:** One on Model 2, 3 or 4. **Limitation:** Cannot be installed with Keyboard (#4771, 4772, 4773). **Field Installation:** Not recommended.

Magnetic Stripe Capability: The 3604 can be equipped with a Magnetic Stripe Reader or a Magnetic Stripe Encoder/Reader which mounts on top of the 3604. To use these features, an operator manually passes a magnetic striped plastic identification card or credit card (for reading), or a passbook with a magnetic stripe label attached (for reading or encoding), through a slot. The 3604 encoding is a unique format at 210 bits per inch. Standard ABA encoding is at 75 bits per inch; therefore, credit cards cannot be encoded to ABA specifications, and thus must be used as "read-only" documents. The 3604 is capable of reading either the standard ABA format or the 3604 passbook



format.

Magnetic Stripe Reader (#4902): Has read capability only. **Maximum:** One on Model 2, 3 or 4. **Limitation:** Cannot be installed with Magnetic Stripe Encoder-Reader (#4906). **Field Installation:** Yes.

Magnetic Stripe Encoder-Reader (#4906): Has encode and read capability. **Maximum:** One on Model 2, 3 or 4. **Limitation:** Cannot be installed with Magnetic Stripe Reader (#4902). **Field Installation:** Yes. **Prerequisite:** Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601, or 3602...see M3601 or M3602 pages.

Modems [Models 2, 3 and 4]: One modem is required at each location which has 3600 Finance Communication System terminals remotely attached to the 3601 or 3602 Finance Communication Controller. The following features provide the required capability in the 3604 Keyboard Display Model 2, 3 or 4.

Line Feature Base (#4752): Required to operate the 1200 bps Loop Integrated Modem (#8002) below. **Maximum:** One on Model 2, 3 or 4. **Limitation:** Only with #8002. **Field Installation:** Yes.

1200 bps Loop Integrated Modem (#8002): An integrated modem for communications with a remotely located 3601 or 3602 Finance Communication Controller. Operates at 1200 bps over unconditioned voice-grade lines. **Maximum:** One on Model 2, 3 or 4. **Limitation:** Not required if a 3614 at the same location has a 1200 bps integrated modem. **Field Installation:** Yes. **Prerequisites:** Line Feature Base (#4752) on the 3604, and a 1200 bps Loop Integrated Modem (#8001) on an Additional Loop Feature (#4735) on the 3601...see 3601 or 3602 for further details.

Accessories: See Accessories at the end of Machine Type 3601.

3604 KEYBOARD DISPLAY—MODELS 5 and 6

Purpose: A combination keyboard and gas-panel display terminal for input and output in interactive banking applications.

Model 5: Displays 120 characters—3 rows of 40 characters. Included with the keyboard display is a 45-key keyboard, the keys of which may be designated by the customer to represent any numeric, alphabetic, or special character, or to represent a preprogrammed function.

Model 6: Displays 240 characters—6 rows of 40 characters. The same 45-key keyboard is available as described above on the model 5.

Highlights: The 3604 Keyboard Display Model 5 displays characters using a 5 x 7 dot matrix. The 3604 Model 6 displays characters using a 7 x 9 dot matrix.

A 45-key keyboard is standard. Can be equipped to read a magnetic stripe on either a plastic card or a passbook. Can be equipped with an audible alarm which is activated under program control. Dimensions are: 9.75 in. (247.67 mm) high x 18.0 in. (457.2) wide x 7.5 in. (190.5 mm) deep. May be either locally or remotely (see Prerequisites) attached to the 3601 or 3602.

Keyboard: The 45-key keyboard contains 3 clusters of 15 keys. The layout of each cluster is a matrix of 5 rows, with three keys in each row. The keyboard includes a blank overlay which may be designated with any notation the customer desires. A second overlay identifies the 10 numeric keys in a blue field, which may be placed in any of the 3 15-key clusters the customer desires. Covering these overlays is a clear plastic, protective overlay. Additional overlays and clear protective overlays are also available. See Accessories at the end of Machine Type 3601.

Indicator Lights: Five indicator lights are provided, three of which can be lighted under program control.

Prerequisites: An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 mdls 2, 3 or 4 is not.

Bibliography: GC27-0370

Specify:

(1) Voltage (AC, 1-phase, 115 V, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not recommended.

(2) Cables: See *3600 Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.



Model Changes: Model 5 to Model 6—Not recommended for field installation. All other model changes—at time of manufacture only.

Special Features

Audible Alarm (#1050): The 3604 Model 5 or 6 can be equipped with an audible alarm which can be enabled or disabled under program control. The audible alarm can be programmed to work with any of the programmable indicator lights. **Maximum:** One. **Field Installation:** Yes.

Magnetic Stripe Capability: The 3604 Model 5 or 6 can be equipped with a Magnetic Stripe Reader which is located in front of the display panel, to the left of the keyboard keys or with a Magnetic Stripe Encoder-Reader attached by a 30 inch cable. To use these features, an operator manually passes a magnetic striped plastic identification card or credit card (for reading), or a passbook with a magnetic stripe label attached (for reading or encoding), through a slot. The 3604 encoding is in a unique format at 210 bits per inch. Standard ABA encoding is at 75 bits per inch.; therefore, credit cards cannot be encoded to ABA specifications; and thus must be used as "read-only" documents. The 3604 is capable of reading either the standard ABA format or the 3604 passbook format.

Magnetic Stripe Encoder-Reader (#1501): Has encode and read capability. **Maximum:** One on the Model 5 or 6. **Limitation:** Cannot be installed with Magnetic Stripe Reader (#4903). **Field Installation:** Yes. **Prerequisite:** Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601 or the 3602 ... see 3601 or 3602.

Magnetic Stripe Reader (#4903): Has read capability only. **Maximum:** One on the Model 5 or 6. **Limitation:** Cannot be installed with Magnetic Stripe Encoder-Reader (#1501). **Field Installation:** Yes.

Accessories: See Accessories at the end of Machine Type 3601.



3606 FINANCIAL SERVICES TERMINAL

Purpose: A keyboard display terminal for use with the 3600 Finance Communication System in point of sale or other applications.

Model 1: Attaches to the 3601 or 3602 Finance Communication Controller local or remote loop. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 mdl 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem.

Model 2: Attaches to the 3601 or 3602 Finance Communication Controller remote loop.

Model Changes: Available at time of manufacture only.

Highlights: Has 8 position numeric display, 9 message indicators, a numeric keyboard, 6 function keys and a magnetic stripe reader capable of reading either standard ABA format (75 bpi) or the 3604 passbook format (210 bpi).

- Used as an interactive terminal in point of sale and other applications (credit authorization, data capture, check verification, funds transfers).

PREREQUISITES:

Model 1: If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 mdl 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and a 3604 mdl 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 mdl 2, 3 and 4 is not.

Model 2: Common carrier termination at location of installation.

Bibliography: IBM Financial Services Terminals. Complementing the IBM 3600 Finance Communication System, GC27-0002.

Customer Responsibilities: The customer must be advised that: (1) He is responsible to make certain that the use of the equipment complies with all Federal, State, and Local Laws, Regulations, and Ordinances...(2) He is responsible for price quotations, installation and cost (initial and recurrent) of common carrier equipment and service...(3) He is responsible for the installation of the unit...(4) The customer will determine the failing unit (see "Maintenance" below)...(5) He is responsible to determine required spares...(6) Purchaser agrees that IBM is relieved of responsibility for all claims including, but not limited to, loss of funds contained in, dispensed by or associated with the 3606.

Spares: The customer may wish to replace a failing 3606 with a spare and must be advised to purchase sufficient spare units for such use. The number of spare units recommended is dependent upon the number of units the customer has installed, his application requirements, physical locations, and layouts. However, the minimum number of spare units recommended is shown in the following table:

Number of 3606s Installed	Minimum Number of Spares Recommended	
	Model 1	Model 2
100	2	2
200	3	4
300	4	5
500	5	6
1000	8	10
1500	11	14
2000	14	18
2500	16	21
3000	19	25
3500	21	28
4000	24	31
4500	26	34
5000	29	37

Maintenance: All maintenance of the 3606 parts replacement, adjustments, and repair shall normally be performed at the designated IBM Repair Center. It shall be the customer's responsibility to install the equipment and to determine when remedial maintenance is required. When remedial maintenance is required, it shall be the customer's responsibility to determine the failing unit, pack the unit in the designated shipping container and ship it prepaid to the designated IBM Repair Center. IBM will pay the transportation charges for return of the repaired unit. There is no regularly scheduled preventive maintenance recommended by IBM on these units.

The repair service is available under an IBM Repair Center Maintenance Supplement to the IBM Maintenance Agreement or on a time and material basis.

Customers with machines not under an IBM Maintenance Agreement have the option to ship the machines to the designated IBM Repair Center for repair under the IBM Machine Repair Authorization Form, G120-2165, in which case the repair will be made (if the machine is repairable). Alternatively, upon request, IBM will provide, for a minimum charge, an estimate of repair charges. This charge covers handling, inspection, cleaning, adjustments, testing, and estimating of repair charges.

IBM Repair Center Services: The 3606 is eligible for maintenance coverage immediately following expiration of the service and parts warranty at the monthly charge shown under MMMC in the Price List.

If maintenance coverage is not contracted for immediately following expiration of any service and parts warranty and the customer now wants maintenance coverage, he may ship the machine(s) to the designated IBM Repair Center for an inspection.

If on the basis of an inspection, the repair center concludes that a machine is not repairable, no further work will be performed and the machine will be returned to the customer without charge.

In other cases, a minimum charge per machine to cover handling, inspection, cleaning, adjustments, and testing will be applied. In addition, all parts needed will be billed at IBM's prevailing parts prices and the additional time required for repairs will be billed at IBM'S applicable service rates. The machine will then be eligible for maintenance coverage.



Specify:

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9901.
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.
- (3) Terminals are shipped with standard keyboard and indicator light nomenclature. See *Financial Services Terminals Complimenting Manual*, GC27-0002. The customer may choose the nomenclature to suit an application. Bank keyboard overlays and filters are available for a fee. See Accessories at the end of Machine Type 3601.
- (4) Keyboard Arrangement: Specify #9390 for a reverse or calculation formatted keyboard (top row—7, 8, 9; middle row—4, 5, 6; bottom row—1, 2, 3). **Field Installation:** Not recommended.

Accessories: See Accessories at the end of Machine Type 3601.



3608 PRINTING FINANCIAL SERVICES TERMINAL

Purpose: A keyboard display terminal, with printer, for use with the 3600 Finance Communication System in point of sale or other applications.

Model 1: Attaches to the 3601 or 3602 Finance Communication Controller local or remote loop. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem.

Model 2: Attaches to the 3601 or 3602 Finance Communication Controller remote loop.

Model Changes: Available at time of manufacture only.

Highlights:

- Can print three lines of alphanumeric data on sales slips, charge receipts, or other documents used in point of sale applications. Line positions must be specified...see "Specify."
- Has 45 character set. Optional 10 character numeric OCR 7B font for uppermost print row is available as a special feature...see "Special Features."
- Document to be printed is inserted into the chute at the right of the terminal, is fed past spring wheels, printed, and ejected at the left side of the terminal.
- Has 8 position numeric display, 9 message indicators, a numeric keyboard, 6 function keys, and a magnetic stripe reader, capable of reading either standard ABA format (75 bpi) or the 3604 passbook format (210 bpi).
- Used as interactive terminal in point of sale applications (e.g., credit authorization, check verification, funds transfers).
- Used as interactive terminal in point of sale applications (e.g., credit authorization, check verification, funds transfer(s)).

Model 1—If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and a 3604 model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 model 2, 3 or 4 is not.

Model 2: Common carrier termination at location of installation.

Bibliography: IBM Financial Services Terminals: Complementing the *IBM 3600 Finance Communication System*, GC27-0002...*IBM Forms Design Reference Guide for Printers*, GA24-3488.

Customer Responsibilities: The customer must be advised that: (1) He is responsible to make certain that the use of the equipment complies with all Federal, State, and Local Laws, Regulations, and Ordinances...(2) He is responsible for price quotations, installation and cost (initial and recurrent) of common carrier equipment and service...(3) He is responsible for the installation of the unit...(4) The customer will determine the failing unit (see "Maintenance" below)...(5) He is responsible to determine required spares...(6) Purchaser agrees that IBM is relieved of responsibility for all claims including, but not limited

to, loss of funds contained in, dispensed by or associated with the 3608.

Spares: The customer may wish to replace a failing 3608 with a spare and must be advised to purchase sufficient spare units for such use. The number of spare units recommended is dependent upon the number of units the customer has installed, his application requirements, physical locations, and layouts. However, the minimum number of spare units recommended is shown in the following table:

Number of 3606s Installed	Minimum Number of Spares Recommended	
	Model 1	Model 2
100	5	5
200	8	9
300	11	12
500	16	17
1000	27	30
1500	38	43
2000	49	55
2500	59	67
3000	70	78
3500	80	90
4000	90	102
4500	100	113
5000	110	124

Maintenance: All maintenance of the 3608 parts replacement, adjustments, and repair shall normally be performed at the designated IBM Repair Center. It shall be the customer's responsibility to install the equipment and to determine when remedial maintenance is required. When remedial maintenance is required, it shall be the customer's responsibility to determine the failing unit, pack the unit in the designated shipping container and ship it prepaid to the designated IBM Repair Center. IBM will pay the transportation charges for return of the repaired unit. There is no regularly scheduled preventive maintenance recommended by IBM on these units.

The repair service is available under an IBM Repair Center Maintenance Supplement to the IBM Maintenance Agreement or on a time and material basis.

Customers with machines not under an IBM Maintenance Agreement have the option to ship the machines to the designated IBM Repair Center for repair under the IBM Machine Repair Authorization Form, G120-2165, in which case repair will be made (if the machine is repairable). Alternatively, upon request, IBM will provide, for a minimum charge, an estimate of repair charges. This charge covers handling, inspection, cleaning, adjustments, testing, and estimating of repair charges.

IBM Repair Center Services: The 3608 is eligible for maintenance coverage immediately following expiration of the service and parts warranty at the monthly charge shown under MMHC in "Price List."

If maintenance coverage is not contracted for immediately following expiration of any service and parts warranty and the customer now wants maintenance coverage, he may ship the machine(s) to the designated IBM Repair Center for an inspection.

If on the basis of an inspection, the repair center concludes that a machine is not repairable, no further work will be performed and the machine will be returned to the customer without charge.



In all other cases, a minimum charge per machine to cover handling, inspection, cleaning, adjustments, and testing will be applied. In addition, all parts needed will be billed at IBM's prevailing parts prices and the additional time required for repairs will be billed at IBM'S applicable service rates. The machine will then be eligible for maintenance coverage.

Forms Characteristics: Printing is possible on single part forms of the following dimensions: From 2.75" (69.9 mm) up to 3.25" (82.6 mm) high by 5.8" (147.3 mm) to 8.5" (215.9 mm) wide by .004" (0.10 mm) to .011" (0.28 mm) thick. In addition, the following dimensions apply to multi-part charge forms: 3.25" (82.6 mm) high by 4.8" (121.9 mm) to 8.5" (215.9 mm) wide by .007" (0.18 mm) to .017" (0.43 mm) thick. Refer to the *IBM Forms Design Reference Guide for Printers, GA24-3488* for additional information. OCR 7B (not inked) printing is intended for two (2) and three (3) part charge forms. Due to variations in card, paper, and carbon stock, the customer should evaluate his printed forms to determine if they meet his performance objectives.

Character Sets:

OCR is 0-9

10-pitch is 0-9, A-Z, and special characters number sign (#), at sign (@), comma (,), minus (-), dollar (\$), period (.), ampersand (&), slash (/), and percent sign (%).

Specify:

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9901.
- (2) Cables: See Accessories at the end of Machine Type 3601 for ordering instructions. Also see *Installation Manual—Physical Planning, GA27-2766*.
- (3) Terminals are shipped with standard keyboard and indicator light nomenclature. See *Financial Services Terminals Complementing Manual, GC27-0002*. The customer may choose the nomenclature to suit an application. Bank keyboard overlays and filters are available for a fee. (See Accessories at the end of Machine Type 3601.)
- (4) Print Line Positions [at time of manufacture only]: The following are standard combinations...see Line Position Chart.
 - #9540 for 1, 4, 10
 - #9541 for 1, 5, 10
 - #9542 for 1, 3, 6
 - #9543 for 1, 7, 10
 - #9544 for 4, 7, 10

(5) Keyboard Arrangement: Specify #9390 for a reverse or calculation formatted keyboard (top row—7, 8, 9; middle row—4, 5, 6; bottom row— 1, 2, 3). **Field Installation:** Not recommended.

Line Position Chart

Line Pos.	Font	Nominal Center Line Location, distance from bottom edge of document	Note
OCR	OCR 7B	3.031" (77.0 mm) (.219" [5.56 mm] from top edge of 3.35" [85.1 mm] document)	Available as Special Feat (#5454) only
1	10-pitch	3.031" (77.0 mm)	Not with #5
2	10-pitch	2.831" (71.9 mm)	Not with #5
3	10-pitch	2.631" (66.8 mm)	
4	10-pitch	2.431" (61.7 mm)	
5	10-pitch	2.231" (56.7 mm)	
6	10-pitch	2.031" (51.6 mm)	
7	10-pitch	1.831" (46.5 mm)	
8	10-pitch	1.631" (41.4 mm)	
9	10-pitch	1.431" (36.3 mm)	
10	10-pitch	1.231" (31.3 mm)	
11	10-pitch	1.031" (26.2 mm)	Only with #5
12	10-pitch	0.831" (21.1 mm)	Only with #5

If a customer desires three print lines positioned in locations other than the five feature combinations shown, an RPQ may be submitted at order time. RPQs to change print line positions or to add the OCR print feature will not be accepted after manufacture and shipment to the customer.

Special Features

OCR 7B Font (#5454): The 10-character OCR 7B font can be substituted for the standard font in the uppermost print row. The 3 print line positions, when this feature is installed, are OCR, 3 and 5. The OCR 7B characters impact printed when #5454 is used can be read on a 1287 Optical Character Reader equipped with the OCR 7B special feature (#3945). **Field Installation:** Available at time of manufacture only.

Accessories: See Accessories at the end of Machine Type 3601.



3610 DOCUMENT PRINTER—MODEL 3

Purpose: A printer for use with the 3600 Finance Communications System to provide a hard-copy output of banking transactions.

Model 3: Prints on a cut form and on continuous fanfold paper.

Model Changes: Available at time of manufacture only.

Highlights: The 3610 printer provides for a hard-copy output on a variety of cut forms and paper stock to meet the customer's printing requirement in banking applications. When combined with a 3604 Keyboard Display, the 3610 provides a bank teller with a work station to use in performing bank transactions. The 3610 printer can also be used alone for administrative printing of required reports. A document-handling device provides the capability to print on cut forms. The forms can be those usually used for printing of one line or a number of lines. When a single line document is used, a lever is provided to engage a document stop which positions the center line of the printed line $13/16'' \pm 1/16''$ (20.6 ± 1.6 mm) from the bottom of the document. The lever is disengaged when the teller wishes to insert the document further into the printer. Printing occurs at 10 characters/inch and 5 or 6 lines/inch. At time of installation, the CE will set line spacing at 5 LPI or 6 LPI as requested by the customer. Speeds range from 15 cps to 30 cps...see "Special Features."

Model 3—contains a pin feed platen assembly which allows printing to occur on continuous fanfold paper stock. A cut form can be placed in front of the continuous form so that printing can occur simultaneously on both documents with the appropriate carbon or impact paper.

Prerequisites:

- (1) An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 Model 2, 3 or 4 is not.
- (2) Selection of print speed...see "Special Features."
- (3) Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601, or 3602...see M 3601 or M 3602 pages.

Forms Specification: Refer to Form Design Reference Guide for Printers, GA24-3488.

Bibliography: GC20-0370

Specify:

- (1) Voltage (115-V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not Recommended.
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.

Special Features

Shared Terminal (#6350): Provides two pushbuttons each labeled, START PRINT. These pushbuttons provide teller identification to the 3601 or 3602 Finance Communication Controller when two tellers are sharing one printer. **Maximum:** One. **Field Installation:** Yes.

15 CPS with 64 Character Set (#6903): Provides a 64 character set consisting of 63 printable graphics and space (blank). **Maximum:** One. **Limitation:** Cannot be installed with #6904. **Field Installation:** Available at time of manufacture only.

Up to 30 CPS with 96 Character Set (#6904): Provides a 96 character set consisting of 95 printable graphics and space (blank). **Field Installation:** Available at time of manufacture only. **Maximum:** One. **Limitation:** Cannot be installed with #6903.

* Either #6903 or #6904 must be selected to complete the machine order.

Accessories: See Accessories at the end of Machine Type 3601.

**3610 DOCUMENT PRINTER—MODEL 4**

Purpose: A printer for use with the 3600 Finance Communications System to provide a hard-copy output of banking transactions. The 3610 Model 4 prints on a cut form and on a journal roll/audit roll.

Model Changes: Available at time of manufacture only.

Highlights: The 3610 Document Printer Model 4 provides a hard-copy output on a variety of cut forms and paper stock to meet the customer's printing requirements in banking applications. In addition, the 3610 Model 4 has the capability of printing single or multiple lines as well as being able to print on a one or two part journal roll. When a single line document is used, a lever is provided to engage a document stop which positions the center of the printed line $.812 \pm .062$ in. (20.625 ± 1.575 mm) from the bottom of the document. A cut form can be positioned in front of the journal roll so that printing can occur simultaneously on the cut form and journal roll, provided that appropriate carbon or impact paper is used.

Printing occurs at 10 characters per inch, and 5 or 6 lines per inch. At time of installation the customer engineer will set the line spacing at 5 or 6 lines per inch as requested by the customer. The 3610 Model 4 prints at speeds up to 30 characters/sec. Forms control capabilities include a right-hand forms-advance knob, and a forms tear bar located, $2.625 \pm .25$ in. (66.675 ± 6.35 mm) above the print line. When one part of the journal paper is attached to the take-up roll, the forms-advance knob may be used to advance the paper. Otherwise, the paper must be advanced manually.

The size of the 3610 Model 4 is 10.5 in. (266.7 mm) high x 18.0 in. (457.2 mm) wide x 10.5 in. (266.7 mm) deep. When used with the 3604 Keyboard Display Model 5 or 6 it provides a teller with a work station which fits within a work area with dimensions 10.5 in. (266.7 mm) high x 18.0 in. (457.2 mm) wide x 18.0 in. (457.2 mm) deep.

Journal Take-up with Locked Cover: Provides a journal take-up roll for accumulating one part of a two-part journal after it is printed. (The other part of the journal exits from the printer past a tear bar.) A locked cover is also provided to prevent unauthorized access to the take-up roll. Two keys are provided for the lock. When a single-part journal is used, it should exit the printer past the tear bar. The journal take-up roll can accommodate up to a maximum of 50 feet (15.24 m) of paper.

48 Character Set: Provides a 48 character set consisting of 47 printable graphics and space (blank).

Prerequisites: (1) an available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and a 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614, since the 3614 will often be operating when the 3604 Model 2, 3 or 4 is not... (2) Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601/3602...see 3601/3602.

Bibliography: GC20-0370

Forms Specifications: Refer to *Form Design Reference Guide for Printers*, GA24-3488.

Specify:

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not recommended
- (2) Cables: See *3600 Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.

Special Features

Shared Terminal (#6350): Provides two pushbuttons for teller identification to the 3601/3602 Finance Communication Controller when two tellers are sharing one printer. **Maximum:** One. **Limitation:** Cannot be installed with the Address Sharing RPO (MG 1586). **Field Installation:** Yes.

**3611 PASSBOOK PRINTER**

Purpose: A printer used in the 3600 Finance Communications System to print on horizontal fold or vertical fold passbooks or on single or multiple part cut forms.

Model 2: Prints on passbooks and cut forms.

Highlights: The 3611 printer provides the capability of printing on a variety of passbooks and forms to meet customer's requirements in banking applications.

The 3611 is a physically compact unit with a flat top suited for placement of a 3604 Keyboard display. When combined with a 3604, the 3611 provides a high function work station in a limited amount of space.

Passbook specifications for both models are the same as for the 3612 passbook printers. Passbook and forms printing occurs at 12 characters/inch and may be at 5 or 6 lines/inch, with up to an 8.3 inch (211 mm) print line of 100 characters.

Model 2—prints on a horizontal fold or vertical fold passbook. Variable size, single or multipart documents can be printed in the passbook chute. The size of document which can be accommodated is determined by the width of the passbook to which the passbook chute is adjusted. The maximum document width is equal to 1/2 the passbook width plus 4.35" (110 mm).

Prerequisites:

- (1) An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 Model 2, 3 or 4 is not.
- (2) Selection of print speed...see "Special Features."
- (3) Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601, or the 3602...see M 3601 or 3602 pages.

Forms Specifications: Refer to *Form Design Reference Guide for Printers*, GA24-3488.

Bibliography: GC20-0370.

Specify

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not Recommended
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.
- (3) Short Page Passbooks: #9650—provides a passbook stop position for passbooks with short pages, cutouts, notches or windows. Optional stop position required when the distance between the edge of the short pages, cutouts, notches or windows and the leading edge of the passbook cover is between .360" (9.14 mm) and .657" (16.7 mm). **Field Installable:** Not recommended.

Special Features

Shared Terminal (#6350): Provides two pushbuttons, labelled START PRINT. These pushbuttons provide teller identification to the 3601 or 3602 Finance Communication Controller when two tellers are sharing one printer. **Maximum:** One. **Field Installation:** Yes.

***15 CPS with 64 Character Set (#6903):** Provides a 64 character set consisting of 63 printable graphics and space (blank). **Maximum:** One. **Limitation:** Cannot be installed with #6904. **Field Installation:** Available at time of manufacture only.

***Up to 30 CPS with 96 Character Set (#6904):** Provides a 96 character set consisting of 95 printable graphics and space (blank). **Maximum:** One. **Limitation:** Cannot be installed with #6903. **Field Installation:** Available at time of manufacture only.

* Either #6903 or #6904 must be selected to complete the machine order.

Accessories: See Accessories at the end of Machine Type 3601.



3612 PASSBOOK AND DOCUMENT PRINTER

Purpose: A printer used in the 3600 Finance Communication System to print on a variety of forms, documents, and passbooks.

Model 2: Prints on a horizontal-fold or vertical-fold passbook, on a cut form, and on a journal/audit roll.

Model 3: Prints on a horizontal-fold or vertical-fold passbook, on a cut form, and on continuous fanfold paper.

Model Changes: Available at time of manufacture only.

Highlights: The 3612 printer provides the capability of printing on a variety of forms and passbooks to meet the customer's requirements in banking applications. This printer, when combined with a 3604 Keyboard Display, provides a full-function work station for handling the wide range of banking transactions through the incorporation of two independent print mechanisms. A document-handling device provides the capability to print on cut forms. The forms can be those usually used for printing of one line or a number of lines. When a single-line document is used, a lever is provided to engage a document stop which positions the center line of the printed line $13/16 \pm 1/16$ inch (20.6 ± 1.6 mm) from the bottom of the document. The lever is disengaged when the customer wishes to insert the document further into the printer. Passbooks are inserted in the bottom half of the printer while cut forms/documents may be inserted in the top half. With this facility, the printer is able to print on the passbook and print on the cut forms. Forms printing occurs at 10 characters per inch and 5 or 6 lines per inch. A maximum of 80 characters may be printed across an 8 inch (200 mm) line. The capability to print a single line on a document that is inserted in the cut form chute is provided. Passbook printing occurs at 12 characters per inch and 5 or 6 lines per inch with up to an 8.3 inch (211 mm) print line of 100 characters. At time of installation, the Engineer will set line spacing to 5 LPI or 6 LPI as requested by the customer. *Note:* Only one print element (either passbook or cut form) prints at a time. Both must be selected with the same print speed.

Model 2: Prints on a passbook and has the capability of printing on a one-part or two-part journal roll, which can be used to maintain an audit trail of bank transactions. A cut form can be positioned in front of the journal so that printing can occur simultaneously on the cut form and journal roll, provided that appropriate carbon or impact paper is used.

Model 3: Prints on a passbook and contains a pin feed platen assembly that allows printing to occur on continuous fanfold paper stock. A cut form can be placed in front of the continuous form so that printing can occur simultaneously on both documents with the appropriate carbon or impact paper. *Note:* Passbook unit (as opposed to forms printing unit) is 12 pitch with an 8.3 inch (211 mm) print line of 100 characters for all models.

Prerequisites:

(1) An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem with the 3614 since the 3614 will often be operating when the 3604 Model 2, 3 or is not.

(2) Selection of print speed...see "Special Features."

(3) Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601, or the 3602...see M 3601 or M 3602 pages.

Forms Specifications: Refer to *Form Design Reference Guide for Printers*, GA24-3488.

Bibliography: GC20-9370.

Specify

(1) Voltage (115 V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installation:** Not recommended

(2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.

(3) Short Page Passbooks: #9650 Provides a passbook stop position for passbooks with short pages, cutouts, notches, or windows. Optional stop position required when the distance between the edge of short pages, etc., and the leading edge of the passbook cover is between .360 inches (9.14 mm) and .657 inches (16.7 mm). **Field Installation:** Not recommended

Special Features

Journal Takeup with Locked Cover (#4652): [Mdl 2 only] Provides a paper roll on which one or both parts of the printed journal can be taken up after it has been printed. If two-part journal paper is used, one part may be put on the takeup roll, while the original can exit past a tear bar. A locked cover is also provided over the takeup roll to prevent unauthorized access to the journal roll. Two keys are provided. **Maximum:** One. **Field Installation:** Yes.

Shared Terminal (#6350): Provides two pushbuttons, labelled start print. These pushbuttons provide teller identification to the 3601 or 3602 Finance Communication Controller when two tellers are sharing one printer. **Maximum:** One. **Field Installation:** Yes.

***15 CPS with 64 Character Set (#6903):** Provides a 64 character set consisting of 63 printable graphics and space (blank). **Maximum:** One. **Limitation:** Cannot be installed with #6904. **Field Installation:** Available at time of manufacture only.

***Up to 30 CPS with 96 Character Set (#6904):** Provides a 96 character set consisting of 95 printable graphics and space (blank). **Maximum:** One. **Limitation:** Cannot be installed with #6903. **Field Installation:** Available at time of manufacture only.

* Either #6903 or #6904 must be selected to complete the machine order. The selected speed applies to both print units, passbook and forms.

Accessories: See Accessories at the end of Machine Type 3601.

**3614 CONSUMER TRANSACTION FACILITY**

Purpose: An unattended self-service banking terminal that issues variable amounts of money, accepts deposits, performs other transactions, and attaches to a 3601 or 3602 Finance Communication Controller or directly to a S/370 Processor via a 3704/3705 Communications Controller...see 3704/3705.

Model 1: Consumer Transaction Facility, Lobby. Designed for use inside a building. Consists of the basic unit with a protective covers, a protective front panel, and a bezel around the front panel. The protective cover contains provision for customer insertion of two keylock cylinders.

Model 2: Consumer Transactions Facility, Through the Wall. Designed for use through the wall of a building. Has a motorized protective door over the keyboard/guidance area for outdoor environmental protection. Can be attached to a heavy duty enclosure, through-the-wall bezel, and mounted on a 4," 7" or 10" high mounting stand. The heavy duty enclosure contains a combination lock and provision for customer insertion of bank examiner's type keylock for locking the combination dial.

Model 11: Same as Model 1 with a capability of issuing two denominations during one transaction. Can also be loaded with a single denomination, doubling the bill capacity currently available in the 3614 Model 1.

Model 12: Same as Model 2 with a capability of issuing two denominations during one transaction. Also can be loaded with a single denomination, doubling the bill capacity currently available in the 3614 Model 2.

Model Changes: Available at time of manufacture only.

Highlights:

Issues Cash: Withdrawal transaction issues single (Model 1 or 2) or dual denominations (Model 11 or 12) up to a maximum of 20 bills from a single account. Withdrawal is from a choice of four accounts.

Accepts Deposits: Deposit transaction and depository with controlled access slot allows users to deposit to checking or savings accounts.

Accepts Payments: Allows user to make various payments by depositing cash or check. User may also deposit payment coupon and have financial institution deduct funds from his account.

Cash Check: A single transaction that allows cash to be issued to user following deposit of a check drawn on another institution.

Additional Transactions: The 3614 provides a general purpose special transaction, an account inquiry transaction, and a funds transfer transaction.

Transaction Chaining: A series of multiple transactions can be performed with a single insertion of magnetic stripe card and single keyed entry of personal identification number.

Issues Statements: Can print and issue a statement or message to user.

Journaling: Transaction documents can be printed and retained in the 3614, as an aid in machine balancing.

3704/3705 Attachment: Can attach via communications link directly to a 3704 or 3705 Communications Controller.

Keyboard/Guidance: Guidance display steps user through a transaction. Customer can specify messages to be displayed.

Encrypt/Decrypt Feature: Encryption/decryption of sensitive data during communication line transmission. Provision for one of two encryption algorithms: the proposed U. S. Federal Information Processing Data Encryption Standard (DES) or the original 3614 Alternate Encryption Technique (AET). See "Specify".

Multi-Institution Usage: Provision to accept magnetic stripe cards for 50 different card issuer identifiers with Data Encryption Standard (DES) technique.

Off-Host Operation: Offline operation via a 3601 or 3602 controller possible.

Customizing Capability: Customer can customize terminal operation (within limits) and change guidance messages.

Identification: The user is identified through the reading of his ABA-standard magnetic stripe card. As a second check, the user is verified by a comparison of a keyed personal identification number.

Installation: Can be installed for use inside the building or through-the-wall for outside use.

Bill Issue: Issues bills directly. No packets or cartridges are used.

Heavy Duty Enclosure: A strong steel protective enclosure to protect bills...available for purchase on Model 2 or 12.

Logo Panel: The 3614 logo panel is a purchase-only accessory. It provides an area on the top half of the front of the 3614 for personalization by the customer (silk screen, painting, etc.). An area is provided for name, logo, and advertising purposes. A logo panel is required with all models of the 3614. Lack of a logo panel detracts from the appearance of the 3614.

Prerequisites:

(1) Each 3614 must have loop attachment to a 3601/3602, or SDLC attachment to S/370 via a 3704/3705.

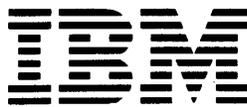
For Attachment to a 3601/3602 there must be an available position on a local loop or remote loop of 3601/3602. The 3614 must have Terminal Loop Feature (#7820) ... if located remotely from the 3601/3602 the remote location must have a 3614 with Loop Integrated Modem (#8001), a 3604 mdl 2, 3 or 4 with Line Feature Base (#4751 or 4752) and appropriate modem, or a 3603 Terminal Attachment Unit. If a 3603 is at the remote location, the 3614 does not require Loop Integrated Modem (#8001). If both a 3614 and a 3604 mdl 2, 3 or 4 are installed in the same remote location without a 3603, it is recommended that the loop modem be located with the 3614 since the 3614 might often be operating when the 3604 is not, e.g., weekends, holidays.

For Attachment to a S/370 with virtual storage capability via a 3704/3705 Communications Controller equipped with appropriate features, see 3704 and 3705. The 3614 must have SDLC Communications Feature With Clocking (#6301) or SDLC Communications Feature Without Clocking (#6302).

(2) Depending upon the configuration, the Additional Storage Feature #1006 may be required on the 3601, or the 3602 ... see 3601 or 3602.

(3) Logo Panel (#9401 or #9402) ... see "Specify." Purchase Only.

(4) The 3614 mdl 2 and 12 require Model 2/12 Accessory Group #9571 ... see "Specify." Purchase Only.



Bibliography: GC20-0370

Specify:

- (1) Voltage, (AC, 1-phase, 60 Hz): #9901 for 115V.
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.
- (3) Currency Denomination: #9091 for \$5, \$10, \$20.
- (4) Keyboard: Specify one of the following. All are field installable.

Specify Number		Transaction Type						From Account To Account				
All Models . . . w/o Change Key	Models 11/12 Only with Change Key	Withdrawal	Special Balance	Transfer	Deposit	Payment Enclosed	Payment from Account	Cash Check	Checking	Savings	Credit Card	Other
		(3)			(2)	(2)	(2)	(2)				
#9351	#9451	(1)							(1)			
9352	9452	(1)							0	0	0	
9353	9453	0	0						0	0	0	
9354	9454	0	0						0	0	0	0
9355	9455	0	0	0					0	0	0	0
9356	9456	0	0	0					0	0	0	0
9357	9457	0	0	0	0	0			0	0	0	0
9358	9458	0	0	0	0	0	0		0	0	0	0
9359	9459	0	0	0	0				0	0	0	0
9360	9460	0	0	0	0				(1)			
9361	9461	0	0	0					(1)			
9362	9462	0	0	0	0	0	0	0	0	0	0	0
9363	9463	0	0	0	0			0	0	0	0	0
9364	9464	0	0	0	0			0	(1)			

(x) Does not have any transaction select or "from Account" keys. *Note 1:* Two currency denominations must be specified.

(5) Logo Panel [Purchase Only]: See 3614 Accessories at the end of 3614 Pages.

(6) Model 2/12 Accessory Group [Purchase Only]: #9571. See Accessories at the end of 3614 pages. See 3614 Accessories at the end of 3614 Pages.

(7) 3614 Host Attachment Designation: 1st and 2nd position designation is required to control distribution of 3614 controller-data media to host system location.

1st Position Designator -- identifies first 3614 of each different Controller Data Version attached to a host system ... used to limit distribution of controller-data media to one copy of each version per host system location.

2nd Position Designator -- identifies additional 3614s of each version ... controller-data media is not distributed to host system location for 2nd position designated 3614s.

The following matrix identifies individual Controller Data Versions and their corresponding 1st and 2nd position specify codes. **Limitations:** Each 3614 must have either 1st or 2nd position specified ... one 1st position must be specified for each version ... only one 1st position may be specified for each version.

Specify either	Host	Encryption
1st or 2nd Pos	Attachment:	Technique
Code below:	Loop-3601/2	DES (#9001)
1st 2nd Version	Direct-SDLC	AET (#9002)

#9701#97023	Loop	Alternate
#9703#97043	Direct	Alternate
#9801#98025	Loop	DES
#9803#98045	Direct	DES

When 1st position (#9701, 9703, 9801 or 9803) is specified, also specify one of the following to indicate magnetic tape density (media) used at the host system location:

- #9412 9-track 800 bpi
- #9413 9-track 1600 bpi
- #9414 9-track 6250 bpi

If magnetic tape is not used at the host system location, select one of the following media: (DOS/VS users only)

- #9431 80 column cards
- #9432 90 column cards

When #9701, 9703, 9801 or 9803 is specified, additional information is required.

Supplemental Spec are to be entered exactly as follows to indicate shipping address of host system location:

- Line 1 IBM PROGRAMMING SUPPORT REPRESENTATIVE (PSR)
- Line 2 C/O (Name of Customer)
- Line 3 Street Address (or P.O. Box)
- Line 4 (etc.) City, State, Zip

(8) Specify one of the following:

DES: #9001 -- provides the data encryption technique (DES) proposed as a U.S. Federal Information Processing Data Processing Standard by the U.S. National Bureau of Standards. DES facilitates multi-institution usage by providing for personal identification number (PIN) validation based on individual user PIN encryption keys for 50 different card issuer identifiers ... PIN offset value may be recorded on magnetic stripe to be used to validate PINs in 3614 which were not based originally on DES technique ... accepts 4 to 16 digit fixed or variable length PINs ... option to load PIN encryption keys via communication line from host. **Field Installation:** Yes. **Limitation:** Cannot be specified if #9002 is specified.

AET: #9002 -- provides the Alternate Encryption Technique (AET) which is the original 3614 encryption technique. **Limitation:** May not be specified if #9001 is specified.

Prerequisite: DES and/or AET encryption capability required on the 3601 or 3602 and in host system ... see 3601 and 3602 in "Machines." DES and AET are used to determine 3614 Host 1st and 2nd Position Host Attachment designation ... see item (7) above.



Customer Responsibilities: Because the 3614 Model 2 and 12 is attached to a customer premise, installation of cables, mounting stand and enclosure and bezel are a customer responsibility. The customer is also responsible for site preparation, such as cutting a hole in the wall for mounting of the 3614 Model 2 or 12. Installation of cables and site preparation is also customer responsibility for the 3614 Model 1 and 11. IBM is not responsible for any loss of money incurred through the use of the 3614.

Sub host operation under control of the 3601 or 3602 Finance Communication Controller requires special customer systems design and support. Maintenance of system integrity in the sub host mode is a customer responsibility.

IBM is not responsible for intentional damage to the 3614 mdl 1, 2, 11 or 12. Repair of such damage is not covered under the IBM Rental Agreement or Maintenance Contract. Repair of such damage at cost of time and materials will be made to rental machines and can be provided for purchased machines.

Customer Responsibilities—Currency Sorting: The general condition of used currency may vary. To achieve satisfactory operation, the customer must ensure that only **good quality** used currency is loaded into the 3614. Used or recirculated currency must be inspected to remove excessively worn, damaged or torn notes. The 3614 Operator's Guide GA66-0001 contains procedures for preparation of new currencies and inspection of used currencies for loading the 3614. For the 3614 Model 11 and 12 the customer must ensure that each hopper is loaded with the proper denomination currency.

Special Features

Depository (#3322): Provides a controlled access slot in the front of the 3614 leading to an internal deposit receptacle for the collection deposit documents. In addition to the controlled access slot, the chute is designed to discourage tampering with previously inserted deposits. **Field Installation:** Yes. **Prerequisite:** One of the following keyboards—#9357, #9358, #9360, #9457, #9458, or #9460.

EIA Interface (#3701): Provides an interface for external modems. **Limitation:** Not available on Terminal Loop Feature (#7820). **Field Installation:** Yes. **Prerequisite:** SDLC Communication Feature.

EXPANDED FUNCTION FEATURE (#3895). Provides the options of transaction chaining, journal printing, and cash check transactions. **Field Installation:** Yes ... any of the individual functions may be field installed. **Prerequisite:** DES (specify code #9001). **Limitation:** May not be ordered with specify code #9002. Equivalent capability is available via RPQ MG3758 for customers ordering 3614s with specify code #9002. **Specify:** Any combination of the following functions may be specified with #3895. Specify at least one:

(1) **Transaction Chaining (#9721)** -- allows a series of multiple transactions with single insertion of magnetic stripe card and single keyed entry of PIN.

(2) **Journal Printing (#9722)** -- print statement documents and retain in 3614 ... can be used as an aid in machine

balancing and settlements. **Prerequisite:** Transaction Statement Printer (#7900).

(3) **Cash Check (#9723)** -- in single transaction, cash is issued to user following deposit of check drawn on other institution. **Prerequisites:** Depository (#3322) and one of the following keyboards ... #9362, #9363, #9364, #9462, #9463, or #9464.

IBM 1200 bps Integrated Modem (#5500): Provides an integrated 1200 bps modem for use with leased voice grade line...see M 2700 pages. This modem is for a point-to-point or tributary SDLC station. **Specify:** #9651 for 4-wire strapping, or #9652 for 2-wire strapping. **Field Installation:** Yes. **Prerequisite:** SDLC Communication Feature with Clocking (#6301).

SDLC Communications Feature with Clocking (#6301): Provides communications capability to communicate with the same S/370 models listed below for #6302. Required for attachment to communication lines through the IBM 1200 bps Integrated Modem (#5500) or any external modem which does not have internal clocking. **Limitations:** Cannot be installed with Terminal Loop Feature (#7820) or SDLC Communications Feature without Clocking (#6302). **Field Installation:** Yes. **Transmission:** This feature operates over common carrier provided or equivalent customer owned communication facilities. For information concerning these facilities, see M 2700 pages.

SDLC Communications Feature without Clocking (#6302): Provides communications capability to communicate with S/370 Processor except 3115 via a 3704/3705...see 3704, 3705. Required for attachment to communications lines through an external modem which does have internal clocking. **Limitations:** Cannot be installed with Terminal Loop Feature (#7820) or SDLC Communications Feature with Clocking (#6301). **Field Installation:** Yes. **Prerequisite:** EIA interface(#3701). **Transmission:** This feature operates over common carrier provided or equivalent customer owned facilities. For information concerning these facilities, see M 2700 pages. **Modems:** External modems operating at up to 4800 bps may be attached...IBM 3872 Modem...IBM 3874 Modem.

TERMINAL LOOP FEATURE (#7820). Provides the capability to attach either to a local or remote 3601/3602 Finance Communication Controller loop directly; or to a remote 3601/3602 loop via a 3603 or 3604 mdl 2, 3 or 4. **Prerequisites:** (1) Available positions on the loop ... (2) Depending on the configuration, the Additional Storage Feature (#1005 or #1006) may be required on the 3601/3602. See M3601 or M3602 pages ... (3) Attachment to remote 3601/3602 loop directly requires a 1200 BPS Loop Integrated Modem (#8001). **Specify:** If loop attachment is without Loop Integrated Modem (#8001), specify one of the following loop speeds: (1) For local loop attachment to 3601/3602, specify local loop speed: #9062 for 1200 bps, #9063 for 2400 bps, or #9064 for 4800 bps ... (a) For remote loop attachment via a 3603 or 3604 mdl 2, 3 or 4, specify loop speed; #9062 for 1200 bps. **Limitations:** (1) Cannot be ordered with SDLC Communications with Clocking (#6301) or SDLC Communications without Clocking (#3602) ... (2) Remote loop speed is 1200 bps. **Maximum:** One. **Field Installation:** Yes.

Transaction Statement Printer (#7900): Prints a statement showing the record of the transaction and passes the printed statement to the customer through the cash issue slot. Data is printed on 96-column card stock (2-5/8" by 3-1/4"). A 57 character set is provided consisting of 56 printable graphics and a space (blank). Four lines one character per line, are printed simultaneously, for up to 34 characters per line...a total of 136



characters on each statement. The data to be printed is determined by the host application program and by the data stored in the 3614. Printing is overlapped with the cash issue cycle and the user deposit cycle. **Prerequisites:** If a statement is to be issued for any transaction on a given keyboard, then the Transaction Statement is required. **Card Limitations:** The 96-column card stock used in the transaction statement printer must not have the optional 60 degree corner cuts.

1200 bps Loop Integrated Modem (#8001): Provides an integrated 1200 bps modem for use over normal quality voice grade lines. **Limitation:** If a 3604 Model 2, 3 or 4 and a 3614 are located at the same remote loop location, it is recommended that the loop modem be located on the 3614 because the 3614 will often be operating when the 3604 is not; e.g., weekends. **Field Installation:** Yes. **Prerequisite:** Terminal Loop Feature (#7820).

3614 ACCESSORIES

3614 LOGO PANEL #9401 or #9402

A purchase only accessory for either a 3614 mdl 1, 2, 11 or 12. The personalization panel provides an area on the top half of the front of the 3614 that can be personalized by the customer (silk-screened, painted, etc.). The area is provided for customer name and/or advertising purposes.

Logo Panel	Feature
If #9401 is specified, logo panel will be shipped with	3614
	#9401

3614 MODEL 2 ACCESSORY GROUP

(Purchase Only) The 3614 Model 2/12 Accessory Group consists of a heavy duty enclosure, a through the wall bezel and a mounting stand.

Heavy Duty Enclosure: Provides a strong steel enclosure for the through-the-wall configuration. This enclosure has a rear access door with a resettable combination lock and a provision for a keylock. The combination for the combination lock is set by the customer. The customer must provide the actual keylock and the key. **Limitation:** For 3614 mdl 2 or 12 only.

Through the Wall Bezel: Provides a frame around the through-the-wall portion of the 3614 mdl 2 or 12 and provides a case-ment for the hole in the wall.

Mounting Stand: Provides a support stand for the 3614 mdl 2 or 12 that comes in three different heights. **Specify:** Height—#9572 for 4', #9573 for 7', or #9574 for 10'.

	Feature
3614 Model 2/12 Accessory Group	#9571

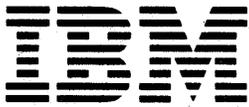
Note: These items are provided as accessories to the 3614 mdl 2 or 12 to facilitate installation of the 3614 mdl 2 or 12 through-the-wall. Installation, checkout, and maintenance of these items will not be provided by IBM. All responsibility and expenses involved must be borne by the customer.

Warranty for 3614 Model 2/12 Accessory Group: For 90 days commencing on the date of installation or 30 days after shipment, whichever comes first, these accessories are warranted from defects in materials and workmanship. IBM's obligation is limited to providing replacement parts on an exchange basis.

Delivery Instructions: Supplemental Specs for the Accessory Group must be submitted at least 90 days prior to the 3614 DP Friday schedule date. Due to installation requirements, the Accessory Group will generally be shipped three weeks prior to the 3614. Supplemental Specs (via Terminal Entry) are to be entered exactly as follows to indicate shipping destination of these items:

- Line 1 — c/o (Name of Customer)
- Line 2 — Customer Designated Delivery Point
(Note special considerations described below)
- Line 3 — Street Address
- Line 4 (etc.) — City, State, Zip

The "Heavy Duty Enclosure" included in this Accessory Group is, in effect, a steel safe with dimensions of approximately 43" x 28" x 63" and weighing approximately 2800 pounds. It does not have casters and will be transported on a skid. The item will be shipped via common carrier to the delivery point designated by the customer and will probably require special handling or rigging at destination. The customer should be advised that it is suggested this item be delivered directly to a local drayman that has the facilities to move an item of these dimensions and weight. The customer should then make local provisions to have the Accessory Group delivered for physical installation at the selected site.

**3618 ADMINISTRATIVE LINE PRINTER**

Purpose: A medium-speed line printer for use in the 3600 Finance Communication System.

Highlights: Provides the capability to print on continuous fan-fold paper up to 80 print positions on an 8 inch (200 mm) print line. The unit has a pin feed mechanism. It accepts paper widths of 3.5 inches (89 mm) to 9 inches (229 mm) pin hole center to center. Paper up to 14.875 inches (378 mm) can be handled with Expanded Print Line (#3860)...see "Special Features." Paper up to six parts plus carbon [maximum total thickness is .02 inches (5 mm)] can be accommodated. A form jam detection capability is provided. Print speeds are dependent upon the number of characters printed per line, loop speed, and available slot position on the loop.

Character Set	Nominal Print Speed
48	155 lpm
64	120 lpm
96	80 lpm

Prerequisites:

- (1) An available position on a local or remote loop of a 3601 or 3602. If located remotely from the 3601 or 3602, the remote location must have either a 3603 Terminal Attachment Unit, a 3614 Consumer Transaction Facility equipped with a Terminal Loop Feature (#7820) and an appropriate modem, or a 3604 Model 2, 3 or 4 equipped with a Line Feature Base (#4751 or #4752) and appropriate modem. If both a 3614 and 3604 Model 2, 3 or 4 are installed in the same remote location, it is recommended that the loop modem be located with the 3614 since the 3614 will often be operating when the 3604 Model 2, 3 or 4 is not.
- (2) Depending upon the configuration, the Additional Storage Feature (#1006) may be required on the 3601 or the 3602...see M 3601 or M 3602 pages.

Forms Specifications: Refer to *Form Design Reference Guide for Printers*, GA24-3488.

Bibliography: GC20-0370

Specify:

- (1) Voltage (115 V AC, 1-phase, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug. **Field Installable:** Not recommended
- (2) Cables: See *Installation Manual—Physical Planning*, GA27-2766. Also see Accessories at the end of Machine Type 3601.
- (3) Character Set Size: #9071 for 48 characters, #9072 for 64, or #9073 for 96. A space (blank) character is included in each character set, resulting in 47, 63, or 95 printable graphics.

Accessories: See Accessories at the end of Machine Type 3601.

Dual Independent Form Feed (#3550): Provides two independently indexed pin feed mechanisms. Different sizes of forms can be handled in each paper feed. **Maximum:** One. **Field Installation:** Not recommended.

Expanded Print Line (#3860): Expands the print line to 132 print positions on a .13.2 inch (33.5 cm) line. **Maximum:** One. **Field Installation:** Not recommended.



3624 CONSUMER TRANSACTION FACILITY

Purpose: An unattended self-service banking terminal that issues variable amounts of money, accepts deposits, and performs other financial transactions ... other documents such as traveler's checks may be dispensed if they complete a document issue qualification test successfully ... attaches to a 3601 or 3602 Finance Communication Controller via loop, or to a virtual storage S/370 Processor through a 3704 or 3705 Communications Controller.

Model 1 Lobby—Single Document Feed Mechanism. For use inside a building in a secure attended location. The basic model includes a single cartridge feed station, card reader, user guidance keyboard and display unit and is suitable for counter-top or free-standing mounting ... includes covers and front trim paneling ... covers contain locking handle, with a standard key, and provision for customer insertion of an additional keylock cylinder. A backlighted logo panel, required for installation of a lobby model, is available as a purchase accessory. A pedestal is available as a purchase accessory to mount the basic lobby model. A pedestal base is included as part of the depository special feature when the depository is added to the basic model.

Model 2 Through the Wall—Single Document Feed Mechanism. For outdoor, vestibule, drive-up, and otherwise less secure, unattended locations to provide availability on a 24-hour basis. The basic model includes a single cartridge feed station, card reader, user guidance keyboard and display unit, and has provision for mounting the currency dispensing and depository mechanisms inside a heavy-duty security enclosure. Covers are provided for the components not contained within the heavy-duty enclosure. A heavy-duty enclosure, pedestal base for mounting the enclosure, through-the-wall bezel, front trim paneling, and logo panel, for through-the-wall installation, are available as purchase accessories.

Model 11 Same as the model 1, but with dual document feed mechanism. Provides capability to issue the same or two different denominations in a single transaction; to load the same denomination in both dispensers, effectively doubling the bill capacity of a single denomination 3624 model 1; or to issue currency and other documents as separate transactions (e.g., cash and traveler's checks).

Model 12 Same as the model 2, but with dual document feed mechanism. Provides capability to issue the same or two different denominations in a single transaction; to load the same denomination in both dispensers, effectively doubling the bill capacity of a single denomination 3624 model 2; or to issue currency and other documents as separate transactions (e.g., cash and traveler's checks).

Model Changes: Available at time of manufacture only.

Highlights:

Cartridge Loading: Currency cartridge provides for quick, easy loading and convenient, tamper-resistant transportation of the currency.

Issues Cash: Issues one denomination (mdls 1 and 2), or two denominations (mdls 11 and 12) up to a maximum of 20 bills from a choice of accounts. Issues all bills at one time in a single stack ... no prepackaging or packets are used.

Individual Document-Feed Control: Allows each cartridge drive station on the dual-feed models 11 and 12 to be associated with a separate transaction select key (e.g., cash and traveler's checks).

Accepts Deposits: Allows user to make a deposit to choice of

accounts. Built-in depository envelope holder available as an accessory on mdls 2 and 12. Envelope holder included with depository on mdls 1 and 11.

Cash-Check: A single transaction that allows cash to be issued to user, following deposit of a check.

Accepts Payments: Allows user to make various payments by depositing cash or check or by having funds deducted from user's account.

Depository Envelope Printer: A special feature which prints unit and sequence number on envelope as it is deposited.

Additional Transactions: Provides account balance inquiry, funds transfer transaction, and special transactions.

Keyboard/Guidance: Comprehensive set of function keys and customized display messages step a user through a transaction ... keyboard and transaction functions can be modified through programming. Option for either numeric or alphanumeric keypad.

Transaction Chaining: Allows user to perform a series of transactions with a single insertion of the magnetic stripe card.

Transaction Statements: Can print and issue individual statements or messages to user. Issues one statement per transaction in a series of chained transactions.

Journaling: Can print and retain documents within the 3624.

Backlighted Logo: Backlighted logo panel that can be customized, extending across full width of the front panel.

Host/Subhost Attachment: Attaches to the System/3 Model 15 host processor through a subhost 3601/3602 via BSC.

Encrypt/Decrypt: Encryption of sensitive data for communication line transmission ... uses the U.S. Federal Information Processing Data Encryption Standard (DES) algorithm.

Multi-Institution Usage: Provision to accept magnetic stripe cards of many different card issuers. Base capacity of issuer identifier table within the 3624 can be expanded by table overflow request message to host or with Additional Storage Feature (#1301) ... "Special Features."

Personal Identification: User account is identified through reading magnetic stripe card. To validate the identity of the person using the card, a personal identification number (PIN) is used ... validation of PIN (up to 16 digits) may be performed in the 3624 and/or host/subhost support system.

Installation Configurations: Can be installed inside a building, for lobby use; or through-the-wall of a building, for walk-up or drive-up use.

Multiple Languages: Capability to display different languages based on identifier code recorded on magnetic stripe card.

Third Track: A special feature provides reading and writing third track data recorded on magnetic stripe card ... see "Special Features."

Additional Storage: Special feature(s) provide additional memory for expanding the number of custom messages and Financial Institution Table entries ... see "Special Features."

Modular Packaging: For model 2 or 12 through-the-wall installation, currency dispenser and depository mechanisms are contained in a heavy-duty enclosure independent of other functional modules.

Compatibility: 3614 family compatibility, designed to minimize transition requirements.



Security: Models 2 and 12 installed with heavy-duty enclosure and through-the-wall installation accessories meet security requirements of UL291 and comply with the intent of U.S. Federal Regulation P for unattended automated paying and receiving machines used when banking offices are closed.

Installation Units and Accessories: Heavy-duty enclosure, through-the-wall bezel, optional pedestal base, front dress panel and front trim border are required for installation of through-the-wall models 2 and 12 ... these are available as purchase only accessories, see "Accessories."

Walk-up Configuration: Recessed through-the-wall bezel, designed to provide a shelf surface for the user, is recommended for walk-up use.

Drive-up Configuration: Non-recessed through-the-wall bezel, designed to position the user area nearer the outer wall surface, is recommended for drive-up use.

A pedestal for mounting lobby models 1 and 11 is available as an optional purchase only accessory ... see "Accessories."

A logo panel and cartridges are required for installation of all models and are available as purchase accessories ... see "Accessories."

Prerequisites

1) Each 3624 must be loop attached to a 3601/3602 for attachment to a System/3 Model 15.

For Loop Attachment to a 3601/3602: There must be an available position on a local or remote loop of the 3601/3602. The 3624 must have Terminal Loop Feature (#7820). If located remotely from the 3601/3602, the 3624 can be attached to a remote loop via any of the following: 1) Directly, using the 1200 BPS Loop Integrated Modem (#8001) ... 2) Via a subloop through a 3603 Terminal Attachment Unit mdl 1 for 1200 bps or a 3603 mdl 2 for 1200 or 2400 bps ... 3) Via subloop through a 3604 Keyboard Display mdl 2, 3 or 4 equipped with Line Feature Base (#4751 or #4752) and an appropriate modem ... 4) Via a subloop through a 3614 equipped with Terminal Loop Feature (#7820) and 1200 BPS Loop Integrated Modem (#8001) ... 5) Via a subloop through another 3624 equipped with Terminal Loop Feature (#7820) and 1200 BPS Loop Integrated Modem (#8001). *Note:* The 3624 does not require #8001 if it is attached to a remote loop via a subloop through a 3603, 3604, 3614, 3624, or if the 3624 is attached to a local loop. It is recommended that the 3624 not be attached through a 3604, as the 3624 might often be operating while the 3604 is not, e.g., weekends and holidays.

For Direct Attachment to a Virtual Storage S/370 Processor: The S/370 requires a 3704/3705 Communications Controller equipped with appropriate features to communicate with the 3624 via SDLC ... see 3704 or 3705. The 3624 must have an SDLC Communications Feature (#6301 or #6302).

2) Encryption modules BQKDES and BQKPRS are required with 3600 Host Support Independent Release program ... see *Guide for Ordering Programs* for feature numbers used to order these modules on the 3600 Host Support IR. Source listings are not orderable for, nor supplied with, these modules. Customers should be informed of this fact before the 3624 is ordered.

3) Depending upon the configuration, Additional Storage Feature (#1005 or #1006) may be required on the 3601, or Additional Storage Feature (#1006) may be required on the 3602 ... see 3601 or 3602.

4) For 3624 mdls 1 and 11: Pedestal, Lobby (#5510) is available

as an option for free-standing lobby configuration without a depository feature ... see "Accessories." #5510 is purchase only. *Note:* A pedestal is included with the Depository, Lobby feature (#3233, #3234).

5) For 3624 mdls 2 and 12: The following units are required for through-the-wall installation: (1) Heavy-duty Enclosure, Single Function (#3901) or Dual Function (#3902). *Note:* Single function enclosure cannot be field modified to a dual function enclosure ... (2) Bezel, Through-the-Wall, Recessed or non-Recessed. Recessed Bezel (#1490) is recommended for walk-up configuration. Non-Recessed Bezel (#1491) is recommended for drive-up configuration ... (3) Front Dress Panel (#3851) ... (4) Front Trim Border, with Envelope Holder (#3961) or without Envelope Holder (#3962) ... (5) Pedestal for single function heavy duty enclosure (#4901) or dual function heavy duty enclosure (#4902) is optional for mounting heavy duty enclosure at appropriate height for walk-up or drive-up use. Storage Cabinet (#4903) is optional when mounting dual function heavy-duty enclosure without pedestal. *Note:* Storage cabinet is included with Pedestal (#4901 or #4902). See "Accessories" for descriptions and ordering information. These accessories are for purchase only.

6) **Logo Panel:** Required on all 3624 models. Shipment of the logo panel is determined by the following specify codes: (1) #9401 if panel is to be shipped with the 3624. (2) #9402 if panel(s) are to be shipped prior to the 3624. *Note:* Specify feature #9402 can be used to order more than one panel if the customer desires to have several panels delivered before the 3624 (e.g., for customization at one time). (3) #9403 if panel is not to be ordered with the 3624 as it will either be ordered separately by part number or ordered under specify code #9402 on another 3624 ... see "Specify" and "Accessories." Purchase only.

7) **Currency Cartridge:** For 3624 mdls 1 and 2: One is required. For 3624 mdls 11 and 12: Two are required. Currency cartridges are not included with the basic 3624 and must be ordered separately. Spare cartridges are recommended for convenience of operation. A minimum of one spare cartridge for mdls 1 and 2 and two spare cartridges for mdls 11 and 12 must be made available by the customer to the CE for normal 3624 maintenance ... see "Accessories." Purchase only. See "Customer Responsibilities - 3624 Currency Cartridge" for installation and maintenance requirements.

Customer Responsibilities

Installation Facilities: Because the 3624 mdl 2 or 12 attaches to customer premises, installation of cables, pedestal, heavy-duty enclosure, through-the-wall bezel, front dress panel, front trim border, and logo panel are customer responsibilities. The customer is also responsible for site preparation, such as cutting a hole in the wall. For mdls 2 and 12, the customer is responsible for placement of the document feed and depository modules into the heavy-duty enclosure and attachment of the I/O module to the heavy-duty enclosure. Installation of cables and site preparation are customer responsibilities also, for 3624 lobby mdls 1 and 11.

Machine Maintenance: IBM will not provide warranty or maintenance service on a 3624 containing money. The customer will be responsible for removing, controlling and reloading all money in the 3624 so that IBM can fulfill its warranty and maintenance obligations.

Keylocks: Covers included with lobby mdls 1 and 11 have a locking handle, with a standard key, and provide for customer insertion of an additional keylock cylinder. Covers included with through-the-wall mdls 2 and 12 have a keylock cylinder, with a



standard key. Cabinet doors, included in all pedestals, have a keylock cylinder with a standard key. Currency cartridges provide for customer insertion of a keylock. If the customer desires to change the locks and/or keys included with those units or to install additional keylock cylinders where provided for, he is responsible for their procurement and installation.

Accessories Maintenance: The customer is responsible for maintenance and parts procurement on all accessories. Repair of the currency issue and depository slot protective environmental gates in the heavy-duty enclosure can be provided by IBM on a time and material basis.

Currency Cartridge: The 3624 Currency Cartridge is a purchase only accessory and is not included with the basic 3624. One cartridge is necessary for mdl 1 and 2, and two for mdl 11 and 12 for installation checkout and operation of the 3624. Models 2 and 12 may also be operated with a single cartridge. Cartridges are not maintained by IBM under the normal lease agreement or MMMC for a purchased machine. The customer is responsible for determining if the cartridge is the failing unit; for providing cartridge for CE 3624 maintenance and testing (a minimum of one spare cartridge for mdl 1 and 2 and two for mdl 11 and 12 must be made available by the customer for normal 3624 maintenance); and for setting the keying system on the cartridges and drive stations so that there is the desired match of currency denomination to drive station ... see "Customer Responsibilities - 3624 Currency Cartridge" in Accessories for installation and maintenance requirements.

Currency Sorting: To achieve satisfactory operation, the customer must ensure that only new currency and good-quality used currency are used in the 3624. The general condition of used currency may vary. Used currency must be inspected to remove excessively worn, damaged, or torn bills. The *IBM 3624 Operator's Guide*, GA66-0006 and *IBM 3624 Cartridge Owner's Manual*, GA66-0005, contain procedures for preparation of new currency and inspection of used currency for operation in the 3624. For the 3624 mdl 11 and 12, the customer must ensure that each feed mechanism is loaded with the proper denomination currency. The cartridges contain a keying mechanism which can be set by the customer to ensure a match between specific cartridges and cartridge drive stations.

Printer Ink Rolls: The customer is responsible for procurement and replacement of ink rolls in transaction statement and depository printers.

Logo Lamp: The customer is responsible for procurement and replacement of the lamp in the logo panel light assembly.

Damage: IBM is not responsible for intentional damage to the 3624 or any 3624 accessories. Repair of such damage is not covered under the IBM Maintenance Contract, Lease Agreement or under the Pilot Test Plan. Repair of such damage at cost of time and materials will be provided for leased machines, Pilot Test machines, and purchase machines.

System Integrity: Subhost operation, under control of the 3600 Finance Communication Controller, requires customer systems design and support. Maintenance of system integrity in the subhost is a customer responsibility.

IBM is not responsible for any loss of money to the financial institution or its customers through the use of the 3624.

Third Track System Security Statement: Customers ordering the Third Track feature (#7950) must be advised that:

"IBM believes that the system security is optimized in an online environment, where PIN validation and transaction authorization

can be performed in conjunction with positive-file data bases. The scope of security exposure expands with the degree of offline implementation, for which the Third Track might be used. The U.S. Federal Information Processing Data Encryption Standard (DES) algorithm is utilized to provide cryptographic security in the 3624 and may be used in conjunction with the third track application. IBM recommends that the customer consider using DES for this purpose. An optional security feature of the proposed ANSI/ISO Third Track Data Content standard is a Crypto Check Digits (CCD) field in the card, that may be used to relate the data elements of track 3 to the magnetic stripe. This does not imply, however, that its use is not subject to fraud techniques. ANSI/ISO has not prescribed using the optional CCD field or any specific CCD implementation technique. IBM recommends that the customer consider its value in his application, weighing possible enhancements in security with economic and performance implications for his system. IBM will continue to pursue a course of action with customers and industry to maintain a high level of system security.

IBM reserves the right to modify the parameters of the track 3 function if the parameters of the final ANSI/ISO standard differ from those now in the process of standardization. However, this reservation of rights is not intended nor should it be construed as a commitment by IBM to support parameters different from those published by ISO/DIS 4909-June 1976."

Bibliography: *IBM System/370 Bibliography*, GC20-0370.

Specify

Voltage (120V, AC, 1-phase, 60Hz): #9911 ... usable on 115V.

Cabling: Refer to *Installation Manual-Physical Planning*, GA27-2766 and GA26-1658.

Keyboard Arrangement: #9301 for numeric-only keypad, or #9302 for alphanumeric keypad ... alphanumeric arrangement is the basic touch-pad telephone format with the Q and Z added over the numeric "O."

Currency Cartridge: See Accessories for ordering instructions.

Currency Denomination: #9091 for 5, 10, 20 dollar.

Keyboard: Specify one of the following for standard keyboard ... an RPQ should be submitted for any keyboard not shown below. All are field installable. The Change key, available on mdl 11 and 12, allows the user to request a change in the denomination mix to be issued.



Specify Number		Transaction Type						From Account To Account					
All Models ... w/o Change Key	Models 11/12 Only ... with Change Key	Withdrawal	Special	Balance	Transfer	Deposit	Payment Enclosed	Payment from Account	Cash Check	Checking	Savings	Credit Card	Other
		(3)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(1)	(1)	(1)	(1)
#9351	#9451	(1)								(1)			
9352	9452	(1)								0	0	0	
9353	9453	0	0							0	0	0	
9354	9454	0	0	0						0	0	0	0
9355	9455	0	0	0						0	0	0	
9356	9456	0	0	0						0	0	0	0
9357	9457	0	0	0	0	0	0	0	0	0	0	0	0
9358	9458	0	0	0	0		0			0	0	0	0
9359	9459	0	0	0	0					0	0	0	0
9360	9460	0	0	0		0				(1)			
9361	9461	0	0	0						(1)			
9362	9462	0	0	0	0	0	0	0	0	0	0	0	0
9363	9463	0	0	0		0				0	0	0	0
9364	9464	0	0	0		0				(1)			

Notes:

- (1) Key position does not appear on the keyboard panel; single function is selected automatically.
- (2) Prerequisite: Depository #3233, 3234, 3243 or 3244.
- (3) Prerequisite: Depository #3233, 3234, 3243 or 3244 if any special transactions are customized to require a deposit step.

Logo Panel Group: Specify one of the following: #9401 if logo panel is to be shipped with 3624 ... #9402 if logo panel(s) is to be shipped prior to the 3624 ... #9403 if logo panel is not to be ordered with 3624 and will either be ordered separately by part number or has been ordered through #9402 on another 3624. *Note:* More than one panel may be ordered on specify code #9402 if customer desires to have several panels delivered before the 3624 (e.g., for customization at one time). Purchase only.

Controller-Data Designation: 1st and 2nd position designation is required to control distribution and maintenance of controller-data media necessary for 3624 load images. Specify #9491 or #9492 as follows:

1st Position Designator (#9491): Used in combination with individual 3624 feature codes to determine which specific controller-data set is to be distributed to the host-system location. Normally, one 3624 attached to a host-system processor is specified #9491. However, more than one 3624 must be specified #9491 when there are both loop and direct attached configurations.

Specify #9491 for the following 3624s:

First 3624 loop attached (Feature #7820) via 3601/3602 to host system processor.

First 3624 direct attached (Feature #6301 or #6302) via SDLC communications to a host-system processor.

2nd Position Designator (#9492): Used to identify additional 3624s attached to host-system ... controller-data set media are not distributed to host-system location for any 2nd position designated 3624s.

When 1st position (#9491) is specified, also specify one of the following:

If magnetic tape is used at the host-system location:

- #94129-track, 800 bpi
- #94139-track, 1600 bpi
- #94149-track 6250 bpi

If magnetic tape is not used at the host-system location (DOS/VS users only):

- #943180 column cards
- #943296 column cards

When 1st position (#9491) is specified, additional information is required to determine the shipping address of the controller-data media. Supplemental Specs are to be entered exactly as follows to indicate the shipping address of the host system location.

- Line 1 - IBM Programming Support
- Line 2 - C/O (Name of Customer)
- Line 3 - Street Address (or P.O. Box No.)
- Line 4 - (etc.) - City, State, Zip

This is the address to which controller-data media will be automatically shipped after first 3624 is ordered.

Changes to 1st Position Designators for On-order and Installed 3624s: If a 1st position (#9491) 3624 is deferred, cancelled, or discontinued and 2nd position (#9492) 3624s have been specified, then one 2nd position 3624 must be altered from 2nd to 1st position (from #9492 to #9491) to ensure continued distribution of controller-data media to the host system location. When altering a 3624 to 1st position, include all items as required to be specified when #9491 is specified (items specified on previous 1st position 3624) ... if the host system location changes the input medium (e.g., from 1600 bpi to 6250 bpi tape), the media specify code must be changed on the 3624 with #9491 specified. In this case, the former media specify code must be deleted and the new one added.

Special Features

Additional Storage Feature (#1301): Provides an additional 2,048 bytes of storage. The user can utilize this to increase the number of custom messages, entries in Financial Institution Table, and as might be necessary for RPOs. To determine the number of additional storage features required, see *IBM 3624 Programmer's Reference Manual and Component Description*, GC66-0009. **Maximum:** Two ... 4,096 bytes total. **Field Installation:** Yes.



Depository, Lobby Without Depository Printer (#3233): [Models 1 and 11 only] Provides envelope transport mechanism leading from a controlled access slot to deposit receptacle inside the 3624. The depository transport is designed to discourage tampering with previously inserted deposits. Includes a pedestal stand, with lockable rear access door and standard key, and a built-in depository envelope holder. Deposit envelopes may vary in size from 88.9mm x 152.4mm (3.5" x 6.0") to 114.3mm x 247.7mm (4.5" x 9.75") and shall be constructed of paper having basic weight of sub 20 through sub 28. Maximum thickness of a deposit envelope and its contents is 12.7mm (0.5"). **Limitation:** Cannot be installed in Pedestal, Lobby (#5510) or with Depository, Lobby with Depository Printer (#3234). **Maximum:** One. **Field Installation:** Yes.

Depository Lobby With Depository Printer (#3234): [Models 1 and 11 only] Provides envelope transport mechanism leading from a controlled access slot to deposit receptacle inside the 3624. The depository transport is designed to discourage tampering with previously inserted deposits. Includes a pedestal stand, with lockable rear access door and standard key, and a built-in depository envelope holder. Deposit envelopes may vary in size from 88.9mm x 152.4mm (3.5" x 6.0") to 114.3mm x 247.7mm (4.5" x 9.75") and shall be constructed of paper having basic weight of sub 20 through sub 28. Maximum thickness of a deposit envelope and its contents is 12.7mm (0.5"). Includes depository envelope printer that prints sequence number on envelope as it passes through the depository throat. Six numeric digits are printed horizontally at repeated intervals along the envelope. Three digits are set by the customer engineer to identify unit, and three digits are automatically sequenced when envelope passes print station. The depository ink roll is IBM Part No. 457149. It is the customer's responsibility to purchase and replace the ink roll when required. **Limitation:** Cannot be installed in Pedestal, Lobby (#5510) or with Depository, Lobby without Depository Printer (#3233). **Maximum:** One. **Field Installation:** Yes.

Depository, Through-the-Wall Without Depository Printer (#3243): [Models 2 and 12 only] Provides envelope transport mechanism leading from a controlled access slot in the security enclosure to deposit receptacle inside the 3624. In addition to the controlled access slot in the security enclosure, the depository transport is designed to discourage tampering with previously inserted deposits. Deposit envelopes may vary in size from 88.9mm x 152.4mm (3.5" x 6.0") to 114.3mm x 247.7mm (4.5" x 9.75") and shall be constructed of paper having basic weight of sub 20 to sub 28. Maximum thickness of a deposit envelope and its contents is 12.7mm (0.5"). **Prerequisite:** Heavy-Duty Enclosure, Dual Function (#3902) ... see "Accessories." **Limitation:** Cannot be installed with Heavy-Duty Enclosure, Single Function (#3901) or Depository, TTW with Depository Printer (#3244). **Maximum:** One. **Field Installation:** Yes. *Note:* Field installation requires that Heavy-Duty Enclosure, Dual Function (#3902) has been initially ordered.

Depository, Through-the-Wall With Depository Printer (#3244): [Models 2 and 12 only] Provides envelope transport mechanism leading from a controlled access slot in the security enclosure to deposit receptacle inside the 3624. In addition to the controlled access slot in the security enclosure, the depository transport is designed to discourage tampering with previously inserted deposits. Deposit envelopes may vary in size from 88.9mm x 152.4mm (3.5" x 6.0") to 114.3mm x 247.7mm (4.5" x 9.75") and shall be constructed of paper having basic weight of sub 20 to sub 28. Maximum thickness of a deposit envelope and its contents is 12.7mm (0.5"). Includes depository envelope printer that prints sequence number on envelope as it passes

through the depository throat. Six numeric digits are printed horizontally at repeated intervals along the envelope. Three digits are set by the customer engineer to identify unit, and three digits are automatically sequenced when envelope passes the print station. The depository ink roll is IBM Part No. 457149. It is the customer's responsibility to purchase and replace the ink roll when required. **Prerequisite:** Heavy-Duty Enclosure, Dual Function (#3902) ... see "Accessories." **Limitations:** Cannot be installed with Heavy-Duty Enclosure, Single Function (#3901) or Depository, TTW Without Depository Printer (#3243). **Maximum:** One. **Field Installation:** Yes. *Note:* Field installation requires that Heavy-Duty Enclosure, Dual Function (#3902) has been initially ordered.

EIA Interface (#3701): Provides the appropriate cables and interface logic necessary to attach an external modem for communications attachment to the S/370 Processor via SDLC through a 3704/3705 Communications Controller. Non-IBM modems may be attached subject to the Multiple Suppliers System Policy. **Prerequisite:** SDLC Communication Feature (#6301 or #6302). **Limitation:** Cannot be installed with 1200 BPS Integrated Modem (#55000), or Terminal Loop Feature (#7820). **Maximum:** One. **Field Installation:** Yes.

IBM 1200 BPS Integrated Modem (#5500): Provides an internal modem for communications attachment to the S/370 processor via SDLC at 1200 bps over non-switched half-duplex or duplex voice grade lines. **Specify:** #9651 for 4-wire strapping, or #9652 for 2-wire strapping. **Prerequisite:** SDLC Communications Feature with Clocking (#6301). **Limitation:** Cannot be installed with EIA Interface (#3701). SDLC Communications Feature Without Clocking (#6302), Terminal Loop Feature (#7820), or 1200 bps Loop Integrated Modem (#8001). **Maximum:** One. **Field Installation:** Yes.

SDLC Communications Feature With Clocking (#6301): Provides capability to attach to a host system via SDLC, e.g., S/370 through a 3704/3705. Required for attachment to communication facilities through the IBM 1200 bps Integrated Modem (#5500), or through the EIA Interface (#3701) to any 1200 bps external modem which does not have internal clocking. **Prerequisite:** IBM 1200 bps Integrated Modem (#5500) if no external modem, or EIA Interface (#3701) if external modem. **Limitation:** Cannot be installed with Terminal Loop Feature (#7820), SDLC Communication Feature without Clocking (#6302), or 1200 bps Loop Integrated Modem (#8001). **Maximum:** One. **Field Installation:** Not recommended for field installation if Terminal Loop Feature (#7820) is installed. SDLC Communications Feature Without Clocking (#6302) can be changed to #6301 in the field. **Transmission:** This feature operates over common carrier communication facilities. For information concerning these facilities, see M2700 pages.

SDLC Communications Feature Without Clocking (#6302): Provides capability to attach to a host system via SDLC, e.g., S/370 through a 3704/3705. Required for attachment to communication facilities through the EIA Interface (#3701) to any external modem which provides internal clocking speeds up to 4800 bps. **Prerequisite:** EIA Interface (#3701). **Limitations:** Cannot be installed with Terminal Loop Feature (#7820), SDLC Communications Feature With Clocking (#6301), IBM 1200 bps Integrated Modem (#5500), or 1200 bps Loop Integrated Modem (#8001). **Maximum:** One. **Field Installation:** Not recommended for field installation if Terminal Loop Feature (#7820) is installed. SDLC Communications Feature With Clocking (#6301) can be changed in the field to #6302. **Transmission:** This feature operates over common carrier communication facilities. For information concerning these facilities, see M2700 pages.



External Modems: IBM external modems that may be attached are: (1) 3872 Modem at 2400 bps ... (2) 3874 Modem at 4800 bps.

Terminal Loop Feature (#7820): Provides capability to attach to a 3601/3602 loop. Attachment to local loop is directly. Attachment to remote loop can be either directly or via remote subloop through a 3603, a 3604 mdl 2, 3 or 4, a 3614, or another 3624. **Prerequisites:** (1) Available position on the loop. (2) Depending upon the configuration, the Additional Storage Feature (#1005 or #1006) may be required on the 3601/3602 ... see 3601 or 3602. (3) Attachment to a 3601/3602 local loop directly does not require an additional feature. (4) Attachment to a 3601/3602 remote loop directly requires 1200 bps Loop Integrated Modem (#8001). (5) Attachment to a 3601/3602 remote loop via remote subloop requires one of the following: 3603 Terminal Attachment Unit mdl 1 or 2 for 1200 bps or mdl 2 for 2400 bps ... 3604 mdl 2, 3 or 4 with Line Feature Base (#4751 or #4752) and appropriate modem ... 3614 with Terminal Loop Feature (#7820) and 1200 bps Loop Integrated Modem (#8001) ... or another 3624 with Terminal Loop Feature (#7820) and 1200 bps Loop Integrated Modem (#8001).

Specify

- 1) For attachment to a 3601/3602 local loop specify one of the following loop speeds: #9062 for 1200 bps, #9063 for 2400 bps, or #9064 for 4800 bps.
- 2) For attachment to 3601/3602 remote loop via subloop through a 3603 mdl 1 or 2 at 1200 bps, #9062.
- 3) For attachment to 3601/3602 remote loop via subloop through 3603 mdl 2 at 2400 bps, #9063.
- 4) For attachment to 3601/3602 remote loop via subloop through 3604, 3614 or another 3624, #9062 for 1200 bps.

Limitations: (1) Cannot be installed with SDLC Communications Feature (#6301 or #6302), EIA Interface (#3701), or IBM 1200 bps Integrated Modem (#5500). (2) Remote loop speed is 1200 bps maximum when attached directly or via subloop through 3603 mdl 1 or 2, 3604, 3614, or another 3624 ... is 2400 bps maximum via subloop through 3603 mdl 2. (3) Loop Integrated Modem (#8001) is not required if the 3624 is attached to a local loop, or via subloop to remote loop through 3603, 3604, 3614 or another 3624. **Maximum:** One. **Field Installation:** Not recom-

3624 MODELS 2 and 12 ... INSTALLATION ACCESSORIES

(Purchase only) Provides heavy-duty steel enclosure, through-the-wall bezel, front trim border, front dress panel, and pedestal base for installation of mdls 2 and 12 in configurations suitable for walk-up or drive-up use.

A heavy-duty enclosure is required. Two heavy-duty enclosures are available. A single function enclosure houses the currency dispensing mechanism on mdls 2 and 12 that do not have a depository. A dual function enclosure houses both the currency dispensing and the depository mechanisms on mdls 2 and 12 that have a depository. The dual function enclosure can also be used to house the currency dispensing mechanism only, on mdls 2 and 12 that do not have a depository. Both enclosures have a single rear access door that includes a combination lock and provides for a dial lock. The combination of the combination lock is set by the customer. The dial lock must be procured by the customer. A second combination lock is available as an optional feature. Both enclosures have a penetration-detection alarm grid across the inside of the front face. Construction of the heavy-duty enclosures meets requirements of UL291 and complies with the intent of U. S. Federal Regulation P for unattended paying and receiving machines.

Pedestal bases are available in a number of sizes to mount the enclosure at a height most suitable for walk-up or drive-up use. The recommended nominal mounting heights are 1321 mm (52 inches) from keyboard centerline to walkway for walk-up use and 1067 mm (42 inches) from keyboard centerline to driveway for drive-up use. The difference in elevation between walkway or driveway and the mounting surface should be considered in selecting the pedestal height ... refer to *Installation Manual—Physical Planning*, GA27-2766 and GA26-1658. A lockable storage cabinet with standard key is included in the pedestal base. A lockable storage cabinet only is also available that can be used with the dual function heavy-duty enclosure to mount the enclosure directly to a floor surface where a pedestal is not required.

A through-the-wall bezel, front trim border that fits around the bezel, and front dress panel that fits within the bezel are required. Two through-the-wall bezels are available—one with a recessed bezel-providing a convenient shelf surface for user and recommended for a

mended for field installation if SDLC Communications Feature (#6301 or #6302) is installed.

Third Track (#7950): Provides for reading data on track two and/or both reading and writing data on track three of magnetic stripe card. Presently conforms to ISO/3554/AD1 Third Track Standard, and proposed Data Content Standard ISO/DIS 4909. Can read tracks two and three independently or in conjunction with each other. **Maximum:** One. **Field Installation:** Not recommended.

Transaction Statement Printer (#8201): Prints document showing record of transaction and issues to user through the transaction statement slot. Prints documents for audit use that can be retained in a journal stacker in the 3624. Print feed hopper has a capacity of 2,000 documents. Journal stacker has a capacity of 400 documents. Data is printed on 96-column card stock 66.7mm x 82.6mm (2-5/8" x 3-1/4") in size. Provides a 57 character set consisting of 56 printable graphics and space (blank). Four lines can be printed with up to 34 characters per line ... maximum of 136 characters on each document. The data to be printed is determined by the host application program. Printing is overlapped with currency issue and user deposit cycles. **Card Limitations:** The 96-column card stock used in the statement printer must not have corner cuts.

1200 BPS Loop Integrated Modem (#8001): An internal modem for attachment to a 3601/3602 remote loop. Operates at 1200 bps over non-switched unconditioned voice-grade lines. **Prerequisite:** Terminal Loop Feature (#7820). **Limitation:** Not required if 3624 is attached to a 3601/3602 remote loop through a 3603, 3604 mdl 2, 3 or 4, 3614, or another 3624 ... or if attached to a 3601/3602 local loop. If there are both a 3604 and a 3624 located at the same remote loop location that does not have a 3603 or 3614, it is recommended that the loop modem (#8001) be located on the 3624, because the 3624 might often be operating while the 3604 is not, e.g., weekends. **Maximum:** One. **Field Installation:** Yes.

3624 Accessories



walk-up installation, and another with a non-recessed bezel positioning the user guidance area near the outside wall surface for more convenient use by a vehicle occupant and recommended for a drive-up installation. Two front trim borders are available—one with an envelope holder for depository transactions, and another without an envelope holder.

Warranty: These accessories are warranted free from defects in materials and workmanship for 90 days, commencing either on the date of installation or 30 days after shipment, whichever occurs first. IBM's obligation is limited to providing replacement parts on an exchange basis during the warranty period.

Delivery Instructions: Supplemental Specs for installation accessory items must be submitted at least 90 days prior to the 3624 Friday schedule date. Due to installation requirements, the heavy-duty enclosure and pedestal items will generally be shipped three weeks prior to the 3624. Other accessories will be shipped with the 3624. Supplemental Specs (via terminal entry) are to be entered exactly as follows to indicate destination of these items:

- Line 1 — c/o (Name of Customer)
- Line 2 — Customer Designated Delivery Point
(Note special considerations described below)
- Line 3 — Street Address
- Line 4 (etc.) — City, State, Postal Zone

The "Heavy-Duty Enclosure" included in this group of accessories is a steel enclosure with dimensions of approximately 432 mm x 914 mm x 1575 mm (17" x 36" x 62") and weight of approximately 950 kg (2100 pounds) for the dual function unit, and dimensions of approximately 432 mm x 914 mm x 991 mm (17" x 36" x 39") and weight of approximately 680 kg (1500 pounds) for the single function unit. The enclosure does not have casters and will be transported on a skid.

The item will be shipped via common carrier to the delivery point designated by the customer and may require special handling or rigging at destination. The customer should be advised that it is suggested this item be delivered directly to a local drayman that has facilities to move an item of these dimensions and weight. The customer then should make local provisions to have the enclosure delivered for physical installation at the selected site.

Heavy-Duty Enclosure, Single Function (#3901): Used to enclose currency dispensing mechanism on 3624 mdl 2 or 12 that do not have a depository. **Prerequisite:** Bezel, Through-the-Wall (#1490 or 1491), Front Dress Panel (#3951), and Front Trim Border Without Envelope Holder (#3962). **Note:** Pedestal (#4901), that includes a lockable storage cabinet, is available in several heights to mount the single function enclosure. **Limitation:** Cannot be installed with Depository, Through-the-Wall (#3243 or 3244), Pedestal for Dual Function Heavy-Duty Enclosure (#4902), Storage Cabinet for Dual-Function Heavy-Duty Enclosure (#4903), or Front Trim Border with Envelope Holder (#3961). Single Function Heavy-Duty Enclosure (#3901) cannot be field upgraded to a Dual Function Heavy-Duty Enclosure (#3902).

Heavy-Duty Enclosure, Dual Function (#3902): Used to enclose the currency dispensing and the depository mechanisms on 3624 mdl 2 or 12 that have a depository. May also be used to enclose the currency dispensing mechanism only and provide spare lockable storage space on 3624 mdl 2 or 12 that do not have a depository. **Prerequisites:** Bezel, Through-the-Wall (#1490 or 1491), Front Dress Panel (#3951), and Front Trim Border, With or Without Envelope Holder (#3961 or 3962). **Note:** Pedestal (#4902), that includes a lockable storage cabinet, is available in several heights to mount the dual function enclosure ... a lockable storage cabinet only (#4903) is also available to mount dual function enclosure directly to a floor surface where a pedestal is required. **Limitation:** Cannot be installed with Pedestal for Single Function Heavy-Duty Enclosure (#4901). Single Function Heavy-Duty Enclosure (#3901) cannot be field upgraded to a Dual Function Heavy-Duty Enclosure (#3902).

Heavy-Duty Enclosure, Dual Function (#3902): Used to enclose the currency dispensing and the depository mechanisms on 3624 mdl 2 or 12 that have a depository. May also be used to enclose the currency dispensing mechanism only and provide spare lockable storage space on 3624 mdl 2 or 12 that do not have a depository. **Prerequisites:** Bezel, Through-the-Wall (#1490 or 1491), Front Dress Panel (#3951), and Front Trim Border, With or Without Envelope Holder (#3961 or 3962). **Note:** Pedestal (#4902), that includes a lockable storage cabinet, is available in several heights to mount the dual function enclosure ... a lockable storage cabinet only (#4903) is also available to mount dual function enclosure directly to a floor surface where a pedestal is not required. **Limitation:** Cannot be installed with Pedestal for Single Function Heavy-Duty Enclosure (#4901). Single Function Heavy-Duty Enclosure (#3901) cannot be field upgraded to a Dual Function Heavy-Duty Enclosure (#3902).

Dual Lock (#3375): (Optional) Provides second combination-lock on rear access door. **Field Installation:** No.

Bezel, Through-the-Wall, Recessed (#1490), Non-Recessed (#1491): Bezel for through-the-wall installation of 3624. #1490 is recessed, providing a shelf surface, and is recommended for walk-up installation. #1491 is non-recessed, placing the user guidance area nearer the outside wall surface for convenience of a vehicle occupant, and is recommended for drive-up installation. **Prerequisites:** Heavy-Duty Enclosure, Single or Dual Function (#3901 or 3902). Front Dress Panel (#3951), and Front Trim Border With or Without Envelope Holder (#3961 or 3962).

Pedestal for Single Function Heavy-Duty Enclosure (#4901): For mounting 3624 mdl 2 or 12 that use the single function enclosure. Consists of a base stand and a lockable storage cabinet. A standard key is provided. Available in heights to position the keyboard centerline 1067, 1194, or 1321 mm (42, 47, or 52 inches) from mounting surface. **Note:** If single function enclosure is installed without a pedestal, the keyboard centerline is 368 mm (14.5 inches) from mounting surface. **Prerequisite:** Heavy-Duty Enclosure, Single Function (#3901). **Limitation:** Cannot be installed with Heavy-Duty Enclosure, Dual Function (#3902). **Specify:** Height of keyboard centerline from mounting surface:



- #9701 1067 mm (42 inches)
- #9702 1194 mm (47 inches)
- #9703 1321 mm (52 inches)

Pedestal for Dual Function Heavy-Duty Enclosure (#4902): For mounting 3624 mdls 2 or 12 that use the dual function enclosure. Consists of base stand and a lockable cabinet. A standard key is provided. Available in sizes to position the keyboard centerline 1067, 1194, or 1321 mm (42, 47, or 52 inches) from mounting surface. *Note:* See Storage Cabinet for Dual Function Heavy-Duty Enclosure (#4903) for installing with keyboard centerline height lower than 1067 mm (42 inches) from mounting surface. **Limitation:** Heavy-Duty Enclosure, Dual Function (#3902). **Limitation:** Cannot be installed with Heavy-Duty Enclosure, Single Function (#3901). **Specify:** Height of keyboard centerline from mounting surface:

- #9701 1067 mm (42 inches)
- #9702 1194 mm (47 inches)
- #9703 1321 mm (52 inches)

Storage Cabinet for Dual Function Heavy-Duty Enclosure (#4903): Lockable storage cabinet only, for 3624 mdls 2 or 12 dual function enclosure mounted directly to floor surface without pedestal. The keyboard centerline height is 965 mm (38 inches) from mounting surface. A standard key is provided. **Prerequisite:** Heavy-Duty Enclosure, Dual Function (#3902). **Limitation:** Cannot be installed with Heavy-Duty Enclosure, Single Function (#3901). *Note:* Storage cabinet is included with the Pedestal for Dual Function Heavy-Duty Enclosure (#4902).

Front Dress Panel (#3951): Provides panel to cover face of heavy-duty enclosure and I/O module. **Prerequisites:** Bezel, Through-the-Wall, Recessed or Non-Recessed (#1490 or 1491), and Heavy-Duty Enclosure, Single or Dual Function (#3901 or 3902).

Front Trim Border, With Envelope Holder (#3961), Without Envelope Holder (#3962): Provides trim paneling around the bezel to seal through-the-wall installation. #3961 includes build-in depository envelope holder and is available only when the depository feature is installed. #3962 does not include a depository envelope holder. **Prerequisites:** (1) Bezel, Through-the-Wall, Recessed or Non-recessed (#1490 or 1491) ... (2) Front Trim Border, With Envelope Holder (#3961) requires Depository, Through-the-Wall (#3243 or 3244).

		Feature
Heavy-Duty Enclosure,	(one req'd)	
Single Function		#3901
Dual Function		#3902
Dual Lock	(optional)	#3375
Bezel, Through-the-Wall,	(one req'd)	
Recessed		#1490
Non-Recessed		
(Drive-up use)		#1491
Pedestal, (includes storage cabinet)	(optional)	
for Single Function Heavy-Duty Enclosure		#4901
(see "Specify" above for mounting height)		
for Dual Function Heavy-Duty Enclosure		#4902
(see "Specify" above for mounting height)		
Storage Cabinet for Dual Function Heavy-Duty Enclosure	(optional)	#4903
(Keyboard height = 965 mm (38 inches))		
Front Dress Panel	(one req'd)	#3951
Front Trim Border,	(one req'd)	
With Envelope Holder		#3961
Without Envelope Holder		#3962

3624 MODELS 1 and 11 ... PEDESTAL, LOBBY (#5510):

(Purchase only) Provides optional mounting stand for 3624 mdls 1 or 11 that do not have depository feature. *Note:* A pedestal base with casters is included with the lobby model depository special feature. **Limitation:** #5510 cannot be installed with Depository, Lobby (#3233 or 3234).

ACCESSORY PRICES:

Pedestal, Lobby

Feature
#5510

3264 LOGO PANEL (#9401, 9402 or 9403):

(Purchase only) Backlighted Logo Panel, suitable for customization by silkscreening or other acceptable process.

ACCESSORY PRICES:

Feature



If #9401 is specified, logo panel will be shipped with 3624

#9401

If #9402 is specified, logo panel will be shipped approximately three weeks prior to 3624. Note: More than one panel may be ordered when #9402 is specified (e.g., customer may desire to order spares or to arrange to have several panels delivered for customization at one time). When more than one panel is ordered using #9402, then #9403 should be specified on the other 3624s to avoid duplicating orders for logo panels.

#9402

	Machine	Part No.
Logo Panel	3624 mdl 1 or 11	945618
Logo Panel	3624 mdl 2 or 12	945617

3624 CURRENCY CARTRIDGE:

(Purchase only) Portable currency container, interchangeable between 3624s. Cartridge case is made of a high-impact resistant, fire retardant material. Removable access cover and built-in carrying handle, for ease of loading and transportation. Locking mechanism provides for customer installation of keylock and affixing security seals to help prevent unauthorized access to contents during storage or transport of the cartridge. The cartridge is connected to a cartridge drive station in the 3624 for power and communication of cash-low and cash-out currency levels. A keying system is provided so that a match between the cartridge and the cartridge drive station must be satisfied before the cartridge can be properly loaded in the drive station. The maximum new bill capacity is 2300 bills. The used bill capacity is approximately 1700.

Customer Responsibilities - 3624 Currency Cartridge: The customer must be advised that: (1) The customer is responsible for determining if the cartridge is the failing unit ... (2) The customer should schedule the frequency of cleaning and belt replacement procedure for optimum cartridge performance according to the usage, to maintain maximum machine availability ... (3) The customer may repair cartridge or send back to Repair Center (see "Maintenance" below) ... (4) The customer is responsible for determining required spares (see "Spares" below) ... (5) The customer is responsible for providing cartridge for CE 6324 maintenance and testing; a minimum of one spare cartridge for mdls 1 and 2 and two spare cartridges for mdls 11 and 12 must be made available by customer

for normal 3624 maintenance ... (6) The customer is responsible for setting the keying system on the cartridges and drive stations so that there is the desired match of currency denomination to drive station ... (7) Purchaser agrees that IBM is relieved of responsibility for all claims, including, but not limited to, loss of currency or documents contained in, dispensed by, or associated with the cartridge.

Spares: The customer may wish to replace (1) an empty or partially loaded cartridge with a fully loaded cartridge, (2) a failing cartridge with a spare for problem determination or while malfunctioning cartridge is being repaired, (3) a cartridge to enable IBM to perform 3624 maintenance and testing. The customer should be advised to purchase sufficient cartridges to cover the above uses. The number of cartridges recommended is dependent upon the total number of cartridge drive stations the customer has installed, application requirements, physical location of 3624s, and location where cartridges are temporarily stored and loaded. The customer must be advised that it is recommended that spare cartridges should remain in use and not be stored for extended periods. A recommended quantity of spare cartridges and spare replacement belts per cartridge drive station is shown below. It assumes for every loaded cartridge installed in a cartridge drive station, another cartridge is available for currency replenishment. In addition, approximately one spare is available for every three cartridge drive stations. This should provide sufficient quantity of spares for customer 3624 testing and for temporary replacement of cartridges in repair. These quantities should be adjusted to the customer's particular application requirements once the physical environment and usage affect on the cartridge and belt wear is understood. The customer can replace separator and restraint belts in conjunction with performing the recommended operator cleaning and belt replacement procedure.

Cartridge Drive Stations (*)	Recommended Quantity of Cartridges (including spares)	Recommended Minimum Quantity Spare Replacement Belts	
		Separator Belt P/N	
		945307	Restraint Belt P/N 945242
1	3	1	1
2	5	1	1
3	7	1	1
4	10	2	2
5	12	2	2
6	14	2	2
7	17	3	3
8	19	3	3
9	21	3	3
10	23	3	3



24 mdls 1 and 2 have one cartridge drive station and mdls 11 and 12 have two cartridge drive stations. Cartridges and belts required for more than ten drive stations can be extrapolated from the above table by taking a multiple of these numbers. Additional quantities over the recommended minimum quantity of spare replacement belts should be ordered as required, as part of the customer periodic belt inspection and replacement schedule for cartridges (in conjunction with IBM's general recommendation).

Maintenance: Cartridges are not maintained by IBM under the normal lease agreement or MMMC for purchased machine. A recommended operator cleaning and belt replacement procedure is provided in the *IBM 3624 Cartridge Owner's Manual* GA66-0005; under adverse operator conditions, it is the customer's responsibility to modify the procedure to meet his own particular requirements. The customer can replace separator and restraint belts in conjunction with performing the recommended procedure. If the cartridge is in need of repair, he can send it to a designated IBM Repair Center. It is the customer's responsibility to package the unit in the designated shipping container and ship it prepaid to the designated IBM Repair Center.

IBM Repair Center Service: For cartridge repair, the customer will fill out an *IBM Repair Authorization Form* GX27-2981, pack it and the defective cartridge in the designated shipping container, and ship it prepaid to the designated IBM Repair Center, where repair will be made if the cartridge is repairable. The charge for the repair of the cartridge at IBM Repair Center will cover handling, inspection, cleaning, repair, adjustment, testing, and return shipping. Billing will be at IBM's applicable hourly rates. In addition, all parts needed will be billed at IBM's prevailing parts prices. Alternately, upon request, the IBM Repair Center will provide, for a minimum charge, an estimate of repair charges.

If on the basis of an inspection, the repair center concludes that a cartridge is not repairable, no further work will be performed and the cartridge will be returned to the customer with a minimum charge to cover handling, inspection, testing, and return shipping charges.

Warranty: The cartridge is warranted to be free from defects in workmanship and material for a period of 90 days, commencing either on the date of installation or 30 days after shipment, whichever occurs first. Warranty service for the cartridge will be performed at the IBM Repair Center. If warranty service is performed at an IBM Repair Center, the customer will fill out an *IBM Repair Authorization Form*, GX27-2981, pack it and the defective cartridge in the designated shipping container, and ship it prepaid to the designated IBM Repair Center.

Ordering: Order by feature number below and specify quantity.

3624 Currency Cartridge

Feature
#9110

** Time and Material at IBM Repair Center only.

Note: For cartridge parts, refer to the *IBM 3624 Cartridge Owner's Manual*, GA66-0005.

Dual Lock (#3375) is available as an option, providing a second combination lock on the rear access door. Penetration-detection grid is provided across the inside front face of enclosure.

Dual Lock (#3375): An optional second combination-lock for the rear access door of a Heavy-Duty Enclosure (#3901 or #3902). **Field Installation:** Available at time of manufacture only.

Bezel, Through-the-Wall (#1490 or #1491): [Mdls 2 and 12 only] Required for installation of mdls 2 and 12. Provides bezel to interface outside wall surface with 3624 enclosure through-the-wall of building or other structure. **#1490:** A recessed bezel that provides a shelf surface. Recommended for walk-up use. **#1491:** A non-recessed bezel which positions the user guidance nearer outside wall surface. Recommended for drive-up use.

Pedestal, for Heavy-Duty Enclosures (#4901 or #4902): [Mdls 2 and 12 only] Available for installation of mdls 2 and 12. A mounting stand to locate the 3624 at a height most convenient for user operation ... includes a lockable storage cabinet ... available for single and dual heavy-duty enclosures in heights appropriate for walk-up or drive-up use. Recommended nominal keyboard heights are 52" for walk-up, 42" for drive-up. **#4901:** for 3624s that use the single function enclosure (#3901). **#4902:** for 3624s that use the dual function enclosure (#3902). **Specify:** For keyboard centerline height from mounting surface ... **#9701:** for 1067mm (42") ... **#9702** for 1194mm (47") ... **#9703:** for 1321mm (52").

Storage Cabinet, For Dual Function Heavy-Duty Enclosure (#4903): [Mdls 2 and 12 only] Available for installation of mdls 2 and 12. A lockable storage cabinet for installation of the dual function heavy-duty enclosure (#3902) directly to a mounting surface where a pedestal is not required.

Pedestal, Lobby (#5510): [Mdls 1 and 11 only] A mounting stand for free-standing configuration of lobby model without the depository feature. *Note:* #5510 is not required if customer intends to install a 3624 mdl 1 or 11, without the depository feature, on an alternative mounting surface or stand. #5510 is not required if a 3624 mdl 1 or 11 is installed with a depository feature (#3233 or #3234) since a pedestal base is included in #3233 or #3234.

Front Dress Panel (#3951): [Mdls 2 and 12 only] Required for installation of mdls 2 and 12. Provides user guidance area panel covers and logo lamp assembly.

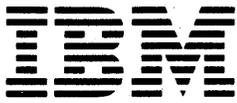
Front Trim Border (#3961 or #3962): [Mdls 2 and 12 only] Required for installation of mdls 2 and 12. Provides trim border panel around the bezel on the outside of building for outer seal of through-the-wall installation. **3961:** includes a built-in depository envelope holder. **#3962:** has no envelope holder.

Logo Panel (#9401, #9402, #9403): [All Models] Required for installation on all models of the 3624. Provides a panel that can be personalized by the customer (silk-screened, painted, etc.). Can be shipped with the 3624 or prior to the 3624. See "Specify Section" above for specification of appropriate specify code.

Currency Cartridge (#9110): Required for installation of any 3624. Portable container for loading, storing, transporting, and issuing currency or other approved documents ... interchangeable between 3624s. See customer responsibilities for recommended number of spare cartridges, and maintenance.



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**3707 REMOTE DATA ACQUISITION AND CONTROL STATION**

Purpose: To provide a remote teleprocessing station with digital input/output and analog input capability.

Models	I/O Feature Capacity
A7	7
A15	15
A23	23
A31	31

Highlights: Provides control, addressing and checking logic to receive and transmit digital input/output and analog input data. The model A7 and A15 enclosure is a one bay 19" relay rack. The model A23 and A31 enclosure is a two bay 19" relay rack. Customer access is provided at the rear of the enclosure by panels with screw down type barrier strips provided with each I/O feature requiring customer connection. Cooling for all models is by natural convection. Refer to the I/O Feature Configurator, located at the end of this section, for allowable feature intermix. The following I/O features can be addressed.

Digital Input Model 1: Provides 16 digital input points where each point is a TTL compatible, 2 terminal circuit. This feature can be optioned to operate in register mode, where it can be read as either latching and/or unlatching inputs, or as eight buffered 15 bit pulse counters.

Digital Input Model 2: Identical to Digital Input Model 1 except that each point is an isolated, voltage sense (48V or 129V), 2 terminal circuit and is protected against high voltage transients.

Digital Output Model 1: Provides 16 TTL compatible digital output points. One of two operating modes can be selected. Either all points are controlled as a 16 position register where each point can be set or reset, or one of the 16 points can be selected and commanded to operate for a programmable time duration from 100 milliseconds to 25.5 seconds in 100 millisecond increments. Read before execute capability is provided on a selectable basis.

Digital Output Model 2: Identical to Digital Output Model 1 except that each point is a form A mercury wetted relay contact rated at 500 Vdc maximum and 1A dc maximum; the product of peak voltage and peak current not to exceed 100 VA and is protected against high voltage transients.

This feature requires that either +48Vdc or +129 Vdc be provided to power the relay coil driver circuits. This power must be wired by the customer to the customer termination panel provided by this feature. Refer to *Installation Manual—Physical Planning*, GA34-0009 for recommended wiring practices.

Digital Output Model 3: Identical to Digital Output Model 1 except that each point is a medium power, solid state, optically isolated digital output which operates at up to 129 Vdc at 250 MA dc and is protected against high voltage transients.

This feature requires that either +48 Vdc or +129 Vdc be provided to power the base drive circuit for the output drivers. This power must be wired by the customer to the customer termination panel provided with this feature. Refer to the *Installation Manual—Physical Planning* for recommended wiring practices.

Analog Input Control: Provides an analog to digital converter and the address controls for up to seven analog input multiplexers. Multiplexer types can be intermixed. The converter output is a binary value of 11 bits plus sign. The maximum conversion rate is 2.5 milliseconds per point.

Analog Input Multiplexer Model 1: Provides a solid state multiplexing switch to connect one of 16 analog input points to the analog to digital converter. One of two gain ranges can be optioned where the full scale range for all 16 points is +5.12 volts or +51.2 millivolts.

Analog Input Multiplexer Model 2: Identical to Analog Input Multiplexer Model 1 except that high voltage transient protection is provided.

Analog Input Multiplexer Model 3: Identical to Analog Input Multiplexer Model 2 except that it also has the capability for simultaneously storing, sequentially converting and then buffering all 16 inputs on command. *Note:* One Digital Output Model 2 feature per 3707 is required to control one or more of these features.

To support and enhance the I/O features, the following special features are also available. These features do not preempt an I/O feature address position.

Analog Voltage Reference: Provides two stable and precise voltage levels for use as reference inputs to the Analog Input Multiplexer features. Output levels are 4.5 V and 45mv. Each level can drive up to four analog inputs.

Analog Power Supply: Provides +24 Vdc to the Analog Input features.

Digital I/O Power Supply: Provides a +48V, 6A dc power supply for use with the Digital Input/Output features. For example, this supply can be used by the customer to power and drive circuits associated with the Digital Output Model 2 and 3 and Digital Input Model 2 features if customer power is not available for this purpose.

Customer Responsibilities: See System 370 in "Systems."

System 3707 Summary: See *IBM 3707 Remote Data Acquisition and Control Station Introduction and Configurator*, GA34-0014.

Specify

1. Voltage: #9901 for 115V, AC, 1-Phase, 60 cycle; #9902 for 208 V, AC, 1-Phase, 60 cycle; #9904 for 230V, AC, 1-Phase, 60 cycle; or #9906 for 48VDC; #9907 for 129VDC.
2. Communications: A communications interface is required, see "Special Features."

Model Changes: Field installable. Changes from AC to DC power and vice versa, (See "Specify" (1) ... above), are not field installable.



For connection to the communications line, one of the following features must be selected.

Communications Adapter (#1510): A communications adapter with speeds of 134.5, 600 or 1200 bps in the asynchronous mode and up to 4800 bps in the synchronous mode (when the attached modem provides its own clocking). The modem interface adheres to the EIA RS232-C specification.

Because of the unique line discipline employed by the 3707, communication may only be with a System/7 with either a TPMF (RPQ D08010) or a TPMM

— the public switched telephone network at speeds of 134.5, 600 or 1200 bps (asynchronous) or up to 4800 bps (synchronous), or

— a Type 3002 non-switched voice grade channel at speeds of 134.5, 600 or 1200 bps (asynchronous) or up to 4800 bps (synchronous).

Limitation: Mutually exclusive with #1520. **Maximum:** One per 3707. **Field Installation:** Yes. **Modem:** IBM 3872 at 2400 bps on the public switched telephone network or on a Type 3002 (with C1 Conditioning) non-switched voice grade channel.

Communications Line Interface (#1520): Provides a communications adapter and an asynchronous modem at speeds of 134.5, 600 or 1200 bps. This modem is compatible with the IBM 1200 bps Integrated Modem.

Because of the unique line discipline employed by the 3707, communication may only be with a System/7 with either a TPMF (RPQ D08010) or a TPMM (RPQ D08011) and an IBM 1200 bps Integrated Modem over a Type 3002 non-switched voice grade channel. **Limitation:** Mutually exclusive with #1510. **Maximum:** One per 3707. **Field Installation:** Yes. **Prerequisite:** Type 3002 Channel.

Note: The communications between the 3707 and a Host System/7 utilizes a unique line discipline incorporating the following characteristics:

1. Data Checking
2. Bit—Significant Data
3. Multi-byte data frames
4. Single-frame or multi-frame data transmission
5. Compatible with asynchronous or synchronous modems
6. Point-to-point or multipoint capability.

The address location of certain features must be specified. The "I/O Feature Configurator" located at the end of this section is used for this purpose. For each feature ordered that requires this specification, indicate the feature number plus a location specify code based on the feature type. *Note:* Specifications stated are a generalized description of the system features. Detail specifications must be quoted or proposed from the latest revision of the *IBM 3707 Remote Data Acquisition and Control Station Installation Manual—Physical Planning*, GA34-0009.

Analog Input Control (#1010): Provides control and analog-to-digital conversion for up to 7 analog input multiplexer features. Converter output is 11 bits plus sign. The maximum conversion rate is 2.5 ms per point. An address location must be specified per the "I/O Feature Configurator" for each #1010 ordered. **Limitation:** Address locations available for #1010 are fixed. **Maximum:** 1 for model A7, 2 for model A15, 3 for model A23, 4 for model A31. **Field installation:** Yes. **Prerequisite:** Analog Power Supply (#5503).

Analog Input Multiplexer Model 1 (#1015): Provides 16 solid state multiplexer points for analog input signals. All signals may either be in the range of +5.12 volts or in the range of +51.2

millivolts. **Limitation:** Address locations available for #1015 are fixed depending on the address location of the Analog Input Control (#1010) to which they are interfacing. **Maximum:** Six for model A7, 13 for model A15, 20 for model A23, and 27 for model A31. **Field installation:** Yes. **Prerequisite:** Analog Input Control (#1010).

Analog Input Multiplexer Model 2 (#1020): Provides 16 solid state multiplexer points, each with high voltage transient protection, **for analog input signals. All signals may either be in the range of +5.12 volts or in the range of +51.2 millivolts. **Limitation:** Address locations for #1020 are fixed depending on the address location of the Analog Input Control (#1010) to which they are interfacing. **Maximum:** Six for model A7, 13 for model A15, 20 for model A23, and 7 for model A31. **Field installation:** Yes. **Prerequisite:** Analog Input Control (#1010).

Analog Input Multiplexer Model 3 (#1025): Provides 16 solid state multiplexer points, each with high voltage transient protection** for analog input signals. With this model the input signals can be read sequentially after first executing a lock-up command which simultaneously stores all of the input signals, or can be read sequentially without the use of the lock-up command. All signals must be either in the range of +5.12 volts or in the range of +51.2 millivolts. **Limitation:** Address locations available for #1025 are fixed depending on the address location of the Analog Input Control (#1010) to which they are interfacing. **Maximum:** Five for model A7, 12 for model A15, 19 for model A23, and 26 for model A31. **Field installation:** Yes. **Prerequisites:** Analog Input Control (#1010) and Digital Output Model 2 (#3345).

Analog Voltage Reference (#1280): Provides one low level and one high level voltage source for use as reference inputs to the analog input multiplexer features. Each level can drive up to four analog inputs. **Maximum:** One per Analog Input Control (#1010). **Field installation:** Yes. **Prerequisite:** Analog Input Control (#1010).

Digital Input Model 1 (#3230): Provides 16 latching and/or unlatching TTL compatible digital input points. These points can be optioned for register in or pulse counter in operation. An address location must be specified per the "I/O Feature Configurator" located at the end of this section. **Maximum:** 7, 15, 23, or 31 per 3707 dependent on the model ordered. **Limitation:** When installed with other I/O features, the maximum applies to the total number of address locations available. Each addressable feature ordered reduces the maximum by one. **Field Installation:** Yes.

Digital Input Model 2 (#3235): Provides 16 latching and/or unlatching, isolated, digital input voltage or contact points, each with high voltage transient protection**. These points can be optioned for register in or pulse counter in operation. An address location must be specified per the "I/O Feature Configurator", located at the end of this section, for each #3235 ordered. **Maximum:** 7, 15, 23, or 31 per 3707 dependent on the model ordered. **Limitation:** When installed with other I/O features, the maximum applies to the total number of address locations available. Each addressable feature ordered reduces the maximum by one. **Field Installation:** Yes.

Digital Output Model 1 (#3340): Provides 16 low power (TTL compatible) digital outputs. An address location must be specified per the "I/O Feature Configurator" for each #3340 ordered. **Maximum:** 7, 15, 23, or 31 per 3707 dependent on the model ordered. **Limitation:** When installed with other I/O features, the maximum applies to the total number of address locations available. Each addressable feature ordered reduces the maximum by one. **Field Installation:** Yes.



Digital Output Model 2 (#3345): Provides 16 isolated Form A mercury wetted relay contacts with high voltage transient protection** and rated at 500 Vdc maximum and 1 A dc maximum; the product of peak voltage and peak current not to exceed 100 VA. An address location must be specified per "I/O Feature Configurator" for each #3345 ordered. **Maximum:** 7, 15, 23, or 31 per 3707 dependent on the model ordered. **Limitation:** When installed with other I/O features, the maximum applies to the total number of address locations available. Each addressable feature ordered reduces the maximum by one. **Field installation:** Yes. **Prerequisite:** +48 V (#5502) required if output bias power is not provided by the customer. Refer to *Installation Manual—Physical Planning* for details.

Digital Output Model 3 (#3350): Provides 16 isolated medium power solid state digital outputs each with high voltage transient protection**. Each output operates at up to 129 V at 250 MA. An address location must be specified per the "I/O Feature Configurator" for each #3350 ordered. **Maximum:** 7, 15, 23, or 31 per 3707 dependent on the model ordered. **Limitation:** When installed with other I/O features, the maximum applies to the total number of address locations available. Each addressable feature ordered reduces the maximum by one. **Field Installation:** Yes. **Prerequisite:** +48 V (#5502) required if output bias power is not provided by the customer. Refer to *Installation Manual—Physical Planning* for details.

Digital I/O Power Supply (#5502): Provides a 48 V, 6A dc power supply for use with the digital input/output features. For recommended wiring and to insure that enough current is available for any given customer configuration, refer to the *Installation Manual—Physical Planning*. **Maximum:** One per model A7 or A15, and two per model A23 or A31. **Limitation:** Customer must provide any wiring from this supply to digital input/output circuits. **Field Installation:** Yes.

Analog Power Supply (#5503): Provides ± 24 Vdc power to the analog input features. **Maximum:** One per 3707. **Field Installation:** Yes. **Prerequisite:** AC Power, #9901, #9902 or #9904.

One of the required tools is test tool (P/N 5891393)—a portable Test Box specifically designed for the 3707 and an integral part of the maintenance philosophy of this system. Although one is not required for each 3707 ordered, it is recommended that a sufficient quantity be obtained by the customer so that he can satisfactorily service his system.

**High voltage transient protection provides each point with the following surge withstand capability: (no physical damage will be done)

Frequency = 1.0 to 1.5 M HZ
Peak Voltage = 2.5 to 3.0 KV

Pattern = An envelope which decays to approximately 50% of crest value, but not less than 1.25 KV, within 6 microseconds of initial peak voltage.

Duration = 120 transients per second for 10 seconds.



I/O Feature Placement Chart

The table below is a physical planning chart to be used in configuring System 3707.

For each of the listed feature types ordered a unique address location must be specified. Include this specify code with each feature ordered.

A total of 31 feature positions are available in the largest model, A31, and the table may be used to configure this, or any smaller model. Model numbers and their capacities are indicated in the table columns labeled "Model" and "Feature Position." You must confine your choices of feature locations to that section of the table which pertains to the model you have chosen.

Two rules concerning the placement of Analog Input Control and Analog Input Multiplexer features must be observed:

1. Analog Input Control feature placement is limited to positions 7, 15, 23 and 31.

2. Analog Input Multiplexer features associated with each Analog Input Control must be located in positions adjacent to the Analog Input Control feature in contiguous descending position numbers. Example: An Analog Input Control feature is specified for position 23. The associated Analog Input Multiplexers must be located in positions 22, 21, 20, etc., in that order, without skipping any position numbers, through position 16. Positions 22 through 16 may contain up to 7 Analog Input Multiplexers, which is the maximum number that may be associated with an Analog Input Control feature in position 23.

Each code identifies a position. Only one specify code in each row may be chosen.

To assist you, a Recommended Procedure may be found following the table.

I/O FEATURE CONFIGURATOR

3707		Analog Input Control #1010	Analog Voltage Reference #1280	AI Model 1 #1015	AI Model 2 #1020	AI Model 3 #1025	DI Model 1 #3230	DI Model 2 #3235	DO Model 1 #3340	DO Model 2 #3345	DO Model 3 #3350	Row Totals should be 0 or 1		
Model	Feature Position													
A31	A7	1		#9101	#9201	#9301	#9401	#9501	#9601	#9701	#9801			
		2		9102	9202	9302	9402	9502	9602	9702	9802			
		3		9103	9203	9303	9403	9503	9603	9703	9803			
		4		9104	9204	9304	9404	9504	9604	9704	9804			
		5		9105	9205	9305	9405	9505	9605	9705	9805			
		6		9106	9206	9306	9406	9506	9606	9706	9806			
		7	#9107	#9207				9407	9507	9607	9707	9807		
	A15	8			9108	9208	9308	9408	9508	9608	9708	9808		
		9			9109	9209	9309	9409	9509	9609	9709	9809		
		10			9110	9210	9310	9410	9510	9610	9710	9810		
		11			9111	9211	9311	9411	9511	9611	9711	9811		
		12			9112	9212	9312	9412	9512	9612	9712	9812		
		13			9113	9213	9313	9413	9513	9613	9713	9813		
		14			9114	9214	9314	9414	9514	9614	9714	9814		
		15	9115	9215				9415	9515	9615	9715	9815		
	A23	16			9116	9216	9316	9416	9516	9616	9716	9816		
		17			9117	9217	9317	9417	9517	9617	9717	9817		
		18			9118	9218	9318	9418	9518	9618	9718	9818		
		19			9119	9219	9319	9419	9519	9619	9719	9819		
		20			9120	9220	9320	9420	9520	9620	9720	9820		
		21			9121	9221	9321	9421	9521	9621	9721	9821		
		22			9122	9222	9322	9422	9522	9622	9722	9822		
		23	9123	9223				9423	9523	9623	9723	9823		
		A31	24			9124	9224	9324	9424	9524	9624	9724	9824	
			25			9125	9225	9325	9425	9525	9625	9725	9825	
	26				9126	9226	9326	9426	9526	9626	9726	9826		
	27				9127	9227	9327	9427	9527	9627	9727	9827		
	28				9128	9228	9328	9428	9528	9628	9728	9828		
	29				9129	9229	9329	9429	9529	9629	9729	9829		
	30				9130	9230	9330	9430	9530	9630	9730	9830		
	31		9131	9231				9431	9531	9631	9731	9831		
Column Totals Equal Number of Features Ordered														

Recommended Procedure

1. Place the Analog. Input features first, observing the rules above.

The first Analog Input Control should go into the highest numbered position in the model you have chosen. (Specify code #9115 in a model A15, for example.)

Place Analog Input Multiplexers into contiguous descending numbered positions following. (#9114, 9113, 9111, 91110, 9109, 9108 in that order as required.)

If more Analog Input remains, continue the above procedure until all Analog Input Control and Multiplexer features are placed. (#9107 for the next Analog Input Control and #9106, 9105, etc., for Multiplexers, as required.)

2. Place any Digital Output features next, starting in position 1 and continuing with contiguous ascending number positions. (#9701, 9702, etc., as required.)
3. Place Digital Input using a similar procedure, continuing with increasing position numbers, leaving no blank positions, until all features are placed.



3713 PRINTER

Purpose: Printer for all models of the 3741.

Highlights: Prints serially at a maximum rate of 40 cps, using the EBCDIC character set. The maximum print line is 128 print positions at 10 characters per inch spacing. Line spacing is 6 lines per inch.

The unit has a pin feed platen which permits the feeding of marginally punched continuous paper. A choice of 12-1/2, 13-1/8, or 13-7/8 inch hole-to-hole pin feed platen widths may be specified for the basic printer ... see "Specify." Smaller platens (to 5-1/4 inches hole-to-hole width) and platen interchangeability can be accommodated in conjunction with the adjustable margin special feature ... see "Special Features."

Matrix characters are formed by 7 vertical wires printing dots in up to 4 of 7 possible horizontal positions. Refer to SRL GA24-3488 for forms design considerations and limitations. Up to six-part forms can be printed with a maximum thickness of .018" (for optimum feeding and stacking, no more than three parts are recommended). Card stock continuous forms are not recommended.

Prerequisites: 3713 Printer Attachment (#8111) and appropriate Expansion Feature (#3891, 3892) on the 3741 Data Station or 3741 Programmable Work Station.

Supplies: A black ribbon, IBM part number 1136970 or equivalent, is required.

Bibliography: IBM 3741 Data Station Reference Manual, GA21-9183, and IBM 3741 Data Station Operator Guide, GA21-9131.

Specify

- 1. Voltage (AC, 1-phase, 60 cycle): #9901 for 115 V, #9902 for 208V, or #9904 for 230 V ... must be consistent with system voltage.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray. Field Installation: Not recommended.
3. Pin Feed Platen: #9162 for 126 print positions (13-1/8" hole-to-hole), or #9167 for 120 print positions (12-1/2" hole-to-hole), or #9168 for 128 print positions (13-7/8" hole-to-hole).

Smaller pin feed platen widths can be specified in conjunction with the Adjustable Margin Feature (#1115) ... see "Special Features."

Note: Do not order #9168 unless paper is available in your area.

Accessories

Forms Stand: Permits placement of continuous forms on the stand above floor level and provides for stacking after printing. This accessory is a two shelf forms stand.

Table with 2 columns: Type, Feature No. Row 1: 3713, 4450

Additional Print Belts (3713): Permits the customer to print more than one character set for various applications. Can be interchangeably used with the belt provided with the machine.

Table with 3 columns: Machine Type, Belt Description, Feature No. Row 1: 3713, 48 Character EBCDIC, 5911. Row 2: 3713, 64 Character EBCDIC, 5910

Pin Feed Platens (3713): For feeding continuous forms that have been prepunched feed holes. On any one machine, one pin feed platen may be ordered for plant installation in lieu of the standard solid platen. The platen becomes the property of the customer and cannot be returned for credit.

Specify: (1) #9509 ... (2) Line Spacing and Hole-to-hole Width: One feature number, depending upon forms width and line spacing, from "Line Spacing" below. Prerequisite: On 3713 the appropriate Feature Number for line spacing on the basic machine (#9435 for 6 line/inch, or #9436 for 8 lines/inch) is required ... see "Specify" under each unit in "Machines."

Line Spacing—with #9509, one of the following Feature Numbers must be specified in accordance with line spacing and hole-to-hole width of the forms which will be used.

Table with 5 columns: Over-all Forms Width, Hole-to-hole Width, Writing Line, Feature No. for 6 lines/inch, Feature No. for 8 lines/inch. Lists various width and line spacing combinations and their corresponding feature numbers.



3715 PRINTER

Purpose: Printer for a 3741 Data Station model 1 or 2 or 3741 Programmable Work Station model 3 or 4.

Model 1 Has a printing rate of 40 cps in both directions.

Model 2 Has a printing rate of 80 cps in both directions.

Highlights: Prints serially in both left-to-right and right-to-left directions using the EBCDIC character set. The maximum print line is 132 print positions at 10 characters per inch spacing. Line spacing is 6 lines per inch.

Reformatting, editing, disk read, line feed, and printed line length, are factors which affect printer throughput. For detail calculation of performance, refer to TNL to *3741 Reference Manual*, GA21-9183. In most cases, however, throughput can be summarized as follows:

- The 3715 model 1 is equal to or faster than the 3713 Printer.
- The 3715 model 2 is approximately 50% faster than the 3715 model 1.

When using the 3741 models 3 or 4 ACL Translator Feature (#1350), the 3715 model 2 is recommended in order to obtain equal or greater throughput than the 3713.

The unit has a pressure feed platen that permits feeding of forms in a range of 3" to 14-7/8" overall width. Continuous forms fold-to-fold length may range from 3" to 14". Edge punched continuous forms are fed using the adjustable forms tractor, which is standard.

Matrix characters are formed by 7 vertical wires printing dots in up to 4 of 7 possible horizontal positions. Refer to SRL GA24-3488 for design considerations and limitations. Up to six-part forms can be printed with a maximum thickness of .018". Five- and six-part forms should be tried for satisfactory feeding, registration, and print quality. Card stock continuous forms are not recommended. For optimum handling of continuous forms, the special features Form Stand (#4450) is recommended.

Prerequisites: Matrix Printer Attachment (#8111) and appropriate Expansion Feature (#8120 or #8121) on the 3741.

Power: Power is supplied to the 3715 by the attaching 3741.

Supplies: A black ribbon, IBM Part No. 1136653 or equivalent, is required.

Accessories

Forms Stand: Permits feed continuous forms from the carton and provides for forms stacking after printing. This accessory is a one shelf forms stand.

Type	Feature No.
3715	4450



3717 PRINTER

Purpose: Printer for a 3741 Data Station model 1 or 2, or 3741 Programmable Work Station model 3 or 4.

Highlights: Line printer with speeds up to 155 lines per minute with 48 character set or up to 120 lines per minute with optional 64 character set. The maximum print line is 132 print positions at 10 characters per inch spacing. Line spacing is 6 lines per inch.

Unit has left and right adjustable forms tractors which hold overall forms widths from 3-1/2" to 14-7/8". Continuous forms fold-to-fold length may range from 3" to 14".

Up to six-part forms can be printed with a maximum thickness of .020". Card stock continuous forms are not recommended. Refer to SRL GA24-3488 for forms design considerations and limitations.

Prerequisite: 3717 Expansion Feature on 3741 (#8122 on model 1 or 3 ... #8123 on model 2 or 4).

Supplies: A black ribbon, IBM part number 1136634, or equivalent, is required.

Bibliography: *IBM 3741 Data Station Reference Manual*, GA21-9183, and *IBM 3741 Data Station Operator Guide*, GA21-9131-1.

Specify

1. Voltage (AC, 1-phase, 60 cycle): #9901 for 115 V, #9902 for 208 V, or #9904 for 230 V ... must be consistent with system voltage.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray. **Field Installation:** Not recommended.
3. Print Belt: Specify one—#9496 for 64-character EBCDIC, or #9497 for 48-character EBCDIC.

Note: #9496 should be specified if printing of application control language source listings is required.

Accessories

Forms Stand (#4450): Permits feed continuous forms from the carton and provides for forms stacking after printing. This accessory is a one shelf forms stand.

Type	Feature No.
3717	4450

Additional Print Belt (#5910, #5911): Permits the customer to obtain more than one character set print belt for various applications. Order #5910 for 64 character EBCDIC, #5911 for 48 character EBCDIC. **Field Installation:** Yes.



3735 PROGRAMMABLE BUFFERED TERMINAL

Purpose: A programmable terminal capable of buffered source document creation, concurrent data capture, and subsequent batch transmissions via an integral binary synchronous communications adapter.

Highlights: The 3735 consists of a control unit and an associated keyboard printer. The programmable control unit houses a fixed disk facility, logic circuits, and a binary synchronous communications adapter.

Keyboard: An IBM Selectric® Keyboard with operator guidance lights and switches.

Printer: A Selectric II® 15.5 cps printer with friction feed platen (standard) or a pin feed platen (optional). Vertical forms movement, and automatic print element positioning can be provided by the control unit.

Control Unit: Contains a non-removable disk with approximately 62.8K bytes of customer usable storage, plus the IBM written terminal control program. Additional user storage is available in two increments of 41.8K bytes each and a third increment of 167.5K bytes, for a total of 314.1K bytes. Installation of some special features will reduce customer usable storage as shown in the "Customer Storage/Feature Table." A binary synchronous communications adapter for transmission rates to 4800 bps is standard. The control unit provides the focal point for application interaction with customer Form Description Programs, the IBM written subroutines, and the operator guidance lights and switches on the keyboard.

Customer Storage/Feature Table: The addition of special features singly or in combination with other features will decrease customer usable storage as follows:

Table with 2 columns: Feature, Total Storage Reduction. Rows include #7880 and/or #4600 (1904 bytes), #4001 (3808 bytes), #4001 and 1 above (5712 bytes), #1450 alone or with 1, 2, & 3 above (7616 bytes).

Output Printer: The 3286 Printer model 3 can be attached for 66 cps output printing.

Security Enhancement Features: The Print Suppress capability (standard) allows selected data fields to be entered without being printed. The Keylock (special feature) is a key-operated switch which is located on the terminal control unit. When the switch is in the "off" position, no keyboard/printer operations are possible. Previously recorded data may be sent to the computer and data may be received from the computer provided the terminal was set up for this operation prior to the Keylock being set to the "off" position.

The Operator Identification Card Reader (special feature) is provided to enter terminal operator identification. This enhances the programmed control of the operator's access to data and allows an audit of his actions. The reader may also be used to enter any sequence of numeric characters pre-recorded on a card for other purposes such as transaction control, account control, and billing. The Operator Identification Card Reader also reads the Magnetic Credit Card announced for the 2730 Transaction Validation Terminal.

Transmission: The 3735 operates in half-duplex mode over facilities D3, D4, D4SB, D5, D5SB, X1M or X2M ... for details concerning these facilities, see M2700 pages.

Binary Synchronous Transmission: Allows for transmission rates of 1200, 2000, 2400 or 4800 bps.

The 3735 can communicate over multi-point or dial facilities to System/3 model 4, model 8, model 10 Disk, model 12 or model 15, System/360 models 22 thru 195, or System/370 models 115 thru 195. See "Programming" section for information on programming support.

Modems: One Integrated Modem or External Modem can be used.

The standard 3735 provides a cable and standard EIA interface for connection of IBM Modems or non-IBM Data Sets at transmission rates of 1200, 2000, 2400 or 4800 bps. See "Special Features" for Integrated Modems that may be used instead of an external modem/data set. Switched network operation and Auto Answer are standard on the 3735. Multipoint Data Link Control (#5010) is required for leased point-to-point or multipoint operation. Synchronous Clock (#7705) is required for 1200 bps operation.

Table with 5 columns: Speed (bps), Facility (1), Integrated Modem (1), IBM External Modem (1), 3735 Prereq Feature. Rows list various facilities like C4, D3, C5M/D4M, C5, D4 (multipt), D4 (pt-to-pt), D4SB, X1M, C6, D5, D5SB (pt-to-pt), D5, D5SB (multipt), X2M.

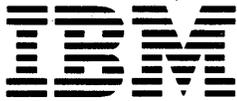
Notes: (1) For communication capabilities, modem utilization, and special features, see M2700, 3872, 3874 and 4872 pages. (2) C1 conditioning not required.

Customer Responsibilities: It is recommended that a telephone handset, which may be used to originate a call over common carrier Public Switched Facilities, be provided within 15 feet of the 3735 to facilitate maintenance. For additional responsibilities also see M2700 pages. In addition, since the 3735 is designed for sequential processing of customer applications, proper forms design is a customer responsibility.

Bibliography: See KWIK Index, G320-1621 or specific system bibliography.

Specify

- 1. Voltage [115 VAC, 1-phase, 3-wire, 60 HZ]: Locking Plug—#9880, or non-lock plug—#9881.
2. Transmission Code: #9761 for EBCDIC, or #9762 for ASCII. The 3735 keyboard and print element support the mono case 64-character ASCII and is supplied when #9762 is specified.



Limitation: Not recommended for field installation.

3. Print Element: If EBCDIC Transmission Code (#9761) is specified, Print Element (Part No. 1167043) is supplied and need not be specified. If ASCII Transmission Code (#9762) is specified, Print Element (Part No. 1167167) is supplied and need not be specified. With #9762, if a Dual Case element (Part No. 1167168) is desired, see pages TC 21 and TC 23 in "Type Catalog."

Accessories

Forms Guide/Roll Paper Holder (3735): Provides for continuous forms or for mounting rolls of paper. Includes a tear bar.

Forms Stand: Permits placement of continuous forms on the stand above floor level and provides for stacking after printing. This accessory is a two shelf forms stand.

Type Feature No.

3735 4450

Pin Feed Platens (3735): For feeding of continuous forms that have pre-punched feed holes. On any one machine, one pin feed platen may be ordered for plant installation in lieu of the standard solid platen. The platen becomes the property of the customer and cannot be returned for credit.

One in lieu of std friction feed platen (max 1 per machine) (On 3735 only 6 lines/inch is available)

Pin Feed Platen (regular) #9509 Pin Feed Platen (with Forms Control)#9510

Specify

(1) #9509 or 9510 ... (2) Line Spacing and Hole-to-hole Width: One feature number, depending upon forms width and line spacing, from "Line Spacing" below ... (3) With #9510, one Feature Number for Bead Chain must also be specified (see "Bead Chain" below). Prerequisite: On 3735 the appropriate Feature Number for line spacing on the basic machine (#9435 for 6 lines/inch, or #9436 for 8 lines/inch) is required ... see "Specify" under each unit in "Machines."

Line Spacing: With either #9509 or #9510, one of the following Feature Numbers must be specified in accordance with line spacing and hole-to-hole width of the forms which will be used.

Over-all Forms Width	Hole-to-Hole Width	Writing Line	Feature No. for Line Spacing	
			6 lines/inch	8 lines/inch
5-3/4"	5-1/4"	4-5/8"	9151	—
6-1/2"	6"	5-3/8"	9152	9272
8"	7-1/2"	6-7/8"	9153	9273
8-1/2"	8"	7-3/8"	9154	9274
9-1/2"	9"	8-3/8"	9155	9275
9-7/8"	9-3/8"	8-3/4"	9156	—
10-3/8"	9-7/8"	9-1/4"	9157	—
10-1/2"	10"	9-3/8"	9158	9278
10-5/8"	10-1/8"	9-1/2"	9159	9279
11-3/4"	11-1/4"	10-5/8"	9160	9280
12"	11-1/2"	10-7/8"	9161	9281
13"	12-1/2"	11-7/8"	9167	9287
13-5/8"	13-1/8"	12-1/2"	9162	9282
14-3/8"	13-7/8"	13-1/4"	9168*	9288*

Additional or replacement keys for Key Lock Feature #4695 may be purchased from IBM.

Additional Customer Storage, 1st Increment (#1001): Provides an additional 41.8K bytes of user storage. Together with the standard customer area of 62.8K, total user storage becomes 104.7K bytes. Field Installation: Yes.

Additional Customer Storage, 2nd Increment (#1002): Provides a second increment of 41.8K bytes of user storage. Together with the standard area, plus #1001, the total user storage becomes 146.6K bytes. Field Installation: Yes. Prerequisite: #1001.

Additional Customer Storage, 3rd Increment (#1003): Provides an additional 167.5K bytes of user storage. Together with the standard area, plus #1001 and #1002, the total user storage becomes 314.1K bytes. Maximum: One. Field Installation: Yes. Prerequisites: Add'l Customer Storage, 1st Increment (#1001) and 2nd Increment (#1002). Limitation: Only 3735s serial no. 12001 and later can have this feature field installed.

Buffer Expansion (#1450): Adds three 480-byte dynamic buffers that provide fast access local storage for user buffers and counters. Two index counters are supplied with this feature and with File Storage Capability (#4001). Maximum: One. Field Installation: Yes. Limitation: Customer storage is reduced by 7,616 bytes total when this feature is installed singly or in combination with any other special features. See "Customer Storage/Feature Table" under "Highlights."

5496 Attachment (#3950): To attach a 5496 Data Recorder model 1. Maximum: One. Field Installation: Yes. Prerequisite: 3735 Attachment (#7801) on the 5496.

File Storage Capability (#4001): Permits user access to a portion of the 3735 disk storage for storage and retrieval of records that are coded with a simple identification key. The maximum record size, including an identification key and two data delimiters, is 236 bytes. The identification key can range from 1 to 15 bytes. Two index counters are supplied with this feature or with Buffer Expansion (#1450). Maximum: One. Field Installation: Yes. Limitations and Restrictions: There is no additional reduction of customer storage of 7,616 bytes when this feature is installed in combination with Buffer Expansion (#1450). On machines without #1450, this feature reduces customer storage by 3,808 bytes. See "Customer Storage/Feature Table" under "Highlights."

Operator Identification Card Reader (#4600): A small (approximately 3" x 4" x 6") self-enclosed device for reading information from a Magnetically Striped and Encoded I.D. Card and a Magnetic Credit Card (2-1/8" x 3-3/8"). An 8-foot cable is provided to accommodate table-top use. Power is supplied by the 3735.

Maximum: One. Field Installation: Yes. See "Customer Storage/Feature Table" under "Highlights."

Keylock (#4695): A key operated switch located on the control unit. When the switch is in the "off" position, no I/O is possible from the printer/keyboard. The control unit may be used for transmission provided it was set up to do so prior to keylock being set to the "off" position. This feature supplies two keys. For additional or replacement keys, see "Locks and Keys" in Accessories. Field Installation: Yes.

Multipoint Data Link Control (#5010): Required for leased line attachment (point-to-point and multipoint). Allows multiple 3735s to be used on the same communications line with a CPU.



Terminal can be polled or selected when acting as a tributary station in a multipoint system. All 3735s installed on the same line facility require this feature, and they must use the same transmission code and modem ... see Modems and M2700 pages.. **Field Installation:** Yes.

1200 BPS Integrated Modem (#5500): A modem for operation at 1200 bps over leased 2-wire or 4-wire voice-grade channel. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Synchronous Clock (#7705) ... Multipoint Data Link Control (#5010) is required for leased point-to-point and for multipoint operation. **Limitation:** Cannot be installed with 2400 BPS Integrated Modems (#5600, #5602, #5610). The communicating transmission control unit or ICA must be equipped with 1200 BPS Integrated Modem, or the IBM 1200 BPS Line Adapter.

1200 BPS Integrated Modem, Switched With Auto Answer (#5501): A modem with auto answer for operation at 1200 bps over a switched telecommunications network via a Telephone Co. supplied Data Access Arrangement Type CBS, or equivalent. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Synchronous Clock (#7705). **Limitation:** Cannot be installed with 2400 BPS Integrated Modems (#5600, #5602, #5610). The communicating transmission control unit or ICA must be equipped with 1200 BPS Integrated Modem, or the IBM 1200 BPS Line Adapter.

2400 BPS Integrated Modem, Point-To-Point (#5600): An integrated self-clocked modem for 2400 bps operation on point-to-point communications facilities ... 2- or 4-wire connection. Half speed capability is standard. Compensation for line distortion is via operator adjustment on the 3735 operator panel. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Multipoint Data Link Control (#5010). **Limitation:** Cannot be installed with Synchronous Clock (#7705), 1200 BPS Integrated Modem (#5500 or #5501), or 2400 BPS Integrated Modem (#5602 or #5610). This modem will operate with the IBM 3872 Modem equipped with Point-to-Point Feature (#6101 or #6102).

2400 BPS Integrated Modem, Multipoint (#5602): An integrated self-clocked modem for 2400 bps operation as a tributary station in a centralized multipoint network ... 4-wire. Half speed capability is standard. Compensation for line distortion between the control and the tributary station is via operator adjustment on the 3735 operator panel. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Submit an RPQ for operation on a basic 3002 channel. Multipoint Data Link Control (#5010). **Limitation:** Cannot be installed with Synchronous Clock (#7705), 1200 BPS Integrated Modem (#5500 or #5501), or 2400 BPS Integrated Modem (#5600 or #5610). All tributary stations in the multipoint centralized network must be equipped with 2400 BPS Integrated Modem, Multipoint or the IBM 3872 Modem with Multipoint Tributary (#5101 or #5102). The master station may be equipped with the IBM 3872 Modem-Basic.

2400 BPS Integrated Modem, Switched (#5610): An integrated self-clocked modem for 2400 bps operation over the switched telephone network facilities. Automatic answer and manual half-speed capability are standard with this feature. Automatic equalization is effected at the beginning of each call. Attachment to the network is via common carrier Data Access Arrangement Type CBS, or equivalent. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with Synchronous Clock (#7705), Multipoint Data Link Control (#5010), 1200 BPS Integrated Modem (#5500 or #5501), 2400 BPS Integrated Modem (#5600 or #5602), or Switched Network Backup (#7951). This modem is compatible with the IBM 3872 Modem equipped with Switched Network-Basic (#7941) or Switched Network-Second (#7942). In addition, this modem

may communicate with a 3872 modem equipped with Switched Network Back-up (#7951 or #7952). The control station may be equipped with Automatic Call Originate (#1091).

Synchronous Clock (#7705): A synchronous clock for use with 1200 BPS Integrated Modems or data sets which do not have an internal clock. The device with which the 3735 is to communicate with must also have an internal clock operating at the same bps rate. **Field Installation:** Yes.

3286 Printer Model 3 Attachment (#7880): To attach a 3286 Printer model 3 (66 cps). A 3735 with EBCDIC Transmission Code (#9761) requires a 3286 model 3 with EBCDIC Character Set (#9089). A 3735 with ASCII Transmission Code (#9762) requires a 3286 model 3 with ASCII Character Set (B) (#9092). **Maximum:** One. **Field Installation:** Yes. See "Customer Storage/Feature Table" under "Highlights."

Switched Network Backup (#7951): Provides the capability of attaching the 2400 BPS Integrated Modem, Multipoint (#5602) or the 2400 BPS Integrated Modem, Point-to-Point (#5600) to the switched telephone network as a back-up to the prime leased facility. A fixed compromise equalizer is provided for backup operation. Attachment to the switched telephone network, is made via the common carrier Data Access Arrangement Type CDT, or equivalent. Calls on the switched network must be established and answered manually. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** 2400 BPS Integrated Modem (#5600 or #5602). **Limitations:** Cannot be installed with 2400 BPS Integrated Modem, Switched (#5610) or with 1200 BPS Integrated Modem (#5500 or #5501). For OS/DOS BTAM programming considerations at the CPU, refer to Switched Network Backup under 3872 and Appendix "C" of *IBM 3872 User's Guide*, GA27-3058.

Pin Feed Platen (#9509): (Purchase Only) For plant installation in lieu of standard friction feed platen. **Maximum:** One. For plant installation, see "Pin Feed Platens" on M10000 pages for feature numbers and purchase price.

Limitation: All platens for the 3735 must be at 6 lines/inch spacing. The maximum width pin feed platen for use with a 3735 is 13-1/8" hole-to-hole.

**3741 DATA STATION—MODELS 1 AND 2****3741 PROGRAMMABLE WORK STATION—MODELS 3 AND 4**

Purpose: Used to record keyed data onto a magnetic disk by manual operation of the keyboard. Also, to verify data that has been previously keyed. Also, to execute programs written in the Application Control Language. Disks can be used as a data storage medium, for batch transmissions via a binary synchronous communications adapter, or read into a 3747 Data Converter to convert captured data onto one-half inch computer tape for subsequent processing. Diskettes can also be read directly into a System/370 model 115, 125, 135, 145, 148, 155 II, 158, 165 II and 168 via a 3540 Diskette I/O Unit. Diskettes can also be read directly into a System/32, System/34, or a System/3 with a 3741 Attachment Feature.

Model 1 A single data entry station ... variable record size, 1 to 128 characters ... 10 program levels standard ... auxiliary duplication ... 240 character CRT display ... operator guidance.

Model 2 Same functional characteristics as model 1 ... also includes a binary synchronous communications adapter ... switched or non-switched, point-to-point, or non-switched multipoint ... auto answer, EBCDIC transparency standard (except when transmitting or receiving blocked data) ... can be used as a remote terminal at 1200, 2000 or 2400 bps over appropriate communications facilities. See "Communication Facilities" below.

Model 3 Executes programs written in the Application Control Language. Optionally can create object programs from source programs. Can operate with same functional characteristics as a Model 1 when not under ACL program control.

Model 4 Same functional characteristics as model 3. Adds the binary synchronous communications capability of the model 2 and can operate with the same functional characteristics as the model 2 when not under ACL program control.

Highlights: Has a buffered storage area into which data is keyed prior to recording on disk, thus allowing for correction of detected errors before record is written. Ten program levels are standard. Programs control the automatic functions of skipping, duplicating, field definition, etc. Automatic program selection provided by program chaining enables operator to key up to a 1,280-character logical record. Modes of operation (ENTER, UPDATE, VERIFY, or SEARCH) are under keyboard control. Data record lengths can be variable from 1 to 128 characters. **Limitation:** All records within a single data set must be the same length; however, more than one data set can be written on the same disk.

Keyboard Has a standard 64-character alphanumeric combination keyboard with "EL" character set for key entry and verifying. In addition to standard keys, the keyboard has: Record-Field-Character Backspace ... Record-Field-Character Advance and Repeat keys.

CRT Display Up to 240 characters can be displayed ... six rows of 40 characters per row ... first row displays machine status (mode of operation, column indicator and error codes) ... rows 2, 3, 4 and the first 8 positions of row 5 display either the data being keyed or the active program, at operator's option ... data is displayed progressively as it is keyed to build full records for visual verification. The last 30 characters of row 5 display, at operator's option, either field prompting information or current field format ... row 6 provides an isolated display of current field data, as it is being keyed.

Operator Guidance Utilizes two display lines of the CRT display (row 5 and row 6) for the purpose of describing to the operator the type of information which is required to be keyed ... display lines are updated on a field-by-field basis ... first line displays a prompting message associated with the field being keyed ... second line displays the data as it is being keyed ... the even numbered program levels are used for guidance information storage.

Magnetic Disk Diskette 1 storage capacity to record up to 1,898 data records (128-character each) ... maximum of 19 data sets per disk ... removable and interchangeable among 3741s ... all data is recorded serially on disk as standard EBCDIC code ... one IBM Diskette for data recording is provided as standard. For additional diskettes, see "Supplies" below.

Search Address Provides a means for direct access to a record that the operator specifies by its track and sector address.

Search EOD Provides a means to directly access the last record of a data set.

Search on Content Allows user to retrieve and display data previously recorded on disk by comparing the contents of the desired data record to a search argument ... argument may be equal to all or portion of the data record ... blank characters in argument are treated as "don't care" characters ... search terminates when equal condition occurs between argument and data record or if a match cannot be found.

Search Sequential Content Provides a search by content that is much faster than "Search Content." The records must be arranged in the data set in ascending alphanumeric order within the portion of the record that corresponds to the search argument.

Application Control Language (ACL) Allows the user to execute programs containing arithmetic, logical, branching, I/O, and control statements. These source statements are translated to executable code by the optional Application Control Language Translator feature ... see "Special Features." Up to 4 disk data sets, the printer, the keyboard, and display can be controlled in one program. The Second Disk (#6677) can be written on as well as read. Includes 4K of "Read/Write Storage."

Matrix Printer Attachment feature (#8111): allows the attachment of the 40-character per second 3713 Printer. Printer formatting can be controlled by programs in the program buffers or by printer control characters in the data stream. Reformatting within a record can be accomplished during printing. Records can also be printed with no format control with one record printed per line. A single record, a complete data set, or records that satisfy a mask record can be printed.

The Matrix Printer Attachment feature (#8111) also allows the attachment of the 40 cps 3715 Printer model 1 or the 80 cps 3715 model 2. In addition to the functions provided for the 3713 Printer described above, the functions provided for the 3715 Printer include:

- Print edit flexibility,
- Printing from second disk drive,



Print constant data stored in program levels,
Print program chaining,
Print disk address along with record,
Page numbering and page headings, and
Reexpansion of compressed data streams.

3717 Expansion Feature (#8122 and #8123): allows the attachment of the 155-line per minute 3717 Printer and/or the Second Disk (#6677) to the 3741 models 1 and 3, or 2 and 4 respectively. The 3717 Printer includes all of the functions described above for the Matrix Printer Attachment feature and also offers 48/64 character set print belt interchangeability by the operator.

I/O Adapter (#3265/3266): allows the direct attachment of the 3741 models 1, 2, 3 or 4 to a System/3 equipped with the 3741 Attachment (#8220).

The 3741 can be used as the System/3 Reader (for OCL) or Punch, and RPG II object programs can read records from, or write records to a diskette (RPG II Telecommunications Feature is not required).

Communications: The binary synchronous communications adapter on the model 2 or 4 operates in half-duplex mode over facilities C4, C5, D3, D4 or X1M ... for information concerning these facilities, see M2700 pages.

Binary Synchronous Transmission: Allows for transmission rates of 1200, 2000 or 2400 bps. May communicate over point-to-point leased or switched facilities to another 3741 model 2 or 4, or a 3747 Data Converter with the appropriate communications adapter.

The 3741 model 2 or 4 may communicate over dial or leased facilities to System/3 model 4, model 6, model 8, model 10 Disk, model 12 and model 15, System/32 (switched or non-switched point-to-point only), System/34 (switched or non-switched point-to-point only), 5231 model 2 (switched or non-switched point-to-point unidirectional only), System/360 models 22 thru 75 and 195 (except model 44 or model 67 in TSS mode), or System/370 models 115 thru 195. See "Programming" section for core size limitations.

Prerequisites

Communication with a System/360 model 22 thru 75 (except model 44 or model 67 in TSS mode) and 195, or System/370 model 115 thru 195: Via a 2701 Data Adapter Unit, 2703 Transmission Control, or a 3704 or 3705 Communications Controller equipped with appropriate features ... see 2701, 2703, 3704, 3705.

Communication with System/370 model 115, 125, 135,: Via its Integrated Communications Adapter (#4640) ... also via a 2701, 2703, 3704 or 3705.

Communication with a System/3 model 4, model 6, model 10 Disk, and model 15: Via the Binary Synchronous Communications Adapter (#2074) on the model 4, model 6, (#2074 or #2084) on the model 10 Disk and model 15. The 3741 model 2 or 4 may also be attached directly, via its external data set (modem) cable, to the Local Communications Adapter (#4765) on the model 6, model 10 Disk, and model 15.

Communication with a System/3 model 8 and model 12: Via the Binary Synchronous Communications Adapter (#2074) or the Integrated Communications Adapter (#4645 and #6202) on the model 8, or the Binary Synchronous Communications Adapter (#2074 and/or #2084) or the Integrated Communications Adapter (#4645 and #6202) on the model 12. The 3741 model 2 or 4

may also be attached directly, via its external data set (modem) cable to the Integrated Communications Adapter (#4645 and #4802) on the model 8 or model 12.

Communication with System/32: Via the Binary Synchronous Communications Adapter (#2074) on the 5320 System Unit.

Communication with System/34: Via its Communications Adapter on the 5340 System Unit.

Communications with 5230 Data Collection System: Via the BSC Adapter (#2074) on the 5231 model 2. Transmission is batch mode only via single diskette transfer, point-to-point unidirectional transmission only.

Customer Responsibilities: See M2700 pages.

Bibliography: *IBM 3741 Data Station Reference Manual*, GA21-9183, and *IBM 3741 Data Station Operator Guide*, GA21-9131.

Specify

1. Voltage (AC, 1-phase, 60 Hz) Standard non-locking plug—(uses customer standard type receptacle) #9881 for 115 V, #9885 for 208 V, or #9887 for 230 V. Locking plug (requires customer locking type receptacle)—#9880 for 115V, #9884 for 208V or #9886 for 230V. Voltage changes cannot be made in the field.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray. *Note:* Color accent is provided on front and back panels only ... top and sides will always be white. Color changes cannot be made in the field.
3. Data Set Attachment (Model 2 or 4 only): The IBM 3872 Modem is recommended for 2400 bps operation on C5 or D4 facilities. One of the following, depending on facility, must be specified—#9120 for C5M/D4M (2000 bps), #9121 for C5/D4 or X1M (2400 bps), #9122 for D3M (1200 bps), or #9123 for C4M (1200 bps). For attachment to the Local Communications Adapter (#4675) or ICA (#4645 and #4802) on the System/3, specify #9121. **Prerequisite:** #9122 or #9123 requires Synchronous Clock (#7705) ... see "Special Features."
4. Data Set Cable (Model 2 and 4 only): A 20 foot data set cable is provided as standard. If a 40 foot cable is desired, specify #9021. On field upgrades (from model 1 to 2 or 4, or model 3 to 4), the 40 foot cable may be specified.

Accessories

Locks and Keys: The 3741 with Keylock (#4655) special feature is shipped with two keys. Additional keys may be purchased only from IBM. (Vendor will supply additional keys only to original purchaser.)

Note: Purchase customers who wish to upgrade to a model 2 or model 4 with Expansion Feature from a model 1 or 3, with or without Expansion Feature (#3891), must purchase Expansion Feature (#3892) at time of upgrade.

**For All Models**

Data Recorder Attachment (#3200): To attach either a 129 Card Data Recorder model 2 equipped with 3741/5320 Attachment (#8201), or a 5496 Data Recorder model 1 equipped with a 2772/3741/5320 Attachment (#7850). **Limitation:** Cannot be installed with I/O Adapter (#3265/3266). **Maximum:** One. **Field Installation:** Yes.

I/O Adapter (#3265/3266): To attach any model of the 3741 to a System/3. #3265 for 3741 Models 1 and 2; #3266 for 3741 Models 3 and 4. A cable with a maximum length of 40 feet is provided with an I/O Adapter (#3265/3266). Specify #9018 indicating length as a quantity of 20' or 40'. **Limitations:** Cannot be installed with Data Recorder Attachment Feature (#3200). See limitations for the 3741 Attachment Feature (#8220) on System/3. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** 3741 Attachment (#8220) on the 5406, 5408, 5410, 5412 or 5415.

3713 Expansion Feature (#3891, 3892): Provides additional capacity to permit installation of Second Disk (#6677) and/or Matrix Printer Attachment (#8111). #3891—for 3741 model 1 or 3 ... #3892—for 3741 model 2 or 4. **Limitation:** Cannot be installed with 3715 Expansion Feature (#8120 or #8121) or 3717 Expansion Feature (#8122 or #8123). **Maximum:** One. **Field Installation:** Yes.

Feature Group A (#4002): Consists of the following:

Verify: provides the capability to check the accuracy of pre-recorded records. If any recorded data is changed as a result of verification, the disk record will be updated upon completion of record ... fields that do not require verification may be bypassed by program control.

Production Statistics: provides machine statistics for customer use in measurement of workload or production, analysis of errors, and job accounting. Counts automatically under machine control (no programming) data and functional keystrokes, verify correction keystrokes, and records processed. Displaying and/or recording of totals on disk is under operator keyboard control.

Field Totals: provides the ability to create a hash total for a group of records or a batch of work, or to crossfoot and write totals in the same record or in a following record under program control.

Feature consists of three 19-position individual accumulators that add any numeric manually keyed or duplicated fields into any accumulator, under program control. The maximum size of the input field is 14 decimal positions. If overflow beyond 19 digits occurs in an accumulator, it will not be indicated.

In addition to the numbers 0-9, a field total field may include any of the 256 EBCDIC characters. All characters with the low order 4 bits of the character being 0-9 will accumulate with numeric values 0-9 respectively. All other characters will accumulate with the value zero. Arithmetic sign control will be determined by the zone portion of the data keyed in the units position of the field. Responsibility for input size limitation and accumulator

overflow is left to the user. Maximum output field size is 19 positions.

Accumulators carry true totals in ENTER mode. In UPDATE or VERIFY mode, accumulators contain the net difference between the data read from the disk and the modified data in the accumulate fields. Thus, the net difference totals provide an auto-balance capability. Accumulators can be displayed on the CRT display at operator's option.

In addition to keying, totals can be accumulated on an "off-line" basis ... function provides for automatic processing of each pre-recorded disk record as it is read ... adds designated field contents to appropriate counters ... reads out and records data from counters ... reads out/resets and records data from counters ... automatic program level selection based on type of record being processed.

Self-Checking Number: (Modulus 10 and 11) ... feature assures that all digits of a number, such as account or item field, have been correctly keyed. The self-checking number consists of two parts—the basic identifying number, and its check digit ... a detected error locks out the keyboard ... operates in ENTER, VERIFY and UPDATE mode. *Note:* Self-checking numbers of Modulus 10 are not compatible with those of Modulus 11 ... left-base numbers are not accommodated ... self-checking numbers and left-zero insertion are mutually exclusive within the same field ... self-check number generating ability is not available.

Disk Initialization: disks sold by IBM will be initialized at time of manufacture. Disks which develop bad tracks in use can be re-initialized with this feature, so that the bad tracks are automatically bypassed.

Field Installation: Yes.

Proof Keyboard (#5901): Modifies the standard alphameric keyboard to provide an alphameric keyboard with a numeric key arrangement similar to the adding machine. **Field Installation:** Yes. *Note:* Customers who elect to purchase a 3741 with #5901 only and later add Feature Group A (#4002) and/or Record Insert (#6123) should consider purchase of the additional features initially because this field upgrade requires replacement of #5901 and the re-installation of #5901 along with Feature Group A and/or Record Insert.

Record Insert (#6123): Provides capability to add records within an existing data file. Sequential files can be updated or corrected by inserting records in their proper location within the sequence. **Maximum:** One. **Field Installation:** Yes.

Second Disk (#6677): Provides a second disk drive that allows the user to accomplish the following functions: Merge—records can be merged from the second disk and the keyboard onto the first disk ... Copy—a data file from the second disk can be copied onto the first disk ... Pooling—data can be copied from more than one disk onto a single disk. The disks that are to be copied are mounted on the second disk drive and the data is written onto the disk mounted on the standard disk drive ... BSCA—the second disk may be used to expand the data storage capacity when transmitting or receiving. All second disk functions are read-only functions except when used in conjunction with BSCA feature or on the 3741 models 3 and 4 when under ACL program control. **Field Installation:** Yes. **Prerequisites:** 3713 Expansion Feature (#3891 or #3892) or 3715 Expansion Feature (#8120 or #8121) or 3717 Expansion Feature (#8122 or #8123). *Note:* Customers wanting Second Disk Only (no printer) should order Expansion Feature #3891 or #3892. However, customers who may elect to purchase a 3741 with Second Disk only and



later add either a 3715 Printer or a 3717 Printer should consider purchase of Expansion Feature #8120, #8121, #8122 or #8123.

Matrix Printer Attachment (#8111): Provides the capability to attach a 3713 Printer (40 cps) or a 3715 Printer (model 1—40 cps bidirectional, model 2—80 cps bidirectional). **Maximum:** One. **Limitation:** Cannot be installed with 3717 Expansion Feature (#8122 or #8123). **Field Installation:** Yes. **Prerequisite:** 3713 Expansion Feature (#3891 or #3892) or 3715 Expansion Feature (#8120 or #8121).

3715 Expansion Feature (#8120, 8121): Provides additional capacity to permit installation of Second Disk (#6677) and/or Matrix Printer Attachment (#8111). #8120—for 3741 models 1 and 3 ... #8121—for 3741 models 2 and 4. **Limitation:** Cannot be installed with 3713 Expansion Feature (#3891 or #3892) or 3717 Expansion Feature (#8122 or #8123). **Maximum:** One. **Field Installation:** Yes.

3717 Expansion Feature (#8122, 8123): Provides the capability to attach a 3717 Printer (155 lpm) and/or the Second Disk (#6677) to the 3741. #8122—for 3741 models 1 and 3 ... #8123—for 3741 models 2 and 4. **Limitation:** Cannot be installed with Matrix Printer Attachment (#8111) or 3713 Expansion Feature (#3891 or #3892) or 3715 Expansion Feature (#8120 or #8121). **Maximum:** One. **Field Installation:** Yes.

For Model 2 or 4 Only

Expanded Communications (#1680). (Model 2/4 only) Consists of the following:

Expanded Communications Buffer: Expands the size of the communications buffer from 128 bytes to 512 bytes providing an increase in transmit and receive throughput. Multiple records can be transmitted or received per block (up to 512 bytes), each record being separated by IRS characters (Transparent mode cannot be used when sending or receiving blocked data).

Transmit Selected Fields: Provides the capability of transmitting selected field from data records, thus increasing communications line efficiency. Fields are selected under a special program level loaded prior to initiating the teleprocessing function (cannot be used in conjunction with "Transmit Selected Records" function).

Transmit Selected Records: Provides the capability of transmitting selected records from a data file, thus increasing communication line efficiency. Records are selected under a special program level loaded prior to initiating the teleprocessing function. All records matching a search argument are transmitted (cannot be used in conjunction with "Transmit Selected Fields" function).

Receive Data and Insert Constants: Provides the capability of receiving data on a communication line and inserting constant information prior to writing records onto the diskette. The constant information and location is controlled by a special program level loaded prior to initiating the teleprocessing function.

Unattended Print Mode: Allows the printer attached to the 3741 model 2 to print the first data set received at the completion of the teleprocessing function without operator intervention. It is accomplished by proper loading of printer program levels and specific operator set-up procedures. **Maximum:** One. **Field Installation:** Yes.

Expanded Communications/Multipoint Data Link Control (#1685): (Model 2/4 only) Provides all of the capabilities listed under Expanded Communications (#1680) plus Inquiry. Inquiry provides the capability of keying an inquiry message, logging it on the diskette, and transmitting it to a host CPU. The response

will be written onto the diskette. A number of records can be received for a long response; after the last record is received, the diskette read/write head will be positioned at the first record received, and it will be displayed on the CRT. The operator can then "record advance" to look at subsequent records in the response.

Also allows multiple 3741 model 2s to reside on a dedicated network as tributary stations along with other BSC devices. 3741 model 2 can be polled or selected when acting as a tributary station in a multipoint system. All 3741 model 2s installed on the same line facility require this feature, and they must all use the same type of modem ... see modems and M2700 pages. **Limitation:** Cannot be installed with Terminal Identification (#7850). **Maximum:** One. **Field Installation:** Yes.

Keylock (#4655): (Model 2 or 4 only) A key operated switch. When the switch is in the "locked" position, entry into the communications mode of operation is prevented. The 3741 may be used for communications provided it was set up to do so prior to the keylock being set to the "locked" position. *Note:* For additional and/or replacement keys, see Accessories. **Field Installation:** Yes.

Operator Identification Card Reader (#5450): (Model 2 or 4 only) Provides the capability of reading a small, 2-1/8" by 3-3/8" (credit card size), plastic card with a magnetic stripe on the back. This card can be encoded with up to 40 numeric characters, including control characters. This feature provides the ability to read an operator identification card to allow identification of the station operator, thus enhancing system data security capability. Available with 115 V (#9880 or #9881) only.

1200 BPS Integrated Modem, Non-Switched (#5500): (Model 2 or 4 only) A modem for operation at 1200 bps over non-switched, two wire or four wire voice grade channel, type 3002. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Synchronous Clock (#7705) ... the terminal device with which the 3741 model 2 or 4 is communicating must also be equipped with an IBM 1200 BPS Integrated Modem.

1200 BPS Integrated Modem, Switched With Auto Answer (#5501): (Model 2 or 4 only) A modem with auto answer for operation at 1200 bps over a switched telecommunications network via a telephone company supplied data access arrangement Type CBS, or equivalent. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Synchronous Clock (#7705) ... the terminal device with which the 3741 model 2 or 4 is communicating must also be equipped with a 1200 BPS Integrated Modem.

Synchronous Clock (#7705). (Model 2 or 4 only) Provides business machine clocking of the data onto and off the transmission line. To be used only when the attached modem does not provide such clocking. The terminal device with which the 3741 model 2 or 4 is communicating must also be equipped with business machine provided clocking. **Field Installation:** Yes. **Prerequisite:** Data Set Attachment (#9122 or #9123) ... see "Specify."

Terminal Identification (#7850): (Model 2 or 4 only) Provides an expanded identification function when operating on a switched (dial-up) facility ... station transmits a 4-character identification sequence when initiating or responding to a line bid ... station can check far-end device identification sequence.

Four character identification sequence consists of a one-character terminal type code (this code is the same for all 3741



model 2s or 4s), followed by a three-character sequence that specifically identifies that station from any other 3741. The specific terminal identification is a plant installed sequence assigned by IBM from a randomly generated master list.

Also, with this feature, a 3741 can identify if a legitimate station within the user's network is initiating the line bid. This is accomplished by comparing an operator-keyed sequence of characters to a terminal identification sequence received after a connection has been established. Transmission or reception of data can commence only after the received terminal identification sequence matches character for character to the operator-keyed sequence. **Limitation:** Cannot be installed with Expanded Communications/Multipoint Data Link Control (#1685). **Field Installation:** Yes.

For Model 3 or 4 Only

Application Control Language Translator (ACL) (#1350): (Model 3 or 4 only) Provides the capability of translating programs written in the Application Control Language into executable code. A program listing is prepared optionally, and diagnostic messages are printed. **Field Installation:** Yes, if Second Disk (#6677) is installed. *Note:* Purchase customers who may elect to later upgrade to 8K storage should consider the purchase of #4975 initially, because the field upgrade requires replacement of the original 4K storage.



3742 DUAL DATA STATION

Purpose: Used to record keyed data onto a magnetic disk by manual operation of the keyboard. Also, to verify data that has been previously keyed. Disks are read into a 3747 Data Converter to convert captured data onto one-half inch computer tape for subsequent processing. Diskettes can also be read into a System/370 model 115, 125, 135, 145, 155 II, 158, 165 II, 168 via the 3540 Diskette Input/Output Unit. Diskettes can be read directly into System/32 or a System/34.

Highlights: Two independently operating stations housed in a single physical unit ... 80-character fixed record size ... verify, production statistics, auxiliary duplicating, and six program levels standard per station ... 120-character CRT display.

The optional 128 Character feature replaces the 80 character record with a record length that is variable from one to 128 characters.

Has buffered storage area into which data is keyed prior to recording on disk, thus allowing for correction of detected errors before record is written. Six program levels are standard. Programs control the automatic functions of skipping, duplicating, field definition, etc. Automatic program selection provided by program chaining enables operator to key up to a 480 character logical record. Modes of operation (ENTER, VERIFY, UPDATE, or SEARCH) are under keyboard control.

Keyboard: Has a standard 64-character alphanumeric combination keyboard with "EL" character set for key entry and verifying. In addition to standard keys, the keyboard has: Record-Field-Character Backspace ... Record-Field-Character Advance and Repeat Keys.

CRT Display: Up to 120 characters can be displayed to each operator ... three rows of 40 characters per row ... first row displays machine status (mode of operation, column indicator and error codes) ... rows 2 and 3 display either the data being keyed or the active program, at operator's option ... data is displayed progressively as it is keyed to build full records for visual verification.

Magnetic Disk: Diskette 1 storage capacity to record up to 1,898 80- or 128-character records ... maximum of 19 data sets per disk ... removable and interchangeable among data stations ... all data is recorded serially on the disk as standard EBCDIC code ... one IBM Diskette per station for data recording is provided as standard.

Standard Features

Verify: Provides the capability to check the accuracy of pre-recorded records. If any recorded data is changed as a result of verification, the disk record will be updated upon completion of record ... fields that do not require verification may be bypassed by program control.

Production Statistics: Provides machine statistics for customer use in measurement of workload or production, analysis of errors, and job accounting. Counts automatically under machine control (no programming) data and functional keystrokes, verify correction keystrokes, and records processed. Displaying and/or recording of totals on disk is under operator keyboard control.

Search Address: Provides a means for direct access to a record that the operator specifies by its track and sector address.

Search EOD: Provides a means to directly access the last record of a data set.

Bibliography: *IBM 3742 Dual Data Station Reference Manual*, GA21-9184, and *IBM 3742 Dual Data Station Operator Guide*, GA21-9136.

Specify

1. Voltage (AC, 1-phase, 60 cycle): Locking plug—#9880 for 115 V, #9884 for 208 V, or #9886 for 230 V. Non-lock plug—#9881 for 115 V, #9885 for 208 V, or #9887 for 230 V. Voltage changes cannot be made in the field.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray. *Note:* Color accent is provided on the front and back panels only ... top and sides will always be white. Color changes cannot be made in the field.

Special Features

128 Character (#5455): Provides record length that is variable from 1 to 128 characters and four additional program levels for a total of ten. Automatic program selection provided by program chaining enables operator to key up to a 1,280 character logical record. Automatic scrolling of the CRT data display permits viewing of the entire 128 character record. (Maximum of 80 data characters are visible at any one time.) Two added keys provide manual scrolling. **Field Installation:** Yes. *Note:* If field installing 128 Character (#5455) and Feature Group A (#4003) has been previously installed, Feature Group A (#4003) must be removed and Feature Group A (#4004) installed. In addition, if Record Insert (#6125) has been previously installed, Record Insert (#6125) must be removed and Record Insert (#6126) installed.

Feature Group A (#4003, 4004): #4003 for 80 character machine, #4004 for 128 character machine. **Prerequisite:** #4004 requires 128 Character (#5455). Consists of the following:

Self-Checking Number: (Modulus 10 and 11) feature assures that all digits of a number, such as an account or item field, have been correctly keyed. The self-checking number consists of two parts—the basic identifying number and its check digit ... a detected error locks out the keyboard ... operates in ENTER, VERIFY, and UPDATE mode. *Note:* Self-checking numbers of Modulus 10 are not compatible with those of Modulus 11 ... left-base numbers are not accommodated ... self-checking numbers and left-zero insertion are mutually exclusive within the same field ... self-check number generating ability is not available.

Off-Line Field Totals: Provides the ability to create a hash total for a group of records or a batch of work, or to crossfoot and write totals in the same record or in a following record under program control.

Feature consists of three 19-position individual accumulators. Data can be summed in accumulators from a specified field or fields in specific or all records of a batch of work. The summation is under program control. Function provides for automatic processing of each pre-recorded disk record as it is read ... adds



designated field contents to appropriate counters ... reads out and records data from counters ... reads out/resets and records data from counters ... automatic program level selection based on type of record being processed.

Maximum size of input field(s) is 14 decimal positions ... overflow beyond 19 digits in the accumulator will not be indicated ... in addition to the digits 0-9, a field total field may include any of the 256 EBCDIC characters. All characters with the low order four bits of the character being 0-9 will accumulate with numeric values of 0-9 respectively. All other characters will accumulate with the value of zero. Arithmetic sign control will be determined by the zone portion of the data keyed in the units position of the fields being processed ... responsibility for input size limitation and accumulator overflow is left to the user ... maximum output field size is 19 positions. *Note:* Off-line field total operations can be initiated at either the primary or secondary operator station; however, the non-initiating station is inoperative until completion of run.

Disk Initialization: Diskettes sold by IBM will be initialized at time of manufacture. Disks which develop bad tracks in use can be re-initialized with this feature, so that the bad tracks are automatically bypassed. *Note:* Initialization can only be performed at the primary operator station ... during the disk initialization process, the secondary operator station is inoperative.

Disk Copy: Reads disk records from disk two (secondary station) and writes those records onto disk one (primary station). Initiating the disk copy can occur *Only* from the primary operator station—control must be relinquished by the secondary operator station before operation can begin. Feature allows the user to accomplish the following functions: Merge—records can be merged *From* the secondary station disk and the primary station keyboard onto the primary station disk ... Copy—a data file from the secondary station disk can be copied onto the primary station disk ... Pooling—data can be copied from more than one disk onto a single disk. The disks that are to be copied are mounted on the secondary station disk drive, and the data is written onto the disk mounted on the primary station disk drive. *Note:* All secondary disk operations associated with this feature are "read only" functions.

Search on Content: Allows user to retrieve and display data on disk by comparing the contents of the desired data record to a search argument ... argument may be equal to all or any portion of the data record ... blank characters in argument are treated as "don't care" characters ... search terminates when equal condition occurs between argument and data record or if a match cannot be found.

Search Sequential Content: Provides a search by content that is much faster than Search Content. The records must be arranged in the data set in ascending alphameric order within the portion of the record that corresponds to the search argument. **Field Installation:** Yes.

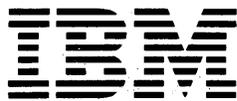
Proof Keyboard (#5902): Modifies the standard alphameric keyboard to provide both keystations of the 3742 with alphameric keyboards having numeric key arrangements similar to an adding machine. *Note:* Customers who elect to purchase a 3742 with #5902 only and later add Feature Group A (#4003 or #4004) should consider purchase of the additional feature initially because this field upgrade requires replacement of #5902 and the re-installation of #5902 along with Feature Group A. **Field Installation:** Yes.

Reading Board Extension (#6065): The extension can be attached to the front edge of the standard reading board to provide an additional 4" x 40" working area to the left of the

keyboard ... feature provides extension board for each station. **Maximum:** One. **Field Installation:** Yes.

Record Insert (#6125, 6126): Provides capability to add records within an existing data file. Sequential files can be updated or corrected by inserting records in their proper location within the sequence. #6125—for 80 character machine ... #6126—for 128 character machine. **Maximum:** One. **Field Installation:** Yes.

Customers who may elect to purchase an 80 character 3742 with Feature Group A and/or Record Insert and later upgrade to a 128 character 3742 should consider purchase of the 128 character machine initially rather than the 80 character machine.



3747 DATA CONVERTER

Purpose: The 3747 is a stand-alone buffered machine used primarily to convert batched data from disk to one-half inch magnetic tape. Special features provide conversion from tape to disk, tape blocking/deblocking, record reformatting, and basic processing of IBM magnetic tape labels. The communications special feature allows point-to-point BSC communications with other BSC devices. This feature also allows the 3747 to be used as a tape transmission device.

Highlights: The basic 3747 Data Converter consists of a control unit, control panel, disk drive and autoloader, and magnetic tape drive. The basic function of this machine is to convert data from disk to tape as a stand-alone, off-line unit. It provides a fast input medium to the CPU via the tape, relieving the computer operator from handling unit records. Errors in data transmission or tape and disk writing are detected and corrected with minimal operator involvement. Job statistics are available via a control panel display.

Special features provide the ability to transcribe data from tape to disk. Basic tape label processing is also possible as a special feature. Another feature permits reformatting of records as well as blocking and deblocking of records. With the communications adapter, the 3747 can be used as a binary synchronous terminal for point-to-point communications with various BSC devices.

Communications: the 3747 may communicate over point-to-point switched or non-switched facilities (C4, C5, D3, D4 or X1M) with another 3747 or 3741 model 2 or 4 with the appropriate communications adapters ... for further information concerning these facilities, see M2700 pages.

Communications are also possible with a System/32 and System/34 via Binary Synchronous Communications; a System/34 via its Communications Adapter; System/370 model 115, 125, 135, 135-3 and 138 via Integrated Communications Adapters; a System/360 models 22-75 (except models 44 and 67 in TSS mode) and model 195; and a System/370 models 115 thru 195 via a 2701 Data Adapter Unit, a 2703 Transmission Control, or a 3704 or 3705 Communications Controller equipped with appropriate BSC adapters and features.

See "Programming" pages for core size requirements for teleprocessing support.

Magnetic Tape: The following tapes and reels can be used: IBM Series 500, IBM Heavy Duty, IBM Dynexcel, or equivalent formulations which meet the tape and reel criteria in *Tape Specifications*, GA32-0006.

Bibliography: *3747 Data Converter Reference Manual and Operator Guide*, GA21-9170.

Specify

1. Voltage (AC, 1-phase, 3-wire, 60 cycle): Locking plug—#9880 for 115 V. Non-lock plug—#9881 115 V, #9885 for 208 V, or #9887 for 230 V. For raised floor applications—#9902 for 208 V, or #9904 for 230 V. Voltage changes cannot be made in the field.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, or #9045 for gray. *Note:* Color accent is provided on the top covers only ... the front, sides and back panels will always be white. Color changes cannot be made in the field.
3. Data Set Attachment: The IBM 3872 Modem is recommended for 2400 bps operation on C5 or D4 facilities. One of the

following must be specified, depending upon the line facilities to be used, if the Communications Adapter (#1660) feature is selected—#9120 for C5M/D4M (2000 bps), #9121 for C5/D4/X1M (2400 bps), #9122 for D3M (1200 bps), or #9123 for C4M (1200 bps). **Prerequisite:** #9122 or #9123 requires Synchronous Clock (#7705) feature ... see "Special Features."

4. Data Set Cable: A 20-foot data set cable is provided as standard. If more than 20 feet of cable are required, specify #9021 for a 40-foot length and indicate 40 as the quantity.
5. Tape Control: A Tape Control feature (#7880, #7885, #7890 or #7895) should be specified ... see "Special Features" below.

Accessories

Locks and Keys: The 3747 Tape Label (#7900) special feature is shipped with a lock and two keys.

Special Features

Selection of a Tape Control feature determines whether any other special feature can be added. One of the Tape Control features should be selected.

Tape Control, Write Only (#7880). Provides a 9-track, 1600 bpi, PE write only tape control. Tape cannot be read. No other special features can be installed on a machine with this control. **Field Installation:** Yes.

Tape Control, Read/Write (#7885). Provides a 9-track, 1600 bpi, PE read and write tape control. Tape can be read as well as written, thus providing a tape-to-disk capability. Other special features may be installed on a machine with this control. **Field Installation:** Yes.

Tape Control, Read/Write (#7890): Provides a 9-track, 800 bpi, NRZI read and write tape control. Tape can be read as well as written, thus providing a tape-to-disk capability. Other special features may be attached to a machine with this control. **Field Installation:** Yes, only to replace Read/Write Tape Control (#7895). Not recommended to replace a Phase Encoded Tape Control (#7880 or #7885).

Tape Control, Read/Write (#7895): Provides a 7-track, NRZI read and write tape control. User selectable options at job time are density (800/556 bpi) and parity (even/odd). Translate on and convert off are standard, fixed modes. The tape can be read as well as written, thus providing a tape-to-disk capability. Other special features may be attached to a machine with this control. **Field Installation:** Yes, only to replace Read/Write Tape Control (#7890). Not recommended to replace a Phase Encoded Tape Control (#7880 or #7885).



Blocking/Reformatting (#1480): Provides capability to block or deblock records on tape or to BSCA up to limits of available storage. Also provides ability to reformat records by rearrangement of fields, deletion of fields, insertion of constants, and splitting and joining of records. Reformatting may be done in conjunction with blocking or deblocking. With an appropriate Storage Feature (#7690, #7691 or #7692) and BSCA Communications Adapter (#1660), provides the ability to send or receive long records (up to limits of available storage) to a similarly configured 3747, or under announced programming support (see "Programming" section for information on programming support). Although transmission blocks up to 8,000 bytes may be sent or received by an appropriately featured 3747, it is recommended that transmission blocks be limited to 512 bytes when communicating with supported systems. Use of larger blocks may be limited by host system buffer size, multiplexer buffer size, line quality, or effects on total system throughput. **Limitation:** Not available with Tape Control, Write Only (#7880). **Field Installation:** Yes. **Prerequisites:** Expanded Function Feature (#3888) and Storage Feature (#7690, #7691, or #7692) and Tape Control, Read/Write (#7885, #7890 or #7895).

Communications Adapter (#1660): Provides the 3747 with a serializer/deserializer, associated registers, and line control logic for binary synchronous operation. The necessary interface is included for point-to-point, half-duplex mode operations on a switched or non-switched network. Transmission is provided at rates of 1200, 2000 or 2400 bps. Included as standard with this feature are user options for Auto-answer, EBCDIC Transparency, Terminal Identification, and Far-End Device (also called CPU) Identification. **Notes:** (1) For increased transmission rates up to 9600 bps, order RPQ S40093 ... (2) See Data Set Attachment under "Specify" for facilities. **Field Installation:** Yes. **Prerequisite:** Tape Control, Read/Write (#7885, #7890 or #7895).

Expanded Function Feature (#3888): Provides additional capacity to permit installation of Storage Feature (#7690, #7691 or #7692) and Blocking/Reformatting (#1480). Also provides capability to position tape to add records to a file, add a file to a tape, or replace a file on tape. Provides checking of diskette label names during disk to tape operations and also for writing and checking of a diskette conversion mark. With BSC Communications Adapter (#1660), provides ability to select from files recorded on one tape to send each to a different location, and to restart communications without retransmission of data correctly received. **Limitation:** Not available with Tape Control, Write Only (#7880). **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Tape Control, Read/Write (#7885, #7890, or #7895).

1200 BPS Integrated Modem, Non-Switched (#5500): A modem for operation at 1200 bps over non-switched two wire or four wire voice grade channel, type 3002. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Synchronous Clock (#7705) ... Tape Control, Read/Write (#7885, #7890, or #7895) and Communications Adapter (#1660) ... the terminal device with which the 3747 is communicating must also be equipped with an IBM 1200 BPS Integrated Modem.

1200 BPS Integrated Modem, Switched With Auto Answer (#5501): A modem with auto answer for operation at 1200 bps over a switched telecommunications network via a telephone company supplied data access arrangement type CBS or equivalent. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Synchronous Clock (#7705) ... Tape Control, Read/Write (#7885, #7890, or #7895) and Communications Adapter (#1660) ... the terminal device with which the 3747 is communicating must also be equipped with a 1200 BPS Integrated Modem.

Storage Feature (#7690, 7691, 7692): Storage for use with Blocking/Reformatting (#1480). #7690 provides 2K bytes of storage, #7691 provides 4K bytes of storage, #7692 provides 8K bytes of storage. **Maximum:** One Storage Feature (#7690, #7691, or #7692) per 3747. **Limitation:** Not available with Tape Control, Write Only (#7880). **Field Installation:** Yes. **Prerequisites:** Expanded Function Feature (#3888), Blocking/Reformatting (1480), and Tape Control, Read/Write (#7885, #7890, or #7895).

Synchronous Clock (#7705): Provides business machine clocking of the data onto and off of the transmission line. To be used only when the attached modem does not provide such clocking. The terminal device with which the 3747 is communicating must also be equipped with business machine provided clocking. **Field Installation:** Yes. **Prerequisites:** Tape Control, Read/Write (#7885, #7890, or #7895) and Communications Adapter (#1660). Also see Data Set Attachment (#9122 or #9123) under "Specify" above.

Tape Label (#7900): Provides the logic to check and build IBM magnetic tape labels. Also provides accessibility to secured tapes via a Keylock/Cipher Lock and an Erase-to-Tape Indicate facility. This assists the user in providing protection for sensitive data. **Note:** For additional or replacement keys, see M10000 pages. **Field Installation:** Yes. **Prerequisite:** Tape Control, Read/Write (#7885, #7890, or #7895).



3767 COMMUNICATION TERMINAL

Purpose: A keyboard/printer terminal for transmission of data or text to or from a Virtual Storage System/370 model 115 thru 168MP via a 3704 or 3705 Communications Controller. The 3767 uses Synchronous Data Link Control (SDLC) line discipline.

Also attaches to System/3 or System/7 via RPQ, see Start/Stop feature description.

- Model 1 40 cps average bi-directional printer.
- Model 2 80 cps maximum bi-directional printer; includes dual 256 byte line buffers and full buffer editing capability.
- Model 3 120 cps maximum bi-directional printer; includes dual 256 byte line buffers and full buffer edit capability.

Note: Throughput on all models is dependent upon output format, line control, buffering, and transmission speed.

Highlights: The 3767 consists of control functions, printer, keyboard, control keys and indicator lights in one integrally designed desk-top unit. This configuration allows an operator/machine relationship that is favorable for both interactive and batch operations. Special features are available which permit tailoring of the terminal to the user's requirements.

Control Functions: Provides the control for all on-line and off-line operations; facilitates communications at speeds up to 2400 bps in SDLC line discipline and controls single line data editing on the base model 1. It also controls, on all models, basic functions such as Automatic Terminal I. D., Station Control, Internal Communications Clocking, Transmit and Receive Interrupt, End of Line Alarm, Buffer Full Alarm and Auto (EOB/EOM) switch.

Printer: (Model 1 and 2) Maximum printer throughput is obtained with bi-directional serial matrix printing and indexing without unnecessary print head movement. Electronic tabbing over the full 132 printable positions is provided. The printer dot matrix is 4 of 7 wide by 8 high giving high legibility with character spacing at 10 to the inch. Line spacing is 6 lines to the inch. Up to 6 part forms (total thickness—0.018") may be used. For any multi-part or pre-printed continuous forms the Variable Width Forms Tractor (#8700) is recommended. Five and six part continuous forms should be tried on an individual basis for acceptable feeding, registration, and print quality. Single part continuous or up to four part cut forms can be used with the standard friction feed platen. Paper bail (#9180) is available for use with roll paper and is recommended for use with single part fan-fold paper when the Variable Width Forms Tractor (#8700) is not used. Maximum overall forms width is 15"; card stock forms are not recommended. (See GA24-3488 for form specifications and limitations.)

Printer: (Model 3) Same as model 1 and 2 with the exception that forms tractor is required for all continuous forms.

Keyboard: Provides several keyboard arrangements and includes typamatic on hyphen, underscore, backspace and space keys. In addition to the standard 44 alpha/numeric data keys, are function keys, indicator lights, operating mode switches, and a 3-position numeric "print position indicator" display to aid the operator.

Security Enhancement Features: Print Suppress allows selected data fields to be entered without being printed. The Security Keylock (optional) with the power switch "ON" allows the 3767 to be operational.

The Magnetic Stripe Reader (optional) is provided to allow operator identification to be transmitted.

Communications Facilities: The 3767 operates in half-duplex mode over facilities C3, C4, C5, D2, D3, D4 or X1M ... for details concerning these facilities, see M2700 pages.

Synchronous Data Link Control: Allows for transmission rates of 600, 1200 or 2400 bps.

The 3767 can communicate on a switched or non-switched point-to-point facility or as a secondary station on a multipoint or duplex multipoint facility to a Virtual Storage System/370 model 115 thru 168MP.

Modems: One Integrated Modem or External Modem can be used. See "Special Features" for options. Synchronous clock is a standard feature.

Problem Determination Procedures: Significant function has been designed into this unit to provide greater availability to the customer. This has been done through the use of problem determination and recovery routines and procedures that are easily understood and used by the operator. See *IBM 3767 Operator's Guide*, SRL GA18-2000, and Customer Responsibility below.

- Customer Responsibility:** The customer is responsible for:
- Unpacking, placement, set-up and checkout of the 3767 at time of delivery, or when relocating the 3767.
 - Removal and packing of the 3767 at time of discontinuance.
 - Relocation of the 3767 (if required) to allow IBM service access.
 - Using and following the Problem Determination Procedures and filling out the Trouble Report prior to calling for service.

See M2700 pages for additional responsibilities.

Bibliography: See *KWIC Index*, G320-1621 or specific system bibliography.

Supplies: A black ribbon, IBM Part No. 1136653 or equivalent, is required.

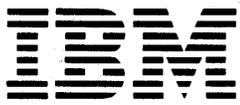
Accessories

Forms Stand: Permits placement of continuous forms on stand above floor level and provides for stacking after printing.

Type	Feature No.
3735	4450

Specify

1. Voltage (115 V AC, 1-phase, 3-wire, 60 Hz): #9880 for locking plug, or #9881 for non-lock plug.
2. Keyboard Arrangement: #9381 for Correspondence, or #9391 for EBCDIC.



3. SDLC Speed Selection: #9533 for C5/D4 (2400 bps); #9532 for C4/D3 (1200 bps); #9531 for C3, D2 (600 bps). See "Special Features" for modems and modem attachments.
4. Integrated/External modem cable: A 20 foot cable is provided as standard. If a longer cable is required, specify #9021, indicating length in feet as a quantity of 25, 30, 35 or 40.
5. 6 Foot Power Cord: Specify #9986, otherwise a 10 foot power cord will be provided.
6. Variable Width Forms Tractor Covers: Specify #9850 if Variable Width Forms Tractor (#8700) is ordered.
7. SNA Terminal Address: #9587 must be specified on all orders—supplemental specs available for giving one EBCDIC byte address. Any two "Hex" characters, excluding "00" and "FF" may be used.
8. Paper Roll Holder and Forms Guide: #9180. Provides a paper holder for roll paper supply. Also provides a guide for single part, fan-fold when Variable Width Forms Tractor (#8700) is not used.

Accepts roll sizes—up to 14-7/8" width, up to 5-1/2" diameter.
9. Blower: #9030. Must be specified for 3767 (model 1 or 2 only) expected to operate in an environment above 90° F ambient temperature (specification limits up to 105° F).
10. Paper Tear Bar: #9422 (Model 1 or 2 only)

A device for tearing continuous forms. This device requires #9180 Paper Roll Holder and Forms Guide with Paper Bail.

Special Features

Note: Customers who elect to purchase one of the features* listed in Group #1 or Group #2 and later order additional features within that group should consider purchase of all features initially because these field upgrades require replacement of the initial feature and installation of the new combination.

*Except when Vertical Forms Control (#8731) has previously been installed and the Magnetic Stripe Reader (#4930) is the additional feature being ordered.

Group #1: Vertical Forms Control (#8731), Magnetic Stripe Reader (#4930), Calculate-Scientific (#1572).

Group #2: Start/Stop Feature—2740-1 (#7111), — 2740-2 (#7112), — 2741 (#7113), Alternate Character Set (#1291), Buffer with Edit—512 (#1481), Buffer with Edit—1,024 (#1482).

Acoustic Coupler—600 BPS (#1110): Provides an acoustic coupler for communications through a telephone handset at speeds up to 600 bps. Requires a 1200 bps Integrated Modem on host end of communications facility. **Maximum:** One. **Field Installation:** Yes. Customer will set up at time of 3767 delivery

Prerequisites:

1200 bps Integrated Modem (#5502 or #5506); 600 bps (#9531), in addition, if Start/Stop Feature (#7111 or #7113) is ordered, 300 bps (#9540). *Note:* For limitations on Public Switched Network, consult M2700.1 and M2700.7, Note (14).

ASCII Feature (#1201): Provides ASCII Keyboard (48 Key) and graphics in lieu of those normally provided by Keyboard Specify Codes. **Maximum:** One. **Field Installation:** Not recommended for field installation. **Limitations:** Cannot be installed with Start/Stop Features (#7111, 7112, 7113), Alternate Character Set (#1291), or Keyboard Arrangement #9381 (Correspondence) or #9391 (EBCDIC).

Alternate Character Set (#1291): Provides a switch control for alternate printed graphics, to those selected by the keyboard specifications. Compatible with Start/Stop Feature #7113 (2741) and #7111 (2740-1). Only specify codes #9394 and #9395 (EBCDIC-Mono) are compatible with #7112 (2740-2). Keytop engraving remains the same. Key front decals will be provided for easy operator reference in using this feature. **Maximum:** One. **Field Installation:** Yes. **Limitation:** Cannot be installed with ASCII (#1201).

CHART A

	SDLC Graphics	Data		START/STOP		Line Code P T T	Keybd Prereq Specify Code (1)	Select Only One (1)
		Code	Graphics	Graphics	Line Code			
Alt.	C E	E C	C C					
Keybd Char.	O B M B	O E	M O /					
	R C O C	R B	O R E					
	R D N D	R C A N	R B					
	E I O I	E D P O	E C					
	S C (2)	C S (2)	L (2)	S D				
Corres.	X	X	X	X			#9381	
EBCDIC	X	X	X	X				#9382
APL			X	X				#9383
EBCDIC	X	X	X	X			#9391	
Corres.	X	X	X	X				#9392
APL				X	X			#9393
MONO (3)		X	X	X	X			#9394
MONO (4)		X	X	X	X			#9395

1. Alternate Character Set (#1291) is a prerequisite.
2. Sub-set of EBCDIC.
3. Upper case alpha printed from keyboard—upper/lower case may be printed from the communications line.
4. Upper case alpha printed from keyboard or the communications line regardless of key shift or line code shift.

Buffer With Edit (#1481, 1482): #1481 (Model 1 only) provides two 256 byte buffers for receiving data. #1482 (Model 1, 2 or 3) provides two additional 256 byte buffers for receiving data. On key entry these two features provide full buffer (up to 512 or 1,024 bytes) edit capability under key control. With the Edit switch "off", a single data line may be transmitted. When used with 2740 model 2 Start/Stop Feature (#7112) single buffer (120-248-440 byte) operation is provided. The Buffer Full Alarm warns the operator 10 positions before full capacity. **Maximum:** One each. **Field Installation:** Yes. **Limitation:** This feature not active if Start/Stop Feature (#7111 or #7113) is active. A 512 buffer (equivalent to #1481) is standard on 3767 model 2 and model 3. **Prerequisite:** On model 1, #1482 requires #1481.

Calculate—Scientific (#1572): In offline mode, this feature, under switch control, using the same keyboard (with supplied keyfront label) allows the following type calculations to take place: addition, subtraction, multiplication, division, inverse calculation, square root, statistical value (mean and standard deviation), exponential, common logarithm, natural logarithm, exponential constant, circular constant and trigonometric functions (sin, cos, tan, arcsin, arccos, arctan). Two memories are provided for temporary storage of totals. Sixteen digit input/output is allowed. **Maximum:** One. **Field Installation:** Yes.

EIA Interface—No Clock (#3718): Provides one EIA interface for the attachment of an IBM 3872 or other external modem, with modem clocking (3767 clock disabled). **Specify:** #9402 for half duplex facility or #9404 for full duplex facility ... #9707 for attaching IBM 3872 Modem #9619 for switched facility. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot



be installed with 1200 bps Integrated Modem (#5500, #5502, #5505 or #5506), Start/Stop Feature (#7111 or #7113), or EIA Interface—With Clock (#3719). *Note:* When installed with Start/Stop Feature (#7112) the communication facilities must be Full Duplex. Full Duplex (#9404), S/S Line Speed (#9542), SDLC Line Speed (#9533) and Attach IBM 3872 Modem (#9707) must be specified. Start/Stop operation is supported only at 1200 bps.

EIA Interface—With Clock (#3719): Provides one EIA interface for the attachment of an external modem with business machine (3767) clocking. *Note:* This feature may be used for local attachment to 3704 or 3705 equipped with Line Set Type 1F for operation at 300, 600 or 1200 bps. If this feature is to be used with a 1F line set, specify #9404. **Specify:** #9402 for half duplex facility, or #9404 for full duplex facility, #9619 for switched facility. #9539 must also be specified when operating at 300 bps on the Public Switched Network with "Originate Only" service when the modem to be used does not provide the "received line signal detector" interchange circuit, as for example the Western Electric 113 A or equivalent. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with 1200 bps Integrated Modem (#5500, #5502, #5505 or #5506), or EIA Interface—No Clock (#3718). **Prerequisites:** #9532 for C4/D3 (1200 bps) or #9531 for C3 or D2 (600 bps). If Start/Stop Feature is installed, that feature's line speed specify.

Magnetic Stripe Reader (#4930): A small self enclosed device for reading information from a Magnetically Striped and Encoded I.D. Card and a Magnetic Credit Card (2-1/8" x 3-3/8"). Reads up to 40 ABA standard numeric characters, including control characters.

Maximum: One. **Field Installation:** Yes. Customer will set up at time of 3767 delivery

Limitation: Not functional when operating in Start/Stop (#7111, 7112, 7113) mode.

1200 BPS Integrated Modem (#5500): Non-switched. A modem for operation at 300, 600 or 1200 bps over two or four wire non-switched voice grade channels. **Specify:** #9402 for 2-wire communications facilities, #9404 for 4-wire facilities. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with EIA Interface (#3718 or #3719) or 1200 bps Integrated Modem (#5502, #5505 or #5506). **Prerequisites:** #9532 for D3 (1200 bps) or #9531 for D2 (600 bps) facilities. If Start/Stop Feature is installed, that feature's line speed should be specified.

1200 BPS Integrated Modem (#5502): Switched. A manual answer modem for operation at 300, 600 or 1200 bps over Public Switched Telephone Networks. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with EIA Interface (#3718 or #3719) or 1200 bps Integrated Modem (#5500, #5505 or #5506). **Prerequisites:** #9532 for C4 (1200 bps) or #9531 for C3 (600 bps) facilities. If Start/Stop Feature is installed, that feature's line speed specify. *Note:* This feature requires either Acoustic Coupler—600 bps (#1110) or a CDT type Data Access Arrangement or equivalent.

1200 BPS Integrated Modem/Interrupt (#5505): (Model 1 and 2 only) Non-switched. A modem for operation at 300 (Start/Stop), 600 or 1200 (SDLC) bps over 2-wire non-switched voice grade channels. This modem includes a bi-directional reverse channel capability. This interrupt signal is transmitted when the ATTN key on the 3767 keyboard is depressed. *Note:* This featured modem is required to transmit or receive an interrupt only with Start/Stop 2741 (#7113) operating at 300 bps in Start/Stop mode on a half-duplex non-switched channel and the EIA Interface (#3719) is not used. Line Set Type 8C on 3704 or

Line Set Type 12A on the 3705 is required to support this feature. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with EIA Interface (#3718 or #3719) or 1200 bps Integrated Modem (#5500, #5502 or #5506). **Prerequisite:** #9532 for D3 (1200 bps) or #9531 for D2 (600 bps) and #9540 for D1 (300 bps) facilities.

1200 BPS Integrated Modem/Interrupt (#5506): (Model 1 and 2 only) Switched. A manual answer modem for operation at 300 (Start/Stop), 600 or 1200 (SDLC) bps over Public Switched Telephone Networks. This modem includes a bi-directional reverse channel capability. This interrupt signal is transmitted when the ATTN key on the 3767 keyboard is depressed. *Note:* This featured modem is required to transmit or receive an interrupt only with Start/Stop 2741 (#7113) operating at 300 bps in Start/Stop mode on a half-duplex switched channel and EIA Interface (#3719) is not used. Line Set Type 8D on the 3704 or Line Set Type 12B on the 3705 is required to support this feature. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with EIA Interface (#3718 or #3719) or 1200 bps Integrated Modem (#5500, #5502, or #5505). **Prerequisite:** #9532 for C4 (1200 bps) or #9531 for C3 (600 bps) and #9540 for C1 (300 bps) facilities. *Note:* This feature requires either Acoustic Coupler—600 bps (#1110) or a CDT type Data Access Arrangement or equivalent.

Security Keylock (#6660): Provides a key operated switch. When in the "locked" position, machine operations cannot be performed. Two keys are provided. For additional or replacement keys, see "Locks and Keys" in M10000 pages. **Maximum:** One. **Field Installation:** Yes.

Start/Stop Feature (#7111, 7112, 7113): These features provide a Type I Start/Stop line control migration aid on the 3767 to allow operation with existing program support (see Programming Section). This feature allows data transmission to or from a Virtual Storage System/370 model 115 thru 168MP via a 3704 or 3705 at 300 bps (2740-1 or 2741 Line Control) or at 600 or 1200 bps (2740-2 Line Control) or via a 2701 at 600 bps (2740-2 Line Control). It also allows transmission, via communications facility to or from a 3115 ICA, 3125 ICA, or 3135 ICA, at 300 bps (2740-1 or 2741 Line Control) or at 600 bps (2740-2 Line Control). 1200 bps (2740-2 Line Control) also supported by 3115 ICA and 3125 ICA. It allows communications via a 3704/3705 Communications Controller attached to a channel of a System/360 model 30, 40, 50, 65, 67 (in 65 mode), 75 and 195 at 300 bps (2740-1 or 2741 Line Control) or at 600 bps or 1200 bps (2740-2 Line Control); via a 2701 attached to a channel of a System/360 model 22, 25, 30, 40, 44, 50, 65, 67 (in 65 mode), 75 and 195; or a System/370 model 155, 165 and 195 at 600 bps (2740-2 Line Control); or via an Integrated Communications Attachment on System/360 model 25 at 600 bps (2740-2 Line Control). For communication with System/3 MLTA, see RPO S40028; for communication with System/7 TPMM/TPMF, see RPO S65044. An SDLC/Start-Stop switch is provided to allow operation in either mode. Communications facility must be specified for this feature. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with ASCII Feature (#1201).

Select One

#7111 2740-1 Line Control (Model 1 or 2 only) Specify: #9540 for C1/D1 (300 bps). *Note:* For multipoint—specify #9560 (Station Control) and see "Terminal and Group Addresses" (below) for additional information to be specified. *Note:* On a given non-switched line, one terminal within each group and one terminal for the entire line (All Call) must provide the necessary checking and addressing responses for that group and/or for



the entire line. Specify #9197 for a group responding and/or #9035 for an All Call responding terminal. Limitation: Group or All Call addressing requires duplex communications facilities. Non-switched facility required for SDLC if Station Control (#9560) is specified. Cannot be installed with 2400 bps (9533) or EIA Interface—No Clock (#3718).

#7112 2740-2 Line Control (Model 1, 2 or 3) Buffer Receive mode is standard operation. Limitations: Group or All Call addressing requires duplex communications facilities. If multi-dropped on the same communications line with 2740-2s the 3767 must not be designated as the Group or All Call Responding terminal. Non-switched facility required for SDLC with this feature installed. Cannot be installed with Correspondence Keyboard (#9381). Specify: See "Terminal and Group Addresses" (below) for additional information to be specified. Note: On a given non-switched line, one terminal within each group and one terminal for the entire line (All Call) must provide the necessary checking and addressing responses for that group and/or for the entire line. Specify #9197 for a group responding and/or #9035 for an All Call responding terminal. Specify Line Speed—#9541 for D2 (600 bps) or #9542 for D3 (1200 bps). Buffer Positions—#9015 for 120, #9016 for 248, or #9017 for 440. Note: This specified feature has no effect on buffer size under SDLC line discipline. Prerequisite: On model 1, Buffer with Edit (#1481 or #1482).

#7113 2741 Line Control (Model 1 or 2 only) Specify: #9540 for C1/D1 (300 bps). Limitations: Cannot be installed with 2400 bps (#9533 or EIA Interface—No Clock (#3718)). Note: See "Terminal Identification" (below) for additional information to be specified.

The 2741 Transmit and Receive Interrupt function on the 3767 with #7113 (2741 Line Control) is supported via the following:

	1200 bps Intg'd Modem			External Modem		
	Sw'd 2-wire	Non-Switched 2-wire	4-wire	Switched 2-wire (1)	Non-Switched 2-wire (1)	4-wire
#3115	—	—	#1231	#1231	#1231	#1231
ICA	—	—	#4781			
#3125	—	—	#1231	#1231	#1231 or	#1231 or
ICA	—	—	#4781		#1232	#1232
#3135	—	—	—	9593-9600	9593-9600	9593-9600
ICA				9721-9728	9721-9728	9721-9728
				9737-9744	9737-9744	9737-9744
				9745-9752	9745-9752	9745-9752
				9625-9632		
#3704	#4786	#4785	#4781	#4711 or	#4711 or	#4711 or
				#4714	#4714	#4714
#3705	#4786	#4785	#4781	#4711 or	#4711 or	#4711 or
				#4714	#4714	#4714
#3767	#5506	#5505	#5500	3719 #3719		#3719

1. Modem must be full duplex.

Terminal and Group Addresses: Terminal and group addresses must be selected when one of the following Start/Stop Features is ordered:

#7111 for 2740 model 1 Line Control with Station Control (#9560) specified.

#7112 for 2740 model 2 Line Control.

For Terminal Address and Group Address, a two-character code must be selected as described below. The first character must be the Terminal Address, and the second character must be the Group Address. (The same character may be ordered for both addresses.) However, the terminal will be wired at the factory as a Group Responding #9197 terminal.

Depending on the Keyboard Arrangement specified for the base machine, the following characters may be selected for Terminal and Group Addresses:

With EBCDIC Keyboard Arrangement (#9391), select characters from:

A thru Z, 0 thru 9, and special characters @ (at sign) ... \$ (dollar sign) ... & (ampersand) ... - (hyphen) (period).

*With Correspondence Keyboard Arrangement (#3981), select characters from:

A thru Z (except B and X), 0 thru 8, and special characters = (equal) ... / (slash) ... ; (semi-colon) ... , (comma) (period) ... ' (apostrophe) ... - (hyphen).

*Not available with #7112.

If Alternate Character Set (#1291) is installed on the terminal, the Terminal and Group Address line code bit configuration remains the same for either switch setting.

Specify: #9644 (Terminal and Group Addresses) and enter the two-character code as Supplemental Specs

Terminal Identification: If Terminal Identification is used in the customers application (provided by RPE 46148 Auto Address Answer-back on the 2741), a four-character Terminal Identification must be selected when Start/Stop Feature—2741 Line Control (#7113) and one of the following are ordered: #5502, #5506, or #3719 with #9619 (switched line operation) specified.

Depending on the Keyboard Arrangement specified on the base machine, the following characters may be selected for the Terminal Identification code.

With EBCDIC Keyboard Arrangement (#9391), select characters from:

A thru Z, 0 thru 9, and special characters # (number sign) ... / (slash) ... \$ (dollar sign) ... & (ampersand) ... @ (at sign) ... , (comma) (period) ... - (hyphen) ... C/R (carriage return) ... space.

With Correspondence Keyboard Arrangement (#3981), select characters from:

A thru Z, 0 thru 9, and special characters = (equal) ... / (slash) ... ' (apostrophe) ... - (hyphen) ... ; (semi-colon) (period) ... , (comma) ... C/R (carriage return) ... space.

The same character may be selected for all four positions except C/R may only be used in the fourth position.

If Alternate Character Set (#1291) is installed on the terminal, the Terminal ID line code bit configuration remains the same for either switch setting.

Specify: #9645 (Terminal Identification) and enter the four-character code as Supplemental Specs

Vertical Forms Control (#8731): Allows vertical forms skipping to a pre-set page header location or a pre-set vertical tab position. Page size, header location and vertical tab stops are entered from the keyboard or received from the host under SDLC line control. Maximum: One. Field Installation: Yes. Prerequisites: Variable Width Forms Tractor Covers (#9850) and Variable Width Forms Tractor (#8700). Limitation: This feature (#8731) is non-functional in Start/Stop (#7111, #7112, #7113) mode.



Variable Width Forms Tractor (#8700): A forms feeding device for continuous edge-punched forms. Overall forms width from 3 to 15 inches can be fed. Specify code #9850 (Variable Width Forms Tractor Covers) is required.



3780 DATA COMMUNICATIONS TERMINAL

Purpose: A data transmission terminal using the BSC technique. It can communicate over appropriate communications facilities to another 3780, a System/360 model 20, a System/360 model 25, a System/360 model 22—195 or System/370 model 115—195, a 2770 Data Communication System, or a 2780 Data Transmission Terminal. May be locally attached to a 3704/3705 Communications Controller. For requirements, see "Prerequisites."

Highlights: Provides medium speed, batch-oriented, buffered card reading and printing via appropriate communications facilities ... see "Communications Facilities." Punched card output provided via attachment of a 3781 Card Punch ... see 3781.

Card Reader: Reads at a rated speed of 600 cards/minute. Provides hopper capacity of 1200 cards and stacker capacity of 1300 cards. Only 80 column cards can be read.

Printing: Prints at a rated speed of 350 lines/minute utilizing the basic 52-character set. Interchangeable type bars of 39 and 63 character sets are available with rated speeds of 425 lpm and 300 lpm respectively. Only the 63 character set may be employed when using ASCII transmission code. The printer provides 120 print positions standard with feature expansion to 144 positions ... see "Special Features." Horizontal and Vertical Format control are provided as standard functions of the printer.

Buffers: Provides two 512-character buffers which service the transmission line and the I/O units alternately to provide overlap operation for efficiency.

Buffer Checking: All characters are checked on the data path when sent to or received from the buffer.

Variable Record Length: End-to-end characters are used to define the end of a record, allowing for complete variable length. Full buffer blocks with variable length records can be transmitted or received. On card transmission, blank positions are removed from the end of the card record to increase the transmission efficiency.

Space Compression/Expansion: Operable under switch control, this capability provides for the removal of consecutive spaces in transmitted data and their re-insertion in received data. A two character sequence is substituted for from two to sixty-three consecutive spaces. If more than sixty-three consecutive spaces are to be transmitted, a second two character sequence will be substituted for the number of consecutive spaces greater than sixty-three. If only one space is to be transmitted, it will be transmitted as a normal space. This feature is inoperable when transmitting in transparency or operating in home mode.

Home Mode: Provides card reader to buffer to printer operation in off-line non-communications mode.

Integrated 2400/1200 BPS Modem: Provides 2400 bps transmission with half speed backup on leased and switched facilities ... compatible with IBM 3872 Modem.

Conversation Mode: Allows a CPU to turn the communications line around after receiving text and return text without additional selection.

Audible Alarm: Alerts the operator when manual intervention is required in line mode ... unattended operation is not provided.

Communications Facilities: The 3780 operates in half duplex mode over facility C4, C5, C6, D3, D4, D4SB, D5, D5SB, D6, D6SB, X1M or X2M ... for information concerning these facilities,

see M2700 pages. The alphanumeric facility designations above correspond to those shown on the charts on those pages.

Binary Synchronous Transmission: Allows for transmission rates of 1200, 2400, 4800, 7200/3600 bps ... see "Modems" below and Data Set Attachment under "Specify."

Communications can be with another 3780, 2780 model 1, 2 or 4, a System/360 model 20 thru 195 (except model 44 or model 67 in TSS mode), or a System/370 model 115 thru 195 ... for requirements, see "Prerequisites."

In addition, the 3780 may be multi-dropped on the same line facility with other BSC devices (System/360 model 20, System/3, 1131, 1826, 2715, 2780, 3271, 3272, 3735) as tributary stations on a multi-point line with a System/360 model 22-195 (except model 44 or model 67 in TSS mode), or System/370 model 115-195 as the control station. In a switched control network, it may use the same termination (phone number) at the computer that is used for the other BSC devices.

Transmission Code: One of two codes can be selected ... see "Specify." For printable graphics, see "Type Catalog."

EBCDIC Code: 256 character set which is the basic code of System/360 and System/370.

ASCII Code: Industry standard code with a 128 character set.

Transmission Checking: A redundancy check is performed on all data. EBCDIC uses a 16-bit cyclic check transmitted as two 8-bit bytes ... ASCII uses an odd-parity VRC on each character, including the LRC character and an LRC check transmitted as a single 8-bit odd parity byte. Format check plus an odd/even block check is provided on both code sets.

Modems: One Integrated 2400/1200 bps Modem feature, IBM 3872 Modem (2400/1200 bps), IBM 3875 Modem (7200/3600 bps), or IBM 4872 Modem (4800 bps) can be attached to the 3780. For communications capabilities, product utilization, and special features, see M2700 pages, 3872, 3874, 3875, 4872 and Integrated Modem under "Special Features" below.

Card Limitations: Generally, scored cards require careful handling and a favorable environment. Use of the following scores has been approved.

Internal Scores: (before separation)—M-4, M-5, OM-2, OM-3, S-1 and ID-3 (2" x 3-1/4" or 2-3/16" x 3-3/4" sizes only). *Note:* When using OM-2 or OM-3, reading must be terminated prior to the scored column.

External Scores: (after separation)—M-3, M-4, M-5, M-6, M-7, M-11, OM-2, CF-4 and CF-11. OM-3 may be used if the score is on the column 1 end. *Note:* Upper left corner cut required when the M-11 or CF-11 is used on the column 1 end.

All other scores may result in unsatisfactory performance.

Customer Responsibilities: See M2700 pages. In addition, the customer must be advised that when non-IBM data sets or privately owned communications facilities are used, he is responsible for insuring that signal levels and impedances are compatible with the IBM communications interface.



Prerequisites

System/360 model 20 (submodel 2, 4, 5, or 6): Communication is via a 2020 equipped with a Binary Synchronous Communications Adapter (#2074).

System/360 model 25: Communications can be via the Integrated Communications Attachment (#4580) with appropriate binary synchronous features on the 2025, or via a 2701 Data Adapter Unit or 2703 Transmission Control ... see below.

System/360 model 22-195 (except model 44 or 67 in TSS mode), or System/370 model 115-195: Communications can be via a 2701 Data Adapter Unit or 2703 Transmission Control equipped with appropriate binary synchronous features ... see 2701, 2703. *Notes:* (1) To utilize OLT support, the host processor requires a minimum of 32K bytes of storage ... (2) The 3780 communicates only in EBCDIC or ASCII codes ... (3) Only EBCDIC Transparency (#3601) is available on the 3780. Therefore, a 2701 or 2703 must be configured with 3780 restrictions and limitations for compatibility ... (4) All 3780s on a multi-point line must have the same code, EBCDIC or ASCII.

System/360 (except models 22, 25, 44, 67 in TSS mode or 85), or System/370 model 115-195: Communications can be via a 3704/3705 Communications Controller ... see 3704, 3705.

System/370 model 115, 125, 135: Communications can be via the Integrated Communications Adapter (#4640) and appropriate binary synchronous features on the 3115, 3125, 3135 as well as via a 2701, 2703 or 3704/3705.

3704/3705 Medium Speed Local Attachment: Attachment without modem at speeds up to 2400 bps via IBM-provided cables. Requires Synchronous Clock ... see "Specify."

2770 Data Communication System: Communication requires Terminal Use (#9711) and the same Transmission Code (#9761 or #9762) on both units. The 2772 must have Buffer Expansion, Add'l (#1491), or both the 3780 and the 2772 must have EBCDIC Transparency.

Another 3780: Communication requires Terminal Use (#9711) and the same Transmission Code (#9761 or #9762) on both units ... see "Specify."

2780 Data Transmission Terminal (models 1, 2, 4 only): Communication requires that both terminals have EBCDIC Code (#9761 on 3780, #9762 on 2780) and EBCDIC Transparency (#3601 on 3780, #8030 on 2780). Communications can be in EBCDIC Transparency mode only. The 3780 may not have multiple records in Transparent mode.

Bibliography: See *KWIK Index*, G320-1621 or specific system bibliography.

Specify

1. Voltage (AC, 1-phase, 3-wire, 60 cycle): Locking plug—#9884 for 208 V or #9886 for 230 V. Non-lock plug—#9881 for 115 V, #9885 for 208 V, or #9887 for 230 V.

2. Transmission Code: #9761 for EBCDIC or #9762 for ASCII ... can be field installed.

3. Character Set: *One* of the available character sets and the type size *must* be specified at no charge on the initial order ... see "Type Catalog" for specified characters in each set and price for additional sets.

4. Printer Tape Punch: Order under Part No. 120910

5. Identification: #9350 ... provides an identification function by which a CPU under stored program control and operating on a switched public network, can identify a legitimate 3780. **Prerequisite:** Switched Network Control (#7651).

6. Terminal Use (point-to-point): #9711 ... for communications with another 3780 or 2780. Provides "Bell" key and light indicator to signal remote terminal that voice mode is desired. Receipt of "Bell" code sounds alarm. Can be installed in the field. When communications is alternately with a CPU and another 3780 or 2780, via switched network, specify #9711.

7. 3704/3705 Medium Speed Local Attachment: Specify Modem or Data Set Attachment ... see item (8) below. #9121 (2400 bps) or #9122 (1200 bps). Also Communications Facilities ... see item (9) below. #9402 for half-duplex.

8. Modem or Data Set Attachment: One of the following, depending upon facility to be used must be specified: #9120 for C5 (2000 or 2400 bps) or D4M (2000 bps), #9121 for D4 (2400 bps), #9122 for D3 (1200 bps), #9123 for C4 (1200 bps), #9124 for D5 (4800 bps), #9125 for D4SB (2400/1200 bps), #9126 for D6 (7200 bps), #9127 for D6SB (7200/3600), #9121 for X1M (2400 bps), #9124 for X2M (4800 bps), 9128 for C6 (4800/2400 bps), or #9129 for D5SB (4800/2400 bps). Can be installed in the field. *Note:* #9120 required with #5610, #9121 with #5600/5602 without #7951, #9125 with #5600/5602 with #7951 ... if Public Switched Network Facility is used at data rate above 2400 bps, specify #9128 in lieu of #9120. **Prerequisite:** #9122 or #9123 may require Synchronous Clock (#7705) ... see "Special Features."

9. Communication Facilities: #9402 for half-duplex, or #9404 for duplex. Can be changed in the field. *Note:* Features specify 3780 control of the data set and do not necessarily correspond to the communication facility. Specify as indicated below:

Switched Network Operation—#9402. Leased Private Line (or equivalent privately owned). Multipoint—#9402 (half-duplex), although the communication facility may be 2-wire or 4-wire.

Point-to-point—#9402 for 2-wire (half-duplex) communications facilities ... #9404 for 4-wire (full duplex) facilities. *Note:* If 3780 Integrated Modem, IBM 3872, 3874 or 3875 Modem is used, specify #9402.



10. **Extended Retry Transmission: #9150**—extends the maximum retry count from three (12 seconds) to a maximum of fifteen (48 seconds) in an effort to recognize a valid response to the last block of data transmitted, prior to sending an EOT code and timing out with an error condition. Can be changed in the field.
11. **Data Set Cable:** A 20' data set cable is provided as standard. If a longer cable is required, specify #9021, indicating length as a quantity of 25, 30, 35 or 40.
12. **WACK Response (Wait before transmit-positive acknowledge): #9936** a ... if initial WACK is to be transmitted immediately. All subsequent WACK responses are transmitted after a 2-second delay. Can be changed in the field.
13. **Color:** #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.

Accessories

Locks And Keys: The 3780 with Keylock (#4560) special feature is shipped with two keys.

Special Features

Communications Special Features: Use of the following special features depends upon the communications application(s) for which the specific 3780 is to be used.

Component Selection (#1601): Provides the capability of specific 3780 I/O device selection. In addition to component selection, it provides priority output selection and multi-point Data Link Control Component Selection capability. It is a prerequisite for attachment of a 3781 Card Punch. **Field Installation:** Yes.

EBCDIC Transparency (#3601): Allows the 3780 to receive and transmit all 256 EBCDIC bit combinations as data characters. Variable length records cannot be transmitted if card I/O or printer is selected. Either normal or transparent text can be received without the "Transparency" switch being in the transparency position. The switch must be ON for *transmitting* in transparency. If a terminal on a multi-point line requires this feature, all terminals on that line must also have this feature. **Field Installation:** Yes. **Prerequisite:** EBCDIC Transmission Code (#9761).

Keylock (#4650): A key-operated Power-On switch for the 3780. The key must be inserted and turned to the "On" position before the control unit Power-On switch is operative. When the key is turned off, power is removed from the control unit. For additional or replacement keys, see Accessories. **Field Installation:** Yes.

Multi-Point Data Link Control (#5010): Allows multiple 3780s to be used on the same communication line with a CPU. Terminal can be polled or selected when operating as a tributary station on a multi-point system. All 3780s installed on the same line facility require this feature and must use the same transmission code and data set attachment. Other BSC devices (2780, 1130, System/360, System/370 System/3, System/360 model 20) as tributary stations, can be on a multi-point line with a processor control station. **Limitation:** If Terminal Use (#9711) is installed, it must be removed prior to installation of this fea-

ture. **Field Installation:** Yes.

Integrated 2400/1200 BPS Modem (#5600, 5602, 5610): Provides an integrated 2400 bps modem with half speed backup capability. Equivalent to and compatible with similarly featured IBM 3872 Modems. Three versions cover different communication requirements, as described below. Operator controls are integrated with the 3780 operator panel. Built-in diagnostic functions are provided for local and remote testing. See M2700, M3782 and "Prerequisites" above for additional information on allowable machine/system combinations and required features. **Maximum:** One #5600, #5602, or #5610.

Leased Line Point-to-Point Modem (#5600): Operates over D4 or (with Switched Network Backup, #7951) D4SB facilities with a similarly equipped 3780 or a 2780, 3780, System/360 or System/370 equipped with appropriate features and an equivalent featured IBM 3872 Modem. Includes manual equalization control. **Field Installation:** Yes. **Prerequisites:** Modem or Data Set Attachment #9121 (#9125 with Switched Network Backup, #7951), Half Duplex (#9402) Communication Facilities Control. Terminal Use (#9711) may be required, depending upon application.*

Leased Line Multipoint Tributary Modem (#5602): Operates on a multipoint network with a controlling CPU. Other 3780s on the same line facility must have either this feature or an IBM 3872 Modem with Multipoint Tributary (#5101 or #5102); other BSC tributary devices on the same line facility must have an IBM 3872 Modem with #5101 or #5102. Utilizes D4 or (with Switched Network Backup, #7951) D4SB facilities. Includes manual equalization control. **Field Installation:** Yes. **Limitation:** Terminal Use (#9711) cannot be installed. **Prerequisites:** Submit an RPQ for operation on a basic 3002 channel. Modem or Data Set Attachment #9121 (#9125 with Switched Network Backup, #7951), Half Duplex (#9402) Communication Facilities Control, Multipoint Data Link Control (#5010).*

Switched Network Modem (#5610): Operates over the Switched Network facility C5 with a similarly equipped 3780 or a 2780, 3780, System/360 or System/370 equipped with appropriate features and an equivalent featured IBM 3872 Modem with Switched Network (#7941 or #7942). Provides automatic line equalization. Provides automatic answering/disconnect capability when used in conjunction with Switched Network Control (#7651). **Field Installation:** Yes. **Prerequisites:** Half Duplex operation (#9402), Modem Attachment (#9120)*.

Print Positions, Additional (#5701): Provides an additional 24 print positions for the 3780 printer. **Field Installation:** Yes.

Switched Network Control (#7651): To attach to a switched network, provides automatic answering of incoming calls initiated by another terminal or central computer over common carrier switched (dial-up) facilities. The line must be equipped with an appropriate data set with auto answer capability and the terminal must be in a "ready" status. Provides automatic disconnect when disconnect sequence is received or when no data is transmitted/received for 20 seconds. Disconnect causes audible alarm to sound. **Specify:** #9850 for use with the IBM 3874 Modem. **Field Installation:** Yes.

Synchronous Clock (#7705): A synchronous clock for use with modems which do not have an internal clock, or for use with 3704/3705 Medium Speed Local Attachment Line Set, Type 1F. Will operate at 1200 bps or 2400 bps. The device with which the 3780 will communicate must also have an internal clock operating at the same bps rate. **Specify:** #9702 for 1200 bps, or #9704 for 2400 bps. **Field Installation:** Yes.



Switched Network Backup (#7951): Provides alternate operation on facility D4SB for Leased Line Point-to-Point (#5600) or Multipoint Tributary (#5602) feature. Auto answer is not provided. Half duplex mode of modem operation is forced when this feature is selected by the operator panel "Mode" switch; a "Talk/Data" switch is provided. This feature can be used with OS/DOS BTAM in certain configurations. Additional use program routines will be required to fully utilize the capabilities of this feature. For additional information see *IBM Modem Marketing Guide*. **Field Installation:** Yes.



3781 CARD PUNCH

Purpose: Punched card output unit for a 3780 Data Communications Terminal.

Highlights: Provides 80 column card output at a rated speed of 160 columns per second. Punches serially with actual throughput dependent upon number of columns punched, communication facility, and 3780 features employed. Refer to the *3780 Component Information Manual* for throughput calculations.

A free standing unit, cable attached within seventeen feet of the supporting 3780. It has a 1200-card capacity hopper and a 1300-card capacity prime stacker. Echo pulse check of punched data is provided by the 3781 in addition to conventional transmission checking provided by the 3780. Error cards are laced in card column 82 and stacked in secondary stacker.

The unit may be used in home mode in conjunction with the 3780 card reader to create punched card output media.

Only one 3781 can be attached to a 3780 Data Communications Terminal.

Prerequisites: A 3780 equipped with Component Selection (#1601) ... see 3780.

Card Limitations: Heavy duty cards, aqua cards, and C-4 corner cut cards cannot be used. Scored cards require careful handling and a favorable environment. Recommended use of scored cards is limited to the following:

Internal Scores Before separation: S-1, ID-1, ID-2, and for a maximum of three passes, M-4 and M-5.

External Scores After separation: M-7, M-11 (with round corners), CF-11 (with round corners) on either end of the card, and M-3 on column 80 end only.

Bibliography: GA24-3089

Specify

1. Voltage (AC, 1-phase, 3-wire, 60 cycle): Locking plug—#9884 for 208 V, or #9886 for 230 V. Non-lock plug—#9881 for 115 V, #9885 for 208 V, or #9887 for 230 V. Must be consistent with that specified for the 3780.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. Transmission Code: #9761 for EBCDIC, or #9762 for ASCII. Specify the same as that for the 3780. Can be field installed.



3845 DATA ENCRYPTION DEVICE

Purpose: A table top or shelf mounted encryption/decryption device for data transmitted over a communication line. The 3845 is positioned between a data terminal equipment (DTE) and a data communications equipment (DCE), one at each end of a half duplex or duplex communication line. The 3845 will operate with Start-Stop, Bisynchronous, or Synchronous Data Link Control (SDLC) protocol at speeds ranging from 110 bps to 19,200 bps. See "Limitations" under "Communications."

Attachable devices: The 3845 is transparent to the DCE and the DTE. Control signals by the 3845 are redriven in compliance with the EIA-CCITT specification. All other signals are cable fed through the 3845. The 3845 will attach wherever EIA-RS-232C/CCITT-V.24 interface requirements are met.

Models 1-3—for use with Start-Stop or SDLC line protocol (S/S or SDLC).

Model 1 A single half duplex unit operating on a 2- or 4-wire half duplex communication line.

Model 2 A dual half duplex unit, with each half duplex device completely independent of the other, operating over 2- or 4-wire half duplex communication lines.

Model 3 A full duplex unit operating over a full duplex communication line.

Models 11-13 for use with Bisynchronous, Bisynchronous with Business Machine Clocking (BMC), or Synchronous Data Link Control (BSC/SDLC or BSC with BMC/SDLC).

Model 11A single half duplex unit, operating on a 2- or 4-wire half duplex communication line in BSC/SDLC or BSC with BMC/SDLC ... see "Specify Features."

Model 12A dual half duplex unit, with each half duplex device completely independent of the other, operating over 2- or 4-wire half duplex lines in BSC/SDLC or BSC with BMC/SDLC ... see "Specify Features." **Limitation:** A Model 12 must have both outputs either BSC/SDLC or both BSC with BMC/SDLC.

Model 13A full duplex unit operating over a full duplex communication line in BSC/SDLC or BSC with BMC/SDLC ... see "Specify Features."

Highlights: A communication security device that provides encryption/decryption of digital data transmitted over a communication line.

Two or more data encryption devices (3845 or 3846) are needed, one at each termination of a communication line (point-to-point or multi-point). **Limitation:** A 3845 or 3846 is required at each node in order to have message header information in the clear through that node.

The 3845 is cabled to the DTE via the cable that is provided by the DTE manufacturer for attachment to the DCE. Attachment from the 3845 to the DCE is by a cable provided with the 3845. One cable is provided per line function. **Limitation:** The cable provided with the 3845 is 1.5 metres long (5 ft.). This adds load capacitance to the DTE/DCE.

An accessory, the Personalization/Key Entry Unit (P/KEU), must be available at each site location having a 3845. This accessory is used to enter the key variable, the seed, and to personalize the 3845 to the customer's communication line. The key variable is

a 56-bit plus parity code, entered by the customer at a frequency consistent with his security requirements. The customer defines his own keys, selects them in a random manner, and enters them manually. The seed is 1 to 16 hexadecimal random characters used to initiate the synchronization message. The personalization consists of 4 hexadecimal characters of information that personalizes the 3845 to the communication facilities, such as line discipline, line speed, method of clocking, and synchronization message length.

The 3845 has a bypass switch that allows messages to be sent in the clear and is also used by the customer in fault isolation. A battery is provided that maintains power to the storage registers containing the key variable, seed, and personalization data when the 3845 AC power is removed.

Security is provided by use of interlocks that remove power, including battery power, from the storage registers whenever the service cover is removed. The seed, key variable and personalization must be re-entered when all (battery and AC) power is removed.

Communications: The 3845 Models 1, 2, and 3 encrypt/decrypt data if (a) the DTE/DCE conforms to interface EIA-RS-232C or CCITT-V.24, (b) uses S/S or SDLC protocol, (c) operates on a half duplex or duplex facility, (d) is within the speed of 110-9600 bps for asynchronous operation or the speed of up to 19,200 bps for synchronous operation, and (e) uses a 7 or 8 bit code (exclusive of the required start and stop bits) for asynchronous operation or uses an 8 bit SDLC flag for SDLC operation.

The 3845 Models 11, 12, and 13 encrypt/decrypt data if (a) the DTE/DCE conforms to interface EIA-RS-232C or CCITT-V.24, (b) uses BSC or SDLC protocol, (c) operates on a half duplex or duplex facility, (d) is within the speed of up to 19,200 bps, and (e) uses an EBCDIC or ASCII code for BSC or uses an 8 bit SDLC flag for SDLC operation.

Limitations: (1) SDLC will not operate with Non-Return to Zero Inverted (NRZI) transmission mode. NRZI describes the way information bits are presented at the EIA interface. NRZI is required in some SDLC networks when using IBM 3872 modems to ensure modem synchronization. (2) Operation at 19,200 bps may require the user to optimize cable length and quality.

Data Communications Equipment: Data Communications Equipment operating in non-NRZI is needed with the 3845 when operating in SDLC protocol. IBM external modems may be attached to the 3845, i.e.:

Modem	Speed (bps)
3872	1200/2400 (BSC only)
3874	4800
3875	7200

Problem Determination Procedures: A bypass switch is provided that allows transmission in the clear to permit determining whether a problem exists in the 3845 or in other equipment. See "Customer Responsibility" below.

Problem determination is a customer responsibility that does not involve the customer engineer. Customer education in problem determination is a marketing responsibility.



Customer Set-Up (CSU): The 3845 is designated as a customer set-up device thereby offering the customer relocation flexibility. CSU is a customer responsibility that does not involve the customer engineer. Customer education in CSU is a marketing responsibility.

Customer Responsibility: The customer is responsible to:

- Provide an adequate site and other preparation.
- Receipt at the customer's receiving dock, unpacking and set up of the 3845.
- Connect cables to the DTE and DCE.
- Personalize to the communication facility.
- Enter the seed.
- Enter the key variable.
- Use and follow the problem determination procedures and to follow instructions for service of the 3845.

Note: Appropriate procedures are provided by IBM for personalization and entering the seed and key variable.

Maintenance

Spares: The customer may wish to replace a failing 3845 with a spare and must be advised to purchase spares for such use. The number of spare devices recommended is dependent upon the number of devices the customer has installed, his application requirements, physical locations, and layouts.

IBM Repair Center Service: Maintenance of the 3845 will normally be at a designated IBM Repair Center. All maintenance, parts replacement, adjustments, and repair shall normally be performed at the designated IBM Repair Center. It shall be the customer's responsibility to set up the equipment and to determine when remedial maintenance is required. When remedial maintenance is required, it shall be the customer's responsibility to determine the failing device, pack the device in the designated shipping container and ship it prepaid to the designated IBM Repair Center.

IBM will pre-pay the transportation charges for return of the repaired device. There is no regularly scheduled preventive maintenance recommended by IBM on these devices.

Customers with machines not under an IBM Maintenance Agreement have the option to ship the machines to the designated IBM Repair Center for repair under the IBM Repair Center Machine Repair Authorization Form, GX27-2981, in which case repair will be made (if the machine is repairable). Alternately, upon request, the IBM Repair Center will provide, for a minimum charge, an estimate of repair charges. This charge covers handling, inspection, adjustments, testing, return shipping charges and estimating of repair charges.

The 3845 is eligible for maintenance agreement service immediately following expiration of the service and parts warranty at the monthly charge shown under MMMC in "Prices" below.

If agreement service is not contracted for immediately following expiration of the service and parts warranty and the customer wants agreement service, the customer may ship the machine(s) to the designated IBM Repair Center for an inspection. If, on the basis of an inspection, the repair center concludes that a machine is not repairable, no further work will be performed and the machine will be returned to the customer with a minimum

charge to cover handling, inspection, testing, and a return shipping charge.

In all other cases, the IBM Repair Center will charge a minimum fee per machine to cover handling, inspection, adjustments, testing, and return shipping. In addition, all parts needed will be billed at IBM's prevailing parts prices and the additional time required for repairs will be billed at IBM's applicable service rates, if so authorized by the customer. The machine will then be eligible for maintenance agreement service.

Prerequisites: (1) A S/S, BSC, or SDLC communication line ... (2) Compliance with EIA-RS-232C or CCITT-V.24 ... (3) External modems, IBM or non-IBM ... (4) Accessory Personalization/Key Entry Unit available at site location.

Specify

1. Line Voltage Plug (115/120 V Power and Line Cord, 1-Phase, 60 Hz): #9890 for locking plug ... #9891 for non-lock plug.
2. Line Cord Length: If the standard 2.8 m (9 ft.) power cable is not desired, specify: #9511 for 1.8 m (6 ft.) line cord, #9512 for 3.7 m (12 ft.) line cord, #9513 for 4.5 m (15 ft.) line cord.
3. For 3845 Models 11, 12, and 13: Specify one ... installation available at time of manufacture only.
#9110—BSC/SDLC, or
#9115—BSC with BMC/SDLC

Model Changes: At time of manufacture only.

Personalization/Key Entry Unit (Part No. 4407908) to enter key variable, seed, and personalization data. One must be available at each site.

A battery, part no. 1743456, is needed to replace the installed battery. The replacement schedule is defined in the *Principles of Operation Manual*. Discharged batteries should be returned to IBM.

	Purchase	MMMC
Personalization/Key Entry Unit, Part No. 4407908	\$265	**
Battery Part No. 1743456	17	—

**Warranty Services are available at the designated IBM Repair Center during the 90 day warranty period, which commences 30 days following date of shipment from the Plant of Manufacture

It shall be the customer's responsibility to determine the failing unit and, if the unit is still under warranty, to pack it in the designated shipping container and ship it prepaid to the designated IBM Repair Center.

IBM Maintenance Agreements are not available. Customer Engineering on-site service will not be provided.



3846 DATA ENCRYPTION DEVICE

Purpose: A rack mounted encryption/decryption device for data transmitted over a communication line. The 3846 is positioned between a data communications equipment (DCE) and a data terminal equipment (DTE), one at each end of a half duplex or duplex communication line. The 3846 will operate with a Start/Stop, Bisynchronous, or Synchronous Data Link Control (SDLC) protocol at speeds from 110 bps to 19,200 bps. See "Limitations" under "Communications."

Attachable Devices: The 3846 is transparent to the DCE and DTE. Control signals used by the 3846 are redriven in compliance with the EIA-RS-232C/CCITT-V.24 specification. All other signals are cable fed through the 3846. The 3846 will attach wherever EIA-RS-232C/CCITT-V2.4 interface requirements are met.

Model 1 A power unit capable of providing power to 1 to 4 line function units.

Models 2 and 3 for use with Start-Stop or Synchronous Data Link Control (SDLC) line protocol meeting EIA-RS-232C or CCITT-V.24 interface. Requires a 3846 Model 1 for power.

Model 2 A dual half duplex line function unit, with half duplex device completely independent of the other, operating over 2 or 4 wire half duplex communication lines.

Model 3 A full duplex line function unit operating over a full duplex communication line.

Models 12 and 13 for use with Bisynchronous, Bisynchronous with Business Machine Clocking (BSC, BSC with BMC), or SDLC with EIA-RS-232C or CCITT-V.24. Requires a 3846 Model 1 for power.

Model 12A dual half duplex line function unit with each half duplex device completely independent of the other, operating over 2 or 4 wire half duplex communication lines in BSC, BMC SDLC line protocol ... see "Specify Features." **Limitation:** A Model 12 must have both outputs either BSC/SDLC or both BSC with BMC/SDLC.

Model 13A full duplex line function unit operating over a full duplex facility in BSC, BMC, SDLC line protocol ... see "Specify Features."

Highlights: A communication security device that provides encryption/decryption of digital data, transmitted over a communication line.

Two or more data encryption devices (3845 or 3846) are needed, one at each termination of a communication line (point-to-point or multipoint). **Limitation:** A 3845 or 3846 is required at each node in order to have message header information in the clear through that node.

The 3846 is cabled to the DTE via the cable that is provided by the DTE manufacturer for attachment to the DCE. Attachment from the 3846 to the DCE is by a cable provided with the 3846. One cable is provided per line function. **Limitation:** The cable provided with the 3846 is 1.5 metres (5 ft.) long. This adds load capacitance to the DTE/DCE.

An accessory, the Personalization/Key Entry Unit (P/KEU), must be available at each site location having a 3846. This accessory is used to enter the key variable, the seed, and to personalize the

3846 to the customer's communication line. The key variable is a 56 bit plus parity code, entered by the customer at a frequency consistent with their security requirements. The customer defines the keys, selects them in a random manner, and enters them manually. The seed is 1 to 16 hexadecimal random characters, used to initiate the synchronization message. The personalization consists of 4 hexadecimal characters of information that personalizes the 3846 to the specific communication line characteristics such as line discipline, line speed, method of clocking, and synchronization message length.

The 3846 depends on the customer providing a method of switching to enable the user to send messages in the clear and for fault isolation. A battery is provided that maintains power to the storage registers containing the key variable, seed, and personalization data when the 3846 AC power is turned off.

Security is provided by the use of interlocks that remove power, including battery power, from the storage registers whenever a line function unit is removed from the rack. The seed, key variable and personalization must be re-entered when all power (battery and AC) is removed.

Communications: The 3846 Models 2 and 3 encrypt/decrypt data if (a) the DTE/DCE conforms to interface EIA-RS-232C or CCITT-V.24, (b) uses an S/S or SDLC protocol ... (c) operates on a half duplex or duplex facility, (d) is within the speed of 110-19,200 bps and (e) uses 7 or 8 bit transmission code exclusive of the required start and stop bits for asynchronous operation or uses an 8 bit SDLC flag for SDLC operation.

The 3846 Models 12 and 13 encrypt/decrypt data if (a) the DTE/DCE conforms to interface EIA-RS-232C or CCITT-V.24, (b) uses a BSC or SDLC protocol, (c) operates on a half duplex or duplex facility, (d) is within the speed of up to 19,200 bps, and (e) uses an EBCDIC or ASCII code for BSC or uses an 8 bit SDLC flag for SDLC operation.

Limitations: (1) SDLC will not operate with Non-Return to Zero Inverted (NRZI) transmission mode. NRZI describes the way information bits are presented at EIA interface. NRZI is required in some SDLC networks when using IBM 3872 modems to ensure modem synchronization. (2) Operation at 19,200 bps may require the user to optimize cable length and quality.

Data Communications Equipment: Data Communications Equipment operating in non-NRZI is needed with the 3846 when operating in SDLC protocol. IBM external modems may be attached to the 3846.

Modem	Speed (bps)
3872	1200/2400 (BSC only)
3874	4800
3875	7200

Problem Determination Procedures: A customer installed switch panel must be used to permit determining whether a problem exists in the 3846 or in the other equipment. See "Customer Responsibility" below.

Problem determination is a customer responsibility that does not involve the customer engineer. Customer education in problem determination is a marketing responsibility.

Customer Set-Up (CSU): The 3846 is designated as a customer set-up device, thereby offering the customer relocation flexibility.



CSU is a customer responsibility that does not involve the customer engineer. Customer education in CSU is a marketing responsibility.

Customer Responsibility: The customer is responsible to:

- Provide an adequate site and other preparation.
- Receipt at the customer's receiving dock, unpacking, and set up of 3846.
- Provide a method of switching to enable the user to send messages in the clear and to assist in fault isolation.
- Make the interconnection between the 3846 Model 1 and the 3846 line function devices.
- Personalize to the communication facility.
- Enter the seed.
- Enter the key variable.
- Use and follow the problem determination procedures and to follow instructions for service of the 3846.

Note: Appropriate procedures are provided by IBM for personalization and entering the seed and key variable.

Maintenance

Spare: The customer may wish to replace a failing 3846 with a spare and must be advised to purchase sufficient spare devices for such use. The number of spare devices recommended is dependent upon the number of devices the customer has installed, his application requirements, physical locations, and layouts.

IBM Repair Center Service: Maintenance of the 3846 will normally be at a designated IBM Repair Center. All maintenance, parts replacement, adjustments, and repair shall normally be performed at the designated IBM Repair Center. It shall be the customer's responsibility to set up the equipment and to determine when remedial maintenance is required. When remedial maintenance is required, it shall be the customer's responsibility to determine the failing device, pack the device in the designated shipping container and ship it prepaid to the designated IBM Repair Center. IBM will pre-pay the transportation charges for return of the repaired device. There is no regularly scheduled preventative maintenance recommended by IBM for these units.

Customers with machines not under an IBM Repair Center Maintenance Supplement to the IBM Maintenance Agreement, have the option to ship the machines to the designated IBM Repair Center for repair under the IBM Repair Authorization Form, GX27-2981, in which case repair will be made (if the machine is repairable). Alternatively, upon request, the IBM Repair Center will provide, for a minimum charge, an estimate of repair charges. This charge covers handling, inspection, adjustment, testing, estimating of repair charges, and return shipping charges.

The 3846 is eligible for maintenance agreement service immediately following expiration of the service and parts warranty at the monthly charge under MMMC in "Prices" below.

If maintenance agreement service is not contracted for immediately following expiration of service and parts warranty and the customer now wants maintenance agreement service, the customer may ship the machine(s) to the designated IBM Repair

Center for an inspection. If on the basis of an inspection, the repair center concludes that a machine is not repairable, no further work will be performed and the machine will be returned to the customer with a minimum charge to cover handling, inspection, testing, and return shipping charges.

In all other cases, the IBM Repair Center will charge a minimum fee per machine to cover handling, inspection, adjustments, testing and return shipping charge. In addition, all parts needed will be billed at IBM's prevailing parts prices and the additional time required for repairs will be billed at IBM's applicable service rates if so authorized by the customer. The machine will then be eligible for maintenance coverage.

Prerequisites: (1) An S/S, BSC, or SDLC communication line ... (2) Compliance with EIA-RS-232C or CCITT-V.24 ... (3) External modems, IBM or non-IBM ... (4) Accessory Personalization/Key Entry Unit available at site location ... (5) Accessory mounting panel ... (6) Accessory blank panel may be ordered if desired.

Specify

1. Line Voltage Plug (115/120 V Power and Line Cord, 1-phase, 60 Ha): #9890 for locking plug, #9891 for non-lock plug.
2. Line Cord Length—if the standard 2.8M (9 ft.) power cable is not desired, specify: #9511 for 1.8M (6 ft.) line cord, #9512 for 3.7M (12 ft.) line cord, #9513 for 4.5M (15 ft.) line cord.
3. For Models 12 and 13: Specify one ... installation available at time of manufacture only.
#9110—BSC/SDLC or
#9115—BSC with BMC/SDLC

Model Changes: Available at time of manufacture only.

Accessories

- Personalization/Key Entry Unit, Part No. 4407908, to enter key variable, seed, and personalization data. One must be available at each site.
- Mounting plate, Part No. 6813128, to attach 4 type 3846 units to a rack. One required for each 4 units.
- Blank panel, Part No. 4409058, to close any unused opening in a mounting panel. One may be ordered for each unused opening.
- A battery, Part No. 1743456, is needed to replace the installed battery. The replacement schedule is defined in the *Principle of Operation Manual*. Discharged batteries should be returned to IBM.



	Purchase	MMMC
Personalization/Key Entry Unit, Part No. 4407908	\$265	**
Mounting Plate, Part No. 6813128	30	—
Blank Panel, Part No. 4409058	5	—
Battery, Part No. 1743456	17	—

**Warranty Services are available at the designated IBM Repair Center during the 90 day warranty period, which commences 30 days following date of shipment from the Plant of Manufacture

It shall be the customer's responsibility to determine the failing unit and, if the unit is still under warranty, to pack it in the designated shipping container and ship it prepaid to the designated IBM Repair Center.

IBM Maintenance Agreements are not available. Customer Engineering on-site service will not be provided.



3872 MODEM

Purpose: A 2400 bps modem, with half-speed capability, used to provide communications products with the means for transmitting data over common carrier provided voiceband private line (non-switched) channels, equivalent privately owned channels or switched telecommunication networks.

Highlights: Modem operation is possible in half-duplex mode over 2- or 4-wire half-duplex facilities, half-duplex or duplex mode over duplex facilities or half-duplex mode over switched telecommunication networks.

Data Rates: 2400 bps with back-up half-speed.

Equalization: Manually adjustable by operator on private line (non-switched) channels and automatic on switched networks.

Operation: Switched network or multipoint control, multipoint tributary, point-to-point on a private line (non-switched) channel. See "Special Features."

Built-in Diagnostics: Included in each modem are the following diagnostic features accessible to the operator: (1) The modem may be *wrap tested* independently of the using machine and telecommunication channel ... (2) It may be *line tested* with a remote modem and telecommunication channel, independently of the attached business machine. The test may be one way or remotely wrapped to the local modem.

Communications Facilities: Communication Common Carrier provided voiceband private line (non-switched) channel, type 3002, (or equivalent) as described in the Bell System Technical Reference PUB 41004, dated October, 1973. *Note:* Machines with a serial number prior to 13100 and a suffix prior to HZ with Multipoint Tributary (#5101, 5102) or Point-to-point (#6101, 6102) feature require the installation of an RPQ to operate on a basic (not conditioned) 3002 channel.

Privately Owned Communication Facilities: Equivalent to above.

Public Switched Networks The customer must be advised that satisfactory data transmission depends upon the characteristics of the particular switched network connection being used. Refer to M2700 pages for further details.

International Facilities: Transmission of data between the United States and Canada on non-switched or switched facilities is supported. (For non-switched operation, the channel in Canada must be a schedule 4, type 4.)

Attachment to Facilities: Attachment to a private line (non-switched) channel is by a cable, supplied with the 3872, which is terminated with a four prong plug (WE 283B or equivalent). The plug mates with a receptacle (WE 404B or 549A surface mount or 493A flush mount, or equivalent) which is connected to the channel. (The receptacle is a conventional item of communication equipment and is, upon customer request, ordinarily furnished by the telecommunication service supplier.)

If the 3872 is equipped with Switched Band Network Back-up (#7951), another cable is supplied with the feature. This cable is also terminated with a four prong plug and requires the aforementioned type of receptacle which is connected to the Data Access Arrangement CDT (WE 1000A or equivalent).

If the 3872 is equipped with Switched Network (#7941, #7942) or Switched Network Back-up with Automatic Answer (#7952) a cable is supplied with the feature which is terminated with spade

lugs for connection to the Data Coupler CBS (WE 1001A, series 5 or later, or WE 1001F, or equivalent).

Related Equipment: The 3872 operates with IBM communications products capable of 2400 bps operation ... see "Related Equipment" under "Specify." Modem clocking must be used. The IBM 3872 Modem must communicate with another appropriately equipped 3872, or with an appropriately equipped IBM 2400 bps Integrated Modem. The interconnecting cable between the business machine and the modem must be supplied by the business machine. If the 3872 is equipped with the Automatic Call Originate (#1091) feature, the interconnecting Auto-Call cable between the business machine and the modem must be supplied by the business machine.

Customer Responsibilities: The customer must be informed of his responsibilities as detailed in the M2700 pages and in the Installation Planning section of the *3872 User's Guide*, GA27-3058. The customer is responsible for:

1. Private line (non-switched) channel—arranging for the telecommunication service supplier to provide a type 3002 voice grade data channel (or equivalent) as described under "Communications Channel Specifications" in the *3872 User's Guide*. Also arranging for the installation of the appropriate receptacle described in "Attachment to Facilities."
2. Switched Telecommunication Network—arranging for the telecommunication service supplier to install the appropriate communication service equipped with the required connecting device as described in "Attachment to Facilities" and for attaching the IBM provided cable to the connecting device.

Also inform the telecommunication service supplier that the speed of data transmission will be 2400 bps and that appropriate conditioning of the local loop is required. The customer must be made aware that the use of local loops not properly conditioned for the speed of data transmission or the use of special switched facilities may result in unsatisfactory data transmission.
3. Providing voice communications between modems to coordinate tests or re-equalization. The voice facility can be provided by the 3872 Alternate Voice feature. Information concerning the handset for the Alternate Voice feature is described in the *3872 Modem User's Guide*. The voice facility must be located such that an operator can use it while operating the controls on the front of the modem.
4. If the 3872 is to be attached to a non-IBM product, the interconnecting cable between the business machine and the modem must be supplied by the business machine.
5. If the 3872 is equipped with the Automatic Call Originate feature (#1091), the interconnecting Auto-Call cable between the business machine and the modem must be supplied by the business machine.

Bibliography: See GA24-3089



Publication: IBM 3872 User's Guide, GA27-3058

Specify

1. Voltage (AC, 1-phase, 3-wire, 60 Hz):

	115V	208V	230V
Locking Plug	#9880	#9884	#9886
Non-Locking Plug	#9881	#9885	#9887

2. Telecommunication Cord (modem to telecommunication facility): Specify one of the following for each telecommunication channel or network connection;

#9750 Telecommunication cord to connect a basic (control station) 3872 modem, or one equipped with Multipoint Tributary (#5101), or Point-to-Point (#6101) feature, to a private line (non-switched) channel.

#9751 Telecommunication cord to connect a basic (control station) 3872 Second Modem (#6302) or second modem equipped with Multipoint Tributary (#5102), or Point-to-Point (#6102) feature, to a private line (non-switched) channel.

#9752 Telecommunication cord to connect a 3872 modem equipped with Switched Network (#7941) to a switched telecommunication network.

#9753 Telecommunication cord to connect a 3872 Second Modem (#6302) equipped with Switched Network (#7942) to a switched telecommunication network.

#9754 Telecommunication cord to connect a 3872 modem equipped with Switched Network Back-up (#7951) or Switched Network Back-up with Automatic Answer (#7952) to a switched telecommunication network.

A 10-foot cable will be supplied. If a longer cable is required, indicate 15, 20 or 25 feet as the quantity of the feature # specified. Note: orders to add the Switched Network Backup feature(s) (#7951 or #7952), to convert a private line (non-switched) channel modem to Switched Network, or to convert a Switched Network modem to private line (non-switched) channel must include the telecommunication cord specify number(s) compatible with the resultant modem configuration.

3. Related Equipment: For record purposes, one 3872 Attachment Feature Code from the table below must be specified for each 3872, depending upon the unit to which it is attached.

3872		3872	
Machine	Attachment #	Machine	Attachment #
1131	9501	3767	9537
1826	9502	3780	9521
2020	9503	5010	9531
2780	9509	5110	9564
2848	9511	5231	9547
3271	9513	5251-2/12	9565
3274	9558	5320	9545
3275	9514	5340	9559
3276	9557	5404	9549
3707	9548	5406	9518
3735	9517	5408	9538
3741-2/4	9526	5410	9519
3747	9526	5412	9546
		5415	9533
		Non-IBM	9520
		PRQ Machine	9524

Special Features

The basic 3872 Modem with no additional feature required is used at the control station in a centralized multipoint network. Additional capabilities/configurations are provided by the following features.

Alternate Voice (#1051, 1052): Provides signalling capability and a socket on the operator panel into which a customer provided handset may be plugged permitting voice communication with the distant 3872 Modem(s). Data cannot be simultaneously transmitted with voice. A handset is not provided. See 3872 User's Guide for description of handset. #1051—for basic modem ... #1052—for Second Modem (#6302). Maximum: One of each. Limitations: a #1051 cannot be installed with Switched Network (#7941) ... #1052 cannot be installed with Switched Network (#7942). Field Installation: Yes. Prerequisites: #1052 requires Second Modem (#6302).

Automatic Call Originate (#1091): Permits automatic origination of a call by the using machine equipped with an IBM auto-call feature. Provides control to the common carrier Data Coupler Type CBS (or equivalent) to dial telephone numbers and to provide on-hook/off-hook control. Note: Can only be used with Rotary Dial System. Maximum: One. Limitation: Cannot be installed with Second Modem (#6302) or Switched Network Back-up (#7951, 7952). Field Installation: Yes. Prerequisites: Switched Network (#7941) on 3872 and an IBM Auto Call feature on the using machine.

Fan-Out (#3901): This feature allows attachment, to the 3872, of up to three IBM Teleprocessing Machines at one location ... see Specify (3) for applicable machines. Only one of the attached machines may transmit at a time.

This feature may be used at a tributary station in a centralized multipoint network. In this configuration, multipoint programming discipline will provide the selection/control of the specified IBM terminals without any additional user involvement.

This feature may also be used to allow up to three of the specified IBM Multiplexers, Communication Controllers, or Integrated Communications Adapters, at a central site to share the same 3872 Modem for back-up purposes. In this case, although all of the machines attached to the 3872 will receive the incoming data simultaneously, the user switchover procedure must insure that only one machine is sending. Maximum: One. Limitations: Cannot be installed with Second Modem (#6302) or Switched Network (#7941). Field Installation: Yes.

Multipoint Tributary (#5101, 5102): Used on each modem attached to tributary stations in a centralized multipoint network to compensate for line distortion between the control and tributary station. Operator adjustment on front panel. #5101—for basic modem ... #5102—for Second Modem (#6302). Maximum: One of each. Limitation: #5101 cannot be installed with Point-to-Point (#6101) or Switched Network (#7941) ... #5102 cannot be installed with Point-to-Point (#6102) or Switched Network (#7942). Field installation: Yes. Prerequisite: #5102 requires Second Modem (#6302). Specify: Telecommunication cord #9750 for feature #5101 ... Telecom-



munication cord #9751 for feature #5102. **Field Installation:** Yes. **Prerequisite:** #5102 requires Second Modem (#6302).

Point-to-Point (#6101, 6102): Used on modems at each end of a point-to-point private line (non-switched) channel to compensate for line distortion. #6101—for basic modem ... #6102—for Second Modem (#6302). **Maximum:** One of each. **Limitation:** #6101 cannot be installed with Multipoint Tributary (#5101) or Switched Network (#7941) ... #6102 cannot be installed with Multipoint Tributary (#5102) or Switched Network (#7942). **Specify:** Telecommunication cord #9750 for feature #6101 ... Telecommunication cord #9751 for feature #6102. **Field Installation:** Yes. **Prerequisite:** #6102 requires Second Modem (#6302).

Second Modem (#6302): Permits two modems, each to operate on a separate line, to be housed in the same stand-alone cabinet. The two modems share the same power supply. **Maximum:** One. **Limitations:** Only the following features are allowed on either or both modems—Alternate Voice (#1051, 1052), Point-to-Point (#6101, 6102), Multipoint Tributary (#5101, 5102), or Switched Network (#7941, 7942). **Field Installation:** No. Plant only.

Switched Network (#7941, 7942): Used for operation over public switched network via the common carrier Data Coupler type CBS (or equivalent). Automatic answering of incoming calls will be performed by the modem. Automatic equalization is effected at the beginning of each call. #7941—for basic modem ... #7942—for Second Modem (#6302). Conditioning of the telecommunication service local loop for transmission of data faster than 300 bps is required. It can communicate with another 3872 equipped with Switched Network (#7941 or #7942), with Switched Network Back-up (#7951) or with Switched Network Back-up with Automatic Answer (#7952). **Maximum:** One of each. **Limitations:** #7941 cannot be installed with Alternate Voice (#1051), Fan-Out (#3901), Multipoint Tributary (#5101), or Point-to-Point (#6101) ... #7942 cannot be installed with Alternate Voice (#1052), Multipoint Tributary (#5102), or Point-to-Point (#6102). **Specify:** Telecommunication cord #9752 for feature #7941 ... Telecommunication cord #9753 for feature #7942. **Field Installation:** Yes. **Prerequisite:** #7942 requires Second Modem (#6302).

Switched Network Back-up (#7951): Provides the capability of attaching the 3872 to the public switched network as a back-up to the private line (non-switched) channel. It can communicate with another 3872 equipped with Switched Network (#7941 or #7942), with Switched Network Back-up (#7951), or with Switched Network Back-up with Automatic Answer (#7952). A fixed compromise equalizer is provided for the back-up operation. A front panel switch permits operator selection of either the prime or the back-up facility. Both facilities cannot be used simultaneously.

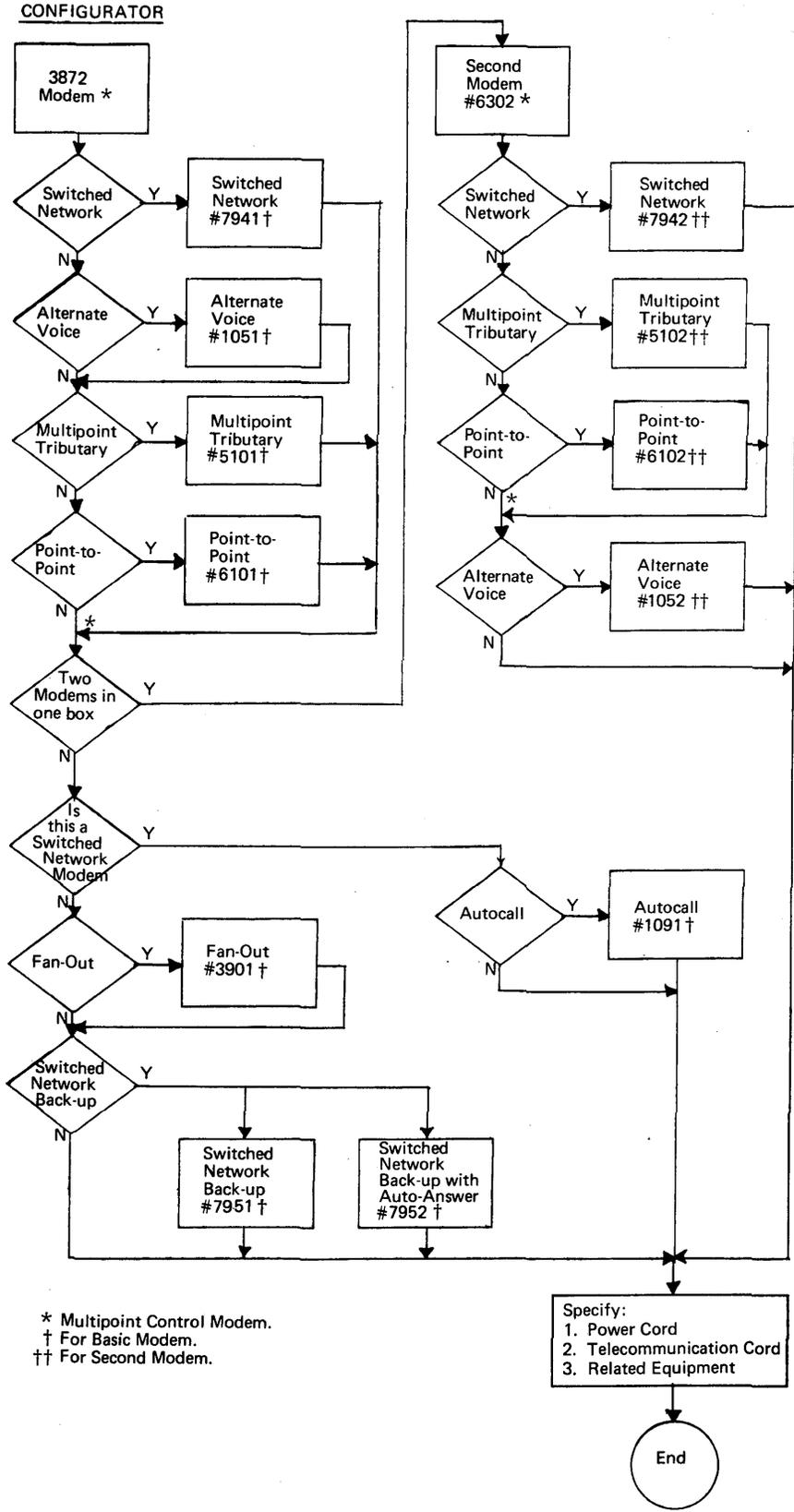
Attachment to the switched network is made via the common carrier Data Access Arrangement type CDT (or equivalent). Calls must be established and answered manually. *Note:* To use this feature, operator intervention at the modem is required. Operator intervention, program modification, or both may be required on the using system/terminal.

This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1 and OS/VS2 in certain configurations. Programming support for 2020, 5231, 5320, 5340, 5404, 5406, 5408, 5410, 5412, and 5415 is still applicable when these devices are used as remote terminals. Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Back-up feature. Conditioning of the telecommunication service local

loop for transmission of data faster than 300 bps is required. For additional information, see the 3872 *User's Guide*. **Maximum:** One. **Limitations:** Cannot be installed with Second Modem (#6302), or Switched Network features (#7941, 7942 or 7952). **Specify:** Telecommunication cord #9754. **Field Installation:** Yes.

Switched Network Back-up with Automatic Answer (#7952): Same as Switched Network Back-up (#7951) plus the added capability of automatically answering incoming calls when attached to a common carrier Data Coupler type CBS (or equivalent). *Note:* To use this feature, operator intervention at the modem is required. Operator intervention, program modification, or both may be required on the using system/terminal.

This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1 and OS/VS2 in certain configurations. Programming support for the 2020, 5231, 5320, 5340, 5404, 5406, 5408, 5410, 5412, and 5415 is still applicable when these devices are used as remote terminals. Additional customer routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Back-up feature. Conditioning of the telecommunication service local loop for the transmission of data faster than 300 bps is required. For additional information, see the 3872 *User's Guide*. **Maximum:** One. **Limitations:** Cannot be installed with Second Modem (#6302), or Switched Network features (#7941, 7942 or 7951). **Specify:** Telecommunication cord #9754. **Field Installation:** Yes.





3874 MODEMS

Purpose: A 4800 bps modem, with half-speed capability, used to provide communications products with the means for transmitting data over common carrier provided voiceband private line (non-switched) channels, equivalent privately owned channels or switched telecommunication networks.

Highlights: Modem operation is possible in half-duplex or duplex mode over 4-wire duplex facilities or half-duplex over 2-wire switched telecommunication networks.

Data Rates: 4800 bps with back-up half speed.

Equalization: Automatic.

Operation: Switched network or multipoint control, multipoint tributary, point-to-point on a private line (non-switched) channel. See "Special Features."

Built-in Diagnostics: Included in each modem are the following diagnostic features accessible to the operator: (1) The modem may be *wrap tested* independently of the using machine and telecommunication channel ... (2) It may be *line tested* with a remote modem and telecommunication channel, independently of the attached business machine. The test may be one way or remotely wrapped to the local modem ... (3) Facility is provided to allow the attached machine to initiate a local wrap test independently from the telecommunication channel via an interface lead.

Communications Facilities: Communications common carrier provided voiceband private line (non-switched) channel, type 3002, with C1 conditioning (or equivalent) as described in the Bell System Technical Reference PUB 41004 dated October, 1973.

Privately Owned Communications Facilities: Equivalent to above.

Public Switched Telecommunication Networks: The customer must be advised that satisfactory data transmission depends on the characteristics of the switched network connection being used ... see M2700 pages for further details.

International Facilities: Transmission of data between the United States and Canada on non-switched or switched facilities is supported. (For non-switched operation, the channel in Canada must be a schedule 4, type 4, with 4A conditioning.)

Attachment to Facilities: Attachment to a private line (non-switched) channel is by a cable, supplied with the 3874, which is terminated with a four prong plug (WE 283B or equivalent). The plug mates with a receptacle (WE 404B or 549A surface mount or 439A flush mount, or equivalent) which is connected to the channel. (The receptacle is a conventional item of communication equipment and is, upon customer request, ordinarily furnished by the telecommunication service supplier.)

If the 3874 is equipped with Switched Network Back-up (#7951) another cable is supplied with the feature. This cable is also terminated with a four prong plug and requires the aforementioned type of receptacle which is connected to the Data Access Arrangement CDT (WE 1000A or equivalent).

If the 3874 is equipped with Switched Network (#7941) or Switched Network Back-up with Automatic Answer (#7952) a cable is supplied with the feature which is terminated with spade lugs for connection to the Data Coupler CBS (WE 1001A series 5 or later or WE 1001F or equivalent).

Related Equipment: The 3874 operates with IBM communications products capable of 4800 bps operation ... see "Related Equipment" under "Specify." Modem clocking must be used.

The 3874 modem must communicate with another appropriately configured 3874 or IBM 4800 bps Integrated Modem. The interconnecting cable between the business machine and the modem must be supplied by the business machine. If the 3874 is equipped with the Automatic Call Originate feature (#1091), the interconnecting Auto Call cable between the attached machine and the modem must be supplied by the attached machine.

Customer Responsibilities: The customer must be informed of his responsibilities as detailed in the M2700 pages and in the Installation Planning Section of the *3874 User's Guide*, GA33-0002. The customer is responsible for:

1. Private line (non-switched) channel—arranging for the telecommunication service supplier to provide a type 3002 voice grade data channel with C1 conditioning (or equivalent) as described under "Communication Channel Specifications" in the *3874 User's Guide*. Also arranging for the installation of the appropriate receptacle described in "Attachment to Facilities."
2. Switched Telecommunication Network—arranging for the telecommunication service supplier to install the appropriate communication service equipped with the required connecting device as described in "Attachment to Facilities."

Also inform the telecommunication service supplier that the speed of data transmission will be 4800 bps and that appropriate conditioning on the local loop is required. The customer must be made aware that the use of local loops not properly conditioned for the speed of data transmission or the use of special switched facilities may result in unsatisfactory data transmission.
3. For attaching the IBM provided line cable to the common carrier provided Data Access Arrangements.
4. Providing voice communications between modems attached to non-switched lines to coordinate tests. This voice facility can be provided by 3874 Alternate Voice feature. Information concerning the handset for the Alternate Voice feature is described in the *3874 Modem User's Guide*. The voice facility must be located such that an operator can use it while operating the controls on the front of the modem.
5. If the 3874 is to be attached to a non-IBM product, the interconnecting cable between the business machine and the modem must be supplied by the business machine.
6. If the 3874 is equipped with the Automatic Call Originate feature (#1091), the interconnecting Auto-Call cable between the business machine and the modem must be supplied by the business machine.

See M2700 pages for additional customer responsibilities.

Bibliography: See *KWIC Index*, G320-1621 or specific system bibliography.

Publication: *IBM 3874 Modem User's Guide*, GA33-0002.

Specify

1. Voltage (AC, 1-phase, 3-wire, 60 Hz):

	115V	208V	230V
Locking Plug	#9880	#9884	#9886
Non-Locking Plug	#9881	#9885	#9887

2. Telecommunication Cord (modem to telecommunication facility): Specify one of the following for each connection to a



private line (non-switched) channel and for each connection to a switched telecommunication network ... see "Attachment to Facilities."

#9750 Telecommunication cord to connect a 3874 modem provided with Point-to-Point (#6101), Multipoint Control (#5100), or Multipoint Tributary (#5101) features to a private line (non-switched) channel.

#9754 Telecommunication cord to connect a 3874 modem provided with Switched Network (#7941) or Switched Network Backup with Automatic Answer (#7952) features to a switched telecommunication network terminated by a Data Coupler type CBS.

#9752 Telecommunication cord to connect a 3874 modem provided with Switched Network Backup (#7951) to a switched telecommunication network terminated by a Data Access Arrangement type CDT.

A 10-foot cable will be provided as standard. If a longer cable is required, indicate 15, 20 or 25 feet as the quantity of the feature # specified. Note: MES orders to add the Switched Network Backup feature (#7951 or #7952) or to convert a non-switched modem to switched network or to convert a switched network to non-switched channel must include the telecommunication cord specify number(s) compatible with the resultant modem configuration.

- 3. Related Equipment: For record purposes, one 3874 Attachment Feature # from the table below must be specified for each 3874, depending upon the unit to which it is to be attached.

3874		3874	
Machine	Attachment #	Machine	Attachment #
1131	9501	5010	9531
1826	9502	5110	9564
2020	9503	5231	9552
2780	9509	5251-2/12	9565
3271	9513	5320	9545
3274	9558	5340	9559
3275	9514	5404	9549
3276	9557	5406	9518
3735	9517	5408	9538
3780	9521	5410	9519
		5412	9546
		5415	9533
		Non-IBM	9520
		RPQ Machine	9524

Prerequisite: One of the following special features must be installed: Multipoint Control (#5100), Multipoint Tributary (#5101), Point-to-Point (#6101) or Switched Network (#7941).

Multipoint Control (#5100): Used on each modem attached to a control station in a centralized multipoint network. Provides for automatic equalization of the private line (non-switched) channel from up to six tributary stations. Operator controls on

front panel. **Maximum:** One. **Limitations:** Cannot be installed with Point-to-Point (#6101), Multipoint Tributary (#5101), or Switched Network (#7941). **Specify:** Telecommunication cord #9750. **Field Installation:** Yes.

Multipoint Tributary (#5101): Used on each modem attached to tributary stations in a centralized multipoint network. Provides for automatic equalization of the private line (non-switched) channel from the control station. Operator controls on front panel. **Maximum:** One. **Limitations:** Cannot be installed with Multipoint Control (#5100), Point-to-Point (#6101), or Switched Network (#7941). **Specify:** Telecommunication Cord #9750. **Field Installation:** Yes.

Point-to-Point (#6101): Used on modems at each end of a point-to-point private line (non-switched) channel. Provides automatic equalization of the channel. Operator controls on front panel. **Maximum:** One. **Limitations:** Cannot be installed with Multipoint Control (#5100), Multipoint Tributary (#5101), or Switched Network (#7941). **Specify:** Telecommunication cord #9750. **Field Installation:** Yes.

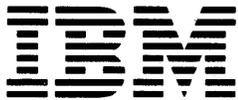
Switched Network (#7941): Used for operation over public switched network via the common carrier Data Coupler type CBS (or equivalent). Automatic answering of incoming calls will be performed by the modem. Automatic equalization is effected at the beginning of each call. It can communicate with another 3874 equipped with Switched Network (#7941), with Switched Network Backup (#7951), or with Switched Network Backup with Automatic Answer (#7952). Conditioning of the telecommunication service local loop for the transmission of data faster than 300 bps is required ... see "Customer Responsibilities." **Maximum:** One. **Limitations:** Cannot be installed with Alternate Voice (#1051), Multipoint Control (#5100), Multipoint Tributary (#5101), or Point-to-Point (#6101). See "Programming" section of *Sales Manual* for restricted configurations. **Specify:** Telecommunication cord #9754. **Field Installation:** Yes.

The following features are optional to enhance the modem function.

Alternate Voice (#1051): Provides signalling capability and a socket on the operator panel into which a customer provided handset may be plugged, permitting voice communications with the distant 3874 modem(s). Data cannot be simultaneously transmitted with voice. A handset is not provided. See *3874 User's Guide* for description of handset. **Maximum:** One. **Limitations:** Cannot be installed with Switched Network (#7941) ... cannot be used when a non-switched line 3874 modem is in Switched Network Back-up operation. **Field Installation:** Yes.

Automatic Call Originate (#1091): Permits automatic origination of a call by the using machine equipped with an IBM Auto Call feature. Provides control to the common Carrier Data Coupler, Type CBS (or equivalent) to dial telephone numbers and to provide on hook/off hook control. **Note:** Can only be used with Rotary Dial System. **Maximum:** One. **Limitations:** Cannot be installed with Switched Network Back-up (#7951), Switched Network Back-up with Automatic Answer (#7952), or Fan-out (#3901). **Field Installation:** Yes. **Prerequisites:** Switched Network (#7941) and an IBM Auto Call feature on the using machine.

Fan-Out (#3901): This feature allows attachment to the 3874 of up to three IBM teleprocessing machines at one location. See "Specify" for applicable machines. Only one of the attached machines may transmit at a time. The feature may be used at a tributary station in a centralized multipoint network. In this configuration, multipoint programming discipline will provide the



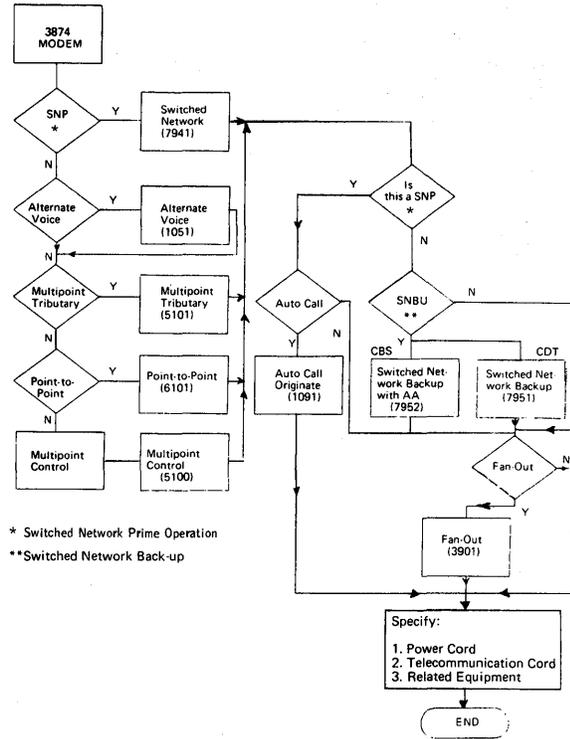
selection/control of the specified IBM terminals without any additional user involvement.

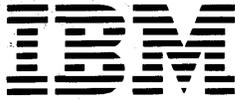
Switched Network Back-up (#7951): Provides the capability of attaching the 3874 modem to a public switched network as a back-up to the prime leased facility. It can communicate at 4800/2400 bps with another 3874 equipped with Switched Network (#7941), Switched Network Back-up (#7951), or Switched Network Back-up with Auto Answer (#7952). Attachment to the switched network is made via the common carrier Data Access Arrangement type CDT (or equivalent). Calls must be established and answered manually. *Note:* To use this feature, operator intervention at the modem is required. Operator intervention, program modification, or both may be required on the using system/terminal.

This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1 and OS/VS2 in certain configurations. Programming support for 2020, 5320, 5340, 5404, 5406, 5408, 5410, 5412 and 5415 is still applicable when these devices are used as remote terminals. Additional customer program routines will be required in existing BTAM programming to fully utilize the capabilities of feature #7951. Conditioning of the telecommunication service local loop for the transmission of data faster than 300 bps is required ... see "Customer Responsibilities." **Maximum:** One. **Limitations:** Cannot be installed with Switched Network (#7941), Switched Network Back-up with Automatic Answer (#7952), or Automatic Call Originate (#1091).

Switched Network Back-up with Automatic Answer (#7952): Same as Switched Network Back-up (#7951) plus the added capability of automatically answering incoming calls. Requires attachment to a Common Carrier Data Coupler Type CBS (or equivalent). Conditioning of the telecommunication service local loop for the transmission of data faster than 300 bps is required ... see "Customer Responsibilities." *Note:* To use this feature, operator intervention at the modem is required. Operator intervention, program modification, or both may be required on the using system/terminal. **Maximum:** One. **Limitations:** Cannot be installed with Switched Network (#7941), Switched Network Back-up (#7951), or Automatic Call Originate (#1091).

CONFIGURATION



**3875 MODEM**

Purpose: Provides communication terminals with the means of transmitting data at 7200 bps, with half-speed capability, over common carrier provided voiceband private line (non-switched) channels, equivalent privately owned channels, or, at 3600 bps, with half-speed capability, over switched telecommunication networks as a back-up to the private line (non-switched) channel.

Highlights: Modem operation is possible in half-duplex or duplex mode over 4-wire duplex facilities or half-duplex mode with the Switched Network Back-up feature over switched telecommunication networks.

Data Rates: 7200 bps with back-up half-speed on private line (non-switched) channels ... 3600 bps with back-up half-speed on switched telecommunication networks.

Equalization: Manually adjustable by an operator on private line (non-switched) channels. Fixed compromise on back-up switched telecommunication networks.

Operation: Multipoint control, multipoint tributary, point-to-point on private line (non-switched) channel. Switched telecommunication network as a back-up to the private line (non-switched) channel. See "Special Features."

Built-in Diagnostics—included in each modem are the following diagnostic features accessible to the operator:

The modem may be *wrap tested* independently of the using machine and telecommunication channel.

The modem may be *line tested* with a remote end modem and telecommunication channel independently of the attached business machines. The test may be one way or remotely wrapped back to the local modem.

Communications Facilities: Communications Common Carrier provided voiceband private line (non-switched) channel, type 3002, with C2 conditioning (or equivalent) as described in the Bell System Technical Reference PUB 41004, dated October, 1973.

Normally the telecommunication service defined in the preceding statement provides for satisfactory operation of the 3875. However, there may be unusual circumstances where the channel characteristics exceed the tolerance level of the 3875. Where these characteristics cause an unacceptable error rate, the customer may request the telecommunication service supplier to provide D1 conditioning in addition to the C2 conditioning. D1 conditioning may not be available in some locations. For this situation the customer may request the telecommunication service supplier to provide alternate routing or special engineering effort.

D1 conditioning is *not* available under existing tariffs for multipoint networks. If an unacceptable error rate is encountered, the alternatives available to the customer are to request the telecommunication service supplier to provide re-routing or special engineering effort.

The telecommunication service supplier may not always be able to supply alternate routing or special engineering effort.

The operation of a multipoint network is more critical of line characteristics due to the cumulative effect of all the segments in the network. Actual performance cannot be accurately predicted but can only be established after the installation of the equipment.

The customer must be made aware of these exposures and the available alternatives prior to ordering the equipment. See M2700 pages—"Customer Responsibilities."

Privately Owned Communications Facilities: Equivalent to above.

Public Switched Network The customer must be advised that satisfactory data transmission depends on the characteristics of the switched telecommunication network connection being used ... see M2700 pages for further details.

International Facilities: Transmission of data between United States and Canada is supported. (In Canada a Schedule 4, Type 4, channel with 4B conditioning is required. The equivalent of D1 conditioning is not available in Canada.)

Attachment to Facilities: Attachment to a private line (non-switched) channel is by a cable, supplied with the 3875, which is terminated with a four prong plug (WE 283B or equivalent). The plug mates with a receptacle (WE 404B or 549A surface mount or 493A flush mount, or equivalent) which is connected to the channel. (The receptacle is a conventional item of communication equipment and is, upon customer request, ordinarily furnished by the telecommunication service supplier.)

If the 3875 is equipped with Switched Network Back-up (#7951) another cable is supplied with the feature. This cable is also terminated with a four prong plug and requires the aforementioned type of receptacle which is connected to the Data Access Arrangement type CDT (WE 1000A or equivalent).

If the 3875 is equipped with Switched Network Back-up with Automatic Answer (#7952) a cable is supplied with the feature which is terminated with spade lugs for connection to the Data Coupler type CBS (WE 1001A series 5 or later or WE 1001F or equivalent).

Related Equipment: The 3875 Modem operates with the binary synchronous control adapters of the IBM machines listed in the table under "Specify." Modem clocking must be used. See M2700 pages for facilities description.

Customer Responsibilities: The customer must be informed of his responsibilities as detailed in the M2700 pages and in the Installation Planning section of the *3875 User's Guide*, GA33-0001. The customer is responsible for:

1. Private line (non-switched) channel—arranging for the communication common carrier to provide a voiceband private line (non-switched) channel, type 3002, with C2 conditioning as defined in the Bell System Technical Reference PUB 41004, "Data Communications Using Voiceband Private Line Channels" (October, 1973). Arrange for the installation of the appropriate receptacle described in "Attachment to Facilities."
2. Public switched telecommunication network—arranging for the telecommunication service supplier to install the appropriate communication service equipped with the required connecting device as described in "Attachment to Facilities" and for attaching the IBM provided cable to the connecting device.

Also inform the telecommunication service supplier that the speed of data transmission will be 3600 bps and that appropriate conditioning of the local loop is required. The customer must be made aware that the use of local loops not appropriately conditioned for the speed of data transmission or the use of special switched facilities may result in unsatisfactory data transmission.



- 3. Providing voice communications between control and tributary stations to coordinate test or re-equalize. This voice facility can be provided by the Alternate Voice feature. Information concerning the handset for the Alternate Voice feature is described in the *3875 Modem User's Guide*.
- 4. When the 3875 is to be attached to other than an IBM machine, that business machine must provide the interconnecting cable between the connector or digital equipment and the modem.

Bibliography: GA24-3089

Publication: *IBM 3875 User's Guide*, GA33-0001.

Specify

- 1. Voltage (AC, 1-phase, 3-wire, 60 Hz):

	115V	208V	230V
Locking Plug	#9980	#9884	#9886
Non-Locking Plug	#9881	#9885	#9887

- 2. Telecommunication Cord (modem to telecommunication facility): Specify one of the following for each connection to private line (non-switched) channel or to a switched telecommunication network.

#9750 Telecommunication cord to connect a 3875 modem to a private line (non-switched) channel.

#9031 Telecommunication cord to connect a 3875 modem equipped with Switched Network Back-up (#7951) to a switched telecommunication network.

#9032 Telecommunication cord to connect a 3875 modem equipped with Switched Network Back-up with Automatic Answer (#7952) to a switched telecommunication network.

A 10 foot cable will be supplied as standard. If a longer cable is required, indicate 15, 20 or 25 feet as a quantity of the feature number specified. *Note:* orders to add Switched Network Back-up (features #7951, #7952) must include the telecommunication cord specify number for the appropriate cord.

- 3. Related Equipment Attachment: For record purposes, one 3875 attachment feature *must* be specified with each 3875 order.

Machine	3875 Attachment #	Machine	3875 Attachment #
2020	9503	5404	9549
3271	9513	5406	9518
3274	9558	5408	9538
3275	9514	5410	9519
3276	9557	5412	9546
5010	9531	5415	9533
5320	9545	RPQ Machine	9520
5340	9559	Non-IBM	9524

Special Features

The basic 3875 Modem (#9101) is used as the control station in a centralized multipoint network. **Specify:** #9101 and telecommunication line cord #9750.

Additional capabilities/configurations are provided by the following features.

Alternate Voice (#1051): Provides signalling capability, and a jack on the operator panel into which the customer provided handset may be plugged, permitting voice communication with the other end. Data cannot be simultaneously transmitted with voice. A handset is not provided. See *3875 User's Guide* for description of handset. **Maximum:** One. **Field Installation:** Yes.

Control Station Equalizer (#1601): Provides the capability for a multipoint control station to operate with the Switched Network Back-up (#7951, 7952) features. **Maximum:** One. **Limitation:** Cannot be installed with Multipoint Tributary (#5101) or Point-to-Point (#6101). **Field Installation:** Yes. **Prerequisite:** Control Station Specify #9101.

Fan Out (#3901): Permits attachment, to one 3875, of up to three business machines at one location. Only one of the machines may transmit at a time. The feature may be used at a tributary station or on a multipoint configuration, in which case the BSC multipoint line control procedure will handle the selection/operation without any additional user involvement. The feature may also be used to share the modem between two or three multiplexers at a central site for back-up purposes. In this case, though both multiplexers may receive the incoming data, the user switchover procedures must ensure that both multiplexers are not transmitting simultaneously. **Maximum:** One. **Field Installation:** Yes.

Multipoint Tributary (#5101): Used on each modem at tributary stations in a centralized multipoint network to compensate for channel distortion between the control modem and tributary modem. Not required on the modem at the control station. Equalizer adjustments are on the operator panel. **Maximum:** One. **Limitation:** Cannot be installed with Point-to-Point (#6101) or Control Station Specify #9101 or Control Station Equalizer (#1601). **Field Installation:** Yes. **Specify:** Telecommunication cord #9750.

Point-to-Point (#6101): Used on modems at each end of a point-to-point private line (non-switched) channel to compensate for the channel distortion. Equalizer adjustments are on the operator panel. **Maximum:** One. **Limitations:** Cannot be installed with Multipoint Tributary (#5101) or Control Station Specify #9101 or Control Station Equalizer (#1601). **Field Installation:** Yes. **Specify:** Telecommunication cord #9750.

Switched Network Back-up (#7951, 7952): Provides the capability of attaching the 3875 to a switched telecommunication network as a back-up to the private line (non-switched) channel. Operation is at 3600 bps with half-speed capability. A fixed compromise equalizer is provided for the back-up opera-



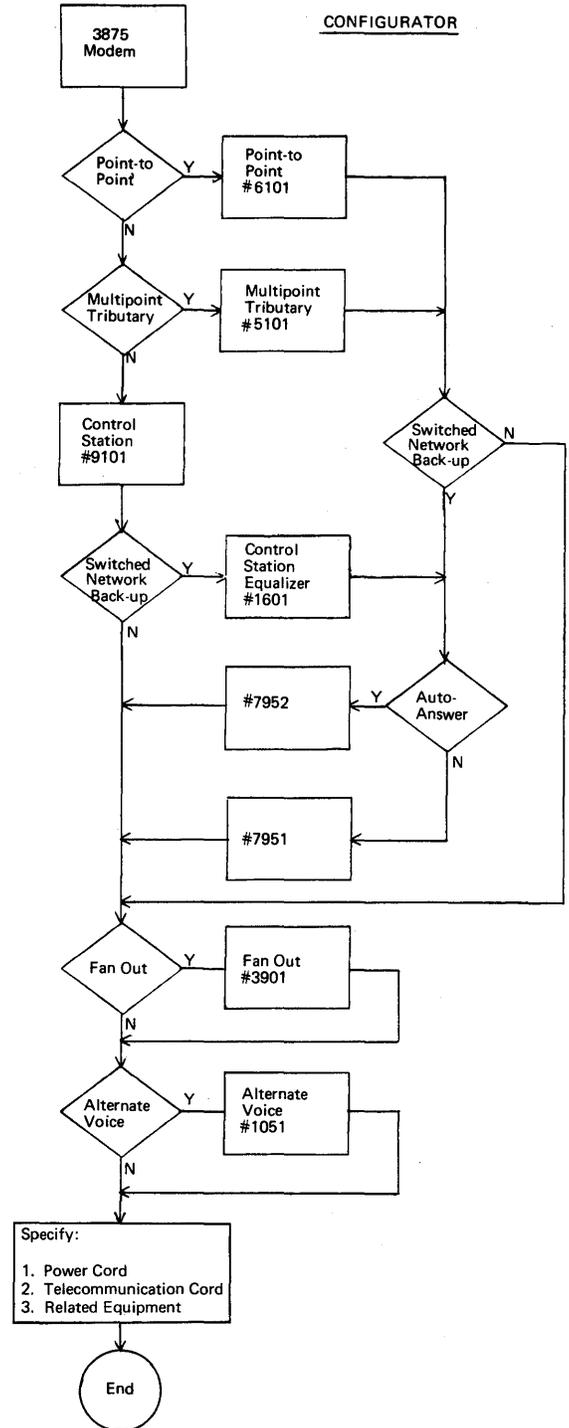
tion. A front panel switch permits operator selection of either facility or speed. Both facilities cannot be used simultaneously.

#7951 for attachment to the common carrier Data Access Arrangement type CDT. Calls must be established and answered manually.

#7952 for attachment to common carrier Data Coupler type CBS. Calls must be established manually and may be answered either manually or automatically.

Note: To use this feature, operator intervention at the modem is required. Operator intervention, program modification, or both may be required on the using system/terminal.

This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1 and OS/VS2 in certain configurations. Programming support for the 2020, 5320, 5340, 5404, 5406, 5408, 5410, 5412 and 5415 is still applicable when these devices are used as remote terminals. Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Back-up feature. Conditioning of the telecommunication local loop for transmission of data faster than 300 bps is required. Maximum: One. Field Installation: Yes. Specify: Telecommunication cord #9031 for FC #7951 ... Telecommunication cord #9032 for FC #7952. Prerequisite: Point-to-Point (#6101), Multipoint Tributary (#5101), or Control Station Equalizer (#1601).





3881 OPTICAL MARK READER

Purpose: Reads machine printed and/or handmarked data on-line into System/370 models 115, 125, 135, 145, 155 II and 158, or System/3 model 8, 10, 12 or 15, or off-line to either of two magnetic media: diskette or compatible 9-track magnetic tape via a 3410 Magnetic Tape Unit model 1.

Model 1 For use with a System/370 model 115, 125, 135, 145, 155 II or 158, or System/3 model 8, 10, 12 or 15. **Field Installation:** Yes.

Model 2 Magnetic tape output via a 3410 Magnetic Tape Unit model 001.

Model 3 Output data written on IBM Diskette.

Model Changes: Field installable.

Highlights: The 3881 is a high speed optical mark reader. Data sheets are fed from a hopper with a 600-sheet capacity, through the reading area and directed to one of two output stackers. The main stacker has a capacity of 600 sheets. Sheets with detected errors are directed to a separate stacker with a 100-sheet capacity. Documents are stacked in the same sequence as they were entered in the hopper.

Data to be read can be placed on data sheets with ordinary #2 pencils, or by a 3203, a 1403 Printer, a 1443 Printer model 1 or 2 with a 52 or 63 character type bar with arrangement A, H or K, a 1443 Printer model N1 or 2203 Printer model A01 with a 52 or 63 character type bar, a 3211 Printer, or a 5203 Printer. The 1403/5203 print chains or trains, the 1443/2203 type bar, or the 3216 Interchangeable Train Cartridge must be equipped with an enlarged dash which replaces the standard dash ... see "Type Catalog."

Data Sheets: 3' x 3' to 9' x 12' ... up to 2,480 mark positions printed on a side. Preprinted mark positions are printed in rows of 40 positions on .2" centres for printer compatibility. Vertical spacing is up to 6 to the inch for printer compatibility. Rows and columns can be grouped into various combinations to form fields for the recording of source data.

Format Control Sheet: Used to load format control information into the 3881. Format control will define:

- The area of the input data sheet which is to be read.
- The marks allowed or discrimination required within each area.
- The sequence of the marking positions which make up the marking matrices.
- The output desired (numeric, alpha, alphameric or multiple mark format).
- The timing mark count which is expected on the sheets to be processed.
- BCD Read (optional feature) requirements.

From one to six formats, each consisting of one or more Format Control Sheets, are read by the 3881 at the beginning of a job. After reading the last Format Control Sheet, the data sheets of the job to be processed are loaded in the 3881.

System/3 and System/370: Documents are read under computer program control with speeds varying up to 6,000 documents/hour and 4,000—8-1/2" x 11" pages/hour. Data is transferred to the System/370 CPU one page at a time on a fully buffered interrupt basis.

3410 Magnetic Tape Unit: Documents are read under control of the 3881 at speeds varying up to 5,400 documents/hour and 3,700—8-1/2" x 11" pages/hour. The 3881 reads and fully buffers a document after which the data from the document is

written as one record on tape. An optional feature, Dual Density, permits output at either 1600 bpi PE or 800 bpi NRZI.

Diskette: Documents are read under control of the 3881 at speeds varying up to 5,700 documents/hour (3' x 3'')—and 3,800 pages/hour (8-1/2" x 11'').

The diskette drive and its control function are installed within the 3881 model 3. Each magnetic diskette has a storage capacity of up to 1,898 data records (128 characters each) with as many as 19 data sets per diskette. The contents of each document read by the 3881 is written within one data record (a maximum of up to 128 characters). The diskette media written by the 3881 is compatible with such devices as the 3741, 3742, 3747 and 3540.

Prerequisites

Model 1 For System/370 models 115 and 125, an available control unit position on the Multiplexer Channel (#5248) ... see 3115 and 3125. For System/370 models 135, 145, 155 II or 158, an available control unit position on a byte multiplexer channel ... see 3135, 3145, 3155, 3158. For System/3 model 8, 10, 12 or 15, a Serial I/O Channel (#7081) on the 5408, 5410, 5412 or 5415. One 3881 can be attached. **Limitation:** System/3 model 10 programming support for the 3881 requires a model 10 Disk System with 12,288 bytes of storage or a minimum model 8; System/3 model 12 programming support requires a minimum model 12 system; System/3 model 15 programming support requires a minimum model 15 system.

Model 2 A 3410 Magnetic Tape Unit model 001 equipped with either Single Density (#3211) or Dual Density (#3221) ... see 3410.

Model 3 None.

Supplies: For printing marks, use IBM ribbon 1136940 or 1136430 on the 1403 (all models) and 1136430 on the 3203; 422536 on the 1443/2203; 1136964 on the 3211; 1136990 on the 5203, or equivalent ribbons capable of producing acceptable marks. For non-readable background printing, use ribbon 419101, or equivalent.

Format Control Sheets: 100 are provided with each 3881 .

Manuals: *3881 Reference Manual*, GA21-9143 ... *3881 Systems Design Guide*, GC20-1751.

Bibliography: GA22-6822

Specify

1. Voltage (AC, 1-phase, 3-wire, 60 Hz): #9902 for 208V, or #9904 for 230V ... must be consistent with system or 3410 voltage. **Field Installation:** Yes.
2. Invalid Marking Condition Code: #9301 for Hex 3F (unprintable), or #9302 for Hex 7C (printable). **Field Installation:** Yes.
3. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white. **Field Installation:** Yes.
4. System/370 Adapter: #9551. Required when a 3881 model 1 is to be attached to System/370. **Field Installation:** Yes.
5. System/3 Adapter: #9552. Required when a 3881 model 1 is to be attached to a System/3 model 8, 10, 12 or 15. **Field Installation:** Yes.
6. Machine Nomenclature: #2927 for English (UK).
7. Kickstrips: #9431 ... if desired.



Metering:

- Model 1 I/O Unit (On-line)
- Model 2 Meter on 3410
- Model 3 Meter on 3881

Model Changes: Field Installation: Yes.

BCD Read (#1471): Provides, in addition to the basic read head, a second 12-position read head which allows the reading of high density, preprinted binary coding. These heads will read as marks, digit "ones," the character "|" or a vertical bar (special character). Each BCD (Binary Coded Decimal) character read will be translated into its equivalent numeric EBCDIC code and transmitted to the CPU or magnetic tape unit, or diskette one byte per character. Five of the twelve positions may contain BCD information which is weighted 1-2-4-8- parity from the reference (aligned) edge. The first row of BCD data following the start BCD Field Mark must indicate which 5 of the 12 positions will contain BCD data for that field. If an invalid BCD character is read or an even parity error is detected, an invalid marking condition code is sent to the CPU, diskette, or magnetic tape unit. **Field Installation:** Yes.

Document Counters (#3450): Provides two 5-position counters to be incremented by one for documents processed by the 3881. Counters can be manually reset to zero. Counter 1 increments by 1 for each accepted document ... Counter 2 increments by 1 for each selected document. **Field Installation:** Yes.

Dual Density (#3550): (Model 002 only) Permits on the 3881 to write on the 3410 Magnetic Tape Unit in either 800 bpi NRZI or 1600 bpi Phase Encoded modes. **Field Installation:** Yes. **Prerequisite:** Dual Density (#3221) on the 3410 Magnetic Tape Unit model 001.

Expanded Storage (#3801): Provides for an additional 512 bytes of memory which may be required in those situations where the number of formats, fields and characters processed exceed the maximum number of positions available within the basic data store. The formula for the determination of this condition is as follows:

$$5(F + n) + \text{BCD Bytes} + \text{Normal Bytes} + S + | \leq E$$

E = 435 for 3881 models 1 and 2;
or 307 for 3881 model 3.

- Where:
- F = Number of instruction fields used on all Format Control Sheets loaded
 - n = Number of different formats used with the alternate format capability (from 1 to 6)
 - S = 7 if Serial Numbering (#6451) is installed and is being used—otherwise S = 0
 - | = Total number of bytes required to store image format data.

Maximum: One. Field Installation: Yes.

Serial Numbering (#6451): A device for printing consecutive serial numbers on the form being processed. Will print a 7-digit number (2-digit batch and 5-digit serial number) which can be manually set to zero or any desired setting. A reading of the counter may be obtained and entered into the 3881 logic via a marked Serial Number Card. Various options exist for the printing of the number. A control switch provides either selective serial numbering based on stacker selection, or a 7-digit batch number without unit advancing. Concurrent with printing, the number will be transmitted to the CPU or the output magnetic tape unit or the diskette. **Supplies:** Ribbon—use IBM purple ribbon 1136944, or equivalent.

Field Installation: Yes.

Document Inspection Gauge—one is furnished with each 3881 as a Customer Engineering tool. Used for checking printing and alignment on data sheets.



3886 OPTICAL CHARACTER READER

Purpose: Optically reads OCR-A font and OCR-B font machine printed numeric digits, alphabetic characters, and handprinted numeric digits from a wide variety of forms. Attaches on-line to System/370 models 115, 125, 135, 145, 155 II, 158, 165 II or 168, or off-line to the 3410 Magnetic Tape Unit model 1 which provides compatible 9-track magnetic tape.

Model 1 For use with a System/370 model 115, 125, 135, 145, 155 II, 158, 165 II or 168.

Model 2 For use off-line with a 3410 Magnetic Tape Unit model 1.

Model Changes: Field Installable.

Highlights: The 3886 is a general purpose optical character recognition reader designed to meet a broad range of data entry requirements. It will read multiple lines of print from forms ranging in size from 3 to 9 inches wide (direction of printing) and from 3 to 12 inches long. Allowable weights range from 16# to card stock ... see "Documents and Printing."

Forms enter the 3886 from the input hopper which has a capacity of one inch of forms. The forms are advanced line by line (maximum 3 lines per inch) past a read station which incorporates a total solid state scanning system to collect character images. These images are analyzed by recognition programs within the 3886 recognition and control processor. After a complete line has been recognized, certain user specified editing and output formatting functions take place. The line output is then transmitted to the System/370 or to a 3410 Magnetic tape Unit model 1.

After the complete form has been read it is directed to one of two output stackers, each having a capacity of one inch of forms.

The recognition, machine control, and CE diagnostic microprograms for the 3886 are supplied on an internal direct access storage device. The use of these programs singly or in combination is dependent on the configuration of the 3886 ... see "Configurator."

Input from several different sources can be read on the 3886. The "Table of Acceptable Characters and Printing Devices" below shows the characters which are acceptable from typewriters, high speed printers, lithograph, or, in the case of Numeric Handprinting, a pencil.

Model 1 The on-line 3886 model 1 provides buffered time-independent attachment to System/370 model 115 and 125 via an optional multiplexer channel, or to System/370 model 135, 145, 155 II, 158, 165 II and 168 via byte multiplexer, block multiplexer or selector channels. Forms are read and other 3886 functions are performed under System/370 program control. The basic 3886 model 1 contains 24K bytes of Instruction Storage for machine control and recognition microprogram storage.

Model 2 The off-line 3886 model 2 operates independently of any CPU. It produces compatible 9-track magnetic tape output via the attachment of a 3410 Magnetic Tape Unit model 1. The user indicates form characteristics and processing requirements with Line/Field and Job Specification Sheets. These are translated on a special 3886 run into the necessary Format Control information, and then stored on the internal DASD for subsequent use.

Up to eight different form layouts (all one size) can be intermixed within a batch (run). Certain editing and validation functions normally performed by the host CPU are also provided. These include self-check digit (Modulus 10) calculation, column or

cross-foot total verification, and field to field comparison. The results of these functions can be specified to control stacker selection, and Serial Numbering and Line Marking features if they are installed ... see "Special Features." The basic 3886 model 2 contains 32K bytes of Instruction Storage for machine control and recognition microprogram storage. Speed—document throughput depends upon 3886 model, document length, number and type of characters read, the amount of output editing and formatting specified, and the user System/370 program (Model 1).

On the model 1 speeds range from approximately 5,800 three-inch long single line 8 character machine printed turnaround documents per hour, to approximately 330 typewritten 8-1/2" x 11" pages with 2,262 characters (29 lines of 78 characters).

On the model 2, speeds for the same forms range from approximately 5,200 documents to approximately 300 pages per hour. SRL GA21-9148 contains formulas which should be used to determine throughput for specific forms.

Documents and Printing—the input forms and printing to be read by the 3886 must conform to the established specifications described in SRL GA21-9148. Only those ribbons (see "Supplies") and background inks specifically meeting the outlined spectral criteria will give satisfactory performance. Certain restrictions apply to document sizes, weights, and combinations thereof. These are discussed in SRL GA21-9148.

Supplies: providing maximum flexibility in background ink colors and intensities requires that ribbons used for printing 3886 input are carefully selected. The following, or their equivalents, should be used: For Film Ribbon Selectric 1136310 or 1136391 ... for Fabric Ribbon Selectric 1136138 ... for 1403 (all models) 1136430 ... for 3211 ribbon 1136627 for 20 to 24 lb. bond and 1136626 for all heavier papers. Ribbons not having similar characteristics may result in reduced recognition performance and/or reduced ribbon life.

Prerequisites

Model 1 An available control unit position on the Multiplexer Channel (#5248) of a System/370 model 115 or 125, or a byte multiplexer, block multiplexer or selector channel of a System/370 model 135, 145, 155 II, 158, 165 II or 168.

Model 2 A 3410 Magnetic Tape Unit model 1 ... if Single Density (#3211) is on the 3410, a Single Density Tape Adapter (#6490) is required on the 3886 ... if Dual Density (#3221) is on the 3410, a Dual Density Tape Adapter (#6485) is required on the 3886. See "Special Features."

Bibliography: GA22-6822

Specify

1. Voltage (AC, 3-phase, 4-wire, 60 cycle): #9903 for 208 V, or #9905 for 230 V ... must be consistent with system or 3410 voltage. **Field Installation:** Yes.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white. **Field Installation:** Yes.
3. Up-Ending Kit: #9840, if required ... loan basis on initial machine order only, remains property of IBM. Dimensions will be 29-1/2" wide, 60" long and 76" high.
4. 3211 B-Font Compatibility #9XXX, if required ... only if predominately reading 3211 OCR-B generated documents.



Data Storage, Additional (#3210): OCR B-Font and Numeric Handprinting recognition require this feature to handle the more complex character shapes which appear in these fonts. **Maximum:** One. **Field Installation:** Yes.

Hopper and Stacker Capacity, Additional (#4520): The standard hopper and two stackers on the 3886 each have a capacity of one inch of forms. This feature adds the motors, sensors, etc. to increase that capacity to approximately 4 inches in each. **Field Installation:** Yes.

Instruction Storage, Additional (#4610): The recognition microprograms for alphameric machine printed fonts and Numeric Handprinting require storage capacity greater than the basic models of the 3886, as do combinations of fonts. This feature provides the necessary additional storage increments of 8K bytes. Up to nine of these features may be added ... see "Configurator." **Field Installation:** Yes.

Line Marking (#4720): Provides a four-position fixed slug printer (1, 2, 4 and 8) which prints 15 different codes to be used as an aid to error correction procedures. It is used to indicate field location or error type information in the margin of lines requiring corrective action. It will also provide page marking capability to indicate user controlled post-processing document handling information. Line Marking is under program control on the model 1 and is controlled by coding on the specification sheets on model 2. **Ribbons:** Line Marking may be done with a purple ribbon (414499) or equivalent if marked documents are to be re-processed through the 3886. Otherwise a black ribbon (414491) or equivalent may be used.

Numbering/Marking Adapter (#5340): Provides a group of common parts necessary for the installation of Serial Numbering (#6450) and/or Line Marking (#4720). **Maximum:** One. **Field Installation:** Yes.

Numeric Handprinting (#5360): Provides the additional machine circuits to read the handprinted numbers 0-9 and the letter X. For optimum operation, character shapes and spacing should conform to the basic rules of handprinting as outlined in SRL G21-9148. Handprinting should be performed with ordinary #2 pencils or grade HB fine line lead for mechanical pencils. The NHP feature includes the ability to read forms supplier preprinted Gothic 3/16" font numbers 0-9. The feature provides two modes of operation, normal and verify. The appropriate mode can be selected on a field-by-field basis depending on the critical nature of the data, the circumstances of form preparation, and the level of other available control techniques. **Field Installation:** Yes. **Prerequisites:** Data Storage, Additional (#3210) and sufficient Instruction Storage, Additional (#4610) ... see "Configurator."

Serial Numbering (#6450): Permits the sequential numbering of forms as they are processed. A ten-position numbering head is provided, of which five are unit advanced and five are stationary. Selection of documents to be printed works in conjunction

with stacker selection. **Ribbons:** Serial Numbering may be done with a purple ribbon (1136844) or equivalent if numbered documents are to be re-processed through the 3886. Otherwise a black ribbon (1136843) or equivalent may be used.

Tape Adapter, Dual Density (#6485): (Model 2 only) Provides the appropriate adapter, within the 3886, to attach a 3410 Magnetic Tape Unit model 1 for writing at 1600 bpi PE or 800 bpi NRZI (Feature #3221 on the 3410). **Field Installation:** Yes.

Tape Adapter, Single Density (#6490): (Model 2 only) Provides the appropriate adapter, within the 3886, to attach a 3410 Magnetic Tape Unit model 1 for writing at 1600 bpi PE (Feature #3211 on the 3410). **Field Installation:** Yes.

Video Collect Features (#8701, 8702, 8703): Prerequisites: Each of the following Video Collect Features requires Additional Data Storage (#3210) plus two increments of Additional Instruction Storage (#4610), in addition to the increments required to hold the font recognition programs as described in Figure 10 of the 3886 SRL's (GA21-9147 and GA21-9154) and the Configurator below. **Limitations:** The required 3277 model 1 or 2 (as described below) cannot be equipped with any of the following: Operator Identification Card Reader (#4600), Selector Light Pen (#6350), ASCII Character Set (#9091 or 9092), or ASCII Keyboard (#4634 or 4635). For #8703, if a 3277 model 1, with the RPQ listed below, is to be attached to the required 3272 Control Unit model 2, at least one 3277 model 2 (with or without the RPQ) must also be attached to the same 3272 Control Unit for diagnostic purposes.

Video Collect (#8701): (Model 2 Only) Provides for direct attachment of a 3277 Display Station model 1 with RPQ 8K0438 to a 3886 model 2. (No 3272 Control Unit is required). Entries on Line and Field Specification sheets allow the 3886 to collect video image data of reject characters in specified fields and/or the collection of the video image of an entire field at either 0.006" or 0.012" resolution. Video image data will be displayed on the cable attached 3277 (with RPQ 8K0438) for visual recognition. The display operator will key enter the correct data. The data record will be updated with the keyed information before being written to tape. **Field Installation:** Yes. **Prerequisites and Limitations:** See above.

Video Collect (#8702): (Model 2 Only) Entries on Line and Field Specification sheets cause collection of video image data of reject characters in specified fields and/or the collection of the video image of an entire field at either 0.006" or 0.012" resolution. Video image data is written to tape in record lengths that match the user selected data record length. The tape can be processed on a system and have the video image data displayed on a 3277 Display Station model 1 or 2 equipped with RPQ 8K0438 and attached to the CPU via a 3272 Control Unit model 2. **Field Installation:** Yes. **Prerequisites and Limitations:** See above.

Video Collect (#8703): (Model 1 Only) Provides the ability to collect video image data of reject characters in specified fields and/or the collection of the video image of an entire field at either 0.006" or 0.012" resolution. The video image data can be transferred from the 3886 to the CPU by user written routines coded with present 3886 Type I programming support. The display of video image data will require a 3277 Display Station model 1 or 2 equipped with RPQ 8K0438 and attached to the CPU via a 3272 Control Unit model 2. **Field Installation:** Yes. **Prerequisites and Limitations:** See above.



Configurator

All 3886 Optical Character Readers will be shipped containing an internal DASD. That device will contain all of the recognition microprograms for OCR-A font, OCR-B font and NHP. (See "Tables of Acceptable Characters.") This configurator shows which features are necessary in order to utilize all valid combinations of those recognition programs.

From the following table, find the combination of fonts which will appear within any one batch (run) of input forms. The features shown on that line are required. If any other batch (run) will contain another font, a greater quantity of #4610 may be required to cover maximum combination of fonts for all batches to be run in various applications.

		Quantity of Features Which Must be Ordered				
Num	Alpha	Alpha	Numeric	Instruction	Numeric	Data
OCR-A	OCR-B	OCR-A	OCR-B	Storage, Add'l* (#4610)	Hand-printing (#5360)	Storage, Add'l (#3210)
Single Machine Font Configurations						
X				1		1
	X			3	1	1
X				4	1	1
	X			4	1	1
		X		4		1
		X		5 1	1	
		X	X	8	1	1
Combination OCR-A and OCR-B Configurations						
X	X			1		1
	X	X		2		1
X	X			5	1	1
X			X	5		1
		X	X	6		
	X	X		6	1	1
X			X	9	1	1

*Equal or smaller size combinations of fonts will operate on machines with the required features (#5360 and #3210).

Example: User batch to be processed will contain Alphameric OCR-A font and Numeric Handprinting. This requires the following features: Quantity of 5 of #4610 plus 1 of #5360 and 1 of #3210.

Other batches this user will be able to run can include the following fonts or combinations of fonts:

Numeric-A	Numeric-A and Numeric-B
Numeric-B	Numeric-B and Alphameric-A
Numeric-A and NHP	Numeric-A and Numeric-B and NHP
Numeric-B and NHP	Numeric-A and Alphameric-B
Alphameric-B	

Tables of Acceptable Characters and Printing Devices

OCR-A Font, Size 1 (1)

IBM 1403 mdls 2, 3, 7, N1 (or equivalent) and IBM Selectric [®] Typewriter (or equivalent). Numeric Set only from IBM 3211 (see Note 6)		Additional Characters from IBM Selectric [®] Typewriter (or equivalent) Only
Numeric	Alphameric	
0 .	A N &	{
1 *	B O	+
2 *	C P	}
3 -	D Q	;
4 /	E R	%
5 .	F S	?
6 blank	G T	(3)
7	H U	:
8	I V	=
9	J W	~
v	K X	⊠ ⊞ (Group Erase)
∇	L Y	⊠ ⊞ (Character Erase)
∩	M Z	(4)
(6)	(5)	

1. The division of characters into sets above refers to 3886 recognition capability. The appropriate type catalog arrangements should be referenced for high speed printer output character sets.
2. These characters are recognized in mode 1 alphameric set.**
3. All these characters are recognized only on mode 2 alphameric set except Group Erase, ⊠ and | which are recognized in the numeric character also.
4. The LVM (long vertical mark) is recognized in all OCR-A character sets. The LVL (preprinted long vertical line) is also recognized.**
5. The timing mark dash (—) can be substituted for a non OCR-A font graphic (#) for the purpose of printing timing marks. See "Type Catalog" for details.
6. The OCR Print Package (#5450), on the 3211 is a prerequisite for OCR applications. Use of reread on reject capability and 20-24 lb. bond is recommended for optimum performance. When other papers are used, customer testing should be performed to assure adequate reading performance.

OCR-B Font, Size 1 (1) (4)

IBM 1403 mdls 2, 3, 7, N1 (or equivalent) and IBM Selectric [®] Typewriter (or equivalent).		Additional Characters from IBM Selectric [®] Typewriter (or equivalent) only. These can be recognized in all OCR-B Font Character Sets.
Numeric	Alphameric	
0 .	A N	(LVM) (2)
1 \$	B O	⊠ ⊞ (Group Erase)
2 *	C P	⊠ ⊞ (Character Erase)
3 -	D Q	
4 /	E R	
5 .	F S	
6	G T	
7	H U	
8	I V	
9	J W	
<	K X	
> (3)	- Y	
+	M Z	

1. The division of characters into sets above refers to 3886 recognition capability. The appropriate type catalog arrangements should be referenced for high speed printer output character sets.
2. The LVM (long vertical mark) is recognized in both numeric and alphameric OCR-B but can only be preprinted or typed. The LVL (long vertical line), a special case of the LVM, can also be recognized.**
3. The timing mark dash (—) can be substituted for the greater than (>) for the purpose of printing timing marks. See "Type Catalog" for details.



4. This is compatible with the European Computer Manufacturers Associated revised OCR-B Font published in the Standard ECMA-11 for Alphameric Character Set OCR-B for Optical Recognition, 2nd Edition, dated October, 1971.
5. The OCR Print Package (#5450) on the 3211 is a prerequisite for OCR applications. Use of reread or reject capability and 20-24 lb. bond is recommended for optimum performance. When other papers are used, customer testing should be performed to assure adequate reading performance.

Numeric Handprinting: Recognizes the following: 1 2 3 4 5 6 7 8 9 0 X. Preprinted Gothic 3/16" font digits 0 1 2 3 4 5 6 7 8 9 can also be read. Blanks are not recognized in NHP. European Numeric Handprinting (ENHP) can be selected by proper codes in the Format Control Record (see SRL GA21-9146).** This provides recognition of the (one) and (seven) commonly used in several European countries in place of the NHP 1 and 7.

Document Inspection Gauge P/N 2448299: One is furnished with each 3886 as a customer engineering tool. It is used for checking printing alignment on data sheets.

**See *IBM OCR Model 1 Component Reference Manual*, GA21-9147, *IBM 3886 Model 2 Component Reference Manual*, GA21-9154.



5010 PROCESSOR MODULE

Purpose: Provides the arithmetic, logic and control functions for System/7.

Models:	Storage (words)	Stand-Alone Models	1130 Attach Models
	2,048	A2	B2
	4,096	A4	B4
	6,144	A6	B6
	8,192	A8	B8
	10,240	*A10	*B10
	12,288	*A12	*B12
	14,336	*A14	*B14
	16,384	*A16	*B16
	16,384	E16	
	20,480	E20	
	24,576	E24	
	28,672	E28	
	32,768	E32	
	36,864	E36	
	40,960	E40	
	45,056	E44	
	49,152	E48	
	53,248	E52	
	57,344	E56	
	61,440	E60	
	65,536	E64	

* Requires #7401 in 5026.

Highlights: Uses binary arithmetic, fixed word length of 16 data bits plus 2 parity bits. Storage cycle time is 400 nanoseconds. Instructions are one or two words in length with full storage addressing.

Standard features include 64 priority interrupts, including 4 interrupt levels with 16 sublevels, 7 index registers, one accumulator, and one instruction address register per interrupt level, two interval timers, and an interface for the 5028 Operator Station.

The 5010 Processor Module includes a **Read Only Tape Cassette Recorder** attachment and associated connection cable (P/N 2703633). The attachment provides the capability to IPL and program load either FE Diagnostic Programs or the Disk Support System (DSS/7) (5707-SC2) from a tape cassette recorder (Norelco Model 1420 or equivalent). See Customer Responsibilities for System/7 in the "Systems" section.

The A and E models have an Asynchronous or Binary Synchronous Communications Adapter as an optional feature. This circuitry provides the capability for initial program load of the System/7 from a remote system with no resident program in the System/7. The B models have an interface for connection to an 1130 System as a standard feature.

Prerequisites: The first module location in the 5026 Enclosure mdl A2, C3 or C6. A and B models with more than 8K of storage require Storage Power Addition (#7401) in the 5026 Enclosure ... see 5026. #7401 is not required for E models. For E models replacing installed A or B models, or vice versa, or RPQ (purchase) must be ordered for the proper 5026 Power Specify Code ... see 5026. The B models require a Storage Access Channel (#7490) on the 1131 or a Storage Access Channel II (#7492) on an 1133. **Limitation:** Program preparation on configurations with 2K storage are not supported by IBM supplied programming.

Customer Responsibilities: See System/7 in "Systems."

System/7 Summary: GA34-0002

1) For the location of the Modules in the system, specify one of the following:

#9141 location of all I/O Modules to be determined at the plant. (Specify Code #9143 if I/O Modules cannot be used.)

#9142 location of all I/O Modules are specified by the customer. Specify Code #9143 must be used in each I/O Module order.

#9144 for shipment without mounting in an enclosure.

2) For identification of major application, specify #9XXX on all models. See Special Features for identifier code. No charge feature.

3) System Control Programs must be ordered prior to Order Confirmation (OC) Time.

4) Cables: Use cable order

Model Changes: Changes within A mdls, B mdls or E mdls are field installable. **Replacement** of A or B mdls with E mdls requires a 5026 to remove code #7401 or #9490 on both and add code #9491 (see 5026). **Change** from A or B mdl to E mdl (and vice versa) within a 5010 cannot be field installed. Changes from A mdl to B mdl (and vice versa) are not recommended for field installation.

STORAGE UPGRADE PURCHASE PRICES: Upgrade price equals the difference in purchase price between the two models. There are no additional installation charges.

Special Features

CYCLE STEAL BASIC (#2662): Provides a path between 5010 main storage for the 5022 Disk Storage Module, equipped with companion cycle steal attachment, Disk Cycle Steal (#2664). **Maximum:** One per 5010. **Field Installation:** Yes. **Prerequisite:** Model A4 or larger, Model B4 or larger, or Model E16 or larger. Required for 5998-T01, 3340 Attachment.

5024 ATTACHMENT FEATURE (#4115): [Model E only] Provides a path between 5010E main storage for the 5024 I/O Attachment to Enclosure. **Maximum:** One per 5010E. **Field Installation:** Yes. **Limitation:** Cannot be installed with IBM 1200 bps Integrated Modem (#5500 or #5501) or with System 360/370 Channel Attach (RPQ D08112). Other 5010E RPQs must be submitted for review.

ASYNCHRONOUS COMMUNICATIONS CONTROL (#1610): [Models A and E only] Provides control circuits for one asynchronous communications line adapter. #1610 is used for communications with S/360 and S/370. See *DP Sales Manual*. Data transmission is serial by bit using start/stop method of character and bit synchronization. The IBM PTTC/EBCD code is used. Point-to-point or multidrop transmission at speeds of 134.5 or 600 bps (14.8 or 66.7 characters per second) are available. Speed changes can be made in the field. Line control characters are identical to 2740 mdl 1. Line control characters are used in a manner similar to 2740 mdl 1, with error checking. See *IBM System/7 Functional Characteristics*, GA34-0003, for exact



description of use. Communication Control provides the capability to load a program from the communication network into System/7 with no resident program in System/7 (remote IPL). For information on communications facilities, see M 2700 pages. **Maximum:** One #1610 per system. **Limitation:** Cannot be installed with Binary Synchronous Communications Adapter (#2074). **Field Installation:** Yes.

COMMON CARRIER ADAPTER (#2165): [Mdl's A and E only] Provides interface to an external modem meeting EIA standard RS-232-C. The interface lines provided are Transmitted Data, Received Data, Request to Send, Clear to Send, Data Set Ready, Data Terminal Ready, Signal Ground and Protective Ground. **Limitation:** Cannot be used with Line Adapter (#4750, 4751 or 4752). **Maximum:** One per #1610. **Field Installation:** Yes. **Prerequisite:** Asynchronous Communications Control (#1610).

LINE ADAPTER, LEASED LINE TYPE 1A (#4751): [Models A and E only] A leased line type 1A modem for 2-wire unlimited distance use at speeds of 134.5 or 600 bps. Only point-to-point communications facilities can be used. See Line Adapter Leased Line Type 1A in SRL GA24-3435 for specifications and requirements. **Limitation:** Cannot be used with Line Adapters (#4750 or #4752) or Common Carrier Adapter (#2165). **Maximum:** One per #1610. **Field Installation:** Yes. **Prerequisite:** Asynchronous Communications Control (#1610).

LINE ADAPTER, LEASED LINE TYPE 1B (#4752): [Models A and E only] A leased line type 1B modem for 4-wire unlimited distance use at speeds of 134.5 or 600 bps. Point-to-point or multipoint communications facilities can be used. See Line Adapter Leased Line Type 1B in SRL GA24-3435 for specifications and requirements. **Limitation:** Cannot be used with Line Adapters (#4750 or #4751) or Common Carrier Adapter (#2165). **Maximum:** One per #1610. **Field Installation:** Yes. **Prerequisite:** Asynchronous Communications Control (#1610).

LINE ADAPTER, LIMITED DISTANCE TYPE 2B (#4750): [Models A and E only] A limited distance type 2B modem for 2-wire use up to 8.25 wire-miles at speeds of 134.5 or 600 bps. Point-to-point or multipoint communication facilities can be used. See Line Adapter Limited Distance Type 2B in SRL GA24-3435 for specifications and requirements. **Limitation:** Cannot be used with Line Adapters (#4751 or #4752) or Common Carrier Adapter (#2165). **Maximum:** One per #1610. **Field Installation:** Yes. **Prerequisite:** Asynchronous Communications Control (#1610).

BINARY SYNCHRONOUS COMMUNICATIONS CONTROL (BSCA) (#2074): [Models A and E only] Provides circuitry for one binary synchronous communications adapter. This feature is used for communications with S/370, another System/7 with BSCA (#2074), or a System/3 mdl 4, 6, 8, 10, 12 or 15 with BSCA, or a System/32 with BSCA (#2074) (switched or non-switched point-to-point only), a System/34 with its Communications Adapter (switched or non-switched point-to-point only), a System/3 mdl 8, 10, 12 or 15 with BSCA and EIA Local Attachment (FC #3601, 3602), or a System/3 mdl 6, 10 or 15 with Local Communications Adapter (LCA) (FC #4765), or a System/3 mdl 8 or mdl 12 with Integrated Communications Adapter (ICA) (FC #4645) or ICA-Local Interface, or a System/3 mdl 8 with ICA or BSCA. Data transmission is half duplex over 2- or 4-wire circuits using binary synchronous line control. Data transfer on point-to-point (switched or non-switched) and multipoint configurations is supported. In multipoint configurations, System/7 operates as a tributary station. On point-to-point networks System/7 functions as a processor terminal. Transmission codes supported are EBCDIC and ASCII, software controlled. Transparent mode is standard in the BSCA, but allowed

only in EBCDIC. Control circuitry provides the capability for IPL of the System/7 from a remote system with no resident program in the System/7. Control of the IPL sequence is by the remote system. IPL can be accomplished on point-to-point switched and multipoint configurations and requires the use of transparent EBCDIC transmission code.

Local Attachment to System/3: Point-to-point Non-Switched Communication is also provided with the System/3 BSCA-EIA-LOCAL, LCA, or ICA-LOCAL.

SYSTEM/3 Model	BSCA-EIA-LOCAL		
	LCA (#4765) Speed (bps)	(#3601, 3602) Speed (bps)	ICA (#4645) Speed (bps)
6	2400	N/A	N/A
8	N/A	2400, 4800, 8000	2400, 8000
10	2400	2400, 4800, 8000	N/A
12	N/A	2400, 4800, 8000	2400, 8000
15	2400	2400, 4800, 8000	N/A

For local attachment to a System/3 BSCA-EIA-LOCAL, ICA-LOCAL, or LCA, an appropriate cable order is required. *Installation Manual - Physical Planning*, GA34-0004, includes cable description and ordering information. (Availability of cable is 08/01/75.)

Limitations: Cannot be installed with Asynchronous Communications Control (#1610); support as a multipoint central system is not provided. **Maximum:** One #2074 per system. **Field Installation:** Yes. **Prerequisite:** 5010 mdl A6 or larger or mdl E16 or larger.

INTERNAL CLOCK (#4703): [Models A and E only] Provides BSCA clocking when modems do not provide clock pulses. Speed options are 1200, 2000 and 2400 bps which are hardware selectable. **Maximum:** One per #2074. **Limitation:** Not available with Line Interface Type 1G (#4805). Do not use if System/7 is to interface to a System/3 mdl 8, 10, 12 or 15 BSCA-EIA-Local Attachment (#3601, 3602) or a System/3 mdl 6, 10 or 15 Local Communications Adapter (LCA) (#4765), or a System/3 mdl 8 or mdl 12 Integrated Communications Adapter (ICA) (#4645). **Field Installation:** Yes. **Prerequisite:** BSCA (#2074).

LINE INTERFACE TYPE 1D (#4800): [Models A and E only] Provides a low and medium speed interface to permit operation with external modems that comply with the EIA RS-232-C standard and with System/3 mdl 8, 10, 12, 15 with BSCA and EIA Local Attachment (#3601, 3602), or a System/3 mdl 6, 10 or 15 with Local Communications Adapter (LCA) (#4765), or System/3 mdl 8 or mdl 12 with Integrated Communications Adapter (ICA) (#4645). Modems of this type operate on switched or non-switched facilities up to 2400 bps and over non-switched facilities at up to 7200 bps. Autoanswer capability is supported. **Maximum:** One per #2074. **Limitations:** Cannot be installed with Line Interface Type 1G (#4805) or IBM 1200 BPS Integrated Modem (#5500, 5501). **Field Installation:** Yes. **Prerequisite:** BSCA (#2074).

LINE INTERFACE TYPE 1G (#4805): [Models A and E operating up to 50.0K bps max.] Provides a high speed interface for stand-alone modems operating on a wide band interface. Modems of this type operate at speeds of 10,000 bps and higher only on non-switched lines. **Maximum:** One per #2074. **Limitations:** Cannot be installed with #4800, #5500, #5501; Internal Clock (#4703) is not available with this feature; Will not interface to S/370 mdl 135, Integrated Communications Adapter (#4640). **Field Installation:** Yes. **Prerequisite:** BSCA (#2074).

IBM 1200 BPS INTEGRATED MODEM, LEASED (#5500): [Models A and E only] Provides one IBM 1200 bps Integrated Modem which is suitable for communication over facility D5



with another IBM 1200 bps Integrated Modem. **Maximum:** One per #2074. **Limitations:** Cannot be installed with #4115, #4800, #4805 or #5501; Will not interface to S/370 mdl 135 Integrated Communications Adapter (#4640). **Field Installation:** Yes. **Prerequisites:** BSCA (#2074); Internal Clock (#4703).

IBM 1200 BPS INTEGRATED MODEM, SWITCHED (#5501): [Models A and E only] Provides one IBM 1200 bps Integrated Modem which is suitable for communication over facility C4 with another IBM 1200 bps Integrated Modem. This adapter includes the automatic answer capability. **Maximum:** One per #2074. **Limitations:** Cannot be installed with #4115, #4800, #4805 or #5500; Will not interface to S/370 mdl 135 Integrated Communications Adapter (#4640). **Field Installation:** Yes. **Prerequisites:** BSCA (#2074); Internal Clock (#4703).

BSCA COMMUNICATIONS FACILITIES

Speed (bps)	BSCA Features
1200	4800, 5500, 5501, 4703
2000	4800, 4703
2400	4800, 4703
4800	4800
7200	4800
19.2K	4805
40.8K	4805
50.0K	4805

SYSTEM/7 APPLICATION IDENTIFIER CODES

Specify Feature Codes have been added to the 5010 Processor Unit. These are no-charge features which identify the major application on the system. This data will be retrievable by marketing requirements and planning areas, and used as additional input to marketing analysis and planning. This data will also provide ready references to the field for specific applications.

Special Features

Processing Unit—major applications on order in the account. Identifier (9XXX) (All Models).

Code	Feature (Application)	Code#	Feature (Application)
9001	Data Collection	9009	Lab. Applications
9002	Telephone Data Entry	9010	Stand-alone Scientific
9003	Power Management	9011	Maritime
9004	Message Switching	9012	TTS/TR
9005	Other TP Applications	9013	CAMA
9006	CAS	9014	ACLR
9007	Testing/Monitoring	9015	ACDMS
9008	Process Control		

Limitations: Only one feature code per 5010 can be specified.

**5012 MULTIFUNCTION MODULE**

Purpose: To provide digital input/output, analog input/output, and 2790 control on System/7.

Highlights: Provides capability for:

- Attachment of a 2790 Control.
- Up to 128 digital input points.
- Up to 32 isolated process interrupt points.
- Up to 64 digital output points.
- Up to 32 differential analog input points.
- Up to 2 isolated analog output points.

2790 Control: Provides the required logical interface for attachment of 2790 Data Communication devices to System/7. This allows System/7 to act as the "system controller" for 2791/2793 Area Stations or 2792 Remote Communication Controller. The 2790 Control allows transmission of data between System/7 and the 2791/2793 Area Stations (and 2795/2796/2797 Data Entry Units, and 2798 Guidance Display Units). Transmission rate is approximately 500,000 bits per second (900 characters per second). See 2790 in "Systems". The combined number of 2791/2793s and 2792 mdl 1s on each 5012 or 5013 may not exceed 16. **Maximum:** Four 2790 Controls per system, one per 5012 Multifunction Module.

Digital Input: Provides up to 8 groups of 16 digital input points. Either isolated or non-isolated Digital Input groups are available. Each digital input point is a voltage or contact sense, 2-terminal circuit. Each group can be program controlled for latching or non-latching operation. Any one of the eight groups may be read under direct program control. The first two groups of digital inputs may be converted to process interrupt points through the addition of the Process Interrupt feature.

Process Interrupt: An "interrupt on change" feature is offered on the first two groups of digital inputs. This feature provides the capability to compare the input of 16 bit groups against a program loadable 16 bit register and initiate an interrupt on either an equal or unequal comparison.

Digital Output: Provides up to four groups of 16 digital output points. Each digital output point may be set or reset under program control. Each Digital Output group may be one of the following circuit types: Low Power, Medium Power, Medium Power Non-Isolated, or Contact Output. Low Power output provides switching with a maximum rating of 6 volts at 4 milliamps. Medium Power and Medium Power Non-Isolated operate up to 48 volts at 450 milliamps. Contact Output provides a Form A mercury wetted relay contact rated at 125 V dc max or 88 V ac RMS max, 2A ac RMS max; the product of peak voltage and peak current must not exceed 100 (100 VA max). Digital outputs operate under direct program control. Medium Power and Contact Output points are isolated and may be directly connected to the standard Digital Input points. This provides the capability for wrap-around testing and multiplexing of digital and analog inputs with digital output points.

Analog Input: Provides up to eight groups of 8 differential analog input points. A multiplexer connects each point to an analog-to-digital converter which is capable of converting voltage signals, in the range of ± 10 millivolts to ± 5.12 volts full scale, into binary values of 14 bits plus sign. Either an amplifier with a unit gain or an automatic multirange amplifier must be selected. The unity gain or high level amplifier provides a full scale range of ± 5.12 volts. The multirange amplifier provides full scale ranges of ± 10 mv, ± 20 mv, ± 40 mv, ± 80 mv, ± 160

mv, ± 640 mv, and ± 5.12 volts. Analog input is under direct program control. Immediate and External Synchronization operations are both available. Two analog scan rates are provided; #5246 uses a mercury wetted relay multiplexer operating at a scanning rate of up to 200 points per second. #5248 uses a solid state multiplexer operating at scanning rates up to 20K points per second, depending on the level of the input signal and mode of operation. For thermocouple operations, resistance bulb thermometer (RBT) termination cards are available to be used for measurement of the reference junction temperature. **Limitations:** All of the 32 analog input points must use the same type of multiplexer in each Multifunction Module. The RBT capability is available only on the multirange amplifier.

Analog Output: Provides one or two isolated analog output voltages. The output signal has a polarized full scale range from 0 to 10.24 volts, with a resolution of 10 bits and an accuracy of $\pm 0.15\%$ of full scale. Polarity of the output signal depends on which side of the isolated output is grounded. Analog Output operates under direct program control at a rate of 25KC (including amplifier settling time).

Attachment Accessories: A customer access area is provided in the back of every I/O Module. Termination cards and connectors can be installed in this area to provide for connecting customer signals to the System/7 I/O interface. For detailed information, see "Attachment Accessories for System/7" under 5029.

Maximum: The total number of Input/Output Modules (5012, 5013, 5014 and 5022 in any combination) per system cannot exceed 11.

Prerequisite: One module location in a 5026 Enclosure mdl A2, C3, C6, D3 or D6.

System/7 Summary: GA34-0002

Specify:

1) For location of the 5012 I/O Module, specify:

(If feature #9141 was specified on the 5010, do not use the following specify features.)

#9143 also enter the desired module location number, as shown in the chart on the 5026 page, in the quantity column of the order form. Specify #9142 in 5010 Processor Module.

#9144 for shipment without mounting in an enclosure (spare).

2) Customer's signal wires enter through the rear side panels of the module. Three types of side panels are available: Type 1 provides a slot for cables ... Type 2 has individual holes for each pair of wires ... Type 3 is a blank panel that can be customized by the customer. Separate side panels are used for digital and analog input signal wires. For details, refer to *System/7 Installation Manual - Physical Planning*, GA34-0004.

For Digital Input/Output specify one:

- #9501 Side Panel Digital Type 1
- #9502 Side Panel Digital Type 2
- #9503 Side Panel Digital Type 3

For Analog Input specify one:

- #9511 Side Panel Analog Type 1
- #9512 Side Panel Analog Type 2
- #9513 Side Panel Analog Type 3

3) When 2790 Control (#8195) is ordered on 5012 specify: #9444 (Multiloop Device) for each new 5012 in a multipoint system. *Note:* When upgrading from a single loop system, #9444 must be ordered for the installed 5012 which



contains #8195. (It must also be ordered which has #8195.)

for any 5013

can either be preset under program control or automatically selected during the conversion process. With preset gains, a resolution of 14 bits plus sign is obtained. With auto ranging, a resolution of 12 bits plus sign and 3 bits for gain indication is obtained. **Limitation:** Cannot be ordered with Amplifier High Level B (#1210). **Maximum:** One per #1232. **Field Installation:** Yes. **Prerequisite:** Analog Input Control Mod B (#1232).

2790 CONTROL (#8195): Interface for 2790 Data Communication devices. For 2790 devices supported by programming, see MSP/7 in "Programming". **Limitation:** Online diagnostics are available for maintenance of the 2790 - System/7 and must be implemented on all systems which include a 2792 or have more than sixteen area stations ... see page P7.3, System/7 Macro Library/Relocatable. All 5012 and 5013 modules with 2790 Control (#8195) must reside within the same 5026 Enclosure. See 2791/2793 Limitations, Loop Delay (2793 "Machines" page) for special configuring considerations. **Maximum:** One per 5012, four per System/7. MSP/7 provides support for a maximum of four 2792 mdl 1s (up to two per 2790 Control) or a maximum of sixty-four 2791/2792 mdl 1/2793s (16 per 2790 Control). **Prerequisite:** Customer signal connection required ... see 5029. **Field Installation:** Yes.

• ANALOG INPUT/OUTPUT

ANALOG BASIC (#1221): Provides the basic analog capability within the 5012. **Maximum:** One per 5012. **Field Installation:** Yes.

ANALOG OUTPUT CONTROL (#1245): Provides control for one or two Analog Output Points (#1246). **Maximum:** One per #1221. **Field Installation:** Yes. **Prerequisite:** Analog Basic (#1221).

ANALOG OUTPUT POINT (#1246): Provides a 0 to 10.24 volts isolated output signal. Polarity of the signal depends on the side of the signal that is grounded. **Maximum:** Two per #1245. **Prerequisites:** Analog Output Control (#1245) and its prerequisite ... customer signal connection required, see 5029. **Field Installation:** yes.

ANALOG INPUT CONTROL MODEL B (#1232): Provides control and analog-to-digital conversion for an amplifier and 8 groups of mercury-wetted relay multiplexers. Multiplexing is at a maximum scanning rate of 200 points per second. **Limitation:** Cannot be ordered with Analog Input Control Mod C (#1213). **Maximum:** One per #1221. **Field Installation:** Yes. **Prerequisite:** Analog Basic (#1221).

AMPLIFIER HIGH LEVEL B (#1210): Provides a unity gain amplifier for high level analog input with a full scale range of ± 5.12 volts. **Limitation:** Cannot be ordered with Amplifier Multirange B (#1215). **Maximum:** One per #1232. **Field Installation:** Yes. **Prerequisite:** Analog Input Control Mod B (#1232).

AMPLIFIER MULTIRANGE B (#1215): Provides a multirange amplifier for analog input signals. Full scale ranges of ± 10 mv, ± 20 mv, ± 40 mv, ± 80 mv, ± 160 mv, ± 640 mv, and ± 5.12 volts

MULTIPLEXER/MR4 (#5246): Provides a group of 4 mercury wetted relay multiplexer points for analog input signals. Multiplexing is at a maximum rate of 200 points per second. Signals may be in the range of 0 to ± 5.12 volts. **Maximum:** 8 per #1210 or #1215. **Field Installation:** Yes. **Prerequisites:** Amplifier High Level B (#1215) ... customer signal connection required, see 5029.

ANALOG INPUT CONTROL MOD C (#1213): Provides control and analog-to-digital conversion for an amplifier and 8 groups of solid state multiplexers. Multiplexer scanning rate is up to 14K points per second for low level signals, and up to 20K points per second for high level inputs. For auto ranging mode, maximum scanning rate is 7K points per second. **Limitation:** Cannot be ordered with Analog Input Control Mod B (#1232). **Maximum:** One per #1221. **Field Installation:** Yes. **Prerequisite:** Analog Basic (#1221).

AMPLIFIER HIGH LEVEL C (#1211): Provides a unity gain amplifier for high level analog input with a full scale range of ± 5.12 volts. **Limitation:** Cannot be ordered with Amplifier Multirange C (#1216). **Maximum:** One per #1213. **Field Installation:** Yes. **Prerequisite:** Analog Input Control Mod C (#1213).

AMPLIFIER MULTIRANGE C (#1216): Provides a multirange amplifier for analog input signals. Full scale ranges of ± 10 mv, ± 20 mv, ± 40 mv, ± 80 mv, ± 160 mv, ± 640 mv, and ± 5.12 volts can either be preset under program control or automatically selected during the conversion process. With preset gains, a resolution of 14 bits plus sign is obtained, while auto ranging provides a resolution of 12 bits plus sign and 3 bits gain indication. **Limitation:** Cannot be ordered with Amplifier High Level C (#1211). **Maximum:** One per #1213. **Field Installation:** Yes. **Prerequisite:** Analog Input Control Mod C (#1213).

MULTIPLEXER/MS4 (#5248): Provides a group of 4 solid state multiplexer points for analog input signals. Multiplexing is at a maximum scanning rate of 20,000 points per second. Signals may be in the range of 0 to ± 5.12 volts. **Maximum:** 8 per #1211 or #1216. **Field Installation:** Yes. **Prerequisites:** One Amplifier High Level C (#1211), or Amplifier Multirange C (#1216) ... customer signal connection required, see 5029.

TEMPERATURE REFERENCE ATTACH (#7830): Provides the capability to attach Termination Cards containing resistance bulb thermometers for determining the reference junction temperatures in thermocouple applications. See 5029. **Maximum:** one per #1221. **Field Installation:** Yes. **Prerequisites:** Amplifier Multirange B (#1215), or Amplifier Multirange C (#1216) ... customer signal connection required, see 5029.

• DIGITAL INPUT/OUTPUT

DIGITAL INPUT CONTROL (#3284): Provides control for up to 4 Digital Input (#3289 or #3292). **Maximum:** Two per 5012. **Field Installation:** Yes.

DIGITAL INPUT GROUP (#3289): Provides 16 latching on non-latching digital input voltage or contact points. The voltage or contact and the isolation capability of each point is determined by the Termination Card used. **Maximum:** Four #3289 or #3292 in any combination per #3284. **Field Installation:** Yes.



Prerequisites: Digital Input Control (#3284) ... customer signal connection required, see 5029.

PROCESS INTERRUPT (#5710): Converts a Digital Input Group (#3289) to a process interrupt group. **Limitation:** #5710 cannot be installed on Digital Input Non-Isolated (#3292). **Maximum:** Two per 5012 ... can only be used with the first two groups of Digital Input Group (#3289) in a 5012. **Field Installation:** Yes. **Prerequisite:** Digital Input Group (#3289).

DIGITAL INPUT NON-ISOLATED (#3292): Provides 16 latching or non-latching points of contact sense capability. Input signals are referenced to frame ground. **Limitation:** Cannot be modified by Process Interrupt (#5710). **Maximum:** Four #3289 or #3292 in any combination per #3284. **Field Installation:** Yes. **Prerequisites:** Digital Input Control (#3284) ... customer signal connection required, see 5029.

FUNCTION max., one per group	1st Digital Input Control (3284)			
	1st Group	2nd Group	3rd Group	4th Group
DIGITAL INPUT ISOLATED	3289	3289	3289	3289
PROCESS INTERRUPT plus ISOLATED	3289 5710	3289 5710	Not Available	Not Available

DIGITAL INPUT NON-ISOLATED	3292	3292	3292	9292
PROCESS INTERRUPT NON-ISOLATED	Not Available	Not Available	Not Available	Not Available

FUNCTION max., one per group	2nd Digital Input Control (3284)			
	5th Group	6th Group	7th Group	8th Group
DIGITAL INPUT ISOLATED	3289	3289	3289	3289
PROCESS INTERRUPT ISOLATED	Not Available	Not Available	Not Available	Not Available

DIGITAL INPUT NON-ISOLATED	3292	3292	3292	3292
PROCESS INTERRUPT NON-ISOLATED	Not Available	Not Available	Not Available	Not Available

DIGITAL OUTPUT CONTROL (#3296): Provides control for up to four groups of Digital Outputs (#3420, 3421, 3422, 3424) in any combination. **Maximum:** One per 5012. **Field Installation:** Yes.

DO CONTACT GROUP (#3420): Provides 16 isolated single pole Form A mercury wetted relay contacts rated at 125 V dc max or 88 V ac RMS max, 2A ac RMS max; the product of peak voltage and peak current must not exceed 100 (100 VA max.). **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

DO LOW POWER GROUP (#3421): Provides 16 low power (4 ma, 6 V) digital output points. No user power supply is required. **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

DO MEDIUM POWER GROUP (#3422): Provides 16 isolated

medium power solid state digital output switches. Power, up to 48 V dc, and 450 ma, must be provided by the user. **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Input Control (#3296) ... customer signal connection required, see 5029.

DO MEDIUM POWER NON-ISOLATED (#3424): Provides 16 non-isolated medium power (0 ma at 5.5 V to 12 ma at 2.4 V supplied by IBM) solid state digital output switches. Output signals are referenced to frame ground. Customer powered loads up to 450 ma at 52.8 V dc can be switched. **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

ATTACHMENT ACCESSORIES: Termination Cords and connectors for customer signal wires are provided as accessories in the 5029. For details, see 5029.

**5013 DIGITAL INPUT/OUTPUT MODULE**

Purpose: To provide digital input/output, expansion capability for custom products, and 2790 control on a System/7.

Highlights: Designed specifically to provide expansion capability for applications that require custom products along with digital input/output and 2790 control.

Provides capability for:

- Expansion for Custom Products
- Attachment of a 2790 Control
- Up to 128 digital input points
- Up to 32 isolated process interrupt points
- Up to 64 digital output points

Expansion Capability: Provides the space, power, and logical interface to attach various Custom Products to the System/7.

2790 Control: Provides the required logical interface for attachment of 2790 Data Communication devices to System/7. This allows System/7 to act as the "System Controller" for 2791/2793 Area Stations or 2792 Remote Communication Controller. The 2790 Control allows transmission of data between System/7 and the 2791/2793 Area Stations (and 2795/2796/2797 Data Entry Units, and 2798 Guidance Display Units). Transmission rate is approximately 500,000 bits per second (900 characters per second). See 2790 in "Systems". The combined number of 2791/2793s and 2792 mdl 1s on each 5012 or 5013 may not exceed 16. **Maximum:** Four 2790 Controls per system, one per 5013 Digital Input/Output Module.

Digital Input: Provides up to 8 groups of 16 digital input points. Either isolated or non-isolated Digital Input groups are available. Each digital input point is a voltage or contact sense, 2-terminal circuit. Each group can be program controlled for latching or non-latching operation. Any one of the 8 groups may be read under direct program control. The first two groups of digital inputs may be converted to process interrupt points through the addition of the Process Interrupt feature.

Process Interrupt: An "interrupt on change" feature is offered on the first two groups of digital inputs. This feature provides the capability to compare the input of the 16-bit groups against a program loadable 16-bit register and initiate an interrupt on either an equal or unequal comparison.

Digital Output: Provides up to 4 groups of 16 digital output points. Each digital output point may be set or reset under program control. Each Digital Output group may be one of the following circuit types: Low Power, Medium Power, Medium Power Non-Isolated, or Contact output. Low Power output provides switching with a maximum rating of 6 volts at 4 milliamps. Medium Power and Medium Power Non-Isolated operate up to 48 volts at 450 milliamps. Contact Output provides a Form A mercury wetted relay contact rated at 125 V dc max or 88 V ac RMS max, 2 A ac RMS max; the product of peak voltage and peak current must not exceed 100 (100 VA max). Digital outputs operate under direct program control. Medium Power and Contact Output points are isolated and may be directly connected to the standard Digital Input points. This provides the capability for wrap-around testing and multiplexing of digital and analog inputs with digital output points.

Maximum: The total number of Input/Output Modules (5012, 5013, 5014 and 5022 in any combination) per system may not exceed 11.

Prerequisite: One module location in a 5026 Enclosure mdl A2, C3, C6, D3 or D6.

System/7 Summary: GA34-0002

1) For location of the 5013 I/O Module, specify: (If feature #9141 was specified on the 5010, do not use the following specify features.)

#9143: Also enter the desired module location number, as shown in the chart on page M 5026, in the quantity column of the order form. Specify #9142 in the 5010 Processor Module.

#9144: For shipment without mounting in an enclosure (spare).

2) Customer's signal wires enter through the rear side panels of the module. Three types of side panels are available: Type 1 provides a slot for cables; Type 2 has individual holes for each pair of wires; Type 3 is a blank panel that can be customized by the customer. Separate side panels are used for digital and analog input signals. For details, refer to *IBM System/7 Installation Manual—Physical Planning*, GA34-0004.

For Digital Input/Output specify one:

#9501: Side Panel Digital Type 1

#9502: Side Panel Digital Type 2

#9503: Side Panel Digital Type 3

3) When 2790 Control (#8195) is ordered on 5013 specify: **#9444** (Multiloop Device) for each new 5013 in a multiloop system. *Note:* When upgrading from a single loop system, #9444 must be ordered for the installed 5013 which contains #8195.

Special Features

2790 CONTROL (#8195): Interface for 2790 Data Communication devices. For 2790 devices supported by programming, see MSP/7 in "Programming". **Limitation:** Online diagnostics are available for maintenance of the 2790 - System/7 and must be implemented on all systems which include a 2792 or have more than 16 area stations ... see page P7.3 System/7 Macro Library/Relocatable. All 5012 and 5013 modules with 2790 Control (#8195) must reside within the same 5026 Enclosure. See 2791/2793 Limitations, Loop Delay (2793 "Machines" page) for special configuring considerations. **Maximum:** One per 5013, four per System/7. MSP/7 provides support for a maximum of four 2792 mdl 1s (up to two per 2790 control) or a maximum of sixty-four 2791/2792 mdl 1/2793s (16 per 2790 control). **Field Installation:** Yes. **Prerequisite:** Customer signal connection required, see 5029.



• DIGITAL INPUT/OUTPUT FEATURES

DIGITAL INPUT CONTROL (#3284): Provides control of up to 4 Digital Input (#3289 or #3292) groups. **Maximum:** Two per 5013. **Field Installation:** Yes.

DIGITAL INPUT GROUP (#3289): Provides 16 latching or non-latching digital input voltage or contact points. The voltage or contact and the isolation capability of each point is determined by the Termination Card used. **Maximum:** Four #3289 or #3292 in any combination per #3284. **Field Installation:** Yes. **Prerequisites:** Digital Input Control (#3284) ... customer signal connection required, see 5029.

PROCESS INTERRUPT (#5710): Converts a Digital Input Group (#3289) to a process interrupt group. **Limitation:** #5710 cannot be installed on Digital Input Non-Isolated (#3292). **Maximum:** Two per 5013 ... can only be used with the first two groups of Digital Input Group (#3289) in a 5013. **Field Installation:** Yes. **Prerequisite:** Digital Input Group (#3289) and its prerequisite.

DIGITAL INPUT NON-ISOLATED (#3292): Provides 16 latching or non-latching points of contact sense capability. Input signals are referenced to frame ground. **Limitation:** Cannot be modified by Process Interrupt (#5710). **Maximum:** Four #3289 or #3292 in any combination per #3284. **Field Installation:** Yes. **Prerequisite:** Digital Input Control (#3284) ... customer signal connection required, see 5029.

FUNCTION max., one per group	1st Digital Input Control (3284)			
	1st Group	2nd Group	3rd Group	4th Group

DIGITAL INPUT ISOLATED	3289	3289	3289	3289
PROCESS INTERRUPT ISOLATED	3289 plus 5710	3289 plus 5710	Not Available	Not Available

FUNCTION max., one per group	2nd Digital Input Control (3284)			
	5th Group	6th Group	7th Group	8th Group

DIGITAL INPUT NON-ISOLATED	3292	3292	3292	9292
PROCESS INTERRUPT NON-ISOLATED	Not Available	Not Available	Not Available	Not Available

DIGITAL INPUT ISOLATED	3289	3289	3289	3289
PROCESS INTERRUPT ISOLATED	Not Available	Not Available	Not Available	Not Available

DIGITAL INPUT NON-ISOLATED	3292	3292	3292	3292
PROCESS INTERRUPT NON-ISOLATED	Not Available	Not Available	Not Available	Not Available

DIGITAL OUTPUT CONTROL (#3296): Provides control for up to four groups of Digital Outputs (#3420, 3421, 3422, 3424) in any combination. **Maximum:** One per 5013. **Field Installation:** Yes.

DO CONTACT GROUP (#3420): Provides 16 isolated single pole Form A mercury wetted relay contacts rated at 125 V dc max or 88 V ac RMS max, 2A ac RMS max; the product of peak voltage and peak current must not exceed 100 (100 VA max).

Maximum: Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

DO LOW POWER GROUP (#3421): Provides 16 low power (4 ma, 6 V) digital output points. No user power supply is required. **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

DO MEDIUM POWER GROUP (#3422): Provides 16 isolated medium power solid state digital output switches. Power, up to 48 V dc, and 450 ma, must be provided by the user. **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #3296. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

DO MEDIUM POWER NON-ISOLATED (#3424): Provides 16 non-isolated medium power (0 ma at 5.5 V to 12 ma at 2.4 V supplied by IBM) solid state digital output switches. Output signals are referenced to frame ground. Customer powered loads up to 450 ma at 52.8 V dc can be switched. **Maximum:** Four #3420, 3421, 3422, 3424 in any combination per #2396. **Field Installation:** Yes. **Prerequisites:** Digital Output Control (#3296) ... customer signal connection required, see 5029.

ATTACHMENT ACCESSORIES: Termination Cards and connectors for customer signal wires are provided as accessories in the 5029 mdl 1. For details, see M 5029.



5014 ANALOG INPUT MODULE

Purpose: To provide System/7 with the capability to use voltage signals as input data. The 5014 Analog Input Module provides capability for up to 128 analog input points.

Model B1: Scanning rate up to 200 points per second.

Model C1: Scanning rate up to 20,000 points per second.

Model D1: Scanning rate up to 100 points per second.

Model E1: Expander for 5014 model D1.

Model E2: Expander for 5014 model B1.

Model Changes: Changes between model E1 and model E2 are field installable. Model changes from B to C to D and vice versa are not recommended for field installation.

Highlights: Provides analog input capability including multiplexing, amplification, and analog-to-digital conversion. Five models are available: Model B1 uses mercury wetted relay multiplexers with a maximum scanning rate of 200 points per second; Model C1 uses a solid state multiplexer with a maximum scanning rate of 7,000 to 20,000 points per second; Model D1, with a maximum scanning rate of 100 points per second, uses either mercury wetted or dry contact relay multiplexers; Model E1 is an expander module connected to model D1 sharing the amplifier and analog-to-digital converter of the model D1 and using either type of multiplexer; Model E2 is an expander module connected to model B1 sharing the amplifier and analog-to-digital converter of the model B1 and using mercury wetted relay multiplexers. Input signals may range from 0 to ± 5.12 volts full scale with mercury wetted relay multiplexers and solid state multiplexers. Input signals may range from -640 mv to +5.12 volts full scale with dry contact relay multiplexers.

The analog-to-digital converter has a resolution of 14 bits plus sign. Analog conversion and point addressing of the multiplexers are under program control. Immediate and External synchronization operations are both available. A special feature provides for attachment of resistance bulb thermometer (RBT) termination cards for determining the reference junction temperature in thermocouple applications. Connection of customer signals and signal conditioning is achieved by termination cards in the customer access area at the back of the Analog Input Module. **Limitations:** The first model E1 must be located directly under its associated model D1. The second model E1 must be located directly under the first model E1. The first model E2 must be located directly under its associated model B1. The second model E2 must be located directly under the first model E2. **Maximum:** Total number of Input/Output Modules (5012, 5013, 5014, 5022, and Customer Product Modules in any combination) per system cannot exceed 11. **Prerequisite:** One module location in 5026 Enclosure mdls A2, C3, C6, D3 or D6.

System/7 Summary: GA34-0002

1) For location of the 5014 I/O Module, specify: (If feature #9141 was specified on the 5010, do not use the following specify features.)

#9143: also enter the desired module location number, as shown in the chart on page M 5026, in the quantity column of the order form. Specify #9142 in the 5010 Processor Module.

#9144: for shipment without mounting in an enclosure (spare).

2) Customer's signal wires enter through the rear side panels of the module. Three types of panels are available; Type 1 provides a slot for cables; Type 2 has individual holes for each pair of wires; Type 3 is a blank panel that can be customized by the customer. For details refer to *IBM System/7 Installation Manual—Physical Planning*, GA34-0004 Specify One;

#9511: Side Panel Analog Type 1

#9512: Side Panel Analog Type 2

#9513: Side Panel Analog Type 3

3) On each 5014 mdl E specify one of the following:

#9185: For expansion from 128 to 256 points. (First 5014 mdl E is connected to a single 5014 mdl B or D).

#9186: For expansion from 256 to 384 points. (Second 5014 mdl E is connected to a single 5014 mdl B or D.)

MODEL DESCRIPTIONS

Model B1: provides amplification, analog-to-digital conversion, and addressing of 128 analog input points at a scanning rate up to 200 points per second using mercury wetted relay multiplexers. A special feature provides addressing for an additional 256 points in two attached model E2s (total 384 points).

Model C1: provides amplification, analog-to-digital conversion, and addressing of 128 analog input points at a scanning rate up to 20,000 points per second using solid state multiplexers. The maximum scanning rate is dependent upon the input signal level and mode of operation. Low level signals may be scanned at a maximum rate of 14,000 points per second. High level signals may be scanned at a maximum rate of 20,000 points per second. Maximum scanning rate with auto ranging is 7,000 points per second.

Model D1: provides amplification, analog-to-digital conversion, and addressing of 384 analog input points at a scanning rate up to 100 points per second using mercury wetted relay or dry contact relay multiplexers. The first 128 points of relay multiplexers are installed in the model D1. The second 128 points of relay multiplexers are installed in a model E1 attached to the model D1. The third 128 points of relay multiplexers are installed in a model E1 attached to the first model E1.

Model E1: expansion model for model D1. Provides for 128 analog input points selected by mercury wetted relay or dry contact relay multiplexers. It is connected to and uses the amplification, analog-to-digital conversion, and addressing circuits of a model D1. The maximum scanning speed is the same as the model D1 (100 points per second). **Limitation:** The first model E1 must be located directly under the model D1 to which it is attached. The second model E1 must be located directly under the first model E1. **Maximum** Two per 5014 mdl D1. **Prerequisite:** 5014 mdl D1.

Model E2: expansion module for model B1. Provides for 128 analog input points selected by mercury wetted relay multiplexers. It is connected to and uses the amplification, analog-to-digital conversion, and addressing circuits of a model B1. The maximum scanning speed is the same as the model B1 (200



points per second). **Limitation:** The first model E2 must be located directly under the model B1 to which it is attached. The second model E2 must be located directly under the first model E2. **Maximum:** Two per 5014 mdl B1. **Prerequisite:** Analog Input Expander (#1250) on the 5014 mdl B1.

AMPLIFIER HIGH LEVEL B (#1210): [Model B1 only] Provides a unity gain amplifier for high level analog input signals with a full scale range of ± 5.12 volts. **Limitation:** Cannot be ordered with Amplifier Multirange B (#1215). **Maximum:** One per 5014 mdl B1. **Field Installation:** Yes.

AMPLIFIER HIGH LEVEL C (#1211): [Model C1 only] Provides a unity gain amplifier for high level analog input signals with a full scale range of ± 5.12 volts. **Limitation:** Cannot be ordered with Amplifier Multirange C (#1216). **Maximum:** One per 5014 mdl C1. **Field Installation:** Yes.

AMPLIFIER HIGH LEVEL D (#1212): [Model D1 only] Provides a unity gain amplifier for high level analog input signals with a full scale range of ± 5.12 volts with Multiplexer/MR16 (#5247) or -640 mv to $+5.12$ volts with Multiplexer/MD16 (#5245). **Limitation:** Cannot be ordered with Amplifier Multirange D (#1217). **Maximum:** One per 5014 mdl D1. **Field Installation:** Yes.

AMPLIFIER MULTIRANGE B (#1215): [Model B1 only] Provides a multirange amplifier for analog input signals. The amplifier gains can be set by the program or determined automatically by the amplifier. Amplifier ranges are ± 10 mv, ± 20 mv, ± 40 mv, ± 80 mv, ± 160 mv, ± 640 mv, and ± 5.12 volts full scale. In program selected gain mode of operation, 14 bits of data plus sign are generated. In auto ranging mode of operation, 12 bits of data plus sign are generated. The remaining 3 bits are used to indicate the range. **Limitation:** Cannot be ordered with Amplifier High Level B (#1210). **Maximum:** One per 5014 mdl B1. **Field Installation:** Yes.

AMPLIFIER MULTIRANGE C (#1216): [Model C1 only] Provides a multirange amplifier for analog input signals. The amplifier gains can be set by the program or determined automatically by the amplifier. Amplifier ranges are ± 10 mv, ± 20 mv, ± 40 mv, ± 80 mv, ± 160 mv, ± 640 mv, and ± 5.12 volts full scale. In program selected gain mode of operation, 14 bits of data plus sign are generated. In auto ranging mode of operation, 12 bits of data plus sign are generated. The remaining 3 bits are used to indicate the range. **Limitation:** Cannot be ordered with Amplifier High Level C (#1211). **Maximum:** One per 5014 mdl C1. **Field Installation:** Yes.

AMPLIFIER MULTIRANGE D (#1217): [Model D1 only] Provides a multirange amplifier for analog input signals. The amplifier gain is set by the program. When used with Multiplexer/MR16 (#5247), the full scale ranges are ± 10 mv, ± 20 mv, ± 40 mv, ± 80 mv, ± 160 mv, ± 640 mv, and ± 5.12 volts. When used with Multiplexer/MD16 (#5245), all of the above ranges are available with the exception that the ± 5.12 volt range

is modified to the range of -640 mv to $+5.12$ volts. 14 bits of data plus sign are generated. **Limitation:** Cannot be ordered with Amplifier High Level D (#1212). **Maximum:** One per 5014 mdl D1. **Field Installation:** Yes.

ANALOG INPUT ADAPTER B (#1230): [Model B1 only] Provides capability for two Multiplexer/MR16 (#5247) groups. **Maximum:** Four per 5014 mdl B1. **Field Installation:** Yes. **Prerequisite:** Amplifier High Level B (#1210) or Amplifier Multirange B (#1215).

ANALOG INPUT ADAPTER C (#1231): [Model C1 only] Provides capability for two Multiplexer/MS16 (#5249) groups. **Maximum:** Four per 5014 mdl C1. **Field Installation:** Yes. **Prerequisite:** Amplifier High Level C (#1211) or Amplifier Multirange C (#1216).

ANALOG INPUT ADAPTER D/E (#1233): [Model D1, E1 and E2 only] Provides capability for two Multiplexer/MR16 (#5247) groups on mdls D1, E1, E2, or two Multiplexer/MD16 (#5245) groups on mdls D1, E1. **Maximum:** Four per 5014 mdls D1, E1 or E2. **Field Installation:** Yes. **Prerequisite:** Amplifier High Level D (#1212) or Amplifier Multirange D (#1217) on 5014 mdl D1.

ANALOG INPUT EXPANDER B (#1250): [Model B1 only] Provides the capability to attach one or two 5014 mdl E2s to a 5014 mdl B1. This provides up to 384 analog input point addresses on a 5014 mdl B1. **Maximum:** One per 5014 mdl B1. **Field Installation:** Yes. **Prerequisite:** Amplifier High Level B (#1210) or Amplifier Multirange B (#1215).

MULTIPLEXER/MD16 (#5245): [Model D1 and E1 only] Provides a group of 16 analog input points. Input points are multiplexed by dry contact relays. Input signals can be in the range of -640 mv to $+5.12$ volts. **Limitation:** The combined quantity of Multiplexer/MD16 (#5245) and Multiplexer/MR16 (#5247) must not exceed two per Analog Input Adapter D/E (#1233). Common mode voltage must not exceed 100 volts and the average sampling rate per point must not exceed 20 samples per minute when averaged over at least 24 hours. This means that a single input point must not be addressed more than 28,800 times in 24 hours. **Maximum:** Two per Analog Input Adapter D/E (#1233). **Field Installation:** Yes. **Prerequisites:** Analog Input Adapter D/E (#1233). Customer signal connection required, see M5029.

MULTIPLEXER/MR16 (#5247): [Model B1, D1, E1 or E2 only] Provides a group of 16 analog input points. Input points are multiplexed by mercury wetted relays. Input signals can be in the range of ± 5.12 volts. **Limitation:** The combined quantity of Multiplexer/MR16 (#5247) and Multiplexer/MD16 (#5245) must not exceed two per Analog Input Adapter B (#1230) or Analog Input Adapter D/E (#1233). Common mode voltage must not exceed 250 volts and the average sampling rate is not limited. **Maximum:** Two per Analog Input Adapter B (#1230) or Analog Input Adapter D/E (#1233). **Field Installation:** Yes. **Prerequisites:** Analog Input Adapter B (#1230) on 5014 mdl B1 or Analog Input Adapter D/E (#1233) on mdls D1, E1 or E2. Customer signal connection required, see M5029.

MULTIPLEXER/MS16 (#5249): [Model C1 only] Provides a group of 16 analog input points. Input points are multiplexed by solid state switches. Input signals can be in the range of ± 5.12 volts. **Limitation:** Common mode voltage must not exceed 10 volts and the average sampling rate is not limited. **Maximum:** Two per Analog Input Adapter C (#1231). **Field Installation:** Yes. **Prerequisites:** Analog Input Adapter C (#1231). Customer signal connection required, see M5029.

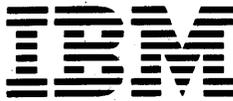
TEMPERATURE REFERENCE ATTACH (#7830): [Model B1,



C1, or D1 only] Provides the capability to attach termination cards containing resistance bulb thermometers (RBT) ... see M 5029. When this feature is installed in a 5014 mdl B1 or D1 the capability is extended to 5014 mdl E1 or E2 associated with it. **Limitation:** A maximum of 32 RBT termination cards can be attached to one Temperature Reference Attach (#7830). **Maximum:** One per 5014 mdls B1, C1 and D1. **Field Installation:** Yes. **Prerequisite:** Amplifier Multirange B (#1215), Amplifier Multirange C (#1216) or Amplifier Multirange D (#1217).

MAXIMUM FEATURE QUANTITY PER MODEL

Feature	Mdl B1	Mdl C1	Mdl D1	Mdl E1	Mdl E2
	200 pt per sec	20K pt per sec	100 pt per sec	100 pt per sec	200 pt per sec
Amplifier High Level B (1210)	1	0	0	0	0
Amplifier High Level C (1211)	0	1	0	0	0
Amplifier High Level D (1212)	0	0	1	0	0
Amplifier Multirange B (1215)	1	0	0	0	0
Amplifier Multirange C (1216)	0	1	0	0	0
Amplifier Multirange D (1217)	0	0	1	0	0
Analog Input Adapter B (1230)	4	0	0	0	0
Analog Input Adapter C (1231)	0	4	0	0	0
Analog Input Adapter D/E (1233)	0	0	4	4	4
Analog Input Expander B (1250)	1	0	0	0	0
Multiplexer/MD 16 (5245)	0	0	8	8	0
Multiplexer/MR 16 (5247)	8	0	8	8	8
Multiplexer/MS 16 (5249)	0	8	0	0	0
Temperature Reference Attach (7830)	1	1	1	0	0



5022 DISK STORAGE MODULE

Purpose: Disk Storage Unit for System/7.

Model 1 Single Drive: 2.457 million 16-bit words ... access 200 cylinders on removable cartridge and 200 cylinders on its non-removable disk ... 269 millisecond average access time.

Model 2 Single Drive: Same as Model 1 except 126 millisecond average access time.

Model 3 Single Drive: 1.228 million 16-bit words ... access 200 cylinders on one non-removable disk ... average access time 269 milliseconds.

Model 4 Single Drive: Same as Model 3 except 126 millisecond average access time.

Model Changes: Field Installable.

Highlights: Removable Disk Cartridges—each 5022 mdl 1 or 2 uses a removable 5440 Disk Cartridge that provides virtually unlimited offline disk storage. 5440s must be ordered separately.

Cylinder Concept: The access mechanism with four vertically aligned heads gives access to the top and bottom tracks of both the removable 5440 and the 5022's non-removable disk for model 1 or model 2. With one positioning of the access mechanism, 12,288 sixteen-bit words are available.

The access mechanism on model 3 or model 4 with two vertical aligned heads gives access to the top and bottom tracks of the non-removable disk, providing 6,144 sixteen-bit words with one positioning of the access mechanism.

Formats: Each of the 200 customer usable cylinders, three alternate cylinders and one CE cylinder on each disk is composed of two tracks of 24 sectors each. Each sector provides a fixed length 128 word data field.

Housing: The 5022 can reside in an I/O module location in any of the 5026 enclosures. However, it is recommended that it be installed in the bottom module location for user accessibility ... see "Specify" [1] below.

Access Times: Minimum access time is 39 milliseconds, average is 269 milliseconds and maximum is 750 milliseconds for model 1 or model 3.

Minimum access time is 28 milliseconds, average is 126 milliseconds and maximum is 255 milliseconds for model 2 or model 4.

Data Transfer Rate: The disk rotates at 1500 rpm, yielding a data rate of 99,500 words per second and a rotational period of 40 milliseconds.

Prerequisites:

- (1) An available I/O module location in the 5026 Enclosure.
(2) Each 5022 mdl 1 or 2 requires a 5440 Disk Cartridge.
(3) Integral Power Supply (#4650) is required for:
a) Each additional 5022 after the first 5022 within a single 5026 Enclosure.
b) A 5022 installed in a 5026 mdl A2.

Configuration: Multiple 5022s may be installed on a single System/7. IBM supplied programming support for the Disk Cycle Steal (#2664) feature is mutually exclusive with Direct Program Control Disk support. Drives of both types are not supported on the same system. Multiple drives of either type are supported.

System/7 Summary: GA34-0002

1) For location of the 5022 Disk Storage Module, specify: #9143: - also enter the desired module location number, as shown under the 5026, in the quantity column of the order form. #9144 - for shipment without mounting in an enclosure (spare). Limitations: the following limitations apply to the location where a 5022 module can be installed in a 5026 Enclosure.

(a) A 5022 cannot be located in a top position of a 5026 (module locations 0, 3, 6 or 9).

(b) It is recommended that 5022s be located in the bottom position of a 5026 enclosure (module locations 2, 5, 8 or 11). Only when absolutely necessary should a 5022 be located in the middle position of a 5026 enclosure (module locations 1, 4, 7 or 10).

(c) Locating a 5022 mdl 3 or 4 in the bottom position of a 5026 enclosure in systems without Internal Air Isolation (#4621 or #4622) will increase its maximum allowable operating temperature from 90°F to 105°F.

(d) Housing a 5022 in a 5026 mdl D3 or D6 is not recommended due to the increased processor loading during data transfer.

2) Each 5022 mdl 1 or mdl 2 requires a 5440 Disk Cartridge which must be ordered separately.

3) Integral Power Supply (#4650) is required for: (1) installation of each additional 5022 after the first 5022 within a single 5026 Enclosure, or (2) a 5022 installed in a 5026 mdl A2 ... see "Special Features" below.

4) Power: Must be consistent with that of the 5026 Enclosure ... see voltage feature #s under "Specify" for the 5026.

Special Features

DISK CYCLE STEAL (#2664): Provides data transfers between the 5022 and main storage of a 5010 equipped with companion Cycle Steal Basic (#2662) feature. Limitation: One per 5022. Field Installation: Yes. Prerequisite: Cycle Steal Basic (#2662) on the 5010.

INTEGRAL POWER SUPPLY (#4650): Provides 24 volts power supply which is required for: (1) Installation of each additional 5022 after the first 5022 within a single 5026 Enclosure. and (2) Installation of 5022 on a 5026 Enclosure mdl A2. Field Installation: Yes.

Table with 4 columns: Special Feature Prices, Feature, MAC, Purchase MMMC. Rows include Disk Cycle Steal and Integral Power Supply.

Environment: The 5022 operates within the following temperature and humidity range.

Table with 2 columns: Parameter, Value. Rows include Temperature, Relative Humidity, and Max. Wet Bulb Temperature.



Non-operating Temperature 50-110°F
Non-operating Humidity 8-95%

*In systems without Air Isolation (#4621 or #4622 on 5026), the maximum operating temperature for a 5022 mdl 3 or 4 (fixed pack) is 105°F if the disk is located in the bottom position of a 5026 Enclosure (module locations 2, 5, 8 or 11).

5998-T01 3340 DIRECT ACCESS STORAGE FACILITY ATTACHMENT

Purpose: Provides a module with the basic control logic for attaching and controlling the 3340 Direct Access Storage Facility to the System/7.

Highlights: The 3340 used with the System/7 may consist of up to 8 drives. The prerequisite 3340-A02 contains two drives and a control unit. Up to three additional 3340 Model B units may be attached giving maximum configuration of 8 drives.

Allows the 3348 Data Module to be formatted to System/370 OS/VS and DOS/VS Standards. It also allows the S/7 programmer to access the 3348 Data Module as multiple 5022s and/or with a new direct access method.

Application programs using MSP/7 symbolic file support access methods can be converted by changing parameters in specification macros such as #DIT, #DISK, #CONF, etc., and recompiling using programming supplied with the hardware (PSH).

The 3340 is an initial program load device. The 3340 can be used as an auto restart device in conjunction with power fail detect., 5026 FC#5731.

Maximum: One 5998-T01 per System/7.

Prerequisite: 5010-E28 with Cycle Steal Basic FC#2662. If ordered for C03 Enclosure RPQ D08332 is required. 5028 required for each system.

Limitations: Limited to 5026 Model C03 equipped with 60 HZ high power RPQ D08332 or a 5026-C06. The 5998-T01 must be mounted in position 2 of the 5026. Power Loading characteristics influence the maximum configuration.

May not be installed in environments where airborne contaminants exist. Installation of the internal air isolation feature, FC#4621 is not permitted.

This RPQ restricts the S/7 to Class B environment:

Temperature 15.6 C to 32.2 C or 60 F to 90 F
Relative Humidity 8 to 80%
Non-Operating Temp 10 C to 43.3 C or 50 F to 110 F
Maximum Wet Bulb 22.8 C or 73.0 F

The following 3340 Features are not supported by this RPQ:

Remote Switch Attachment (#6148)
Rotational Position Sensing (#6201, 6202)
String Switch (#8150)

A 5022 module cannot be mounted in Position 1 of a 5026 Enclosure when a 5998-T01 is mounted in Position 2.

5998-T01 to be installed in Position 2 of 5026. Specify #9590 (System/7 Model E) on 3340 Model A02.

Power for 3340 must be consistent with that of 5026 Enclosure.



5024 I/O ATTACHMENT ENCLOSURE

Purpose: To provide line printing and/or card reading capability for System/7.

Model 1: Basic Enclosure with Line Printer.

Model 2: Basic Enclosure with 2502 Attachment.

Model 3: Expanded Enclosure with Line Printer and 2502 Attachment.

Highlights:

Enclosure: The 5024 I/O Attachment Enclosure is a data processing oriented addition to the System/7. The enclosure provides basic space, power and logic to attach a printer, a card reader, or both. If both a printer and a card reader are utilized, an enclosure expansion is provided. The 5024 attaches to any 5010 Processor Module Model E equipped with 5024 Attachment Feature (#4115). A fixed length cable is supplied with the 5024 (see *Physical Planning Manual* for further details).

5024 Attachment Feature (#4115) on 5010: Provides the interface between the 5010 model E and the 5024 and handles data transfers between 5010 model E storage and the 5024 on a cycle steal basis. Cycle Steal Basic (#2662) is required on the 5010 model E. If both a card reader and a printer are attached, operations may be interleaved but not overlapped. In the interleave mode of operation, performance of the devices will be less than the individual unit's rated speed of 300 cpm reading and 155 lpm printing. For more details see GA34-0002. Only one 5024 may be attached per 5010 model E. The 5024 attachment is mutually exclusive with IBM 1200 bps Integrated Modems (#5500, 5501) and S/360 and S/370 Channel Attachment (RPQ D08112). All systems planning to use any 5010 RPQ (except D08119, Sensor Based Control Adapter) together with Feature Code #4115 must resubmit the RPQ for evaluation before it is proposed to the customer.

PREREQUISITES: Cycle Steal Basic (#2662) and 5024 Attachment Feature (#4115) on a 5010 model E Processor. For 5024 model 2 or 3, a 2502 model A2 with specify features #9901 for 115 V AC, and #9046 for white color.

System/7 Summary: GA34-0002

[1] Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.

[2] Print Belt: Specify—#9490 for 96-character belt, #9491 for 64-character belt, or #9492 for 48-character belt. (48-character belt uses a character set with =, (and) rather than €, %, and, respectively.)

[3] FC9901 for 115V AC, 1-Phase, 60 cycle.

ACCESSORIES:

FORMS STANDS: Permits feed continuous forms from the carton and provides for forms stacking after printing. This accessory is a one-shelf forms stand.

TYPE FEATURE NO.

5024 4450

ADDITIONAL PRINT BELTS (5024): Permits the customer to print more than one character set for various applications. Can be interchangeably used with the belt provided with the machine.

MACHINE TYPE	BELT DESCRIPTION	FEATURE N
5024	48 Character	5552
5024	64 Character	5551
5024	96 Character	5550

Model Changes: Changes from Model 1 or 2 to Model 3 are field installable. No other model changes can be made.



5026 ENCLOSURE

Purpose: To provide housing and power for System/7 Processor and Input/Output Modules.

Model A2: 2 Position ... for a Processor Module and one I/O Module.

Model C3: 3 Position ... for a Processor Module and two I/O Modules.

Model C6: 6 Position ... for a Processor Module and five I/O Modules.

Model D3: 3 Position Extension ... 3 additional I/O Module locations with C3 or C6.

Model D6: 6 Position Extension ... 6 additional I/O Module locations with C3 or C6.

Model D3 or D6 is cable attached to model C3 or C6 and may be located up to 200 feet from the model C3 or C6.

Highlights: Provides housing for the Processor Module and all Input/Output Modules. Also included are the necessary power supplies (see RPQ D08331 for power restrictions on 3340 Attachment) and interface connections for all modules. The Processor Module must be located in the first module location of A2, C3 or C6 models. I/O Modules may be housed in any of the remaining module locations, except Module 5998-TO 1 must be located in module position 2 and if it is installed, a 5022 module may not be located in module position 1. The D3 or D6 model may be located up to 200 feet from the C3 or C6 model. An Internal Air Isolation feature (not available on model A2) seals the enclosure and prevents the outside air from entering into the enclosure. Internal air is filtered through an activated carbon filtration system. Heat within the enclosure is dissipated through an air-to-air heat exchanger. This feature allows the System/7 to be used in environments where airborne elements might harm the electronic circuitry. Since this feature is not available on model A2 enclosures, in environments where there is a possibility of existence of contaminants, a C3 or C6 model must be used.

An "Early Warning" corrosion detector card is installed as a standard item in every System/7 enclosure. This card is specifically designed to be sensitive to airborne contaminants. Inspection of this card gives an early warning so that appropriate action for protection of the system may be taken.

A Power Failure Detect feature (#5731) provides an early indication of imminent power failure so that the program can bring the system to an orderly halt. When power is restored, the auto restart function of the system can provide automatic program load from either the Operator Station or host teleprocessing link. The processor console switch must be appropriately set.

A thermal detector in the enclosure generates a warning interrupt if the internal temperature of the enclosure rises above a specified operating level. The thermal detector causes a power shutdown after the warning signal is generated. The time between the thermal interrupt and the power shutdown could be used by the program to cause an orderly halt of the operation.

Prerequisite: Models D3 and D6 require a Dx Enclosure Attachment (#3715) feature in models C3 and C6 enclosures.

Module Locations:

5026 - Module Location Chart

C3	C6	D3	D6
0	0 3	6	6 9
1	1 4	7	7 10
2	2 5	8	8 11

Front view

System/7 Summary: GA34-0002

1) Voltage (AC, 60 cycle):

#9902 for 208 V, 1-phase (mdls A2, C3, D3 only),

#9903 for 208 V, 3-phase (mdls C3, C6, D3, D6 only),

#9904 for 230 V, 1-phase (mdls A2, C3, D3 only),

#9905 for 230 V, 3-phase (mdls C3, C6, D3, D6 only).

Note: When options are available, use of 3-phase power is recommended. This would eliminate the need for rewiring for system expansion to models C6 or D6.

2) Power: Specify one—#9490 for 5010 A and B models ... #9491 for 5010 E models.

3) Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.

4) Storage Power Addition (#7401) required for systems with more than 8K of storage (5010 A and B models only) ... see "Special Features."

5) Proposal of all 5026 Enclosures must be in accordance with procedures outlined at the end of this section.

6) Kickstrips: #9431, if needed. When kickstrips are installed, the open area underneath the machine is enclosed. This may be inconvenient for the operator or for signal wiring. Use of kickstrips is recommended only when the physical appearance of the system is of prime importance.

Model Changes: Changes from C3 to C6 and from D3 to D6 are field installable. No other model changes can be made.

Special Features

Dx ENCLOSURE ATTACHMENT (#3715): [Mdl's C3 and C6 only] This feature provides for the connection of the Enclosure models D3 or D6 to Enclosure models C3 or C6. **Maximum:** One #3715 per system. **Field Installation:** Yes.

INTERNAL AIR ISOLATION 3 (#4621): (not with 5998-TO 1) [Mdl's C3 and D3 only] This feature seals the model C3 or D3 enclosures and provides an air-to-air heat exchanger for dissipation of the internal heat. An activated carbon filtration system filters the internal air. The feature isolates the inside air from the outside and is used in severe industrial environments where



gaseous contaminants harmful to electronic circuitry exist. **Limitations:** Proposals are not to recommend the IAI feature unless the FE Installation Planning Representative has determined that the feature is required, or the internal system detector indicates measures are necessary to protect an installed system. **Maximum:** One per C3 or D3 enclosure. **Field Installation:** Yes.

INTERNAL AIR ISOLATION 6 (#4622): (not with 5998-TO 1) [Mdl's C6 and D6 only] This feature is identical to #4621 and is provided for model C6 or D6 enclosures. **Maximum:** One per C6 or D6 enclosure. **Field Installation:** Yes.

POWER FAILURE DETECT (#5731): Provides a signal to the system when the input AC voltage falls below a safe level. This signal is used by the program to bring the system to an orderly halt. This feature also provides auto restart which can automatically restart system power when input AC power is restored. **Maximum:** One per enclosure. **Field Installation:** Yes.

STORAGE POWER ADDITION (#7401): [Mdl's A2, C3 and C6 only] Provides a power supply for the 5010 Processor Module models A and B only, with storage in excess of 8K words. **Maximum:** One per system. **Field Installation:** Yes.



5028 OPERATOR STATION

Purpose: To provide an operator and computer input/output device for System/7.

Highlights: The 5028 Operator Station provides a keyboard, printer, paper tape punch, and paper tape reader. It is attached via a multi-wire cable to a System/7 Processor Module. The printer, paper tape reader, and paper tape punch operate at a speed of 10 characters per second. Transmission code is 7 level ASCII, with the 8th level for "even parity." The paper tape reader and punch can also read and punch 8-bit binary code without parity. The recording tape is one inch wide and may be paper (Part No.s 304469 or 426362), or lubricated, non-metallic plastic. A printing line is 72 characters with 6 lines per inch. Only single part paper may be used for printing.

LOCAL REMOTE: Switches provide for offline and online operations. The 5028 is used for program loading, data input/output, and paper tape preparation.

The 5028 Operator Station must be available for system maintenance in all configurations. An Operator Station may be shared among several System/7s, except those with 5998-TO 1. The customer must attach the Operator Station to the system requiring maintenance prior to the arrival of a customer engineer. Delays due to the relocation of an Operator Station from one system to another may result in extended down time. Before ordering a system without an Operator Station, the customer must realize the above condition as well as the procedure for disconnecting an Operator Station which requires these steps: stop system; power off Operator Station; disconnect Operator Station; start system.

Prerequisite: 5010 Processor Module.

System/7 Summary: GA34-0002

Input Power: 115 V AC, 1-phase, 60 cycle.

Supplies: A black ribbon, IBM Part No. 1136260 or equivalent, is required.

Specify:

(1) Voltage: (AC 60Hz) #9901 115V, 1-phase.

**5029 MODEL 1 ATTACHMENT ACCESSORIES (Purchase Only) FOR SYSTEM/7**

Purpose: 5029 mdl 1 is an accessory control number used for ordering components and Termination Cards for connection of customer signal wires to the System/7 interface. 5029 is not a machine in itself; it is entered in the machine field. Specify 5029 in the machine field only once per system for all Termination Cards and components. Features on 5029 cannot be ordered. Accessories in the 5029 are for purchase only and no maintenance service is available. Normal parts warranty of 3 months applies to the accessories.

Highlights: 5029 Attachment Accessories provide a number of cards and components used for connection of customer signals to System/7 as well as conditioning and filtering of the signals. Standard circuits are offered for each type of sensor I/O point. Special circuits can be constructed by the customer on the Custom Cards. Termination Cards provide a screw-down terminal for connection of customer wires. This feature offers several advantages, such as (a) the customer can wire his signals to the cards prior to system arrival at the site, thereby reducing the installation time; (b) when a system is upgraded, rewiring is merely a matter of unplugging the cards from the old module and plugging them into the new module; (c) sensor-based points may be quickly disconnected for trouble shooting.

System/7 Summary: GA34-0002.

Accessories:

Table 1, below, shows a summary of the requirements for the Attachment Accessories.

AI Custom (#1110): This card contains screw terminals for customer connection of four analog input signals to Multiplexer/MR16 (#5247 in 5014), Multiplexer/MD16 (#5245 in 5014), Multiplexer/MR4 (#5246 in 5012), Multiplexer/MS16 (#5249 in 5014), or Multiplexer/MS4 (#5248 in 5012). Solder terminals are provided for the customer addition of networks to each point to complete the connection. This card should be used where the customer desires to construct analog input networks of his own design. **Limitation:** Use of this card can affect accuracy and repeatability of the analog to digital conversion of analog signals connected to it.

AI/MR Filter (#1113): This card contains filter circuits and screw terminals for customer connection of four analog input signals to Multiplexer/MR16 (#5247 in 5014), Multiplexer/MD16 (#5245 in 5014), or Multiplexer/MR4 (#5246 in 5012). Current resistors can be added to the terminals. No provision is made to add other components.

AI/MR RBT/Filter (#1114): This card contains one resistance bulb thermometer circuit plus three filter circuits for customer connection of three analog input signals to Multiplexer/MR16 (#5247 in 5014), Multiplexer/MD16 (#5245 in 5014), or Multiplexer/MR4 (#5246 in 5012). The resistance bulb thermometer circuit output can be used to calculate a reference junction temperature. Current resistors cannot be added to the terminals. No provision is made to add components. **Maximum:** 32 per Temperature Reference Attach. **Prerequisite:** Temperature Reference Attach (#7830 in 5012 or 5014).

AI/MS Connector (#1122): This card contains circuits and screw terminals for customer connection of four analog input signals to Multiplexer/MS16 (#5249 in 5014) or Multiplexer/MS4 (#5248 in 5012). No filter circuits are provided.

Current resistors can be added to the terminals. No provision is made to add other components. **Limitation:** Use of this card can affect accuracy and repeatability of the analog to digital conversion of analog signals connected to it.

AI/MS Non-Polarized Filter (#1121): This card contains filter circuits and screw terminals for customer connection of four analog input signals to Multiplexer/MS16 (#5249 in 5014) or Multiplexer/MS4 (#5248 in 5012). The filter circuit is a non-polarized network; can accept both positive and negative signals. Current resistors can be added to the terminals. No provision is made to add other components.

AI/MS Polarized Filter (#1124): This card is identical to the AI/MS Non-Polarized Filter (#1121), except the filter circuit is polarized; accepts only a single polarity signal.

AI/MS RBT/Non-Polarized Filter (#1123): This card contains one resistance bulb thermometer circuit plus three filter circuits for customer connection of three analog input signals to Multiplexer/MS16 (#5249 in 5014) or Multiplexer/MS4 (#5248 in 5012). The resistance bulb thermometer circuit output can be used to calculate a reference junction temperature. The filter circuit is a non-polarized network; can accept both positive and negative signals. Current resistors cannot be added to the terminals. No provision is made to add other components. **Maximum:** 32 per Temperature Reference Attach. **Prerequisite:** Temperature Reference Attach (#7830 in 5012 or 5014).

Capacitor Non-Polarized 10UF (#1570): A special capacitor used to construct the network on the AI/MS Non-Polarized Filter (#1121) termination card. This 10 microfarad, 5 volt, non-polarized capacitor has very low dielectric absorption, low leakage, and small physical size.

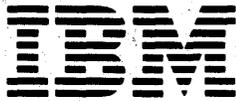
Connector, 3-Pin (#1240): This cable plug is used to connect the customer analog output signal wires to the analog output points on the 5012. One is required for each Analog Output Point (#1246 in 5012). Installation of wires on the connector is a customer responsibility.

Connector, 4-Pin (#8185): This plug is used to connect the 2790 loop transmission lines to the 2790 Control (#8195) in the 5012. One is required for the 2790 Control (#8195 in 5012). This plug is also used to connect to the external synchronization control on the 5012 and 5014. One is required for each 5014 and one for each 5012 with Analog Input Control MOD B (#1232) or Analog Input Control MOD C (#1213). Installation of wires on the connector is a customer responsibility.

Current Resistor 4-20 MA (#1670): This precision resistor can be connected across analog input terminals to act as a current shunt. It converts 4 to 20 milliamperes to 128 to 640 millivolts. **Limitation:** Cannot be used on analog input termination cards AI/MR RBT/Filter (#1114) or AI/MS RBT/Non-Polarized Filter (#1123).

Current Resistor 10-50 MA (#1671): This precision resistor can be connected across analog input terminals to act as a current shunt. It converts 10 to 50 milliamperes to 128 to 640 millivolts. **Limitation:** Cannot be used on analog input termination cards AI/MR RBT/Filter (#1114) or AI/MS RBT/Non-Polarized Filter (#1123).

DI Contact Sense (#3281): This card contains contact sensing circuits and screw terminals for customer connection of eight digital input signals to Digital Input Group (#3289 in 5012 or 5013) or Process Interrupt (#5710 in 5012 or 5013). One side of each contact sense point is connected to a common 48 volts DC



to provide contact sensing capability. No provision is made to add components.

DI Contact Sense Non-Isolated (#3280): This card contains contact sensing circuits and screw terminals for customer connection of eight digital input signals to Digital Input Non-Isolated (#3292) in the 5012 or 5013. One side of each contact sense point is connected to a common 48 volt DC to provide contact sensing capability. No provision is made to add components.

DI Custom (#3282): This card contains screw terminals for customer connection of eight digital input signals to Digital Input Group (#3289 in 5012 or 5013), Digital Input Non-Isolated (#3292 in 5012 or 5013), or Process Interrupt (#5710 in 5012 or 5013). Solder terminals are provided for the customer addition of networks to each point to complete the connection. This card should be used where the customer desires to use digital input networks of his own design.

DI Voltage Sense (#3283): This card contains circuits and screw terminals for customer connection of eight digital input signals to Digital Input Group (#3289 in 5012 or 5013) or Process Interrupt (#5710 in 5012 or 5013). No provision is made to add components on this card.

DO Connector (#3410): This card contains screw terminals for direct customer connection of eight digital output signals to DO Low Power Group (#3421 in 5012 or 5013), DO Medium Power Group (#3422 in 5012 or 5013), DO Medium Power Non-Isolated (#3424 in 5012 or 5013), or DO Contact Group (#3420 in 5012 or 5013). No provision is made to add components.

DO Custom (#3430): This card contains screw terminals for customer connection of eight digital output signals to DO Low Power Group (#3421 in 5012 or 5013) or DO Medium Power Group (#3422 in 5012 or 5013), DO Medium Power Non-Isolated (#3424 in 5012 or 5013), or DO Contact Group (#3420 in 5012 or 5013). Solder terminals are provided for the customer addition of networks to each point.

Voltage Check Card (#1184): This card provides seven voltage outputs of either polarity suitable for use as an analog input checking source. The card can be plugged into a specific socket and wired to one analog input point at a time to be used as a program addressable voltage check source. The following voltages are provided: 4 volts, 512 millivolts; 128 millivolts, 64 millivolts, 32 millivolts, 15 millivolts, and 5 millivolts.

Accessories

Accessory	Feature
AI Custom	#1110
AI/MR Filter	1113
AI/MR RBT/Filter	1114
AI/MS Connector	1122
AI/MS Non-Polarized Filter	1121
AI/MS Polarized Filter	1124
AI/MS RBT/Non-Polarized Filter	1123
Capacitor Non-Polarized 10 UF	1570
Connector, 3-Pin	1240
Connector, 4-Pin	8185
Current Resistor 4-20 MA	1670
Current Resistor 10-50 MA	1671
DI Contact Sense	3281
DI Contact Sense Non-Isolated	3280
DI Custom	3282
DI Voltage Sense	3283
DO Connector	3410
DO Custom	3430
Voltage Check Card	1184

TABLE 1

5029 ATTACHMENT ACCESSORIES FOR SYSTEM/7

Components Required to Connect to each Sensor Input/Output Feature

Components	Sensor Input/Output Features							2790 Control
	Analog Input (AI)	External Sync	Analog Output (AO)	Digital Input (DI)	Digital Output (DO)			
	Multiplexer/MR 4 Group Relay 4 Points per Group #5246 in 5012 mdf A1							
	Multiplexer/MD16 Group Relay 16 Points per Group #5245 in 5014 mdf D1, E1							
	Multiplexer/MR16 Group Relay 16 Points per Group #5247 in 5014 mdf B1, D1, E1, E2							
	Multiplexer/MS4 Group Solid State 4 Points per Group #5248 in 5012 mdf A1							
	Multiplexer/MS16 Group Solid State 16 Points per Group #5249 in 5014 mdf C1							
	External Synchronization Control for AI. Standard on: 5014 all Models 5012 with Analog Input							
	Analog Output Point 4 Point per Group #1246 in 5012 mdf A1							
	Digital Input Group (Isolated) 16 Points per Group #3289 in 5012 or 5013, mdf A1							
	Digital Input Group (Non-Isolated) 16 Points per Group #3292 in 5012 or 5013, mdf A1							
	Contact Output Group 16 Points per Group #3420 in 5012 or 5013, mdf A1							
	Medium Power Group (Isolated) 16 Points per Group #3422 in 5012 or 5013, mdf A1							
	Medium Power Group (Non-Isolated) 16 Points per Group #3424 in 5012 or 5013, mdf A1							
	Low Power Group 4 Points per Group #420 in 5012 or 5013, mdf A1							
	7900 Control System 4 Loops per System #8195 in 5012 or 5013, mdf A1							
Analog Input (AI) Termination Cards	AI/MR Filter (#1113)	1	4	4				
	AI/MR RBT/Filter (#1114)	1	4	4				
	AI Custom (#1110)	1	4	4	1	4		
	AI/MS Connector (#1122)				1	4		
	AI/MS Non-Polarized Filter (#1121)				1	4		
	AI/MS Polarized (#1124)				1	4		
	AI/MS RBT/Non-Polarized Filter (#1123)				1	4		
	Total - Maximum Cards per AI Group	1	4	4	1	4		
AI Current Resistors	Current Resistor 4-20 MA (#1670)	4	16	16	4	16		
	Current Resistor 10-50 MA (#1671)	4	16	16	4	16		
	Total Maximum Resistors per AI Group	4	16	16	4	16		
DI Termination Cards	DI Contact Sense (#3281)				2			
	DI Contact Sense Non-Isolated (#3280)				2			
	DI Voltage Sense (#3283)				2			
	DI Custom (#3282)				2	2		
	Total Maximum Cards per DI Group				2	2		
DO Termination Cards	DO Connector (#3410)					2	2	2
	DO Custom (#3430)					2	2	2
	Total Maximum Cards per DO Group					2	2	2
Connectors	Connector, 3 Pin (#1240)						1 per Point	
	Connector, 4 Pin (#8185)							1 per Loop

AI Voltage Check Card (#1184) is available to check AI - maximum, one per 5012 with #1213 or #1232; four per 5014. Capacitor Non-Polarized 10 UF (#1570) is available to construct custom networks.



IBM 5100 PORTABLE COMPUTER

Purpose: The IBM 5100 Portable Computer is a desk top, interactive computer designed primarily for the professional problem solver.

Model	Language	Main Storage (Bytes)
A1	APL	16,384
A2	APL	32,768
A3	APL	49,152
A4	APL	65,536
B1	BASIC	16,384
B2	BASIC	32,768
B3	BASIC	49,152
B4	BASIC	65,536
C1	APL and BASIC	16,384
C2	APL and BASIC	32,768
C3	APL and BASIC	49,152
C4	APL and BASIC	65,536

Model Upgrades: Field Installable.

Highlights:

- User-oriented, problem solving tool
- Built-in interactive language—APL or BASIC or both
- Easy-to-use keyboard for programs and data
- CRT display screen
- Tape cartridge for data and program storage
- Communications capability—2741 compatibility in start/stop mode
- Serial I/O Adapter—EIA Standard RS-232-C Interface

Features

Metal Oxide Semiconductor Field Effect Transistor (MOSFET) main storage ... 530 nanosecond main storage cycle time ... main storage available in 16, 32, 48 or 64K bytes (see note below) ... internal parity checking ... an adapter for black and white TV monitors ... portable ... threaded inserts on the bottom so that it can be secured to a table or desk ... all features and model upgrades are field installable. *Note:* The language interpreters utilize part of main storage which is not available to the user. With BASIC this amounts to 4,400 bytes and with APL 6,700 bytes.

Keyboard: Has familiar alphanumeric layout plus a numeric pad. Four arithmetic operator keys located to right of numeric pad provide a calculator function. Keypops indicate special characters for APL and/or BASIC, depending on model. The top row of typewriter keys provide 14 machine commands, when depressed with the COMMAND key. With a BASIC machine, the 10-key pad keys can be programmed by the user to perform special functions. These are activated by the COMMAND key. Also on a BASIC machine, frequently used BASIC statement keywords are printed on the front of the keys. The user may then enter a statement keyword, such as GOTO or PRINT, by pressing the COMMAND key with the appropriate word key. The primary purpose of the use of the COMMAND key in the above is to make it easier and faster to use the 5100.

Display Screen: Is used to display keyed input, provide user guidance and display output. Up to 1,024 characters can be displayed ... 16 lines of 64 characters each. Data is written at the bottom of the screen only, then scrolled up. User may select black characters on white background, or vice versa. Via switch, user may separate and display either left or right 32 positions of line, or all 64.

Tape Cartridge: Is a removable media for data and program storage. Provides up to 204K bytes on 300 feet of 1/4" tape. Tape speed is 40 inches/second yielding read rate of 2,850 bytes/second and write/check rate of 950 bytes/second.

Interactive Languages: Are implemented in three options within Read-Only Storage (ROS): APL, BASIC and a combined APL/BASIC. With a combination machine the language is selectable with a switch and a combined APL/BASIC keyboard is provided.

Accessories

Tape Cartridges: Tape cartridges for the IBM 5100 or 5106 are available in packages of five from the IBM IRD Branch Office.

Carrying Case: Soft, leather-like case provides environmental protection plus hand and shoulder straps to facilitate carrying. Order Feature Number 1501 on AAS.

Specify

There are no specify requirements. The machine comes with a 6 foot power cable. Voltage is 115V, AC, 1 Phase, 60 Hz, non-lock plug. Color is pebble gray. The modem cable for the communications feature and cables for the Serial I/O Interface feature are 6 feet.

Special Features

Expansion Feature (#1524): A prerequisite for attachment of the Communications Adapter (#1525) or the Serial I/O Adapter feature (#6301). **Maximum:** One. **Field Installation:** Yes.

Communications Adapter (#1525): Provides the IBM 5100 with the capability to appear as an IBM 2741 (using EBCD or correspondence notation) to a remote system. The customer may select either 134.5 bps or 300 bps start/stop transmission speeds, depending upon remote system. Operation will be over appropriate B1, B2, C1, C2 and D1 facilities. Line connection is through a customer-supplied modem.

The IBM 5100 is supported in stop/start mode connected to a System/370 via an Integrated Communications Adapter or a 3704/3705 Communications Controller with the Emulation Program (EP/VS) or the Network Control Program (NCP/VS). See M2700 pages for details concerning the facilities and prerequisites on these units.

When in communications mode the 5100 is supported as a 2741 by the following:

SCP	Options	TP Access Methods
OS/VS1		BTAM, TCAM or VTAM
OS/VS2	TSO	BTAM, TCAM or VTAM
DOS/VS		BTAM or VTAM
VM/370		

In the communications mode, the IBM 5100 keyboard will be used in the same way as a 2741 keyboard. Output will be displayed on the CRT and may be printed on the optional printer. The user may also transmit data stored on the tape cartridge to the remote computer, and receive data from the remote system on the cartridge.

While in the communications mode the IBM 5100 is a dedicated terminal device. Therefore, interaction with the APL or BASIC interpreters takes place only after the session is completed. **Maximum:** One. **Field Installation:** Yes.



Prerequisites: A customer-supplied modem meeting EIA RS-232C specifications and Expansion Feature (#1524).

Additional Communications Information

I. References

1. See M2700 pages for additional information concerning communication facilities, machine attachment requirements, operating capabilities and customer responsibilities.
2. Refer to the *IBM U.S. Data Communications Handbook*
3. Refer to *IBM 5100 Preinstallation Planning Guide*, GA21-9219, for physical installation requirements.

II. Notes

1. For questions regarding emulation of 2741 features and/or RPQs, contact your regional GSC. The functions of Receive Interrupt and Transmit Interrupt features on the 2741 are standard with the 5100 Communications Adapter, but require full-duplex modems.
2. A 6-foot modem cable is automatically provided with this feature.

III. Customer Responsibilities

1. The customer must be advised, in writing, of certain responsibilities related to the installation and maintenance of common carrier facilities/services as well as the IBM equipment. For further information see M2700 pages

External I/O Adapter (#3601): A prerequisite for attachment of either the 5103 Printer or 5106 Auxiliary Tape Unit. A single I/O port is available; when both devices are attached, the Printer is attached to the Auxiliary Tape Unit which is then attached to the IBM 5100. **Maximum:** One. **Field Installation:** Yes.

Serial I/O Adapter (#6301): Provides the IBM 5100 with the capability to attach any one of a variety of peripherals which satisfy EIA Standard RS-232-C specifications. The customer may select 5, 6, 7 or 8 bit code and data rates from 20 to 9600 bps (2400 maximum for 5 bit). Interaction with an attached device is through the APL or BASIC languages. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Expansion Feature (#1524).

Additional Serial I/O Adapter Information

I. References

Refer to the IBM 5100 Serial I/O Adapter Face Sheet—GA21-9241 for information concerning attachment requirements for the 5100 Serial I/O Adapter.

II. Customer Responsibilities

The customer must be advised, in writing, that he is responsible:

1. To attach a device which meets the defined EIA Standard RS-232-C specifications, interface type D.
2. To assure with the device manufacturer that time between data transfers is sufficient for his application.

3. For supporting his I/O device with APL or BASIC programs.

4. For determining program storage requirements.



5103 PRINTER

Purpose: Provides hard-copy output for the IBM 5100 and the IBM 5110 Computer System.

- Model 1 80 CPS Maximum Bidirectional Printer 5100 Portable Computer
- Model 2 120 CPS Maximum Bidirectional Printer 5100 Portable Computer
- Model 11 80 CPS Maximum Bidirectional Printer for use with the IBM 5110 Computer System
- Model 12 120 CPS Maximum Bidirectional Printer for use with the IBM 5110 Computer System

Specify

There are no specify features for the 5103 Printer. Power is supplied by a 6-foot cable. Voltage is 115V, AC, 1-Phase, 60 Hz, non-lock plug. Attachment to the Computer, Auxiliary Tape Unit, or 5114 Diskette Unit is via a 4-foot cable. The color is pebble gray for Models 1 and 2, and pearl white for Models 11 and 12.

Accessories

Forms Stand: Permits feed of continuous forms from the carton and provides for forms stacking after printing. This accessory is a one shelf forms stand.

Type	Feature
5103	4450

Model Change Considerations: The upgrade purchase price for model changes may be greater than the purchase price differentials. The customer should carefully evaluate his future requirements prior to purchasing a system.

Highlights: Prints serially in both left-to-right and right-to-left directions. The maximum print line is 132 print positions at 10 characters/inch. Line spacing is at six lines/inch. All APL and BASIC special characters can be printed.

The 5103 Models 11 and 12 allow the IBM 5110 System to overlap printing with processing functions. The Models 11 and 12 also support both upper and lower case character printing.

The 5103 is packaged in its own table-top covers, measuring 24" x 14 1/2" x 12" It weighs 55 pounds. The standard forms tractor allows multi-part, fan-folded paper. Overall forms width ranges from 3 1/2" to 15". Continuous forms fold-to-fold length may vary from 3" to 14". Up to six-part forms can be printed with a maximum thickness of .018". Five and six-part forms should be tried for satisfactory feeding, registration and print quality. Forms that exceed .018" thickness can create printer feeding registration and print quality problems. Card stock continuous forms are not recommended. Matrix characters are formed by 8 vertical wires printing dots in up to 4 of 7 possible horizontal positions. Refer to SRL GA24-3488 for forms design considerations and limitations.

Prerequisites: 5103 Models 1 and 2 only: External I/O Adapter (#3601) on IBM 5100.

5103 Model 2 only. EC 829572 on IBM 5100. IBM 5100's shipped after November 12, 1976 will incorporate EC 829572 while those shipped prior to the date must be field upgraded.

Supplies: A black ribbon, IBM part number 1136653



5106 AUXILIARY TAPE UNIT

Purpose: Provides a second tape cartridge I/O unit for the IBM 5100 Portable Computer and the IBM 5110 Computer.

Model 1 Attaches to IBM 5100 Portable Computer

Model 11 Attaches to IBM 5110 Computer, Model 1s

Model Upgrades: Field Installable

Highlights: Attractive for the user with extensive tape data storage requirements.

Housed in its own covers, the 5106 measures 12 1/4" x 10" x 7 1/4" and weighs 20 pounds. It's characteristics are the same as those of the inboard unit provided with the IBM 5100 and the IBM 5110. It is cable-connected to both the IBM 5100 and the IBM 5110.

Prerequisites: IBM 5100 requires External I/O Adapter (#3601). None for attachment to the IBM 5110.

Accessories

Tape Cartridges: A tape cartridge is required and is available in packages

Specify

There are no specify features for the 5106 Auxiliary Tape Unit.

Power is supplied by a 6-foot cable. Voltage is 115V, AC, 1-Phase, 60 Hz, non-lock plug. Attachment to the Portable Computer is via a 2-foot cable. The color is pebble gray for Model 1 and pearl white for Model 11.



IBM 5110 COMPUTER

Purpose: Designed to address a wide variety of commercial and problem solving applications in both the small and large business.

The IBM 5110 is offered in two Model Groups. Models A11 through C14 include a standard inboard tape cartridge unit and can also attach a 5106 Auxiliary Tape Cartridge Unit and the 5114 Diskette Unit. These are called the Model 1s. Models A21 through C24 do not include the inboard or auxiliary tape cartridge unit and are designed to attach the 5114 Diskette Unit as the storage media. These are called the Model 2s. All other IBM 5110 features pertain to all models within configuration constraints.

Models A21 through C24 can be field upgraded to Model 1s to provide for the inboard tape cartridge unit and the attachment of 5106 Auxiliary Tape Cartridge Unit.

Configuration Planning Guidelines

- Tape Media only System—Use IBM 5110 Model 1
• Diskette Media only System—Use IBM 5110 Model 2
• Tape and Diskette Media System—Use IBM 5110 Model 1

Table with 4 columns: Model, Language, Main Storage (Bytes), Inboard Tape. Rows include models A11 through C24 with their respective configurations.

Model Upgrades: Field Installable

Model Change Considerations

- 1. The upgrade purchase price for model changes may be greater than the purchase price differentials. The customer should carefully evaluate his future requirements prior to purchasing a system.
2. Replaced parts from any model change become the property of IBM.

Highlights

- User-oriented data processing
Built-in high level interactive languages—APL or BASIC or both
Easy-to-use keyboard for programs and data

CRT display screen

Optional communications adapters with Asynchronous or Binary Synchronous

Optional I/O adapters: either Serial via EIA standard RS-232-C, or Parallel Based on IEEE-488-1975

Optional Diskette Sort Feature

Optional Audible Alarm

Features

Metal Oxide Semiconductor Field Effect Transistor (MOSFET) main storage ... 530 nanosecond main storage cycle time ... main storage available in 16K 32K, 48K or 64K bytes (see note below) ... internal parity checking ... an adapter for black and white TV monitors ... portable ... threaded inserts on the bottom so that it can be secured to a table or desk ... all features and model upgrades are field installable.

Note: The language interpreters utilize part of main storage which is not available to the user. With BASIC this amounts to 4,624 bytes and 6,915 bytes with APL.

Keyboard: has familiar typewriter layout plus a numeric pad. Four arithmetic operator keys located to right of numeric pad provide a calculator function. Keytops indicate special characters for APL and/or BASIC, depending on model. The top row of typewriter keys provides 14 machine commands, when depressed with the COMMAND key. With a BASIC machine, the keys on the 10-key pad can be programmed by the user to perform special functions. These are activated by the COMMAND key. Frequently used APL and/or BASIC statements are printed on the front of the keys. The user may then enter a statement keyword, such as GOTO or PRINT, by pressing the COMMAND key and the appropriate word key. The primary purpose of the use of the COMMAND key is to make it easier and faster to use the IBM 5110.

Display Screen: is used to display keyed input, provide user guidance and display output. Up to 1,024 characters can be displayed ... 16 lines of 64-characters each. Under program control the user is permitted full screen management and display of upper/lower case characters. The user may select black characters on white background, or vice versa.

Tape Cartridge: is a removable media for data and program storage on the IBM 5110 Model 1s. Provides up to 204K bytes on 300 feet of 1/4 inch tape. Tape speed is 40 inches/second yielding read rate of 2,850 bytes/second and write/check rate of 950 bytes/second.

Interactive Languages: are implemented in three options within Read Only Storage (ROS): APL, BASIC and a combined APL/BASIC. With a combination machine the language is selectable with a switch and a combined APL/BASIC keyboard is provided.

Input/Output Operations: provide for update in place and Record I/O with tape and diskette.

Customer Support Functions: are distributed with the IBM 5110 on diskette or tape cartridge as appropriate. The functions provided include a relocatable loader, diskette initialize, diskette compress, tape-to-tape copy, tape-to-diskette copy, tape header recovery, tape data recovery, diskette-to-tape copy, diskette-to-diskette copy, diskette recovery, and label display.



Specify

The IBM 5110 comes with a 6 foot power cable. Voltage is 115V, AC, 1 Phase, 60 Hz, non-lock plug. Color is pearl white with raven black highlights. The modem cable for the Asynchronous Communications Feature and cables for the Serial I/O Feature are 6 feet.

IBM 5110 Configuration Considerations

Model 1

Most configurations of I/O and optional features are possible, but due to power and packaging considerations, some configurations are not available.

With the IBM 5110 Model 1s, only the following storage media configurations are possible:

1. One 5106 Auxiliary Tape Unit or
2. One 5105 Auxiliary Tape Unit and one 5114 Diskette Unit or
3. One or two 5114 Diskette Units

The IBM 5110 Model 2s can attach one or two 5114 Diskette Units as storage media and cannot attach the 5106 Auxiliary Tape Unit.

A maximum of two special features from the following list may be installed on any model of the IBM 5110:

- 1525 Asynchronous Communications Adapter
- 5825 Parallel I/O Adapter
- 6301 Serial I/O Adapter
- BSCA Modem attachment options—one of the following:

- 3701 EIA/CCITT Interface
- 5650 or 5651 DDS Adapter
- 5500 or 5501 1200 BPS Integrated Modems
- *5508 1200 BPS Integrated Modem (SNBU/AA)

*Note: If #5508 (SNBU/AA) is selected as the BSCA modem none of the other special features (#1525, #5825, or #6301) may be selected.

If BSCA (#2074) is used in conjunction with APL, a 32K minimum IBM 5110 is required.

In addition to the above considerations, when planning an IBM 5110 configuration for a Model 1 with BSCA (#2074) and without a 5114, the following chart must be used. *Valid configurations are those with options that do not exceed the maximum value of 18 for Model 1s, with BSCA (#2074) and without a 5114.*

	Options	Value
Memory	48K	4
	64K	8

I/O Devices

5103 Printer	7
5106 Auxiliary Tape Unit	4

Features

#1524 Expansion Feature	3
#5825 Parallel I/O Adapter Feature	2
#5650, 5651 Data-Phone* Digital Data Service Adapter	1
#3200 Diskette Sort/Feature	1

*Registered Trademark of the American Telephone & Telegraph Co.

Accessories

Tape Cartridges: Tape Cartridges for the IBM 5110 or 5106 are available in packages

Carrying Case: Soft, leather-like case provides environmental protection plus hand and shoulder straps to facilitate carrying.

Parallel I/O Cables: Cables to attach peripheral devices to the IBM 5110 computer via the Parallel I/O Adapter may be purchased from IBM or from a customer selected source ... **See *IBM 5110 General Information and Physical Planning Manual*, GA21-9300 for cable and connector specifications. (Note: Maximum interconnecting device cabling as specified in IEEE 488-1975 standard is 20 meters.)

Special Features

Expansion Features (#1524): A prerequisite for attachment of the Asynchronous Communications (#1525) or the Serial I/O Feature (#6301). **Maximum:** One. **Field Installation:** Yes.

Binary Synchronous Communications (#2074): In conjunction with APL or BASIC program control, this feature permits the IBM 5110 to function on a switched, leased or private communications line as a processor terminal emulating 3741 line protocol with:

A System/3 equipped with BSCA (#2074 or #2084) or BSCC (#2094)

A System/32 equipped with BSCA (#2074)

A System/34 equipped with Communications Adapter (#2500 or #3500)

An IBM 5110 equipped with BSCA (#2074)

A 3741 Model 2 or 4

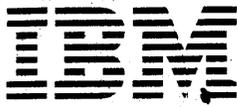
Or emulating 2770 line protocol with:

A System/370 (which is supported by OS/VS-1 or OS/VS-2 BTAM or TCAM; DOS/VS BTAM via an Integrated Communications Adapter, or a 3704/3705 Communications Controller with NCP or EP, any of which are equipped with a binary synchronous adapter and appropriate sub features).

This feature will operate with any of the above systems capable of communicating at the following nominal transmission rates on a point-to-point (non-switched) data link: 1200/600, 2000, 2400, 4800 BPS. See M2700 pages for information on communications facilities. The IBM 5110 may also operate as a tributary station residing on a multipoint (leased or private) communications line as a compatible member of the IBM family of BSC terminals in conjunction with a System/370 Models 115 through 195 control station at transmission rates of 1200 to 4800 BPS.

This feature will operate in half-duplex mode over dial (switched network) facilities, and in half-duplex mode over leased (or equivalent private) communications lines which may be half or full duplex facilities.

Operation of this feature on the IBM 5110 will be overlapped with printer operation at all rates including 4800 BPS.



BSC units at each termination of a data link to which the IBM 5110 is attached must be set to operate at the same transmission rate and to use the same transmission code.

This feature supports, as a basic capability, the transmission and reception of blocked records. Switched network versions include the support of Manual Dial and Manual or Auto Answer (where the attached modem supports this capability). The feature may be configured to operate with the EBCDIC transmission code or EBCDIC transparency code.

The Internal Clock will generate synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. The decision to use, or not use, the internal clock is made at Configuration time. When the internal clock is used, all other terminals attached to the same data link must also be equipped with similar internal clocking capability. Transmission rates of 600 or 1200 BPS are selectable at configuration time and initialization time.

One of the IBM modems, 3872 Model 1 (2400 BPS) or 3874 Model 1 (4800 BPS), may be attached to the BSCA (#2074) of the IBM 5110. For more information on the capabilities of these modems refer to M3872 and M3874 of the sales pages.

Additional Information

Communications facilities attachments for the IBM 5110 BSCA are designed to operate on transmission facilities such as:

1. Common Carrier leased telephone line services (voice grade).
 - a. AT & T or Western Union Class 3002 (to 600 BPS)
 - b. AT & T or Western Union Class 3002 with C1 conditioning (to 4800 BPS)
2. Private (customer owned) communications facilities equivalent to the above common carrier facilities.
3. Voice Grade (common carrier or private) lines supporting a 4800 BPS transmission rate. Channel requirements may vary according to the type of data set selected. The data set manufacturer should be consulted by the customer for this information.
4. Common carrier switched network telephone (Voice Grade) service at 600, 1200, 2400, or 4800 BPS.

Reference—See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities and customer responsibilities.

For speed selection when using the Data-Phone* Digital Service Adapter with BSCA, specify:

DDSA (#5650, 5651) transmission speed
#9822 for 2400 BPS

*Registered Trademark of the American Telephone & Telegraph Co.

Customer Responsibilities The customer must be advised that:

1. He is responsible for making arrangements for installation, pricing, charges if the data communication facility and attachment of selected data sets.
2. Toll charges, if required for installation and/or maintenance of BSCA, are to be paid by the customer.
3. The IBM marketing representatives must have the customer obtain a firm installation date for transmission services (including modems) before the order, BSCA (#2074), can be

confirmed. For further information refer to "Teleprocessing Systems" in the General Information section and M2700 pages.

Configuration options are as follows:

Leased point-to-point, Switched point-to-point, multipoint
Internal clock, modem clock
Integrated Modem, Data-Phone* Digital Service Adapter, EIA (Electronic Industries Assn) RS-232-C, and CCITT, V.24 and V.28 interface

Full speed, half speed line rate
Full-duplex, Half-duplex
Use Switched Network Backup (SNBU), no SNBU
Use 202 mode—Yes/No
Use Auto Answer—Yes/No
Transparent Mode—Yes/No
Error Threshold (1:8, 1:4, 1:2, 1:1, 2:1, 4:1, 8:1)
Transmit/Receive
Protocol Emulation 2770/3741
Blank Truncation—Yes/No
ENQ maximum count
NAK maximum count
IBM 5110 Inactive timer
Line Hold Timer (default 20 seconds)
Record Length
Poll ID
Select ID
Local ID
Remote ID
Space Compression Expansion—Yes/No
Punch Device Number (DC1/DC2/DC3)
Read/Write with Hold—Yes/No
Connect dataset to line—Yes/No
Send answer tone—Yes/No
Online Test—Yes/No
Calling Station—Yes/No
Write Unblocked—Yes/No

Modem and Data Set interfaces to the BSCA (#2074) feature are:

Facility	Speed	Type of Service	Type of Modem
C4	1200/600	Switched	Integrated
C4M	1200/600	Switched	Stand Alone
C5	2400	Switched	IBM 3872
C5M	2000/2400	Switched	Stand Alone
C6	4800	Switched	IBM 3874
C6M	4800	Switched	Stand Alone
D3	1200/600	Non-switched	Integrated
D3M	1200/600	Non-switched	Stand Alone
D4	2400	Non-switched	IBM 3872
D4M	2000/2400	Non-switched	Stand Alone
D4SB	2400/1200	Non-switched	IBM 3872
D5	4800	Non-switched	IBM 3874
D5M	4800	Non-switched	Stand Alone
D5SB	4800/2400	Non-switched	IBM 3874
X1M	2400	Private	Stand Alone
X2M	4800	Private	Stand Alone

In addition to the basic functions of Binary Synchronous Communications, one of the following special features must be added: Integrated Modem (1200/600 BPS), EIA/CCITT Interfaces or Data-Phone* Digital Service Adapter (DDSA).

*Registered Trademark of the American Telephone & Telegraph Co.



A modem for BSC data transmission at 1200 or 600 BPS over non-switched or switched network facilities is available as follows:

IBM 1200 BPS Integrated Modem (#5500): A modem for BSC data transmission at 1200 BPS over non-switched facilities. Half-speed operation at 600 BPS is possible by a systems configuration parameter and can be initiated by the initialization command of the APL or BASIC language program.

Attachment to the non-switched (2- or 4-wire) Facility D3 is via an IBM provided cable directly to the line. **Specify:** #9402 for 2-wire, #9404 for 4-wire. **Prerequisite:** BSCA (#2074). **Limitation:** Cannot be installed with EIA/CCITT Interface (#3701) Data-Phone* Digital Service Adapter (DDSA) (#5650, 5651) or Integrated Modem (#5501, 5508). **Maximum:** One. **Field Installation:** Yes.

*Registered Trademark of the American Telephone & Telegraph Co.

1200 BPS Integrated Modem (#5501): A modem for BSC data transmission at 1200 BPS over switched facilities. Half-speed operation at 600 BPS is possible by a systems configuration parameter and can be initiated by the initialization command of the APL or BASIC language program.

Attachment to the switched C4 facility is via an IBM provided cable directly to the line. **Prerequisite:** BSCA (#2074). **Limitation:** Cannot be installed with EIA/CCITT Interface (#3701) or Data-Phone* Digital Service Adapter (DDSA) (#5650, 5651) or Integrated Modem (#5500, 5508). **Maximum:** One. **Field Installation:** Yes.

*Registered Trademark of the American Telephone & Telegraph Co.

1200 BPS Integrated Modem, Switched Network Backup with Auto Answer (SNBU/AA) (#5508): Provides for backup attachment of the IBM 5110 to the switched network when the primary facility is non-switched.

Communication can be with another IBM 1200 BPS Integrated Modem when it is equipped with the switched network capability. Selection of the primary or backup facility is via the systems configuration parameters and can be changed by the initialization command of the APL or BASIC language program. The capability exists to automatically answer incoming calls when attached to a common carrier arrangement type CBS or equivalent. Operator intervention, program modification or both may be required on the using system/terminal.

This feature can be used with BTAM programs for DOS/VS, OS/VS-1 and OS/VS-2. In certain configurations it can be used with TCAM under OS/VS-1 and OS/VS-2.

Additional customer program routines will be required in existing BTAM programming to fully utilize the capabilities of the Switched Network Backup feature.

Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with the IBM 5110 must also be equipped with an integrated modem capable of operating at the same speed as this modem.

Attachment to the non-switched (2- or 4-wire) facilities is via an IBM provided cable directly to the line, Type 3002. **Specify:** #9402 for 2-wire, #9404 for 4-wire. **Prerequisite:** BSCA (#2074). **Limitations:** Cannot be installed with EIA/CCITT Interface Feature (#3701), Data-Phone* Digital Service Adap-

ter (DDSA) feature (#5650, 5651) or Integrated Modem (#5500, 5501). **Maximum:** One. **Field Installation:** Yes.

*Registered Trademark of the American Telephone & Telegraph Co.

EIA/CCITT Interface (#3701): Provides a cable and interface for the attachment of an IBM or non-IBM modem meeting RS-232-C characteristics. Non-IBM modems may be attached subject to the multiple suppliers system policy. **Limitation:** Cannot be installed with 1200 BPS Integrated Modem (#5500, 5501, 5508) or DDSA (#5650, 5651). **Field Installation:** Yes. **Maximum:** One. **Prerequisite:** BSCA (#2074).

Data-Phone* Digital Services Adapter—DDSA (#5650, 5651): An integrated adapter for data transmission at speeds of 2400 or 4800 BPS over the AT&T non-switched Data-Phone* Digital Service network. The DDSA interfaces to a DDS channel service unit, the customer site termination of the DDS network.

Attachment to the above service is via an IBM provided cable. **Specify:** #5650 for point-to-point, #5651 for multipoint tributary. **Prerequisite:** BSCA (#2074). **Limitations:** Cannot be installed with EIA/CCITT Interface (#3701) or 1200 BPS Integrated Modem (#5500, 5501, 5508). **Maximum:** One. **Field Installation:** Yes.

*Registered Trademark of the American Telephone & Telegraph Co.

Asynchronous Communications (#1525): Provides the IBM 5110 with the capability to appear as an IBM 2741 (using EBCD or Correspondence notation) to a remote system. The customer may select 134.5 bps or 300 bps start/stop transmission speeds, depending upon remote system. Operation will be over appropriate B1, B2, C1, C2 and D1 facilities. Line connection is through a customer supplied modem.

The IBM 5110 is supported in stop/start mode connected to a System/370 via an Integrated Communications Adapter or a 3704/3705 Communications Controller with the Emulation Program (EP/VS) or the Network Control Program (NCP/VS). See M2700 pages for details concerning the facilities and prerequisites on these units.

When in asynchronous communications mode the IBM 5110 is supported as a 2741 by the following:

SCP	Options	TP Access Methods
OS/VS1		BTAM, TCAM or VTAM
OS/VS2	TSO (via TCAM)	BTAM, TCAM or VTAM
DOS/VS		VTAM
VM/370		

In the asynchronous communications mode, the IBM 5110 keyboard will be used in the same way as a 2741 keyboard. Output will be displayed on the CRT and may be printed on the optional printer. The user may also use the tape cartridge or diskette to transmit and receive data from the remote system.

While in the asynchronous communications mode the IBM 5110 is a dedicated terminal device. Therefore, interaction with the APL or BASIC interpreters takes place only after the session is completed. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** A customer supplied modem meeting EIA RS-232-C specifications and Expansion Feature (#1524).

**Additional Communications Information****I. References**

1. See M2700 pages for additional information concerning communication facilities, machine attachment requirements, operating capabilities and customer responsibilities.
2. Refer to the *IBM Data Communications Handbook*
3. Refer to *IBM 5110 General Information and Physical Planning Manual*, GA21-9300, for physical installation requirements.

II. Notes

1. For questions regarding emulation of 2741 features and/or RPQs, contact your regional GSC. The functions of Receive Interrupt and Transmit Interrupt features on the 2741 are standard with the IBM 5110 Communications Feature, but require full-duplex modems. (OS/V5 BTAM does not support the transmit interrupt feature)
2. A 6-foot modem cable is automatically provided with this feature.

III. Customer Responsibilities

1. The customer must be advised, in writing, of certain responsibilities related to the installation and maintenance of common carrier facilities/services as well as the IBM equipment. For further information see M2700 pages and "Teleprocessing Systems" in the General Information section

Parallel I/O Adapter (#5825): Based on IEEE Standard 488-1975 (Dated April 4, 1975), the IBM Parallel I/O Adapter provides the capability to attach up to 14 IEEE 488-1975 compatible devices (such as laboratory instruments, plotters, and printers) to the IBM 5110, with the 5110 acting as the sole controller in the network. The Parallel I/O Adapter is operated directly from the APL or BASIC languages with device dependent message exchange in either 8-bit binary or 7-bit ASCII code. All interface messages are encoded according to the IEEE 488-1975 specification. Interface address assignment and management is the responsibility of the user. **Maximum:** One. **Field Installation:** Yes.

Serial I/O Feature (#6301): Provides the IBM 5110 with the capability to attach any one of a variety of peripherals which satisfy EIA Standard RS-232-C specifications. The customer may select 5-, 6-, 7-, or 8-bit code and data rates from 20 to 9600 bps (2400 maximum for 5-bit). Interaction with an attached device is through the APL or BASIC languages. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Expansion Feature (#1524).

Additional Information for Serial I/O and Parallel I/O Features**I. References**

Refer to the *IBM 5110 General Information Manual and Physical Planning Manual*, GA21-9300 for information concerning attachment requirements for the 5110 Parallel I/O

and Serial I/O Adapters.

II. Customer Responsibilities

The customer must be advised, in writing, that he is responsible:

1. For attaching a device which meets the defined EIA Standard RS-232-C specifications (interface type D) for Serial I/O, or IEEE Standard 488-1975 for Parallel I/O.
2. For assuring with the device manufacturer that time between data transfers is sufficient for his application.
3. For supporting his I/O device with APL or BASIC programs.
4. For determining program storage requirements.

Diskette Sort Feature (#3200): Provides the IBM 5110 user with the ability to sort diskette data files. Both full record sorts and address out (ADDROUT) sorts are possible. The sort resides in ROS can be initiated through the system language or the keyboard.

Audible Alarm (#1250): The audible alarm is provided to signal system attention required and, under program control, operator messages like "end of job."

Channel Terminator (#1600): Required when an IBM 5110 Model 1 or 2 is used with either or both the Auxiliary tape (#5106) or the diskette unit (#5114) and a printer (#5103) is not attached. It logically and physically provides the load terminator to the channel.



5114 DISKETTE UNIT

Purpose: Provides diskette attachment to the IBM 5110 computer.

Highlights

- 1.2 to 2.4 Megabyte Storage Capacity
- Direct Access capability
- Multiple Open files (maximum of 10)
- Media exchange capability with other diskette devices that conform to basic interchange conventions
- Self-contained floor standing unit
- Average access .243 seconds (25 tracks, including latency, excluding head load)

Housed in its own covers, the 5114 measures 17 3/4" x 22 1/4" x 29" and weighs from 120 to 136 pounds. Diskette types 1, 2 and 2D can be initialized and used to READ/WRITE data and to LOAD/SAVE programs and data. Rotational speed is 360 RPM yielding: (in 1,000 Bytes/Second).

Diskette Type	Maximum Capacity	Data Transfer	Read	Write & Verify
1	303	31.3	24	9.5
2	606	31.3	24	9.5
2D	1,212	62.5	48	18.9

One diskette drive is standard. A second drive is optional. A maximum of two 5114s is possible on the IBM 5110 Computer.

Features

Second diskette drive (#3240) provides for up to twice the capacity in single 5114 Diskette Unit. The second drive can be used for increased capacity and backup requirements.

**5203 PRINTER**

Purpose: Printed output for a System/3 Model 8, 10 or 12 or System/370 Model 115.

Models: Model 1 and 2 for use with System/3 Model 8, 10 or 12 only. Model 3 for use with System/3 Model 8, 10 or 12 or System/370, Model 115.

Model 1 100 lpm rated speed with a 48 character set.

Model 2 200 lpm rated speed with a 48 character set

Model 3 300 lpm rated speed with a 48 character set

Model Changes: Can be made in the field.

Highlights: The standard unit has 96 print positions ... can be expanded to 120 or 132 positions. See "Special Features." Vertical spacing is 6 or 8 lines/inch, under operator control. Horizontal spacing is 10 characters to the inch.

One interchangeable chain cartridge is supplied with the 5203 Models 1 and 2 ... see "Specify." One interchangeable chain cartridge is supplied with the 5203 Model 3 ... see "Specify."

When Universal Character Set Control (#9848) is installed on the Processing Unit (#8642 on 5408 or 5410 or 5412 ... #9848 on 3115), and the 5203 is equipped with Universal Character Set Attachment (#8639), interchangeable chain cartridges containing character sets with from 49 to 120 characters can be used. Use of such character sets may result in reduced throughput, depending upon the character set being used and the text being printed. See 5203 Printer in "Type Catalog" for details.

Vertical forms control (spacing and shipping) is provided by the 5408 or 5410 or 5412 and the stored program. Printed format is controlled by the stored program. Continuous marginally punched forms are fed by a forms tractor. Maximum forms dimensions are 16-3/4" wide and 14" long (edge-to-edge). Minimum forms dimensions are 3-7/8" wide and 3" long (edge-to-edge). Paper eject speed is 16.67"/second at 6 lines/inch ... 12"/second at 8 lines/inch. A Dual Feed Carriage is available ... see "Special Features."

Limitations

1. Only marginally punched, pin fed, continuous forms can be used on the 5203. No staples are permitted in the print chain area.
2. No representations or commitments as to readability of 5203 printing by optical character recognition equipment shall be made.
3. Print quality and forms feeding varies with paper specifications, ribbon and number of copies. Multiple copy forms of more than four parts and forms with a first part heavier than 13-pounds should be tested under operating conditions to determine that results are satisfactory for the user's application.
4. Forms sets which gave satisfactory results on 5203 Models 1 and 2 may show a decrease in print quality when used on a 5203 Model 3.

Maximum: Only one 5203 can be attached to a System/3 Model 8, 10 or 12 or System/370 Model 115.

For a System/3 Model 8 The 5203 Printer Base Attachment (#3960) with the appropriate 5203 Printer Speed Attachment

on the 5408 Processing Unit ... #3970 for a 5203 Model 1 or Model 2 ... #3972 for a 5203 Model 3.

For a System/3 Model 10 An appropriate 5203 Printer Attachment on the 5410 Processing Unit ... #3970 for a 5203 Model 1 ... #3971 for a 5203 Model 2 ... #3972 for a 5203 Model 3.

For a System/3 Model 12 The 5203 Printer Base Attachment (#3960) with the appropriate 5203 Printer Speed Attachment on the 5412 Processing Unit ... #3970 for a 5203 Model 1 or Model 2 ... #3972 for a 5203 Model 3.

Bibliography: System/3 Model 8, 10, or 12—GC20-8080.
Metering: I/O Unit (Online).

Specify

1. Voltage (AC, 3-phase, 60Hz): #9903 for 208 V or #9905 for 230 V ... must be consistent with system voltage.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white ... must be consistent with 5408 or 5410 color.
3. Print Chain or Twin Arrangement: See 5203 Printer in "Type Catalog" for arrangements and required feature #s.
4. System Attachment Adapter: (Model 1, 2, 3) #9221 for attachment to System/3 Model 8, #9222 for attachment to System/3 model 10, #9224 for attachment to System/3 model 12, or (Model 3 only).

Special Features

Dual Feed Carriage (#3475): In addition to standard carriage. Allows two sets of forms, non-overlapped, to be printed simultaneously, each independently controlled. The number of horizontal printing positions is reduced by 17. Both forms tractors are independently controlled by the stored program.
Limitation: Not available on the System/370 model 115.
Prerequisite: Dual Feed Carriage Control (#3480) on the 5408, 5410 or 5412.

Interchangeable Chain Cartridge, Additional (#4730): (Models 1 and 2 only) An additional operator changeable chain cartridge containing from 48 to 120 different characters. See "Type Catalog" for feature numbers of available arrangements.
Prerequisites: If any character set containing more than 48 different characters is to be used, Universal Character Set Attachment (#8639) is required on the 5203 and Universal Character Set Control (#8642) is required on the 5408, 5410 or 5412.

Interchangeable Chain Cartridge, Additional (#4740): (5203 model 3 only) An additional operator changeable chain cartridge containing from 48 to 120 different characters. See "Type Catalog" for feature numbers of available arrangements.
Prerequisites: If any character set containing more than 48 different characters is to be used, Universal Character Set Attachment (#8639) is required on the 5203. In addition, Universal Character Set Control (#8642) is required on the 5408, 5410, or 5412 ... #9848 is required on 3115.

Print Positions, 24 Additional (#5558): Increases the number of print positions from 96 to 120. **Prerequisite:** 120 Print Position Attachment (#9495) on the 5408, 5410 or 5412 ... see "Specify" under 5408, 5410, or 5412.

Print Positions, 12 Additional (#5559): [For field installation only ... for plant installation of 132 print positions, order #5560 below.] Increases the number of print positions from 120 to 132. **Prerequisites:** Print Positions, 24 Add'l (#5558) on the



5203 ... 132 Print Position Attachment (#9496) on the 5410 ... see "Specify" under 5408, 5410 or 5412.

Print Positions, 36 Additional (#5560): Increases the number of print positions from 96 to 132. **Prerequisite:** 132 Print Position Attachment (#9496) on the 5408, 5410 or 5412 ... see "Specify" under 5408, 5410 or 5412.

Universal Character Set Attachment (#8639): Required if any Interchangeable Chain Cartridge or Interchangeable Train Cartridge with more than 48 different characters is to be used. See 5203 Printer in "Type Catalog" for details. **Prerequisite:** Universal Character Set Control (#8642) on the 5408, 5410 or 5412.



5211 PRINTER

Purpose: Printed output unit for System/34 and System/38.

Model	Description	Speed (LPM)
1 Stand-alone	(S/34 only)	160
2 Stand-alone	(S/34 and S/38)	300

Nominal rated speeds are based on 48-character set. Specialized accessory belts allowing increased speeds are available. See Highlights below:

Model Changes: Field Installable.

Highlights: A universal character set buffer of 192 positions. The 5211 Attachment allows the use of graphic sets of up to 192 characters. Print speeds vary depending on character set size and frequency of character repetition on the belt. General purpose belts of 48, 64, and 96 characters are available with the following rated speeds:

	Model 1	Model 2
48 character set	160 lpm	300 lpm
64 character set	123 lpm	235 lpm
96 character set	84 lpm	164 lpm

Specialized print belts which can provide greater speeds up to 225 lpm for Model 1 and up to 395 lpm for Model 2, for numeric printing, are available as accessories. (See 5211 in Type Catalog Section). 132 print positions are standard. Horizontal spacing is 10-character per inch. Vertical spacing is 6 or 8 lines per inch under operator control (S/34) and CL control (S/38). Continuous marginally punched forms from 89mm (3 1/2") to 387mm (15 1/4") in overall width are fed by an automatic carriage. Forms skipping and spacing are program controlled. The carriage is a single speed unit allowing skipping up to 20 inches per second. Continuous forms are fed by a forms tractor. See Forms Design Reference Guide for Printers, for forms design considerations.

OCR capability is provided for the Model 2 only. 48-character print belts containing numeric A or B-font (13 characters) are available as accessories. The Model 2 can prepare OCR documents on 20 to 24 lb. (75-90 gram/m²) OCR bond single-part paper, using an OCR ribbon, that can be read by the IBM 3886 Optical Character Reader with feature code 9701 compatibility requiring one rescan. No representation or commitment as to readability of 5211 Model 2 printing by Optical Character Recognition equipment other than IBM 3886 Reader with feature code 9701 shall be made.

The translation capability within the 5211 Attachment Feature (#5810) on the 5340 provides for character substitution when using a print belt which does not contain all the characters in the printer data stream.

Limitations: (1) Only pin fed, continuous forms can be used. (2) Both edges of the forms must be fastened in the forms tractors. (3) No staples are permitted in the areas exposed to the interchangeable print belt. (4) Printer operation and print quality vary with paper and number of copies. Form sets of more than four parts should be tested in operating conditions to verify that results are satisfactory. (5) Due to the complexity of certain characters on the 188-character Multinational print belt, all multiple part forms should be tested in operating conditions to ensure results are satisfactory.

Maximum: Only one 5211 Printer Model 1 or 2 may be attached to a System/34. Two 5211-2 printers may be attached to System/38.

Prerequisites: A 5211 Attachment (#5810) on the 5340 System Unit. Specify #9301 or #9302 on 5340. See 5340 "Specify." OCR print available only with 5211-2 machines with serial numbers above 51200. A 5211 Attachment feature on the 5381 System Unit (#1100 for the first 5211 Attachment; #1110 for the second 5211 Attachment). See 5381 special features.

Specify

1. Voltage (AC, 1-Phase, 3-Wire, 60 Hz): #9902 for 208V, or #9904 for 230V.
2. Color: One color accent panel must be specified. #9060 for Willow Green, #9061 for Garnet Rose, #9062 for Sunrise Yellow, #9063 for Classic Blue, #9064 for Charcoal Brown, #9065 for Pebble Gray (System/38 only), RPQ #GK1755 for Pearl White. Printer background color is Pearl White.
3. Interchangeable Print Belt: (Available at time of manufacture only). See "Type Catalog" for print belt arrays. When ordering, indicate one specify code for character set and one specify code for character height. When printing 8 lpi, .079" character height is recommended.
4. System Attachment: For System/38 Attachment #9010 (Model 2 only).

Specify Code

	Models
	1,2
48 Character EBCDIC	9497
48 Character FORTRAN **	9492
60 Character S/38 Special	9509
64 Character EBCDIC	9498
64 Character ASCII	9496
64 Multinational*	9505
96 Character EBCDIC*	9501
96 Character ASCII*	9502
96 Multinational*	9504
188 Multinational*	9503

The 60 character System/38 special belt is a specially designed belt which will enable the user to print the System/38 Control Language characters.

*Available only with .095" character height. (#9950)

**System/34 only

Character Set Height	Specify Code
.079 inches	#9951
.095 inches	#9950

If Spanish N printing capability is desired on the print belt provided with the 5211, order Specify Code #2961 plus two additional Specify Codes selected from the following offerings of character set size and height:

Character Set Size	Character Set Height
48 #2767	.095" #9950
64 #2768	.079" #9951
96* #2770	

*Available only with .095" character set height.

Only one "Specify" print belt may be ordered with each 5211.

Supplies: (1) A black ribbon, part number 1299115, or equivalent, is required. For OCR applications, an OCR ribbon, part number 1299243, or equivalent, is required.



Accessories: Additional print belts permit the customer to print more than one character set for various applications. Can be interchangeably used with the belt provided with the machine. See "Type Catalog" for print belt arrays.

Feature Number	Model
	1,2
38 Character	5915
42 Character Numeric	5916
48 Character	5911
48 Character FORTRAN**	5552
48 Character OCR A	5919 (Mdl 2
48 Character OCR B	5920 only)
60 Character S/38 Special	5956
64 Character EBCDIC	5910
64 Character ASCII	5912
64 Multinational*	5925
96 Character EBCDIC*	5917
96 Character ASCII*	5918
96 Multinational*	5924
188 Multinational*	5923

The 60 character System/38 special belt is a specially designed belt which will enable the user to print the System/38 Control Language characters.

* Available only with .095" character height (#5950).

** System/34 only

Note: Accessory feature numbers 5910, 5911, and 5912 are the same as System/32 accessory belts 5910, 5911, and 5912, respectively.

Character Set Height	Feature Number
.079 inches	5951
.095 inches	5950

For Spanish N printing capability on an additional 5211 print belt, order FC #2761 **plus two** additional feature codes selected from the following offerings of character set size and height:

Character Set Size	Character Set Height
48 #2867	.095" #5950
64 #2868	.079" #5951
96* #2870	

*Available only with .095" character set height.

Prices: See Price List.



5213 PRINTER

Purpose: Printer for System/3 model 4 (5213 model 3 only), or System/3 model 6, or optional console printer for System/370 model 115 or 125 (5213 model 1 only).

Model 1 Has a pin feed platen.

Model 2 Has vertical forms control.

Model 3 Has vertical forms control and bi-directional print.

Model Changes: Model 1 to model 2 or 3: Requires a capacity replacement of machine. Model 2 to model 3: Field installable: Yes.

Highlights: Prints serially at a rate of 85 cps, 115 cps nominal when controlled by 5213 model 3 Enhanced Print Rate Attachment (#3960). The maximum print line is 132 positions at 10 characters/inch spacing. Line spacing is 6 lines/inch. Electronic tab is provided under program control. EBCDIC coded matrix characters are formed by 7 vertical wires, each printing a dot in up to 4 of 7 possible horizontal positions. The 26 letters and 10 digits can be printed; the following special characters can also be printed:

& @ # ? ¢ \$ % . , ; : ' () _ + - * / † = ≠ < > | ~

Use of the underscore in conjunction with another character will overprint the lowest matrix dot forming that character and is not recommended. Refer to SRL GA24-3488 for form design considerations and limitations.

Three models of the 5213 are available:

Model 1: Has a pin feed platen, which feeds marginally-punched continuous forms 13-7/8" wide (hole-to-hole), provides single space forms indexing under program control, and has high speed tab left. Up to 6-part forms can be printed, with a maximum thickness of .018" (for optimum feeding and stacking, no more than 3 parts are recommended). Forms length can be 3" to 14" in increments of 1/6". Card stock continuous forms are not recommended. An optional forms stand stacker is available ... see "Special Features."

Model 2: Has a tapeless, vertical forms control tractor. Space suppress, single, double, or triple space, and skip are controlled by the program and attachment. High speed tab left is provided. The maximum overall form width is 14-7/8", minimum is 3". Forms length can be 3" to 14". Up to 6-part forms, with maximum thickness of .025" can be accommodated. A forms rack that provides for continuous forms stacking after printing is standard.

Model 3: Has the same characteristics as Model 2, with the addition of bi-directional print and high speed tab left and right. Bi-directional print increases throughput by eliminating the carrier return. It allows printing with the print element moving either left-to-right or right-to-left.

Performance Considerations: An analysis of each document type to be printed is necessary to find actual throughput of a serial printer. When used for dedicated printing jobs, throughput depends upon the ratio (R) of lines printed per page to the maximum number of lines available per page and upon the number of character positions (C) in the printed line. Lines printed per minute (LPM) can be approximated using formulas:

For Model 1 LPM = 2700 R / (RC + 5) where C is average number of character positions

For Model 2 LPM = 2700 R / (RC + 1) where C is average number of character positions

For Model 3 LPM = 4500 R / (RC + 5) where C is maximum number of character positions when program prints alternate line in opposite directions

LPM = 6500 R / (RC + 10) where 5213 Model 3 Enhanced Print Rate Attachment (#3960) is used and where C is maximum number of character positions when program prints alternate lines in opposite directions

Example: For Model 3. If 22 of 66 lines on a page are printed, R = 1/3. Assume a maximum line length of 75 character positions

Then: LPM = 4500 (1/3) / (1/3 (75) + 5) = 50 (approximate throughput)

For System/3-4: 5213 Model 3 Enhanced Print Rate Attachment (#3960) on the 5404 Processing Unit.

For System/3-6: An appropriate 5213 Printer Attachment (#3901, 3902, 3903) or 5213 Model 3 Enhanced Print Rate Attachment (#3960) on the 5406 Processing Unit.

Limitations: Only one printer can be attached to a 5404, 5406, 3115, or 3215 Processing Unit.

Supplies: Serial #12000 and below (model 1)—#21000 and below (model 2), and #31000 and below (model 3), a black ribbon, IBM Part No. 1136906 or equivalent, is recommended. Serial #12001 and above (model 1)—#21001 and above (model 2), and #31001 and above (model 3), a black ribbon, Part No. 1136970 or equivalent, is recommended

Bibliography: GC20-8080. Metering: Base Unit (meter on 5404, 5406, 3115, or 3125.)

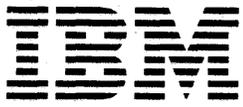
Specify

Voltage (AC, 1-phase, 3-wire, 60 cycle): #9902 for 208 V, or #9904 for 230 V ... must be consistent with system voltage.

Special Features

Forms Stand: Permits placement of continuous forms on the stand above floor level and provides for stacking after printing. This accessory is a two shelf forms stand.

Table with 2 columns: Type, Feature No. Row 1: 5213, 4450





5231 CONTROLLER

Purpose: Control Unit for the 5230 Data Collection System for central collection of data from 5234 Time Entry Stations and 5235 and 5236 Data Entry Stations. Data is collected at the controller on either card or diskette media for subsequent transfer and processing on a data processing system. All controller models can be ordered with loop connection features which allow attachment of up to 15 entry stations in any combination. All models provide operator guidance to the user to assist him in responding to conditions requiring operator attention; e.g., output media full and almost full or a loop error. See the *5231 Data Collection Console Guide* for details.

Host Support For IBM System/32, System/34, and System/3: See 5230 "Systems."

Controller Models

Model 1: Punches and interprets 96-column card output records from data entered through the Time Entry and Data Entry Stations ... punches and prints at 20 cards per minute ... Also provides read capability for loading system definition records for system startup. Characters punched and interpreted are the standard 64 character set corresponding to the 96-column card code. All other EBCDIC characters will be accepted by the system and converted to blanks. Card hopper and stacker capacity is 350 cards.

Model 2: Stores output records entered through the Time Entry and Data Entry Stations on diskette in 128 character records. An additional feature provides binary synchronous communication of data directly to a data processing system (unidirectional transmission only) over switched or non-switched point-to-point or multipoint (non-switched) telephone lines. The 5231 Controller can be used as a remote data collection device at 1200, 2000, 2400, 4800 bps over appropriate communication facilities. Data can be batch transmitted or each transaction transmitted as received by the controller depending on the capability of the receiving system. The 5231-2 communicates as a 3741-2 or 4 to a System/3, System/32 (point-to-point only), System/34 (Point to Point only), System/7 3741-2, 4 (point-to-point only), 5110 (point-to-point only), or a System/370 115, 125, 135, 138, 145, 148, 155 II, 158, 165 II, 168, 3031, 3032, 3033. See "communications" for special attachment instructions to System/370 and 3741. The Model 2 also provides read capability for loading system definition records for system start up.

Model 3: Punches and interprets 80-column card output records from data entered through Time Entry and Data Entry Stations. The Model 3 punches and prints at 21 cards per minute. Printed characters will be represented by the 64 character set EL. All other EBCDIC characters will be accepted by the system and converted to blanks. Card hopper and stacker capacity is 400 cards. The Model 3 also provides read capability for loading system definition records for system start up.

Model Changes: Controller models not recommended for field conversion. All features are field installable.

Highlights:

- Non-programmable
- Personalized through easy to use fill in the blanks forms
- Application independent
- Performs self diagnosis during "idle" time
- Choice of output media available
- Operator guidance at entry stations
- Optional communication capability via BSCA
- Audible alarm sounds when operator attention is required

System Features

A non-programmable device utilizing Read Only Storage (ROS) for operational control with Random Access Memory (RAM) for definitions uniquely specifying output record format and input requirements from Entry Stations. Definitions are personalized for customer application through up to six simple question and answer forms; key entered into appropriate media for input into controller at system startup.

- **Two Wire Loop Attachment:** Controls two wire loop for attachment of Time Entry Stations and Data Entry Stations to controller.
- **Unattended Operation.** Once loaded with definition records the system will operate in an unattended mode (assuming no power or system failures) collecting data from entry devices. Status codes will be displayed and the internal alarm will sound whenever operator attention is required. In addition, the external alarm contacts will activate any external alarm provided by the customer. The alarm will also be activated when the output storage device is "almost" filled to capacity.
- **Input Media Validation.** A check character can be defined for each card or badge entered at the entry stations. If the character does not match, the error will be indicated at the entry station and wait for the correctly coded badge or card to be entered into the station. It is recommended that the check character capability be used for card input to ensure proper orientation of the card when it is inserted into the Data Entry Station.
- **Self Diagnosis.** Whenever there is idle time, the system will continue self diagnosis and display a status message if any problem is found. Alarm contacts will be activated and the internal alarm will sound if operator attention is required.
- **Controller Console.** The Console provides user communication with the controller to perform such functions as start/stop controller, set time of day, start/stop individual loops, respond to status messages, etc.
- **Console Lock.** A keylock is provided to enable entry of data through the console. The key is removable in the "locked" or "disabled" position so no entry of data can be made via the console.
- **Alarm Contacts.** Provides the capability for the customer to add an external alarm to indicate a system status message has been displayed at the controller console requiring operator attention. Alarm contacts work in conjunction with the standard alarm. A customer may require both alarms, the standard audible alarm for the immediate vicinity and his own external (audible or visual) alarm for a remote location.
- **CE Diagnostic Port.** The first loop can be used to attach up to three entry stations to the controller. The three remaining loops can support up to four entry stations each. The first loop is limited to three in order to accommodate a CE Port in the controller to be used only by the CE (or other maintenance personnel for purchased systems) for entry station diagnosis, checkout, and repair of failing units.

**Communications**

The 5231-2 with the optional BSCA feature can communicate with appropriately configured System/3, System/34 Point-to-Point only), System/7, 3741-2, 4 (point-to-point only), 5110 (point-to-point only) or System/370-115, 125, 135, 138, 145, 148, 155II, 158, 165II, 168, 3031, 3032, 3033. Communications with System/370 is via ICA (where applicable), 2701, 2703, 3704 and 3705 operating under DOS/VS BTAM, OS/VS1 BTAM, or OS/VS2 BTAM. BSCA attachment is supported by CICS/VS (operating under DOS/VS, OS/VS).

Transmission to a 3741 is via single diskette transfer only. (On switched lines the telecommunications link must be reestablished for subsequent diskette transmission.) Data Communications on the Model 2 controller is supported as a 3741-2 or 4. Transmission of data is one way only, from the 5231-2 to a host. Communications is over multipoint (non-switched) or point-to-point leased or switched facilities.

Specify

1. Voltage: (AC, 1 Phase, 60Hz 3 wire, 115V, Locking Plug) #9880.
2. Color:

#9060	Willow Green
#9061	Garnet Rose
#9062	Sunrise Yellow
#9063	Classic Blue
#9064	Charcoal Brown
3. Processing system for the data collected by the 5231:

#9270	System/3-15
#9271	System/3-All Others
#9272	System/32
#9273	System/7
#9274	System/360
#9275	Other IBM Equipment
#9276	Non-IBM Equipment
#9277	System/370, below 145
#9278	System/370, 145 - 168
#9279	System/34, Processing System
#9294	System/34, Planned Device Attachment
#9280	5110
#9281	System/370 3031, 3032, 3033

Prerequisite: 5230 Data Collection System Accessory Package.

P/N 2461786 Loop Connector: One required for each 5231 controller (one also required for each additional loop, FC 4700, 4701, 4702).

P/N 2461785 External Alarm Connector: (optional) if selected, one is needed per 5231 Controller.

P/N 2461780 Station Connector: one required for each 5234, 5235 and 5236 entry station plus one spare.

P/N 2461781 Station Connector Mounting Bracket: one required for each 5234 and 5235 Entry Station (for rigid mounting and easy unit replacement) unless suitable alternative mounting is provided.

P/N 2461783 152m (500 feet) spool for loop cable OR

P/N 2461784 304m (1000 feet) of loop cable

P/N 4413082 Contacts Closure Accessory: One required for each 5234, 5235 and 5236 Entry Station for Feature 1480.

See Accessory Package paragraphs in this section for details and ordering instructions. The ship date required for these prerequisites must be at least seven weeks prior to the ship date specified for the 5231 Controller. This is to allow the customer time to fulfill his preinstallation responsibilities prior to the delivery of the controller. See 5230 Data Collection System User Guide for schedule details.

Cables: No special orders required for 5230 Data Collection System. Cables are shipped automatically with the type model and the associated features except for loop cables.

For All Models

Loop 2 Attachment (#4700): Provides capability to attach four additional Data Entry or Time Entry Stations to the 5231 Controller. This expands total system capability to seven entry stations. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** 5230 Data Collection System Accessory Package B/M 2461786.

Loop 3 Attachment (#4701): Provides capability to attach four additional Data Entry or Time Entry Stations to the 5231 controller. This expands the total system capability to eleven Entry Stations. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Loop 2 Attachment (#4700) ... 5230 Data Collection System Accessory Package B/M 2461786.

Loop 4 Attachment (#4702): Provides capability to attach four additional Data Entry or Time Entry Stations to the 5231 controller. This expands the total system capability to its full capacity of fifteen entry stations. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Loop 3 Attachment (#4701) ... 5230 Data Collection System Accessory Package B/M 2461786.

For Models 1 and 3 Only

Secondary Output Punch Attachment (#3210): When ordered with the 5231 Model 1 provides attachment of a 5496 Data Recorder equipped with System/3 Model 6/5230 Attachment (#7501). When ordered with Model 3 provides attachment of a 129 Card Data Recorder equipped with Card Input/Output Attachment (#7503). The attachment allows the 5496 Data Recorder or the 129 Card Data Recorder to be connected as a backup card punch/print for the 5231 Primary Punch. **Maximum:** One. **Field Installation:** Yes.

For Model 2 Only

Binary Synchronous Communications Adapter (BSCA) (#2074): This feature permits the 5231 Controller to function on a switched or non-switched point-to-point line or multipoint non-switched line as a terminal communicating in binary synchronous mode. The transmission is unidirectional from the 5231-2 to the host system. The 5231-2 will transmit to:

- A System/32 with #2074 (point-to-point only)
- A System/34 with communications adapter (#2074) (Point-to-Point only)
- A System/3 equipped with BSCA (#2074, #2084), LCA (#4765) or ICA (#4645 and #4802)



- A 3741 Data Station Model 2 or 3741 Programmable Work Station Model 4. Transmission to the 3741 is restricted to single diskette transfer only (point-to-point only).
- A 5110 with BSCA (#2074). Transmission to the 5110 is restricted to Single Diskette Transfer (Point-to-Point only).
- A System/370-115, 125, 135, 138, 145, 148, 155 II, 158, 165 II, 168, 3031, 3032, 3033 operating under DOS/VS BTAM, OS/VS1 BTAM, or OS/VS2 BTAM. BSCA attachment is supported by CICS/VS (operating under DOS/VS, OS/VS).
- A System/7 with TPMM (RPQ D08011) or TPMF (RPQ D08010)

Note: For data communications program support on the receiving host, the 5231-2 is supported as a 3741-2 or 4.

See M2700 pages for information on communications facilities. This feature will operate in half duplex mode over non-switched communications lines which may be duplex or half duplex facilities.

Switched Network versions include as a basic capability support of manual dial and manual or auto answer operations. (Assumes the attached modems will support this mode of operation.) Transmission code is EBCDIC. **Maximum:** One. **Field Installation:** Yes. *Note:* If ordering BSCA (#2074), either one of the integrated modems (#5500, #5501) or the EIA Interface (#4780) must also be ordered.

EIA Interface (#4780): Provides a cable and interface which meets RS-232C characteristics for attachment of an IBM modem or Non-IBM data set. Non-IBM modems may be attached subject to Multiple Suppliers System Policy. **Maximum:** One. **Field Installation:** Yes **Prerequisite:** BSCA (#2074). **Limitation:** Cannot be installed with IBM 1200 BPS Integrated Modem (#5500, #5501). **Specify:** #9483 for attachment to switched lines. *Note:* This feature may also require internal clock specify code (#9334) if the external modem does not provide its own clocking. Internal clock is available at 1200 bps only. If the internal clock is desired with the EIA interface, specify #9334.

IBM 1200 BPS Integrated Modem (#5500, #5501): A modem for BSC data transmission at 1200 bps over non-switched facilities or switched facilities. Available in two versions: #5500—non-switched ... #5501—switched with auto answer. Attachment to the non-switched facilities is via an IBM provided cable directly to the telephone line. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with the 5231 Controller must also be equipped with an IBM 1200 bps Integrated Modem/Line Adapter. **Limitation:** Cannot be installed with EIA Interface (#4780). The #5500 and #5501 cannot be installed together. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** BSCA (#2074). **Specify:** Internal Clock (#9334). (#9483) if #5501 was selected.

Additional Information—Communications

I. Optional Specifications

When ordering FC #2074 (Model 2), one selection must be specified from each of the first three categories. Selection from category (4) must be made based on the notes below:

1. Transfer Rate

1200 BPS	#9751
2000 BPS	#9752
2400 BPS	#9753
4800 BPS	#9754
2. Network Attachment

Point-to-Point (Non-Switched)	#9481
Multipoint Tributary	#9482
Point-to-Point (Switched)	#9483
3. Planned Device Attachment

System/370	#9570
3741 Model 2, Model 4	#9579
System/3	#9580
System/7	#9590
System/32	#9591
System/34	#9594
5110 (Point-To-Point only)	#9595
System/370 3031, 3032, 3033	#9596
Other—IBM Equipment	#9592
Non-IBM Equipment	#9593
4. Line Facility Attachment

Duplex (4 wire only)	#9391
Half duplex (2 wire)	#9392

Notes:

Only specify 9391 or 9392 as follows:

- (a) If multipoint (tributary) #9482 is ordered, specify #9391.
- (b) If 1200 bps integrated modem-non-switched #5500 is ordered, specify #9391 or #9392 based on 4 wire or 2 wire telephone line attachment.
- (c) If EIA interface #4780 is ordered, specify #9391 if external modem attachment is to a 4 wire telephone line.
- (d) If EIA interface #4780 with a 2 wire telephone connection or a 1200 bps integrated modem switched is ordered, no specify code is required.

II. IBM Modems

The following IBM modem can be attached to a 5231-2 Controller:

Modem	Speed (bps)
3872 Model 1	2400/1200
3874 Model 1	4800/2400

Note: The 5231 Controller does not support Auto Call Originate (#1091) on the 3872 or the 3874.

III. Cables

A 9.1m (30 feet) modem cable will be furnished with the Control Unit. No cable order is required for 5231-2.



IV. BSCA Feature Configuration

When the BSCA feature is ordered, either the Integrated Modem or External Modem Interface must be selected. Select either Item 1 or 2 and the required or optional special features.

Modem Interface	Internal Clock (#9334)
1. EIA Interface (#4780)	Optional
2. 1200 bps Integrated Modem:	
a) Non-switched (#5500)	Required
b) Switched with Auto Answer (#5501)	Required

V. Communication Facility Attachments

The BSCA feature is designed to operate at speeds between 1200 and 4800 bps over common carrier switched or non-switched facilities or equivalent privately owned communication facilities.

VI. References

1. See M2700 pages for additional information concerning modems, communication facilities, machine attachment requirements, operating capabilities, and customer responsibilities.
2. Refer to the *U.S. Data Communications Handbook*

Cards Four cards commonly used in manufacturing related data collection applications can be ordered as standard supplies. Each type of card may be individually ordered.

Type Card	80 Column	96 Column
Order/Material Receipt	W41071	W41067
Material Issue	W41072	W41068
Move	W41073	W41069
Operation	W41074	W41070

For format of these cards see the *Data Collection Application Workbook*, GH30-0203.

Customer Responsibilities: For specific customer responsibilities see "Systems" 5230.

For detailed preinstallation responsibilities, see the *5230 Data Collection System User Guide*, GA34-0040.

Environment: See "Systems" 5230.

Publications

5230 Data Collection System User Guide, GA34-0040 ... *5230 Data Collection System Console Guide, Model 1* GX34-0041 ... *5230 Data Collection System Console Guide, Model 2* GX34-0042 ... *5230 Data Collection System Console Guide, Model 3* GX34-0043 ... *5230 Data Collection System Data Communications Guide*, GC34-0044 ... *5230 Data Collection System Badge Specifications*, GA21-9259

Test Allowance: No pre- or post-test allowance available for the 5230 Data Collection System. See General Information "Test Facility Operations."

5230 Data Collection System Accessory Package

Purpose: Contains the parts necessary for the customer to complete his preinstallation responsibilities. All items in the Accessory Package are prerequisites (except the Alarm Connector B/M 2461785) to some machines of the 5230 System. The Contacts Closure Accessory is a prerequisite only for feature code #1480. The accessory items are ordered via the *MES Order Guide*, Z120-2665 through AAS. Normal schedule ship date for the accessory package items or customer supplied equivalents should be scheduled to precede the 5230 system by seven weeks. Items ordered are purchase only and no maintenance is available. Normal parts warranty of 3 months is applicable.

Highlights: The Accessory Package provides the capability for the customer to order and install those physical installation accessories not readily available from the customer's normal supplier. The ship date for these accessory items must be a minimum of seven weeks prior to the other 5230 machines. This is to allow the customer time to complete his preinstallation responsibilities prior to receiving the 5230 system. See the *5230 Data Collection System User Guide*, GA34-0040 chapter titled "Installation—Schedule of Events."

Publications

See *IBM 5230 Data Collection System User Guide*, GA34-0040 for schedule and preinstallation instructions.

Customer responsibilities: See "Systems" 5230.

For Model 1 Ribbon (*) P/N 1136849 and 96-column cards, P/N 3700.

For Model 2 IBM 128 byte diskettes, P/N 2305830.

For Model 3 Ink Roll Assembly (*) P/N 432695 and 80 column cards, P/N 5081.

(*) One supplied with the controller.



Features

Station Connector B/M 2461780: Provides the interface between each Entry Station (5234, 5235 and 5236) and the loop cable. Addressing switches for entry station identification and a bypass relay are included as part of the connector. One station connector is required for each 5234, 5235 and 5236. It is recommended that at least one spare station connector should be ordered per 5230 system. The customer is responsible for supplying the receptacle housing for the station connector. (Refer to GA34-0040 for details).

Mounting Bracket B/M 2461781: Provides a metal bracket for either wall, pedestal or table mounting of a 5235 or a 5234. One mounting bracket is a prerequisite for each 5235 and 5234.

Loop Cable B/M 2461783 and B/M 2461784: Cable available from IBM to meet the loop requirements. Available in either 152m (500 ft.) spools B/M 2461783 or 304m (1000 ft.) spools B/M 2461784.

Loop cable B/M 2461783 or B/M 2461784 or equivalent must be used for system preinstallation. Specifications of this cable must be met if other cable is used.

Alarm Connector B/M 2461785: Provides a three pin connector to attach an external alarm to the 5231 Controller. The customer provides the external alarm and the wiring to the alarm connector B/M 2461785. The customer provided wire must be stranded 20 AWG. Voltage and current on the wire must not exceed 48V and 1.5 Amps respectively. The connector is plugged into the 5231 Controller at installation time. The customer supplied alarm is used, if desired, to provide an audible or visual signal to the customer when the 5231 Controller requires operator attention. This no charge feature may be desirable even though the 5231 has an internal audible alarm as a standard feature.

Loop Connectors B/M 2461786: Provides the connection between the 5231 Controller and the loop cable. One loop connector is a prerequisite for each 5231 Controller, and one for each additional loop (4700, 4701, 4702) attached to the controller.

Contacts Closure Accessory B/M 4413082: is prerequisite for installing the Contacts Closure Feature (#1480) on the 5234 or 5235/5236. Accessory contains associated connectors, printed circuit card, and relay. It is recommended that at least one spare be ordered per 5230 System. More may be required if several features are installed per system. Customer must provide the external devices with required power and, if necessary, any circuitry to activate external devices that may require a longer time than the contact closure time of 0.5 seconds minimum. Contact maximum ratings are 28 VAC/VDC at 1.5 amperes. The IBM supplied crimp on terminals for connecting external device are designed for 18 to 22 AWG wire. Two sets of contacts are provided that can be used in a normally open or normally closed mode. The customer is responsible for supplying the receptacle housing for the Contact Closure Accessory. (Refer to GA34-0040 for details.)

Ordering Instructions

All accessories must be ordered against the 5231 Controller only

On the MES physically enter the chargeable accessories before entering the non-chargeable items

Accessories	Bill of Material
Station Connector	2461780
Mounting Bracket	2461781
Loop Cable 152m (500')	2461783
Loop Cable 304m (1000')	2461784
Alarm Connector	2461785
Loop Connector	2461786
Contacts Closure Accessory	4413082



5234 TIME ENTRY STATION

Purpose: An input device for the 5230 Data Collection System.

Prerequisites:

1. An available position on a loop multiplexer on the 5231 Controller.
2. The following items from the 5230 Data Collection System Accessory Package. See 5231 Machines for details.

B/M 2461780 Station Connector (One)
B/M 2461781 Mounting Bracket (One)

B/M 4413082 Contact Closure Accessory (one) required for feature #1480.

Note: The 5230 Data Collection Accessory Package items must have a scheduled ship date at least seven weeks prior to the ship date of the 5234 Time Entry Station. See the "5230 Data Collection System User Guide" for the preinstallation schedule.

Cables: No cable order required.

Highlights: The 5234 is industrially packaged and attaches to the 5231 Controller via a twisted pair, shielded loop. Both models provide a four-position continental time of day display. Additionally, a key operated, three position mode switch (supervisor, test, and normal mode) is provided. Two keys operate the mode switch, one for supervisor mode and a separate key for test mode.

Model 1 With Hole Badge Reader: Reads identification badges (22-column card sized) prepunched in IBM code with a maximum of 10 numeric digits. Badges with or without a pocket clip may be used.

Model 2 With a Magnetic Stripe Badge Reader: Reads identification badges (22-column card sized) magnetically encoded with a maximum of 17 numeric digits. Size compatible badges used with other IBM products are accepted by the 5234. Badges with or without a pocket clip may be used.

Model Changes: Field installation. Yes.

Customer Responsibilities: Maintenance of the 5234 will take place at the 5231 Controller location. The dedicated maintenance port (first entry station position on the standard loop multiplexer) will be used for maintenance only.

Limitations: Loop operations will not continue properly in the event of a 5234, 5235 and 5236 Entry Station power off situation if the total resultant distance between operating units (5231/5234/5235/5236) exceeds 690m (2000 feet).

Environment: See "5230 Systems."

Supplies: See 5231 "Machines."

Publication

IBM 5230 Data Collection System User Guide, GA34-0040.

Specify

(1) Voltage (115VAC, 1-phase, 3 wire, 60 cycle, locking plug) #9880.

Special Features

Audible Indicator (#1470): Provides an audible indication to the operator at the successful completion of a badge operation.
Field Installation: Yes.

Contacts Closure (#1480): Provides the capability for the activation of customer provided external devices. These devices, for example, may be audible alarms, visual indicators, or devices that provide limited access to restricted areas. Activation of the external contracts will occur on 5234 Entry Station successful badge read. This feature, which is in addition to the normal visual indicators, can be ordered instead of or in addition to the audible indicator feature (Feature Code #1470). A set of DPDT contacts is available. (Two sets of contacts that can be used in either a normally open or normally closed mode). **Prerequisite:** Contacts Closure Accessory (B/M 4413082). **Limitations:** Customer must provide power supply for driving external devices. Contact maximum rating is 28 VAC/VDC at 1.5 amperes. Contact activation time is 0.5 seconds minimum. **Field Installation:** Yes. **Installation:** Refer to *User's Guide*, GA34-0040. Installation of Contacts Closure Accessory is similar to installation of Station Connector Assembly.

**5235 DATA ENTRY STATION MODEL 1**

Purpose: An input device for the 5230 Data Collection System.

Prerequisites:

1. An available position on a loop multiplexer on the 5231 Controller.
2. The following items from the 5230 Data Collection System Accessory Package. See 5231 in Machines for details.

B/M 2461780 Station Connector (One)

B/M 2461781 Mounting Bracket (One)

B/M 4413082 Contact Closure Accessory (one) required for feature #1480

Note: The 5230 Data Collection System Accessory Package items must have a scheduled ship date at least seven weeks prior to the ship date of the 5235 Data Entry Station. See the "5230 Data Collection System User Guide" for the preinstallation schedule.

Cables: No cable order required.

Highlights: The 5235 is industrially packaged and attaches to the 5231 Controller via a twisted pair, shielded loop.

The basic unit provides variable numeric data entry capability ... customer defined action keys ... numeric display ability ... continental time of day display ... mode switch (key operated) ... control keys ... status indicators.

Action Keys Eight customer defined keys used for individual action definitions.

Numeric Keyboard Ten numeric keys arranged in a pattern similar to a telephone keypad.

Display An eight-position display used for continental time of day, operator guidance, and display of key entered data. Data entered through the Value Read Attachment (#3400) is also displayed.

Mode Switch Key Operated—A three-position keylock (Supervisor, test, and normal mode). One key is supplied for supervisor use and a second different key for test mode use.

Control Keys The "ENTER" (E) key is used to indicate completion of a field of keyed data ... the "CLEAR" (C) is used to delete a field of keyed data.

Status Indicators Advise the operator that the station is ready, in process, or error.

Optional Features: Either an 80- or 96-column card reader may be attached as a feature. Either a punched hole or magnetic stripe badge reader may be attached as a feature. See "Special Features."

Customer Responsibilities: Maintenance of the 5235 will take place at the 5231 Controller location. The dedicated maintenance port (first entry station position on the standard loop multiplexer) will be used for maintenance only.

Limitations: Loop operations will not continue properly in the event of a 5234, 5235 or 5236 power off situation if the total

resultant distance between operating units (5231/5234/5235/5236) exceeds 609m (2000 feet).

Environment: See 5230 "Systems."

Supplies: See M5231 "Machines."

Publication

IBM 5230 Data Collection System User Guide, GA34-0040.

Specify

Voltage (115V AC, (1) 1-phase, 3 wire, 60 cycle, locking plug) #9880.

Special Features

Badge Reader—Punched Hole (#1401): Provides the ability to read identification badges (22-column card sized) pre-punched in IBM code with a maximum of 10 numeric digits. Badges with or without a pocket clip may be used. Size compatible hole badges used with other IBM products are accepted by the 5235 if they meet other specifications for the 5235.

Badge Reader—Magnetic Stripe (#1402): Provides the ability to read identification badges (22-column card sized) magnetically encoded with a maximum of 17 numeric characters. Badges with or without a pocket clip may be used. Sizes compatible magnetic badges used with other IBM products are accepted by the 5235.

Audible Indicator (#1470): Provides an audible indication to the operator at the successful completion of a badge read operation or upon completion of a transaction when the Transaction Indicator RPQ (D07009) is installed on the associated 5231. Either Badge Reader or RPQ (D07009) is required for this feature. **Field Installation:** Yes.

Card Reader—96 Col (#1510): Provides a single card reader capable of reading columns 1-32 of a 96-column card (1st tier) at a rated speed of 30 columns/second. A 64 character set including blanks is recognized. All other EBCDIC characters will be accepted by the entry station and converted to blanks. Cards are inserted face up column one edge first. Upper left and upper right corner cuts are permitted. External scores System/3-1 (bottom edge) and System/3-3 (column 32 edge) are permitted as well as left and right edge continuous forms scores. Standard DP-7 Point, Heavy Duty card stock, DP-9 Point, Super Stock, and Merchandise Tags with or without upper right score or hole may be used. **Limitation:** This feature is mutually exclusive on the same data entry station with CARD READER—80 COL (#1520). **Field Installation:** Yes.

Card Reader—80 Col (#1520): Provides a single card reader capable of reading columns 1-64 of an 80-column card at a rated speed of 30 columns/second. A 64 character set including blanks is recognized. All other EBCDIC characters will be accepted by the entry station and converted to blanks. Upper left and upper right corner cuts (C1, C2, C3) are permitted.



Cards are inserted face up 80-column edge first. External scores (column 1 end only) M-3, M-4, M-5, M-6, M-7, OM-2, CF-4 and CF-11 are permitted. Internal scores may be M-3, M-4, inverse M-5. Standard DP-7 Point. Heavy Duty card stock, DP-9 Point, Super Stock, and Port-A-Punch cards may be used. **Limitation:** This feature is mutually exclusive on the same data entry station with Card Reader—96 Col (#1510).

Field Installation: Yes.

Contacts Closure (#1480): Provides the capability for the activation of customer provided external devices. These devices, for example, may be audible alarms, visual indicators, or devices that provide limited access to restricted areas. Activation of the external contacts will occur on 5235 Entry Station successful badge read or upon completion of a transaction when the Transaction Indicator RPQ (D07009) is installed on the associated 5231. Either Badge Reader or RPQ (D07009) is required for this feature. This feature, which is in addition to the normal visual indicators, can be ordered instead of or in addition to the audible indicator feature (Feature Code #1470). Customer may order spare Contact Closure Accessory (B/M 4413082). A set of DPDT contacts is available. (Two sets of contacts that can be used in either a normally open or normally closed mode). **Prerequisite:** Contact Closure Accessory (B/M 4413082). **Limitations:** Customer must provide power supply for driving external devices. Contact maximum rating is 28VAC/VDC at 1.5 amperes. Contact activation time is 0.5 seconds minimum. **Field Installation:** Yes. **Installation:** Refer to *User's Guide* GA34-0040 TNL available prior to first customer ship. Installation of Contact Closure Accessory is similar to installation of Station Connector Assembly.

Value Read Attachment Feature (#3400). Provides the capability to enter values from scales, counters, keyboards, switches and other similar devices directly into the 5235 or 5236 data entry station. Connection of the device to the Value Read Attachment is accomplished through the 5239 Value Read Module. The Value Read Attachment is mutually exclusive with the badge or card reader in the 5235 or 5236 Data Entry Station. **Field Installation:** Yes.

Note: The user is responsible for setting up the 5239 and performing all connections to the Value Input Device.

**5236 DATA ENTRY STATION MODEL 1**

Purpose: An input device for the 5230 Data Collection System.

Prerequisites:

1. An available position on a loop multiplexer on the 5231 Controller.
2. The following items from the 5230 Data Collection System Accessory Package. See 5231 in Machines for details.

B/M 2461780 Station Connector (One)

B/M 4413082 Contact Closure Accessory (one) required for feature #1480

Note: The 5230 Data Collection System Accessory Package items must have a scheduled ship date at least seven weeks prior to the ship date of the 5236 Data Entry Station. See the "5230 Data Collection System User Guide" for the preinstallation schedule.

Cables: No cable order required.

Highlights: The 5236 is packaged in attractive desktop configuration and attaches to the 5231 Controller via a twisted pair, shielded loop.

The basic unit provides variable numeric data entry capability ... customer defined action keys ... numeric display ability ... continental time of day display ... mode switch (key operated) ... control keys ... status indicators.

Action Keys Eight customer defined keys used for individual action definitions.

Numeric Keyboard Ten numeric keys arranged in a pattern similar to a telephone keypad.

Display An eight-position display used for continental time of day, operator guidance, and display of key entered data. Data entered through the Value Read Attachment (#3400) is also displayed.

Mode Switch Key Operated—A three-position keylock (Supervisor, test, and normal mode). One key is supplied for supervisor use and a second different key for test mode use.

Control Keys The "ENTER" (E) key is used to indicate completion of a field of keyed data ... the "CLEAR" (C) is used to delete a field of keyed data.

Status Indicators Advise the operator that the station is ready, in process, or error.

Optional Features: Either an 80- or 96-column card reader may be attached as a feature. Either a punched hole or magnetic stripe badge reader may be attached as a feature. See "Special Features."

Customer Responsibilities: Maintenance of the 5236 will take place at the 5231 Controller location. The dedicated maintenance port (first entry station position on the standard loop multiplexer) will be used for maintenance only.

Limitations: Loop operations will not continue properly in the event of a 5234, 5235 or 5236 power off situation if the total

resultant distance between operating units (5231/5234/5235/5236) exceeds 609m (2000 feet).

Environment: See 5230 "Systems."

Supplies: See M5231 "Machines."

Publication

IBM 5230 Data Collection System User Guide, GA34-0040.

Specify

Voltage (115V AC, (1) 1-phase, 3 wire, 60 cycle, locking plug) #9880.

Special Features

Badge Reader—Punched Hole (#1401): Provides the ability to read identification badges (22-column card sized) pre-punched in IBM code with a maximum of 10 numeric digits. Badges with or without a pocket clip may be used. Size compatible hole badges used with other IBM products are accepted by the 5236 if they meet other specifications for the 5236.

Badge Reader—Magnetic Stripe (#1402): Provides the ability to read identification badges (22-column card sized) magnetically encoded with a maximum of 17 numeric characters. Badges with or without a pocket clip may be used. Sizes compatible magnetic badges used with other IBM products are accepted by the 5236.

Audible Indicator (#1470): Provides an audible indication to the operator at the successful completion of a badge read operation or upon completion of a transaction when the Transaction Indicator RPQ (D07009) is installed on the associated 5231. Either Badge Reader or RPQ (D07009) is required for this feature. **Field Installation:** Yes.

Card Reader—96 Col (#1510): Provides a single card reader capable of reading columns 1-32 of a 96-column card (1st tier) at a rated speed of 30 columns/second. A 64 character set including blanks is recognized. All other EBCDIC characters will be accepted by the entry station and converted to blanks. Cards are inserted face up column one edge first. Upper left and upper right corner cuts are permitted. External scores System/3-1 (bottom edge) and System/3-3 (column 32 edge) are permitted as well as left and right edge continuous forms scores. Standard DP-7 Point, Heavy Duty card stock, DP-9 Point, Super Stock, and Merchandise Tags with or without upper right score or hole may be used. **Limitation:** This feature is mutually exclusive on the same data entry station with CARD READER—80 COL (#1520). **Field Installation:** Yes.

Card Reader—80 Col (#1520): Provides a single card reader capable of reading columns 1-64 of an 80-column card at a rated speed of 30 columns/second. A 64 character set including blanks is recognized. All other EBCDIC characters will be accepted by the entry station and converted to blanks. Upper left and upper right corner cuts (C1, C2, C3) are permitted.



Cards are inserted face up 80-column edge first. External scores (column 1 end only) M-3, M-4, M-5, M-6, M-7, OM-2, CF-4 and CF-11 are permitted. Internal scores may be M-3, M-4, inverse M-5. Standard DP-7 Point, Heavy Duty card stock, DP-9 Point, Super Stock, and Port-A-Punch cards may be used. **Limitation:** This feature is mutually exclusive on the same data entry station with Card Reader—96 Col (#1510). **Field Installation:** Yes.

Contacts Closure (#1480): Provides the capability for the activation of customer provided external devices. These devices, for example, may be audible alarms, visual indicators, or devices that provide limited access to restricted areas. Activation of the external contacts will occur on 5236 Entry Station successful badge read or upon completion of a transaction when the Transaction Indicator RPQ (D07009) is installed on the associated 5231. Either Badge Reader or RPQ (D07009) is required for this feature. This feature, which is in addition to the normal visual indicators, can be ordered instead of or in addition to the audible indicator feature (Feature Code #1470). Customer may order spare Contact Closure Accessory (B/M 4413082). A set of DPDT contacts is available. (Two sets of contacts that can be used in either a normally open or normally closed mode). **Prerequisite:** Contact Closure Accessory (B/M 4413082). **Limitations:** Customer must provide power supply for driving external devices. Contact maximum rating is 28 VAC/VDC at 1.5 amperes. Contact activation time is 0.5 seconds minimum. **Field Installation:** Yes. **Installation:** Refer to *User's Guide*, GA34-0040 TNL available prior to first customer ship. Installation of Contact Closure Accessory is similar to installation of Station Connector Assembly.

Value Read Attachment Feature (#3400): Provides the capability to enter values from scales, counters, keyboards, switches and other similar devices directly into the 5235 or 5236 data entry station. Connection of the device to the Value Read Attachment is accomplished through the 5239 Value Read Module. The Value Read Attachment is mutually exclusive with the badge or card reader in the 5235 or 5236 Data Entry Station. **Field Installation:** Yes.

Note: The user is responsible for setting the 5239 and performing all connections to the Value Input Device.



5239 VALUE READ MODULE MODEL 1

Purpose: An input device for the 5230 Data Collection System that provides an interface between external devices (such as scales, counters, keyboards and switches) and the Value Read Attachment of the 5235 and 5236 Data Entry Stations.

Prerequisites:

1. Value Read Attachment Feature (#3400) on a 5235 or 5236 Data Entry Station.

Highlights: The 5239 provides 4 selectable modes of operation from manual to automatic:

- Manual: Operator controlled reading and entry. Keyboard or device input available.
- Protected: Keyboard locked during data reading. Operator controlled reading and entry from device.
- Semi-Automatic: Automatic reading with operator entry.
- Automatic: Reading and entry controlled from external device. Permits unattended data collection of externally provided data. Customer selection of reading mode for each terminals. Up to eight numeric digits can be entered from one or more devices.

Operates with either BCD/TTL parallel or, 1 of 10 dry contact external devices.

Cables: No cable order required.

Customer Responsibilities: Maintenance of the 5239 will take place at the 5231 Controller location.

For specific customer responsibilities, see "Systems" 5230.

Environment: See 5230 "Systems".

Publication: IBM 5230 Data Collection System User Guide (GA34-0040).

Specify:

1. Value Read BCD (#9950). Electronic Device Input provides for connection of BCD/TTL parallel external devices to the Value Read Attachment. Provides manual and automatic selectable modes of operation. The Value Read Attachment #3400 for the 5235 and 5236 Data Entry Stations is a prerequisite
or
Value Read 1 of 10 (9951). Electromechanical Device Input provides for connection of 1 of 10 or BCD dry contact external devices to the Value Read Attachment. Provides manual and automatic selectable modes of operation. The Value Read Attachment #3400 for the 5235 and 5236 Data Entry Stations is a prerequisite.
2. Voltage (115 V AC, 1-phase, 3 wire, 60 cycle, locking plug) #9880.
3. Color #9065: Pebble Gray if used with the 5235 Data Entry Station.

#9066: Pearl White if used with the 5236 Data Entry Station.



5251 DISPLAY STATION

Purpose: The 5251 is an advanced function display station for System/34 and System/38 for entering, editing and displaying alphanumeric data. A movable keyboard permits the operator to display, enter and manipulate data on the screen in a highly flexible and efficient manner. Available in four models:

Model 1 Displays up to 960 characters with 12 lines of 80 characters each. Attaches to the 5251 Models 2 or 12, 5340, or 5381. Used as the system console with System/34.

Model 2 Displays up to 960 characters with 12 lines of 80 characters each. Provides communication capability with System/34 and System/38 in SNA/SDLC mode. Optional features allow up to eight additional work stations to be attached.

Model 11 Displays up to 1920 characters with 24 lines of 80 characters each. Attaches to the 5251 Models 2 or 12, 5340, or 5381. Used as the system console with System/34.

Model 12 Displays up to 1920 characters with 24 lines of 80 characters each. Provides communication capability with System/34 and System/38 in SNA/SDLC mode. Optional features allow up to eight work stations to be attached.

Model Changes: Available at time of manufacture only.

Highlights: The standard character set includes ninety-six 8 x 16 dot matrix characters—52 upper/lowercase alphabetic, 10 numeric, 34 special characters in addition to "space." A 188-character Multinational Character Set (see Special Features below) is available, providing 112 alphabetic, 10 numeric, and 66 special displayable characters in addition to "space." See Type Catalog for character set and keyboard layout. Display functions in addition to normal intensity are high intensity, nondisplay, blinking, underscore, column separator, and reverse image (dark characters on a light background) on a field basis. The operator can reverse the image of the entire screen. An audible alarm, under program control, is provided to alert the operator to special conditions. The keyboard with 24 application assigned command functions provides input and control flexibility. See "Special Features" below.

Security Enhancements: Data fields may be defined so entered data is accepted without being displayed on the screen. A Keylock (special feature) prevents operator usage of the display and keyboard when the key is in the locked position. The display is blanked and keyboard data entry is inhibited when the Keylock is locked. A Magnetic Stripe Reader (Feature #4910) is available for entering user identification.

Field Editing: Individual data input fields may be edited as Alphanumeric, Alpha Only, Signed Numeric, Field Exit Required, Right Adjust, Mandatory Entry, Mandatory Fill, Bypass, Auto Enter, Dup Enable, Monocase and Self-Check Modulus 10 and 11 (Self-Check is optional on the 5251 Models 2 and 12).

For Direct Attachment to System/34: One 5251 Model 1 or 11 Display Station or 5252 Dual Display Station is required on System/34 for use as a system console. The console is attached to one of four twinax cable connectors on the 5340 via a 6 m (20 ft) cable provided with the 5340. For maintenance reasons, only one of the above machine types (5251 or 5252) should be attached to this cable. Three additional twinax cable connectors on the 5340 are provided for attachment of additional work stations (5251 Models 1 or 11 or 5252 or 5256). A maximum of eight work stations, including the system console, may be attached to the 5340. A 5252 represents two work

stations. The maximum length of any one twinax cable is 1525 m (5000 ft). Up to three such cables may be attached to the 5340. Multiple work stations (up to seven) may be attached to one cable via a Cable Thru feature with each work station. See *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277 for cabling information.

For Direct Attachment to System/38: The 5381 System Unit provides 8 cable connectors for attachment of the 5251 Model 1 and 11 Display Stations, 5252 Dual Display Stations and 5256 Printers and supports up to 12 of these work stations. Optional features on the 5381 allow up to 40 work stations to be attached. The 5252 represents 2 work stations.

The cable attachment may be made with either Twinax or Coax cable. Twinax cable connection: Maximum length of any one Twinax cable is 1525 m (5000 ft.). Up to 7 work stations may be attached to a Twinax cable via a Cable Thru feature (#2680) on each work station. Coax cable connection: Maximum length of any one Coax cable is 610 m (2000 ft.) between the system attachment and the work station. (Twinax/Coax Adapter Kit is required. Refer to Accessories.) A second work station may be attached via the Cable Thru feature (#2680). Twinax cable must be used between the first and second work station and the maximum allowable distance between these two work stations is 30 m (100 ft.) See *IBM 5250 Information Display System Installation Manual Physical Planning* (GA21-9277) for cabling information.

Clustering: The 5251 Models 1 and 11 may be attached to the 5251 Model 2 or 12 with the Cluster (#2550) or the Dual Cluster (#2551) feature. The Cluster feature allows attachment of up to four work stations (5251 Models 1 or 11 or 5252 or 5256) and the Dual Cluster feature allows attachment of up to eight work stations. A 5252 represents two work stations. See *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277 for cabling information.

Communications: The 5251 Models 2 and 12 communicate with a System/34 or a System/38 equipped with Communications Adapters operating in SDLC mode only. See 5340 and 5381 for Communication Adapters. The Models 2 and 12 communicate in half duplex mode on non-switched (leased) point-to-point and multipoint communication lines which may be duplex or half-duplex facilities at speeds up to 9600 bps, and on switched (dial) point-to-point communication lines at speeds up to 4800 bps. See M2700 pages for information on communications facilities.

A 1200 BPS Integrated Modem (#5500 or 5502), or EIA Interface (#3701), or DDS Adapter (#5650 or #5651) is required. See "Special Features" and "Specify" for the required communication cable.

IBM Modems: One IBM modem may be attached to a 5251 Model 2 or 12. **Prerequisite:** EIA Interface (#3701).

Modem	Speed (bps)
3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

Note: 5251 Models 2 and 12 do not support Auto Call Originate (#1091) on the 3872 or 3874 and Fan-Out (#3901) on the 3872, 3874 or 3875. For communications capabilities, product utilization and special features, see M2700, M3872, M3874 and M3875.



IBM Data Encryption Devices: An IBM 3845 or IBM 3846 Data Encryption Device may be attached between the 5251-2/12 and the external modem. **Prerequisite:** EIA Interface (#3701).

Note: Refer to M2700, 3845, and 3846 pages for information on 3845 or 3846 configuration and communications capability. 3845 or 3846 devices operating with SDLC protocol will not operate with NRZI transmission mode.

Problem Determination Procedures: Significant function has been designed into this unit to provide greater availability to the customer through the use of problem determination and recovery procedures that are easily understood and used by the operator. The procedures are provided in the *IBM 5251 Operator's Guide*. Also, see "Customer Responsibility" below.

Customer Setup (CSU): The 5251 is designated as a customer setup device thereby offering the customer early availability and relocation flexibility. For additional information on CSU, refer to the GI Section 2. The Marketing Representative must advise the customer of his responsibilities before receipt of the machine.

Customer Responsibility: The customer is responsible for:

- Receipt, unpacking and placement of the 5251.
- Physical setup, connection of cables to TP lines/modems and IBM devices incorporating protected access areas, switch setting and checkout in accordance with instructions supplied by IBM. Under certain conditions, when using integrated modems, an IBM CE may be required. Details of these conditions will be described in the Customer Setup instructions.
- Notifying IBM of intent to relocate and following IBM instructions for relocation of the 5251.
- Disconnecting, packing and removal to the customer's shipping dock at the time of discontinuance. Removal instructions and packaging materials (if required) will be ordered by the Branch Office.
- Relocation of the 5251, if required, to allow IBM service access.
- Using and following the problem determination procedures for the 5251 prior to calling for IBM service.
- Providing a desk or tabletop to support the 5251.
- Installation and maintenance of signal cables and associated parts for attaching the 5251 Model 1 or 11 to the 5251 Model 2 or 12, 5340 or the 5381.
- The installation and maintenance of common carrier facilities/services. For further information, see M2700 pages and "Teleprocessing Systems" in the General Information section of the *Sales Manual*.
- Obtaining a firm installation date for the start of transmission services (including any required modems). The IBM Marketing Representative must assure that a firm installation date is established prior to processing the Order Confirmation card.
- When adding additional direct or remote display stations to System/34 or System/38, the customer may have to modify the system configuration specifications. See *IBM System/34 Program Product Installation and Modification Reference Manual* (SC21-7689) or *IBM System/38 Program Product Installation Guide* (availability to be announced in a future PRL).

Prerequisites

For Models 1 and 11: A 5251 Model 2 or 12 with Cluster (#2550) feature or Dual Cluster (#2551) feature or a 5340 or a 5381.

For Models 2 and 12: Transmission via common carrier facility, to a 5340 or 5381 with a Communications Adapter, requires a modem or a DDS Adapter. See 5340 and 5381 for Communications Adapters.

Manuals: *IBM 5250 Information Display System Introduction Manual*, GA21-9246 and *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277.

Specify

1. Voltage (115V AC, 1-Phase, 60 Hz): #9881 for a standard non-locking plug (uses customer standard type receptacle) or #9880 for a locking plug (requires customer locking type receptacle).
2. A keyboard must be selected (see Special Features).
3. Color: Pearl white only (no specify required).
4. Cables: See Accessories for 5251 Models 1 and 11 cable ordering instructions. For cable specifications, see the *5250 Information Display System Installation Manual—Physical Planning*, GA21-9277. **Specify:** #9050 if cable is ordered from IBM, #9055 if cable is ordered from another source, #9060 if 5251 is used with System/34 as the system console (no cable order required), #9065 if existing cable will be used (no cable order required).
5. Communication Cable (Models 2 and 12 only): A 6 m (20 ft) communication cable is provided as standard for attachment to an external modem or to a communication facility when an integrated modem is used. If a 12 m (40 ft) cable is desired, specify #9461.
6. DDSA (#5650 or #5651) Transmission Speed: #9822 for 2400 bps, #9823 for 4800 bps or #9825 for 9600 bps.
7. System Attachment: Specify the unit that the 5251 Model 1 or 11 is attached to: #9559 for 5251 Model 2, #9560 for 5251 Model 12 or #9561 for 5340, or #9562 for 5381.

Prices: See price list.

Special Features

All Models

Keyboard (#4600, #4601, #4602): One of the following must be selected:

(#4600)—83-key keyboard with the EBCDIC character set, typewriter-like layout, movable, with 49 alphanumeric keys, 24 control keys and 10-key numeric pad.

(#4601)—66-key data entry style keyboard, movable, with 36 alphanumeric keys, 23 control keys, and 7 blank keys.

(#4602)—66-key data entry style keyboard with proof arrangement, movable, with 36 alphanumeric keys, 23 control keys and 7 blank keys. The numeric keys are arranged similar to those of an adding machine. **Limitations:** #4601 and #4602 are not supported when 5251 is directly or remotely attached to the 5340. **Maximum:** One of the above. **Field Installable:** Yes.

Keylock (#4655): Provides a lock and two keys which prevents operator entry and display of data when in a locked position. **Maximum:** One. **Field Installable:** Yes.



Multinational Character Set (#4905): Provides the capability of displaying the 188 character Multinational Character Set to facilitate the interchange of information between systems with different language groups. **Limitations:** The keyboards do not include the additional characters of the Multinational Character Set. All characters may be entered via a single or multiple key sequence. **Prerequisites:** Multinational Control (#4905) on 5340. All work stations attached to the System/34 and 5251 Model 2 or 12, must have the same character set. **Maximum:** One. **Field Installable:** Not recommended for field installation.

Magnetic Stripe Reader (#4910): Provides the capability of reading numeric encoded information from a magnetic stripe on a wide range of credit cards, identification cards, and documents. The magnetic stripe may be encoded with up to 128 ABA numeric characters, including control characters. This feature enhances system data security by providing the ability to read an operator identification card without being displayed.

Limitations: Valid for numeric-only data and single data fields. Not supported when 5251 is directly attached to the 5381. **Prerequisite:** Expanded Function (#3600) on 5251 Models 2 and 12 or Work Station Control Expansion A (#4900) on 5340 when 5251 Models 1 or 11 are directly attached. **Maximum:** One. **Field Installable:** Yes.

Selector Light Pen (#6300): A hand-held, pen-like device that permits the operator to select fields of data from the display screen for system input. **Limitations:** Not supported when 5251 is directly or remotely attached to the 5340 or directly attached to the 5381. **Prerequisite:** Expanded Function (#3600) on 5251 Models 2 or 12. **Maximum:** One. **Field Installable:** Not recommended for field installation.

Models 1 and 11 Only

Cable Thru (#2680): Provides the capability of connecting multiple 5251 Models 1 and 11, 5252s and 5256s to a single twinax cable. Each unit on the cable, except the last, requires this feature. (*Note:* For relocation flexibility, the customer should consider including #2680 on all work stations). **Maximum:** One. **Field Installable:** Yes.

Models 2 and 12 Only

Cluster (#2550): Allows attachment of up to four work stations (5251 Models 1 or 11, 5252 or 5256). Provides four cable connections. The maximum allowable length of each twinax cable is 1525 m (5000 ft) and the maximum allowable length of each coax cable is 610 m (2000 ft.). To attach multiple work stations (up to four) to one twinax cable, see Cable Thru (#2680) feature for the 5251 Models 1 and 11, 5252 and 5256. **Limitation:** Cannot be installed with Dual Cluster (#2551) feature. A 5252 represents two work stations. **Maximum:** One. **Field Installable:** Yes.

Dual Cluster (#2551): Allows attachment of up to eight work stations (5251 Models 1 or 11, 5252s and 5256s). Two sets of four cable connectors are provided and up to four work stations may be attached to each set. The maximum allowable length of each twinax cable is 1525 m (5000 ft) and the maximum allowable length of each coax cable is 610 m (2000 ft.). To attach multiple work stations (up to four) to one twinax cable, see Cable Thru (#2680) feature for the 5251 Models 1 and 11, 5252s and 5256s. **Limitation:** Cannot be installed with Cluster (#2550) feature. A 5252 represents two work stations. **Maximum:** One. **Field Installable:** Yes.

Expanded Function (#3600): Provides the following:

Copy provides for the direct transfer and printing of a screen image from the 5251 Model 2 or 12 or an attached 5251 Model 1 or 11 or 5252 to a printer attached to the 5251 Model 2 or 12. The selection and allocation of the printer is controlled by the system program.

Magnetic Stripe Reader Control provides control for Magnetic Stripe Readers (#4910) feature on the 5251 Models 2 or 12 and on attached 5251 Models 1 and 11 and 5252s.

Selector Light Pen Control provides control for Selector Light Pen (#6300) features on the 5251 Model 2 or 12 and on attached 5251 Models 1 and 11.

Self Check Number provides Modulus 10 and 11 checking to assure that all digits of a number have been correctly keyed from the 5251 Model 2 or 12 keyboard or the attached 5251 Model 1 or 11 or 5252 keyboards.

Maximum: One. **Field Installable:** Yes.

EIA Interface (#3701): Provides an interface for attachment of an IBM Modem or non-IBM Modem meeting RS-232-C characteristics. Non-IBM Modems may be attached subject to the Multiple Suppliers System Policy. **Limitation:** Cannot be installed with DDS Adapter (#5650 or #5651) or 1200 bps Integrated Modem (#5500, 5502). **Prerequisite:** Specify #9492 when external modem has SNBU capability.

Note: Internal Clock (#4703) is also required when the external modem does not provide its own clocking. **Maximum:** One. **Field Installable:** Yes.

Internal Clock (#4703): Generates synchronizing and timing signals at 1200 bps when they are not provided by the modem. See *IBM Data Communications Handbook*

Maximum: One. **Field Installable:** Yes. **Prerequisite:** EIA Interface (#3701) or 1200 BPS Integrated Modem (#5500, 5502).

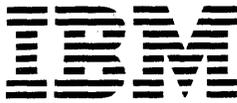
1200 BPS Integrated Modem (#5500, 5502): A modem for operating at 1200 bps over a nonswitched or switched network. Available in two versions: #5500—Non-switched and #5502—Switched with Manual Answer. Attachment to the non-switched (four-wire) facilities is via an IBM provided cable directly to the line, Type 3002. Attachment to the switched network is via an IBM provided cable to a data access arrangement type CDT or FCC certified equivalent. The system communicating with the 5251 must also be equipped with an IBM 1200 BPS Integrated Modem.

Limitations: Cannot be installed with EIA Interface (#3701) or DDS Adapter (#5650 or #5651). #5500 and 5502 cannot be installed together. **Prerequisite:** Internal Clock (#4703). **Maximum:** One. **Field Installable:** Yes.

Digital Data Service Adapter (#5650, 5651): An integrated adapter for data transmission at speeds of 2400, 4800, or 9600 bps over the AT & T nonswitched Data-Phone* Digital Service network. The DDSA interfaces to a DDS channel service unit, the customer site termination of the DDS network. For point-to-point (#5650), for multipoint tributary (#5651), see "Specify" for speed selection.

Limitations: Cannot be installed with EIA Interface (#3701) or 1200 BPS Integrated Modem (#5500, 5502). **Maximum:** One. **Field Installable:** Yes.

*Registered Trademark of AT & T.



Special Features and Accessory Prices: See Price List.

Accessories

Keylock, Keys: The 5251 with Keylock #4655 is shipped with 2 keys. Additional keys may be purchased from IBM. (Vendor will supply additional keys to original purchaser)

Display Screen Filter (#3225/3226): #3225 for Models 11 and 12, #3226 for Models 1 and 2. A specially designed filter which attaches to the display screen reducing reflected glare in those installations with adverse lighting conditions. Character contrast may also be enhanced. The filter is a CSU accessory.

Cables: 5251 Models 1 and 11 Display Station cables and/or associated parts to attach the 5251 Model 1 or 11 to the 5251 Model 2 or 12, the 5340, or the 5381 may be purchased from IBM or from a customer selected source. For the description of these cables and parts, see the *IBM 5250 Information Display System Installation Manual—Physical Planning, GA21-9277*. The customer is responsible for the installation and maintenance of these cables and their associated parts. When cabling is ordered from IBM, specify a shipping date at least 4 weeks in advance of receiving the 5251 Model 1 or 11.

Coax Cabling (for attachment to the 5251 Models 2 and 12 and the 5381). See Note 4.

Assm No	2577672	Coax Cable Assembly Indoor
Bulk No	0323921	Coax Wire Indoor ¹
Part No	1836418	Coax Connector Kit Indoor ¹
Assm No	1833108	Coax Cable Assembly Outdoor
Bulk No	5252750	Coax Wire Outdoor ²
Part No	1836419	Coax Connector Kit Outdoor ²
Part No	5252643	Coax Adapter ³
Part No	7361118	Twinax/Coax Adapter Kit ⁴

Note 1: Coax wire and 1 connector kit (includes 2 connectors No. 1836444) required for each indoor cable assembly.

Note 2: Coax wire and 1 connector kit (includes 2 connectors No. 1836447) required for each outdoor cable assembly.

Note 3: Used to join 2 No. 2577672 or 2 No. 1833108 Coax Cable Assemblies together.

Note 4: Required to connect Coax Cable Assembly to the connectors on the 5251 and 5381 Individual adapters, Part No. 7363102, are available for replacement purposes.

Twinax Cabling (for attachment to the 5251 Model 2 and 12, 5340 and 5381):

Part #7362268 Twinax Connector kit; includes two connectors. Twinax Wire and one Twinax Connector Kit are required for each attachment cable. (Individual connectors part #7362229 are available for replacement.)

Part #7362211 Twinax Wire; order must specify the desired length. Twinax Wire and one Twinax Connector Kit are required for each attachment cable. (This is an indoor/outdoor cable.)

Part #7362267 Twinax Cable Assembly; includes a Connector Kit (2 connectors) attached to bulk wire. The required length of wire must be specified on the order. The cost of the wire must be added to the fixed assembly price to obtain the total price of the cable assembly.

Part #7362230 Twinax Adapter; permits two Twinax Cable Assemblies to be joined together.

Coax Station Protector Kit (#7855). A kit provides two protectors. One is required at each end of each Coax Cable Assembly installed outdoors (either above or below ground level). Individual Coax Station Protectors, Part No. 7362427, are available for replacement purposes.

Twinax Station Protector Kit (#7850). A kit includes two protectors. One is required at each end of each Twinax Attachment Cable installed outdoors (either above or below ground level). Individual Twinax Station Protectors, PN 7362426, are available for replacement purposes.

**5252 DUAL DISPLAY STATION, MODEL 1**

Purpose: The 5252 is an advanced function dual display station which attaches to the 5251 Models 2 and 12 or 5340 System Unit or 5381 System Unit for entering, editing and displaying alphanumeric data. It may be used as the system console with System/34. The 5252 displays up to 960 characters on each display with 12 lines of 80 characters each. Two movable keyboards permit both operators to display, enter and manipulate data in a highly flexible and efficient manner.

Highlights: The 5252 functions as two independent display stations. The standard character set includes ninety-six 8 x 16 dot matrix characters—52 upper/lower case alphabetic, 10 numeric, 34 special characters in addition to "space." A 188-character Multinational Character Set (see Special Features below) is available, providing 112 alphabetic, 10 numeric, and 66 special displayable characters in addition to "space." See "Type Catalog" for character set and keyboard layouts. Each display provides functional characteristics which permit normal intensity, high intensity, non-display, blinking, underscore, column separator, and reverse image (dark characters on a light background) on a field basis. The image of each display can be reversed independently. Audible alarms, under program control, are provided to alert each operator to special conditions. The keyboards with 24 application assigned command functions provide input and control flexibility. See "Special Features" below.

Security Enhancements: Data fields may be defined so entered data is accepted without being displayed on the screen. A Keylock (special feature) prevents operator usage of both displays and both keyboards when the key is in the locked position. The displays are blanked and keyboard data entry is inhibited when the keylock is locked. Two Magnetic Stripe Readers (Feature #4910) are available for entering user identification.

Field Editing: Individual data input fields may be edited as Alphanumeric, Alpha Only, Signed Numeric, Field Exit Required, Right Adjust, Mandatory Entry, Mandatory Fill, Bypass, Auto Enter, Dup Enable, Monocase and Self Check Modulus 10 and 11.

For Direct Attachment to System/34: One 5252 Dual Display Station or 5251 Model 1 or 11 Display Station is required on System/34 for use as a system console. When the 5252 is used as the system console, one keyboard/display functions as the system console and the other keyboard/display functions as a System/34 work station. The console is attached to one of four Twinax cable connectors on the 5340 via a 6 m (20 ft.) cable provided with the 5340. For maintenance reasons, only one of the above machine types (5251 or 5252) should be attached to this cable. The three additional Twinax cable connectors on the 5340 are provided for attachment of additional work stations (5252 or 5251 Model 1 or 11 or 5256 Printer). A maximum of eight work stations, including the system console, may be attached to the 5340. The 5252 represents two work stations. The maximum length of any one Twinax cable is 1525 m (5000 ft.). Up to three such cables may be attached to the 5340. Multiple work stations (up to seven) may be attached to one cable via Cable Thru feature with each work station. See *IBM 5252 Information Display System Installation Manual—Physical Planning*, GA21-9277 for additional cabling information.

For Direct Attachment to System/38: The 5381 System Unit provides 8 cable connectors for attachment of the 5251 Model 1 and 11 Display Stations, 5252 Dual Display Stations

and 5256 Printers and supports up to 12 of these work stations. Optional features on the 5381 allow up to 40 work stations to be direct attached. The 5252 represents 2 work stations.

The cable attachment may be made with either Twinax or Coax cable. Twinax Cable Connection: Maximum length of any one Twinax cable is 1525 m (5000 ft.). Up to 7 work stations may be attached to a Twinax cable via a Cable Thru feature (#2680) on each work station. Coax Cable Connection: Maximum length of any one Coax cable is 610 m (2000 ft.) between the system attachment and the work station. (Twinax/Coax Adapter Kit is required. Refer to Accessories.) A second work station may be attached via the Cable Thru feature (2680). Twinax cable must be used between the first and second work station and the maximum allowable distance between these two work stations is 30 m (100 ft.). See *IBM 5250 Information Display System Installation Manual Physical Planning* (GA21-9277) for cabling information.

Clustering: The 5252 may be attached to the 5251 Model 2 or 12 with the use Cluster (#2550) or the Dual Cluster (#2551) feature. The Cluster feature allows attachment of up to four work stations (5252 or 5251 Model 1 or 11 or 5256) and the Dual Cluster feature allows attachment of up to eight work stations. The 5252 represents two work stations. See *IBM 5252 Information Display System Installation Manual—Physical Planning*, GA21-9277 for cabling information.

Problem Determination Procedures: Significant function has been designed into this unit to provide greater availability to the customer through the use of problem determination and recovery procedures that are easily understood and used by the operators. The procedures are provided in the *IBM 5252 Operator's Guide*. Also, see "Customer Responsibility." **Customer Setup (CSU):** The 5252 is designated as a customer setup device thereby offering the customer early availability and relocation flexibility. The Marketing Representative must advise the customer of his responsibilities before receipt of the machine.

Customer Responsibility: The customer is responsible for:

- Receipt, unpacking and placement of the 5252
- Physical setup, connection of cables to IBM devices incorporating protected access areas, switch setting, and check-out in accordance with instructions supplied by IBM.
- Notifying IBM of intent to relocate and following IBM instructions for relocation of the 5252.
- Disconnecting, packing, and removal to the customer's shipping dock at the time of discontinuance. Removal instructions and packaging materials (if required) will be ordered by the branch office.
- Relocation of the 5252, if required, to allow IBM service access.
- Using and following the problem determination procedures for the 5252 prior to calling for IBM service.
- Providing a desk or tabletop to support the 5252.
- Installation and maintenance of signal cables and associated parts for attaching the 5252 to the 5251 Model 2 or 12, the 5340 or the 5381.
- When adding additional display stations to System/34 or System/38, the customer may have to modify the system



configuration specifications. See *IBM System/34 Program Product Installation and Modification Reference Manual*, SC21-7689 or *IBM System/38 Program Product Installation Guide* (availability to be announced in a future PRL).

Manuals: *IBM 5250 Information Display System Introduction*, GA21-9246 and *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277.

Specify

1. Voltage (115V, AC, 1-Phase, 60 Hz): #9881 for a standard non-locking plug (uses customer standard type receptacle) or #9880 for locking plug (requires customer locking type receptacle).
2. Two keyboards must be selected (see Special Features).
3. Color: Pearl white only (no specify required).
4. Cables: See Accessories for 5252 cable ordering instructions. For cable specifications, see the *5250 Information Display System Installation Manual—Physical Planning*, GA21-9277. **Specify:** #9050 if cable is ordered from IBM, #9055 if cable is ordered from other source, #9060 if 5252 is used with System/34 as the system console (no cable order required), #9065 if existing cable will be used (no cable order required).
5. System Attachment: Specify the unit that the 5252 is attached to:
 - #9559 for 5251 Model 2
 - #9560 for 5251 Model 12
 - #9561 for 5340
 - #9562 for 5381

Prices: See price list.

Special Features

Keyboard (#4600, 4601, 4602): Two of the following must be selected:

(#4600)—83-key keyboard with the EBCDIC character set, typewriter-like layout, movable, with 49 alphanumeric keys, 24 control keys and 10-key numeric pad.

(#4601)—66-key data entry style keyboard, movable, with 36 alphanumeric keys, 23 control keys and 7 blank keys.

(#4602)—66-key data entry style keyboard with proof arrangement, movable, with 36 alphanumeric keys, 23 control keys and 7 blank keys. The numeric keys are arranged similar to those of an adding machine.

Limitations: #4601 and #4602 are not supported when 5252 is directly attached to the 5340. **Maximum:** Two of the above. **Field Installable:** Yes.

Keylock (#4655): Provides a lock and two keys which prevents operator entry and display of data on either work station when in a locked position. **Maximum:** One. **Field Installable:** Yes.

Magnetic Stripe Reader (#4910): Provides the capability of reading numerically encoded information from a magnetic stripe on a wide range of credit cards, identification cards, and documents. The magnetic stripe may be encoded with up to 128 ABA numeric characters, including control characters. This feature may be used to enhance system data security by providing the ability to read an operator identification card without being displayed.

Limitations: Valid for numeric-only data and single data field. Not supported

when 5252 is directly attached to the 5381. **Prerequisite:** Expanded Function (#3600) on 5251 Models 2 or 12 or Work Station Control Expansion A (#4900) on 5340 when 5252 is directly attached. **Maximum:** Two. **Field Installable:** Yes.

Multinational Character Set (#4905): Provides the capability of displaying the 188 character Multinational Character Set to facilitate the interchange of information between systems with different language groups. **Limitations:** The keyboards do not include the additional characters of the Multinational Character Set. All characters may be entered via a single or multiple key sequence. **Prerequisites:** Multinational Control (#4905) on 5340. All work stations attached to the System/34 and 5251 Model 2 or 12, must have the same character set. **Maximum:** One. **Field Installable:** Not recommended for field installation.

Cable Thru (#2680): Provides the capability of connecting multiple 5252s, 5251 Models 1 and 11, and 5256s to a single twinax cable. Each unit on the cable, except the last, requires this feature. (Note: For relocation flexibility, the customer should consider including #2680 on all work stations.) **Maximum:** One. **Field Installable:** Yes.

Special Features and Accessory Prices

See price list.

Accessories

Keylock and Keys: The 5252 with Keylock #4655 is shipped with 2 keys. Additional keys may be purchased from IBM.

Cables: 5252 Dual Display Station cables and/or associated parts to attach the 5252 to the 5251 Model 2 or 12, the 5340 or the 5381 may be purchased from IBM or from a customer selected source. For the description of these cables and parts, see the *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277. The customer is responsible for the installation and maintenance of these cables and their associated parts. When cabling is ordered from IBM, specify a shipping date at least 4 weeks in advance of receiving the 5252.

Coax Cabling (for attachment to the 5251 Models 2 and 12 and the 5381). See Note 4.

Assm No	2577672	Coax Cable Assembly Indoor
Bulk No	0323921	Coax Wire Indoor ¹
Part No	1836418	Coax Connector Kit Indoor ¹
Assm No	1833108	Coax Cable Assembly Outdoor
Bulk No	5252750	Coax Wire Outdoor ²
Part No	1836419	Coax Connector Kit Outdoor ²
Part No	5252643	Coax Adapter ³
Part No	7361118	Twinax/Coax Adapter Kit ⁴

Note 1: Coax wire and one connector kit (includes 2 connectors No. 1836444) required for each indoor cable assembly.

Note 2: Coax wire and one connector kit (includes 2 connectors No. 1836447) required for each outdoor cable assembly.

Note 3: Used to join two No. 2577672 or two No. 1833108 Coax Cable Assemblies together.



Note 4: Required to connect Coax Cable Assembly to the connectors on the 5252, 5251 Models 2 and 12 and 5381 Individual adapters, Part No. 7363102, are available for replacement purposes.

Twinax cabling (for attachment to the 5251 Models 2 and 12, 5340 and 5381):

Part #7362268 Twinax Connector Kit; includes two connectors. Twinax Wire and one Twinax Connector Kit are required for each attachment cable. (Individual connectors Part #7362229 are available for replacements.)

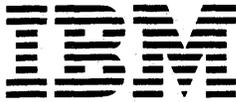
Part #7362211 Twinax Wire; order must specify the desired length. Twinax Wire and one Twinax Connector Kit are required for each attachment cable. This is an indoor/outdoor cable.

Part #7362267 Twinax Cable Assembly; includes a Connector Kit (2 connectors) attached to bulk wire. The required length of wire must be specified on the order. The price of the Twinax Wire (Part #7362211) must be added to the purchase price of the Cable Assembly to obtain the total price of the Cable Assembly.

Part #7362230 Twinax Adapter; permits two Twinax Cable Assemblies to be joined together.

Coax Station Protector Kit (#7855): A kit provides two protectors. One is required at each end of each Coax Cable Assembly installed outdoors (either above or below ground level). Individual Coax Station Protectors, PN 7362427, are available for replacement purposes.

Twinax Station Protector Kit (#7850): A kit includes two protectors. One is required at each end of each Twinax attachment cable installed outdoors (either above or below ground level). Individual Twinax Station Protectors, PN 7362426, are available for replacement purposes.

**5256 PRINTER**

Purpose: Printed output for System/34 and System/38

A bi-directional printer with dual 256 byte buffers and full buffer formatting capabilities.

Model 1 40 cps Maximum
Model 2 80 cps Maximum
Model 3 120 cps Maximum

Model Changes: Field Installable

Highlights

Maximum printer throughput is obtained with bi-directional serial matrix printing and indexing without unnecessary print head movement. Matrix characters are formed by 8 vertical wire printing dots in up to 4 of 7 possible horizontal positions, giving high legibility with character spacing at 10 characters to the inch for the standard upper/lower case 96-character set. A 188 character Multinational Character Set is available (see Specify below).

The operator can select six or eight lines per inch (lpi) vertical spacing. (Overlapped printing may result when printing at 8 lpi). A variable width forms tractor provides for feeding continuous forms. Single cut forms may be processed in typewriter fashion. For optimum handling of continuous forms, the special feature Forms Stand (#4450) is recommended. See Accessories. Refer to *Form Design Reference Guide for Printers*, GA24-3488 for forms design considerations and limitations. See the "Type Catalog" for character set arrays.

Problem Determination Procedures: Significant function has been designed into this unit to provide greater availability to the customer through the use of problem determination and recovery procedures that are easily understood and used by the operator. The procedures are provided in the *IBM 5256 Operator's Guide*. Also, see "Customer Responsibility" below.

Customer Setup (CSU): The 5256 is designated as customer setup, thereby offering the customer early availability and relocation flexibility. The Marketing Representative must advise the customer of his responsibilities before receipt of the machine.

Customer Responsibilities: The customer is responsible for:

- Receipt, unpacking and placement of the 5256.
- Physical setup, connection of cables to IBM devices incorporating protected access areas, switch setting and check-out in accordance with instructions supplied by IBM.
- Notifying IBM of intent to relocate and following IBM instructions for relocation of the 5256.
- Disconnecting, packing and removal to the customer's shipping dock at the time of discontinuance. Removal instructions and packaging materials (if required) will be ordered by the Branch Office.
- Relocation of the 5256, if required, to allow IBM service access.
- Using and following the problem determination procedures for the 5256 prior to calling for IBM service.
- Providing a desk or tabletop to support the 5256.
- Installation and maintenance of signal cables and associated parts for attaching the 5256 to the 5251 Model 2 or 12, the 5340 or the 5381.

When adding additional Printers to System/34 or System/38, the customer may have to modify the system configuration specifications. See *IBM System/34 Program Product Installation and Modification Reference Manual* or *IBM System/38 Program Product Installation Guide*.

Supplies: A black ribbon, IBM P/N 1136653, or equivalent, is required.

For Direct Attachment to System/34: The 5340 System Unit provides four twinax cable connectors for attachment of 5251 Model 1 and 11 Display Stations, 5252 Dual Display Stations, and 5256 Printers. One cable connector is dedicated to the exclusive attachment of a display station utilized as the system console. No other devices may be attached to this cable. The three additional twinax cable connectors on the 5340 are provided for attachment of additional work stations (5251 Model 1 or 11, or 5252 or 5256). A maximum of eight work stations, including the system console, may be attached to the 5340. The 5252 represents two work stations. The maximum length of any one twinax cable is 1525 m (5000 ft). Up to three such cables may be attached to the 5340. Multiple work stations (up to seven) may be attached to one cable via a Cable Thru Feature with each work station. If a 5256 Printer is designated as the system printer (in lieu of a 5211), a 6 m (20 ft) cable is provided with the 5340. See *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277 for additional cabling information.

If the 5256 is the system printer, specify #9306 on the 5340. See 5340 "Specify."

For Direct Attachment to System/38: The 5381 System Unit provides 8 cable connectors for attachment of the 5251 Model 1 and 11 Display Stations, 5252 Dual Display Stations and 5256 Printers and supports up to 12 of these work stations. Optional features on the 5381 allow up to 40 work stations to be attached. The 5252 represents 2 work stations.

The cable attachment may be made with either Twinax or Coax cable. Twinax Cable Connection: Maximum length of any one Twinax cable is 1525 m (5000 ft.). Up to 7 work stations may be attached to a Twinax cable via a Cable Thru feature (#2680) on each work station. Coax Cable Connection: Maximum length of any one Coax cable is 610 m (2000 ft.) between the system attachment and the work station. (Twinax/Coax Adapter Kit is required. Refer to Accessories.) A second work station may be attached via the Cable Thru feature (#2680). Twinax cable must be used between the first and second work station and the maximum allowable distance between these two work stations is 30 m (100 ft.). See *IBM 5250 Information Display System Installation Manual Physical Planning* (GA21-9277) for cabling information.

Clustering: The 5256 may be attached to the 5251 Model 2 or 12 with the Cluster (#2550) or the Dual Cluster (#2551) feature. The Cluster feature allows attachment of up to four work stations (5251 Model 1 or 11 or 5252 or 5256) and the Dual Cluster feature allows attachment of up to eight work stations. The 5252 represents two work stations. See *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277 for cabling information.

Manuals: *IBM 5250 Information Display System Introduction*, GA21-9246 and *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277.



Specify

1. Voltage (115V AC, 1-Phase, 60 Hz): #9881 for standard non-locking plug, (uses customer standard type receptacle) or #9880 for a locking plug (requires customer locking type receptacle).
2. Color: Pearl white only (no specify required).
3. Cables: See Accessories for cable ordering instructions. For cable specifications, see the *IBM 5250 Information Display System Manual—Physical Planning*, GA21-9277. Specify: #9050 if cable is ordered from IBM, #9055 if cable is ordered from another supplier, #9060 if 5256 is used with System/34 as system printer (no cable order required), #9065 if existing cable will be used (no cable order required).
4. System Attachment: Specify the unit to which the 5256 is attached: #9559 for 5251 Model 2, #9560 for 5251 Model 12, #9561 for 5340 or #9562 for 5381.
5. Print Spanish N: #9570. Provides the following character substitutions: prints N, n,], [, and * in place of #, !, l, c and r.
6. Character Set: The 96-character EBCDIC character set is provided as standard. If the 188-character Multinational Character Set is desired, specify #9470. All work stations and printers attached to a System/34 and a 5251 Model 2 or 12, must have the same character set.

Prices: See Price List.

Special Features

Audible Alarm (#1470): Provides an audible indication to the operator when manual intervention is required. **Maximum:** One. **Field Installable:** Yes.

Cable Thru (#2680): Provides the capability of connecting multiple 5256s, 5251 Models 1 or 11 and 5252s to a single twinax cable. Each unit on the cable, except the last, requires this feature. (Note: For relocation flexibility, the customer should consider including #2680 on all work stations). **Maximum:** One. **Field Installable:** Yes.

Special Feature and Accessory Prices: See Price List.

Accessories

Cables: 5256 Printer cables and/or associated parts to attach the Printers to the 5251 Model 2 or 12, the 5340, or the 5381 may be purchased from IBM or from a customer selected source. For the description of these cables and parts, see the *IBM 5250 Information Display System Installation Manual—Physical Planning*, GA21-9277. The customer is responsible for the installation and maintenance of these cables and their associated parts. When cabling is ordered from IBM, specify a shipping date at least 4 weeks in advance of receiving the 5256.

Coax Cabling (for attachment to the 5251 Models 2 and 12 and the 5381. See Note 4.

Assm No	2577672	Coax Cable Assembly Indoor
Bulk No	0323921	Coax Wire Indoor ¹
Part No	1836418	Coax Connector Kit Indoor ¹
Assm No	1833108	Coax Cable Assembly Outdoor
Bulk No	5252750	Coax Wire Outdoor ²
Part No	1836419	Coax Connector Kit Outdoor ²
Part No	5252643	Coax Adapter ³
Part No	7361118	Twinax/Coax Adapter Kit ⁴

Note 1: Coax wire and one connector kit (includes 2 connectors No. 1836444) required for each indoor cable assembly.

Note 2: Coax wire and one connector kit (includes 2 connectors No. 1836447) required for each outdoor cable assembly.

Note 3: Used to join two No. 2577672 or two No. 1833108 Coax Cable Assemblies together.

Note 4: Required to connect Coax Cable Assembly to the connectors on the 5256, 5251 Models 2 and 12 and 5381 Individual adapters, Part No. 7363102, are available for replacement purposes.

Twinax Cabling (for attachment to the 5251 Models 2 and 12, 5340 and 5381:

Part # 7362268 Twinax Connector Kit; includes two connectors. Twinax Wire and one Twinax Connector Kit are required for each attachment cable. (Individual connectors part #7362229 are available for replacements.)

Part #7362211 Twinax Wire; order must specify the desired length. Twinax Wire and one Twinax Connector Kit are required for each attachment cable. This is an indoor/outdoor cable.

Part #7362267 Twinax Cable Assembly; includes a Connector Kit (2 connectors) attached to bulk wire. The required length of wire must be specified on the order. The cost of the wire must be added to the fixed assembly price to obtain the total price of the cable assembly.

Part #7362230 Twinax Adapter; permits two Twinax Cable Assemblies to be joined together.

Coax Station Protector Kit (#7855): A kit provides two protectors. One is required at each end of each Coax Cable Assembly installed outdoors (either above or below ground level). Individual Coax Station Protectors, PN 7362427, are available for replacement purposes.

Twinax Station Protector Kit (#7850): A kit includes two protectors. One is required at each end of each Twinax Attachment Cable installed outdoors (either above or below ground level). Individual Twinax Station Protectors, PN 7362426, are available for replacement purposes. The Station Protector is a CSU accessory.

Forms Stand (#4450): Permits feeding continuous forms from a carton and provides for forms stacking on a single shelf after printing.



5320 SYSTEM UNIT

Purpose: The System/32 is a compact commercial data processing system designed primarily for small businesses.

Model	Printing Speed	Disk Storage Capacity
A01	40 CPS Unidirectional	3,210,240 bytes
A02	40 CPS Unidirectional	5,053,440 bytes
A03	40 CPS Unidirectional	9,169,920 bytes
A04	40 CPS Unidirectional	13,777,920 bytes
A11	40 CPS Bidirectional	3,210,240 bytes
A12	40 CPS Bidirectional	5,053,440 bytes
A13	40 CPS Bidirectional	9,169,920 bytes
A14	40 CPS Bidirectional	13,777,920 bytes
A21	80 CPS Bidirectional	3,210,240 bytes
A22	80 CPS Bidirectional	5,053,440 bytes
A23	80 CPS Bidirectional	9,169,920 bytes
A24	80 CPS Bidirectional	13,777,920 bytes
A31	120 CPS Bidirectional	3,210,240 bytes
A32	120 CPS Bidirectional	5,053,440 bytes
A33	120 CPS Bidirectional	9,169,920 bytes
A34	120 CPS Bidirectional	13,777,920 bytes
B11	50 LPM	3,210,240 bytes
B12	50 LPM	5,053,440 bytes
B13	50 LPM	9,169,920 bytes
B14	50 LPM	13,777,920 bytes
B21	100 LPM	3,210,240 bytes
B22	100 LPM	5,053,440 bytes
B23	100 LPM	9,169,920 bytes
B24	100 LPM	13,777,920 bytes
B31	155 LPM	3,210,240 bytes
B32	155 LPM	5,053,440 bytes
B33	155 LPM	9,169,920 bytes
B34	155 LPM	13,777,920 bytes
C41	285 LPM	3,210,240 bytes
C42	285 LPM	5,053,440 bytes
C43	285 LPM	9,169,920 bytes
C44	285 LPM	13,777,920 bytes

Note: All models have 16,384 bytes of main storage standard.

Model Changes: Field Installable.

Model Change Considerations:

- Any model change that involves a disk storage capacity may require replacement of the disk storage mechanism. Adequate provision must be made for retaining the data contained on the replaced disk mechanism and elimination of user proprietary information.
- Model changes between "A," "B" and "C" Models require replacement of the print mechanism and may require replacement of the power supply. A0X, A1X or A2X Models, when changed to A31, A32, A33 or A34 Models must be at E.C. level 828749 or the print mechanism must be replaced.

Highlights

- Operator oriented data processing.
- Direct keyboard data entry.
- Display screen.
- Batch processing with stored job stream procedures.
- RPG II programming support.
- Communications capability via SDLC or BSC.
- Word processing functions

System Features

Metal Oxide Semiconductor Field Effect Transistor (MOSFET) main storage ... 600 nanosecond main storage cycle time ... main storage available in 16K, 24K or 32K bytes with 2K bytes reserved for SCP functions ... internal structure is EBCDIC eight-bit byte ... all model changes and features are field installable.

Keyboard is used for data entry and operator/system communication. It features a familiar typewriter layout plus a 10-key proof keyboard and function keys. The top row of typewriter keys are dual-defined, providing 24 command keys. In addition to the standard alphanumeric keys, the keyboard has record/field/character advance/backspace keys, repeat keys, and printer control keys.

A Dual Case Keyboard and Display feature provides upper/lower and special character/graphic support and a special key used by application programs to simulate the OPD Mag Card ("Selectric," II, A, and "Executive") Typewriter code key.

Display Screen provides operator guidance and prompting and auxiliary output under program control. Up to 240 characters can be displayed ... 6 rows of 40 characters each. All data entered through the keyboard is displayed on the screen by the programming system.

Disk Storage capacity of 3.2, 5.0, 9.1 or 13.7 million bytes of non-removable high speed direct access storage. The disk rotates at 2964 RPM, yielding a data rate of up to 889,000 bytes per second ... permitting efficient sequential and random access processing. The following table provides corresponding capacity data and access times. For more specific access times, refer to timing charts. Average latency is 10.1 ms.

	3.2 MB	5.0 MB	9.1 MB	13.7 MB
Bytes/Sector	256	256	256	256
Sectors/Track	60	60	60	60
Tracks/Cylinder	2	2	2	3
Bytes/Cylinder	30,720	30,720	30,720	46,080
Cylinders	104.5	164.5	298.5	299.0
Access Time (ms)				
Minimum	13.0	13.0	14.2	14.2
Average	50.4	70.0	72.5	72.5
Maximum	121.0	180.0	166.9	166.9

Line Printing "B" and "C" Models with a 48 character print belt provide printed output at nominal rated speeds of 50, 100, 155 or 285 lines per minute depending upon model. Included as standard is one engraved font print belt selected from 48 or 64 character EBCDIC, 64 character ASCII or 96 character dual case modified Courier or Artisan. Nominal printing speeds are as follows:

Character Set Size			
Model	48	64	96
B1x	50 lpm	50 lpm	50 lpm
B2x	100 lpm	100 lpm	80 lpm
B3x	155 lpm	120 lpm	80 lpm
C4x	285 lpm	225 lpm	160 lpm*

*80 LPM when used with Word Processor/32 (5725-XX1) PPA.

Horizontal spacing is 10 characters to the inch with a 132 position print line. Vertical spacing is 6 lines to the inch. For



8 lines to the inch vertical spacing and programming support, see RPQ S40127. A variable width forms tractor provides for feeding continuous forms. Refer to SRL, GA24-3488, Form Design Reference Guide for Printers, for forms design considerations and limitations. Forms jam detection is standard. See "Type Catalog" section for character set arrays and styles.

Serial Printing "A" Models print at a maximum rate of 40 characters per second in a unidirectional mode or 40, 80 or 120 characters per second in a bidirectional mode depending on model. Matrix characters are formed by eight vertical wires. Horizontal spacing is 10 characters to the inch with a 132 position print line. Vertical spacing is 6 lines to the inch. A variable width forms tractor provides for feeding continuous forms. Refer to SRL, GA24-3488, Form Design Reference Guide for Printers, for forms design considerations and limitations. See the "Type Catalog" for character set array.

Notes:

(1) Differences between line and serial printing are transparent to RPG II object code for continuous forms and recompilation is not required when changing printer models ... (2) System/32 printed output is not recommended for optical character reading ... (3) A forms stand, providing for the feeding and stacking of continuous forms, is provided with the system ... (4) Printed output utilizing Artisan or Modified Courier print belts should not be expected to compare in quality to the "Selectric" typewriter.

Diskette Drive provides the capability of entering data recorded off-line and also is a load/dump back-up facility via the IBM Diskette 1. The diskette also provides compatible media for interchange with other systems utilizing IBM Diskette 1... (up to 242,944 byte capacity). For System/32 use, Diskette 1... capacity is 246,272 bytes in basic data exchange format and 303,104 bytes in 512 byte Extended Format. 128 byte records are processed at rates up to 3400 per minute reading and up to 1800 per minute writing. "Read" and "Write" are not overlapped with processing or other devices, however, "one track forward seek" is overlapped.

Card I/O utilizing the 129 Card Data Recorder (80 column) provides reading up to 50 cards per minute and punching or punching and printing from 12 to 50 cards per minute. In punch mode, throughput may vary. When two or more adjacent columns are blank, the equivalent of read speed is achieved until a non-blank column is encountered. Utilizing the 5496 Data Recorder (96 column) provides reading, punching and printing speeds of up to 21 cards per minute. Cannot be installed with Mag Card Unit (Attachment #4900) and Half Line Space Printing (#4530). Card I/O operation within the same program as the diskette drive, BSCA or SDLC is not supported.

Mag Card I/O utilizing the 5321 Mag Card Unit provides reading and recording of information up to 102 char/track and 50 tracks/card ... Reading is at the rate of 230 millisecond/track; recording is at the rate of 450 millisecond/track. The 5321 Mag Card Unit uses the same card and recording discipline as the Mag Card products. Operation of the Mag Card Unit within the same program as the diskette drive, BSCA or SDLC is not supported.

Magnetic Character Reading utilizing the 1255 Magnetic Character Reader provides reading and sorting of MICR inscribed documents at 500 documents per minute for the

Model 1 and 750 documents per minute for the Models 2 and 3. Six stackers are provided on the Models 1 and 2, and twelve stackers on the Model 3. Operation of the 1255 within the same program as the diskette drive, BSCA, or SDLC is not supported.

Supplies: (1) A black ribbon, part number 1136653, or equivalent, is required for the A models ... (2) A black ribbon, part number 1136634, or equivalent, is required for the B models ... (3) A black ribbon, part number 1136670, or equivalent, is required for "C" Models .

Bibliography: GC20-0032

- 1. Voltage (AC, 1 Phase, 60 Hz): #9884 for 208V, or #9886 for 230V.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue or #9045 for light gray.
3. Print Belt (B and C Models only): Available at time of manufacture only except when upgrading an installed "A" Model. Specify one of the following:

Table with 3 columns: Belt Description, Specify No. .079 inches, Specify No. .095 inches. Rows include 64 Char EBCDIC, 48 Char EBCDIC, 64 Char ASCII, 96 Char modified Courier, 96 Char Artisan, 48 Char FORTRAN.

*Recommended for use with 6 or 8 lpi RPQ (S40127).

- 4. ASCII key tops and Display Screen graphics: Specify #9370.

Note: Includes ASCII graphics on serial printing (A models).

- 5. Modem Cable (SDLC or BSCA only): Required for attaching System/32 to the communications facility regardless of whether an IBM integrated modem or an external modem is used. #9460 for a 20-foot cable ... #9461 for a 40-foot cable.

Note: Up ending, if required, may be accomplished by following the instructions shipped with the system.

Purchase Considerations

- 1. Any model upgrade that involves a disk storage capacity change may require replacement of the disk storage mechanism. Adequate provision must be made for retaining the data contained on the replaced disk mechanism and elimination of user proprietary information.
2. Model changes between "A," "B" and "C" Models require replacement of the print mechanism and may require replacement of the power supply. A0X, A1X or A2X Models when changed to A31, A32, A33 or A34 Models must be at E.C. level 828749 or the complete print mechanism must be replaced.
3. The upgrade purchase prices for model changes may be greater than the purchase price differentials. The customer should carefully evaluate his future requirements when purchasing a system.



4. Replaced parts from any model change become the property of IBM.

Special Feature

Additional Storage (#1005): Provides an additional 8,192 bytes of main storage. **Maximum:** Two. **Field Installation:** Yes.

1255 Attachment (#1100): To attach a 1255 Magnetic Character Reader Model 1, 2 or 3, equipped with a System/3/32/34 Adapter (#6303). See GA21-9177, *IBM System/32 Installation Manual—Physical Planning*, for cabling information. **Maximum:** One. **Field Installation:** Yes. **Limitation:** Cannot be installed with Data Recorder Attachment (#3200) or 5321 Mag Card Unit Attachment (#4900).

Control Storage Increment (#1500): Provides additional control storage and access to a Scientific Instruction Set, a group of additional instructions which perform functions commonly required in scientific programs. Required for execution of FORTRAN IV (5725-FO1) generated object programs. #1500 is not required for compiling programs. **Maximum:** One. **Field Installation:** Yes.

Keylock (#4655): Replaces on/off power switch to protect against unauthorized use. See Locks and Keys for additional information. **Field Installation:** Yes.

Data Recorder Attachment (#3200): To attach either a 129 Card Data Recorder Model 2 equipped with a 3741/5320 Attachment (#8201) or a 5496 Data Recorder Model 1 equipped with a 2772/3741/5320 Attachment (#7850). A ten foot cable and connector required to attach a 129 or 5496 to the 5320 is included. **Maximum:** One. **Field Installation:** Yes. **Limitation:** Cannot be installed with 5321 Mag Card Unit Attachment (#4900) or 1255 Attachment (#1100).

5321 Mag Card Unit Attachment (#4900) (B and C Models only): To attach a 5321 Mag Card Unit Model 1 to a System/32. A 15 foot cable and connector required to attach the 5321 is included. **Maximum:** One. **Field Installation:** Yes. **Limitation:** Cannot be installed with Data Recorder Attachment (#3200) or 1255 Attachment (#1100).

Dual Case Keyboard Display (#3400) (B and C Models only): Provides upper and lowercase characters and new graphics as well as redefines the character/graphic arrangement of the System/32 keyboard and display. (See "Type Catalog" for character/graphic arrangements supported.) One set of prompt templates (10 keyboard arrangements) are supplied with #3400. **Field Installation:** Yes. See Dual Case Keyboard Print Templates for additional sets. **Limitations:** Not compatible with #9370 ASCII Key tops and Graphics; not compatible with RPG GG0339—(additional Print Belt—96-character); not compatible with RPQ S40127—(6 or 8 lines per inch spacing).

Half Line Space Printing (#4530) (B and C Models only): Provides half line vertical spacing for printing. This feature supports superscript and subscript requirements normally associated with the character sets provided by Artisan and modified Courier print belts. **Field Installation:** Yes. **Limitation:** Application programs using half line spacing must include repositioning to the next full vertical space where full space alignment is required. Cannot be installed with RPQ S40127 (8 lines/in spacing) or Data Recorder Attachment (#3200).

Locks and Keys: The 5320 with Keylock (#4655) special feature is shipped with 2 keys. Additional keys may be pur-

chased from IBM. (Vendor will supply additional keys to original purchaser).

Additional Print Belts (Bond C Models only): Permits the customer to print more than one character set for various applications. Can be interchangeably used with the belt provided with the machine.

Belt Description	Feature No.	Feature No.
	.079 inches	.095 inches
64 Char EBCDIC	#5905*	#5910
48 Char EBCDIC	5906*	5911
64 Char ASCII	5907*	5912
96 Char modified Courier	N/A	5913
96 Char Artisan	N/A	5914
48 Char FORTRAN	N/A	5552

*Recommended for use with 6 or 8 lpi RPQ (S40127).

Dual Case Keyboard Prompt Templates: (P/N 2773082) A set of ten keyboard redefine prompt templates support the OP keyboard options as identified in the GSD Type Catalog. One set is provided with Dual Case Keyboard and Display (#3400).

Communications Features

Synchronous Data Link Control Communications (SDLC) (#6301): In conjunction with stored program control, this feature provides communications capability with System/370 Models 115, 125, 135, 145, 155II, 158, 158MP, 165II, 168 and 168MP via a 3704 or 3705 Communications Controller equipped with appropriate features ... see 3704, 3705

The System/370 must be operating under control of DOS/VS, OS/VS1 or OS/VS2 VTAM and the 3704/3705 under control of the Network Control Program/VS (NCP/VS). See the System/32 programming pages for a description of the program support provided on System/32 for this feature.

The SDLC feature (#6301) will allow System/32 to communicate on a non-switched point-to-point or multipoint line at speeds up to 7200 bps and on a switched point-to-point line at speeds up to 4800 bps. See M2700 pages for information on communication facilities.

This SDLC feature will operate in half-duplex mode over dial (switched network) facilities, and in half-duplex mode over non-switched (or equivalent private) communication lines which may be duplex or half-duplex facilities. Operation of this feature on System/32 will be overlapped at all transmission rates with processing and/or I/O device operations including fixed disk. SDLC units at each termination or drop point of a data line to which the System/32 is attached must use the same clocking source (modem or business machine), the same transmission encoding option (NRZ or NRZI) and must be operating at the same transmission rate.

Switched network versions include as a basic capability support of Manual Dial and Manual or Auto Answer (where the attached modem supports this capability) operations.

The System/32 operates as an SDLC secondary station and can operate on a communication line with other IBM SDLC terminals.



Limitation: Cannot be installed with BSCA (#2074). Card I/O, the 5321 Mag Card Unit, the 1255 Magnetic Character Reader or the diskette drive cannot be operated within the same program as SDLC. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** One of the Integrated Modems (#5500, 5501, 5600, 5602 or 5610) or EIA Interface (#3701). *Note:* See "Specify" for required modem cable. SDLC supported by SCP (5723-SC1) requires 24K bytes of main storage.

Binary Synchronous Communications Adapter (BSCA) (#2074): In conjunction with stored program control, this feature permits System/32 to function on a switched, non-switched, or private communications line as a processor/terminal communicating in binary synchronous mode with:

Another System/32 equipped with #2074.

A System/34 equipped with a Communication Adapter.

A 6640 Document Printer* equipped with BSC/EBCDIC feature

IBM Office System* 6/430, 6/440, and 6/450 equipped with BSC/EBCDIC feature

An IBM Mag Card II typewriter—Communicating

A System/3 equipped with #2074 or #2084.

A System/360 Model 20 equipped with #2074.

A System/360 or System/370 (which is supported by OS or DOS BTAM; OS TCAM; OS/VS1 or OS/VS2 BTAM, TCAM or VTAM; DOS/VS BTAM or VTAM) via an Integrated Communications Adapter, a 2701 Data Adapter Unit, or a 3704/3705 Communications Controller with the Network Control Program (NCP) or the Partitioned Emulation Program (PEP), any of which are equipped with a binary synchronous adapter and appropriate sub-features.

A 3741 Data Station Model 2 or 3741 Programmable Work Station Model 4.

A 3747 Data Converter equipped with Communications Adapter (#166Q).

A 5110 Computer System equipped with BSCA #2074 (as a 3741 Model 2 or 4).

A 5231 Model 2 equipped with BSCA (#2074) (Point-to-point unidirectional transmission only)

A System/7 equipped with BSCA (#2074).

*Requires communicating features 3700 and 3701 or 5501 or 5508, or 5510 (The system/32 requires SCP feature 6002 with WPCU)

See the System/32 programming pages for a description of the program support provided on System/32 for this feature.

The BSCA feature (#2074) will allow System/32 to communicate on a non-switched point-to-point or multipoint line at speeds up to 7200 bps and on a switched point-to-point line at speeds up to 4800 bps. See M 2700 pages for information on communication facilities.

On a multipoint line System/32 operates as a tributary station. No support is provided for System/32 to operate as a control station on a multipoint line; therefore, communication with other devices which do not provide control station capability must be done on a point-to-point line only.

This feature, Binary Synchronous Communications Adapter, will operate in half-duplex mode over dial (switched network)

facilities, and in half-duplex mode over non-switched (or equivalent private) communication lines which may be duplex or half-duplex facilities. Operation of this feature on System/32 will be overlapped at all transmission rates with processing and/or I/O device operations including disk. BSC units at each termination or drop point of a data link to which the System/32 is attached must use the same clocking source (modem or business machine) and must be set to operate at the same transmission rate and to use the same transmission code.

Switched network versions include as a basic capability support of Manual Dial and Manual or Auto Answer (where the attached modem supports this capability) operations.

ASCII, EBCDIC, or EBCDIC Text Transparency are standard. One of the above transmission codes is selected at program compilation time.

Limitation: Cannot be installed with SDLC (#6301). Card I/O, the 5321 Mag Card Unit, the 1255 Magnetic Character Reader or the diskette drive cannot be operated within the same program as the BSCA. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** One of the Integrated Modems (#5500, 5501, 5600, 5602 or 5610) or EIA Interface (#3701). *Note:* See "Specify" for required modem cable.

EIA Interface (#3701): Provides a cable and interface for the attachment of an IBM Modem or non-IBM data set meeting RS-232-C characteristics. Non-IBM modems may be attached subject to the Multiple Suppliers System Policy. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Cannot be installed with 1200 BPS Integrated Modem (#5500, 5501) or 2400 BPS Integrated Modem (#5600, 5602, 5610). *Note:* This feature may also require Internal Clock (#4703) if the external modem does not provide its own clocking.

Internal Clock (#4703): Generates synchronizing and timing signals for SDLC or BSC operation when they are not provided by the modem. Clocking speeds available with this feature are 600 bps and 1200 bps. Selection of speed is indicated via a system utility program (SCP). When this feature is installed on System/32, all other SDLC or BSC stations attached to the same data link must also be equipped with a similar IBM Internal Clock feature.

Maximum: One. **Field Installation:** Yes.

Prerequisite: SDLC (#6301) or BSCA (#2074); EIA Interface (#3701) or 1200 BPS Integrated Modem (#5500, 5501). **Limitation:** Cannot be installed with 2400 BPS Integrated Modem (#5600, 5602, 5610).

1200 BPS Integrated Modem (#5500, 5501): A modem for SDLC or BSC data transmission at 1200 bps over non-switched facilities or switched network. Available in two different versions: #5500—Non-Switched ... #5501—Switched with Auto Answer. Attachment to the non-switched (2 or 4-wire) facilities is via an IBM provided cable directly to the line, Type 3002 Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/32 must also be equipped with 1200 BPS Integrated Modem/Line Adapter. **Limitation:** Cannot be installed with EIA Interface (#3701) or 2400 BPS Integrated Modem (#5600, 5602, 5610). #5500 and 5501 cannot be installed together. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** SDLC (#6301) or BSCA (#2074); and Internal Clock (#4703).

2400 BPS Integrated Modem (#5600, 5602, 5610): A modem for SDLC or BSC data transmission at 2400 bps over non-switched facilities or switched network, equivalent to and



compatible with similarly featured IBM 3872 modems. Available in three different versions: #5600—Non-Switched Point-to-Point ... #5602—Non-Switched Multipoint Tributary ... #5610—Switched Network with Auto Answer.

Attachment to Non-Switched (2 or 4-wire) facilities is via an IBM provided cable directly to the line, Type 3002. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/32 must also be equipped with 2400 BPS Integrated Modem/Line Adapter or IBM 3872 Modem. Limitation: Cannot be installed with EIA Interface (#3701) or 1200 BPS Integrated Modem (#5500, 5501). #5600, 5602, or 5610 cannot be installed together. Maximum: One. Field Installation: Yes. Prerequisites: SDLC (#6301) or BSCA (#2074); Processing Unit Expansion (#5733).

Processing Unit Expansion (#5733): Provides for mounting of one IBM 2400 BPS Integrated Modem (#5600, 5602, 5610). Maximum: One. Field Installation: Yes. Prerequisites: SDLC (#6301) or BSCA (#2074); IBM 2400 BPS Integrated Modem (#5600, 5602, 5610). Limitation: Cannot be installed with EIA Interface (#3701) or IBM 1200 BPS Integrated Modem (#5500, 5501).

Switched Network Backup (SNBU) (#7951): Provided for back-up attachment of System/32 to the public switched network when the 2400 BPS Integrated Modem (#5600, 5602) is used on a non-switched line as the prime facility. It can communicate with another 2400 BPS Integrated Modem or an IBM 3872 Modem when either is equipped with switched network capability. Selection of the primary or back-up facility is via an operator invoked system utility program (SCP).

Attachment to the switched network is made via a common carrier arrangement type CDT or equivalent. Calls must be established and answered manually. Operator intervention, program modification, or both may be required on the using system/terminal. This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1, and OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2. Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Back-Up feature. For additional information see the 3872 User's Guide. Maximum: One. Limitations: Cannot be installed with SDLC (#6301) or Switched Network Back-Up with Auto Answer (#7952). Field Installation: Yes. Prerequisites: BSCA (#2074); 2400 BPS Integrated Modem (#5600 or 5602); Processing Unit Expansion (#5733).

Switched Network Back-up with Auto Answer (SNBU/AA) (#7952): Same as Switched Network Back-Up (#7951) plus the added capability of automatically answering incoming calls when attached to a common carrier arrangement type CBS or equivalent. Selection of the prime or back-up facility is via an operator invoked system utility program (SCP). Operator intervention, program modification, or both may be required on the using system/terminal. This feature can be used with BTAM program for DOS, DOS/VS, OS, OS/VS1 or OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2. Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Back-Up feature. For additional information see the 3872 User's Guide. Maximum: One. Limitations: Cannot be installed with SDLC (#6301) or Switched Network Back-Up (#7951). Field Installation: Yes. Prerequisites: BSCA (#2074); 2400 BPS Integrated Modem (#5600 or 5602); Processing Unit Expansion (#5733).

IBM Modems One IBM modem can be attached to a System/32. Prerequisite: SDLC (#6301) or BSCA (#2074); EIA Interface (#3701).

Modem	Speed (bps)
3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

Note: System/32 does not support Auto Call Originate (#1091) on the 3872 or 3874. For communications capabilities, product utilization, and special features, see M2700, 3872, 3874, 3875 pages.

To verify the proper integrated modem or external modem interface configuration, refer to the following chart. Select one of the categories numbered from 1 to 3 and follow across for the required and optional special features.

Modem/Interface Feature Configurator

Modem/Interface	Internal Clock (#4703)	Processing Unit Expansion (#5733)	SNBU or SNBU/AA (#7951)(#7952)
1.EIA Interface (#3701)	Optional	—	—
2.1200 BPS Integrated Modem:			
A. Non-Switched (#5500)	Required	—	—
B. Switched with Auto Answer (#5501)	Required	—	—
3.2400 BPS Integrated Modem:			
A. Non-Switched Point-to-Point (#5600)	—	Required	Optional
B. Non-Switched Multipoint Tributary (#5602)	—	Required	Optional
C. Switched Network Auto Answer (#5610)	—	Required	—

Additional Information

I. Communication Facility Attachments

The SDLC and BSCA features are designed to operate at speeds between 600 and 7200 bps over common carrier switched or non-switched facilities or equivalent privately owned communication facilities.

II. References

1. See the Host System Programming pages
2. See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities, and customer responsibilities.
3. Refer to the *Data Communications Handbook*
4. Refer to *Installation Manual—Physical Planning*, GA21-9177, for physical installation requirements.
5. Refer to SCP feature (6002) for Word Processing Communications Utility Support to 6640 Document Printer, IBM Office Systems 6/430, 6/440, 6/450 a



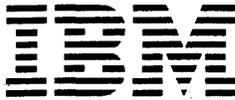
second Word Processing System/32, and the IBM
Mag Card II Typewriter—Communicating.

III. Customer Responsibilities

1. The customer must be advised, in writing, of certain responsibilities related to the installation and maintenance of common carrier facilities/services as well as the IBM equipment.
2. The IBM Marketing Representative must have the customer obtain a firm installation date for the start of transmission services (including any required modems) prior to processing the Order Confirmation card.

IV. Cables

A Modem Cable is required. See "Specify." No other Cable Order is required for the System/32.



5321 MAG CARD UNIT

Purpose: To provide magnetic card input and output for System/32.

Highlights: Reads and records information using OPD 50 track magnetic cards. Reading is at the maximum rate of 20 seconds/card (102 char/track). Recording is at the maximum rate of 30 seconds/card (102 char/track). OPD Mag Card products may be used to prepare the cards to be read by the 5321. Playback of the cards recorded by the 5321 can be on Mag Card "Selectric," Mag Card II, IBM 6640 Document Printer and Mag Card/A. Character sets and command codes are supported by application programming. The input hopper holds a maximum of fifty cards and the output stacker a maximum of sixty cards. The unit is cable connected to the System/32 with Mag Card Unit Attachment (#4900) installed.

Prerequisite: 5321 Mag Card Unit Attachment (#4900) on System/32 and System Control Program SCP 5725-SC1 with feature #6002.

Limitations: Cannot be installed on 5320 "A" Models. Cannot be installed on 5320 "B" or "C" Models with 1255 Attachment (#1100) or Data Recorder Attachment (#3200) installed. Can be located a maximum of 15 feet from the System/32.

Physical Characteristics: The 5321 requires 115V, AC, 1-phase, 60 Hz power and is provided in cloud white color.

Maximum: Only one 5321 may be attached to System/32.

Supplies: Only diagnostic magnetic cards are shipped with the 5321. Magnetic cards for customer applications must be separately ordered.

Bibliography: GC20-0032

**5340 SYSTEM UNIT**

Purpose: Contains main storage, disk storage, diskette drive, facilities for addressing main storage, and logical processing circuits and control for I/O units on System/34.

Model	Main Storage	Diskette	Disk Storage Capacity
A11	32K	Diskette 1	8.6 MB
A12	32K	Diskette 1	13.2 MB
A13	32K	Diskette 1	27.1 MB
A14	32K	Diskette 1	63.9 MB
A15	32K	Diskette 1	128.4 MB
A21	32K	Diskette 2D	8.6 MB
A22	32K	Diskette 2D	13.2 MB
A23	32K	Diskette 2D	27.1 MB
A24	32K	Diskette 2D	63.9 MB
A25	32K	Diskette 2D	128.4 MB
A31	32K	Magazine	8.6 MB
A32	32K	Magazine	13.2 MB
A33	32K	Magazine	27.1 MB
A34	32K	Magazine	63.9 MB
A35	32K	Magazine	128.4 MB
B11	48K	Diskette 1	8.6 MB
B12	48K	Diskette 1	13.2 MB
B13	48K	Diskette 1	27.1 MB
B14	48K	Diskette 1	63.9 MB
B15	48K	Diskette 1	128.4 MB
B21	48K	Diskette 2D	8.6 MB
B22	48K	Diskette 2D	13.2 MB
B23	48K	Diskette 2D	27.1 MB
B24	48K	Diskette 2D	63.9 MB
B25	48K	Diskette 2D	128.4 MB
B31	48K	Magazine	8.6 MB
B32	48K	Magazine	13.2 MB
B33	48K	Magazine	27.1 MB
B34	48K	Magazine	63.9 MB
B35	48K	Magazine	128.4 MB
C11	64K	Diskette 1	8.6 MB
C12	64K	Diskette 1	13.2 MB
C13	64K	Diskette 1	27.1 MB
C14	64K	Diskette 1	63.9 MB
C15	64K	Diskette 1	128.4 MB
C21	64K	Diskette 2D	8.6 MB
C22	64K	Diskette 2D	13.2 MB
C23	64K	Diskette 2D	27.1 MB
C24	64K	Diskette 2D	63.9 MB
C25	64K	Diskette 2D	128.4 MB
C31	64K	Magazine	8.6 MB
C32	64K	Magazine	13.2 MB
C33	64K	Magazine	27.1 MB
C34	64K	Magazine	63.9 MB
C35	64K	Magazine	128.4 MB
D11	96K	Diskette 1	8.6 MB
D12	96K	Diskette 1	13.2 MB
D13	96K	Diskette 1	27.1 MB
D14	96K	Diskette 1	63.9 MB
D15	96K	Diskette 1	128.4 MB
D21	96K	Diskette 2D	8.6 MB
D22	96K	Diskette 2D	13.2 MB
D23	96K	Diskette 2D	27.1 MB
D24	96K	Diskette 2D	63.9 MB
D25	96K	Diskette 2D	128.4 MB
D31	96K	Magazine	8.6 MB
D32	96K	Magazine	13.2 MB
D33	96K	Magazine	27.1 MB
D34	96K	Magazine	63.9 MB

D35	96K	Magazine	128.4 MB
E11	128K	Diskette 1	8.6 MB
E12	128K	Diskette 1	13.2 MB
E13	128K	Diskette 1	27.1 MB
E14	128K	Diskette 1	63.9 MB
E15	128K	Diskette 1	128.4 MB
E21	128K	Diskette 2D	8.6 MB
E22	128K	Diskette 2D	13.2 MB
E23	128K	Diskette 2D	27.1 MB
E24	128K	Diskette 2D	63.9 MB
E25	128K	Diskette 2D	128.4 MB
E31	128K	Magazine	8.6 MB
E32	128K	Magazine	13.2 MB
E33	128K	Magazine	27.1 MB
E34	128K	Magazine	63.9 MB
E35	128K	Magazine	128.4 MB

Model Changes: Field Installable

Highlights

- Multiple work station system capability
- Multiprogramming and printer spooling provided with System Program Product (5726-SS1)
- Extension of System/32 capabilities
- Direct and remote work station attachment flexibility
 - 5251 Display Station
 - 5252 Dual Display Station
 - 5256 Printer
- I/O unit attachment features
 - 1255 Magnetic Character Reader
 - 5211 Printer
- Diskette Magazine Drive
- Communications capability via BSC or SDLC through one or two common adapters
- Easy-to-use work station utility programming support available
- Facilities to provide high-level of system availability
- Main Storage Failure Recovery
- Scientific Instruction Set
- Fixed interval timer
- Address Translation Registers
- Storage protection
- MICR document processing capability
- 5211 translation tables for character substitution.

5340 System Unit Components

Processor Unit: The main storage processor represents a hardwired System/3 language processor with 32K, 48K, 64K, 96K, or 128K bytes of main storage. A microprocessor, with 16K words of control storage, operates in parallel with the main storage processor, and supports a microcoded control function and each of the I/O devices. The processor unit uses a combination of LSI/MSI—large and medium scale integration for the logic circuitry. Memory technology is Metal Oxide Semiconductor Field Effect Transistor (MOSFET). Data and instructions are stored as EBCDIC characters...each EBCDIC character is stored in an 8-bit byte...a ninth bit is added for parity checking. Main storage internal cycle time is 600 nano-seconds.

Work Station Controller: The 5250 Information Display System devices (5251 Models 1 and 11 Display Stations, the 5252 Dual Display Station and the 5256 Printer), used as directly attached System/34 work stations, attach to a controller in the 5340 System Unit via four twinax cable connectors on the 5340. One cable connector must be dedicated to attachment of a 5251 Model 1 or 11 or 5252 to be used as the sys-



tem console. For maintenance reasons, only one of the above machine types (5251 or 5252) should be attached to this cable. A 6 m (20 ft) cable is provided with the 5340 for attachment of the system console. Up to three additional twinax cables may be connected to the 5340 for attachment of additional work station devices. A maximum of eight display stations and printers (the 5252 counts as two display stations), including the console, may be attached. The maximum length of any one twinax cable attached to the 5340 cable connector is 1525 m (5000 ft). Multiple work stations may be attached to one cable via the Cable Through feature on the 5251 Models 1 and 11 or 5252 or 5256. See IBM System/34 Installation Manual—Physical Planning, GA21-9242.

Diskette: Included in the Models x1x of the System Unit is the diskette 1 drive, Models x2x incorporate the IBM Diskette 2D drive, and the Models x3x use the Diskette Magazine drive.

The Diskette 1 drive is capable of reading and writing the IBM Diskette 1 in Basic format or Extended format. The Diskette 2D drive can read and write either the IBM Diskette 1 (Basic or Extended format) or the two-sided double density IBM Diskette 2D (Basic or Extended format).

The Diskette Magazine drive can process individual diskettes or magazines. The magazine holds up to ten operator accessible diskettes. The magazine drive can accommodate two magazines and three individual diskettes. The selecting of diskettes within a magazine, and proceeding from the first magazine to the second, is automatic (under program control). The magazines will typically be used for Save/Restore functions. The three individual slots may be used for smaller jobs. Selection of up to three individual diskettes is automatic (under program control). Both IBM Diskette 1 (Basic or Extended format) or the two-sided double density IBM Diskette 2D (Basic or Extended format) can be used in the Diskette Magazine. The select cycle time (eject diskette, move to next diskette, load diskette) is approximately 3 sec.

The compatible media for data exchange with other devices such as 3740 is the IBM Diskette 1 in Basic format. The formats for diskettes are:

	Diskette 1	Diskette 2D
Data Tracks/Diskette	74	148 (74 Cylinders)
Capacity		
Basic format		
Bytes/Sector	128	256
Sectors/Track	26	26
Tracks/Cylinder	1	2
Data Bytes/Diskette	246,272	985,088
Extended Format		
Bytes/Sector	512	1,024
Sectors/Track	8	8
Tracks/Cylinder	1	2
Data Bytes/Diskette	303,104	1,212,416

The data transfer rate for the Diskette 1 drive is 31.2KB/sec; for Diskette 2D drive it is 62.5KB/sec (using Diskette 2D); and for the Diskette Magazine drive it is 125.0KB/sec (using Diskette 2D).

“Read or Write” of diskettes is overlapped with processing and other device functions except disk storage data transfer. All diskette seek operations are overlapped with processing and I/O devices.

Disk Storage: Each model of the 5340 System Unit contains one of five disk storage capacities. The disk storage is physi-

cally non-removable, high speed, direct access media, and the primary processing file in the system. Programs and data are stored on the disk for processing. Data can be stored offline for security or backup purposes by first copying the data from disk storage to either of the two diskette media. The System/34 with the Diskette 1 drive, the Diskette 2D drive, or the Diskette Magazine drive, plus a multiprogramming capability provide flexible combinations to optimize diskette functions with system disk storage. See M5340.8 for disk storage specifications:

System Console: A system console is not a component of the 5340 System Unit. The system console may be either a 5251 Model 1 or 11 Display Station or a 5252 Dual Display Station which is physically attached to the System Unit similar to other directly attached work station devices. For system operation and service reasons, the console is required to be located within 6 m (20 ft) of the System Unit. Its primary use is to facilitate operator control of the system via operator commands and to allow the operator to respond to system messages presented on the display. It may also be used as a data entry/inquiry work station, interacting with a user application. The mode of operation is easily switched from work station mode to console mode for servicing system requests.

Minimum System Configuration: 5340 System Unit, 5256 Printer (serial) or 5211 Printer (line), and 5251 Model 1 or 11 Display Station or 5252 Dual Display Station. A system printer must be provided to satisfy IBM maintenance requirements when using IBM System Support Program Product (5726-SS1).

Purchase Considerations

1. Any model upgrade that involves a disk storage capacity change may require replacement of the disk storage mechanism. Adequate provision must be made for retaining the data contained on the replaced disk mechanism and elimination of user proprietary information.
2. The upgrade purchase prices for model changes may be greater than the purchase price differentials. The customer should carefully evaluate his future requirements when purchasing a system.
3. Replaced parts from any model change that includes disk storage capacity change becomes the property of IBM.
4. Replaced parts from any model change which changes the diskette remain the property of the customer.
5. Replaced parts from any Special Feature installation or removal remain the property of the customer.

Accessories

Keylock Keys: The 5340 with Keylock #4655 special feature is shipped with two keys. Additional keys may be purchased from IBM. (Vendor will supply additional keys only to the original purchaser).



Specify

1. Voltage (AC, 1 Phase, 60 Hz): 9902 for 208V, or 9904 for 230V.
2. Color: Pearl white only (no specify code required).
3. Modem Cable (with #2500, #3500): Required for attaching System/34 to the communications facility regardless of whether an IBM integrated modem, an external modem or DDSA is used. #9460 for a 6 m (20 ft) cable; #9461 for a 12 m (40 ft) cable. Specify this cable only once per system. If two Communications Adapters are installed, the cable length will be the same on both.
4. A 6 m (20 ft) twinax cable is included with the system unit for 5251 Model 1 or 11 Display Station or 5252 Dual Display Station (system console). A 6 m (20 ft) cable is also included if a 5256 Printer is used as the system printer. See M5251, M5252, and M5256 pages for additional workstation twinax cable order information.
5. System Printer: #9301 if 5211 Model 1 is attached; #9302 if 5211 Model 2 is attached; or #9306 if 5256 is the system printer (no 5211).
6. Mandatory Specify Codes for Communications: One or more selections per adapter must be specified from the following list indicating prime usage of the first and/or second Communications Adapter.

	1st Adapter #2500	2nd Adapter #3500
System/360	9570	9670
System/370 Model 138 and below	9277	9477
System/370 Model 145 and up	9278	9478
System/3	9580	9680
System/32	9591	9691
System/34	9593	9693
3740	9579	9679
5230	9592	9692
5250	9595	9695
Other IBM	9275	9475
Non-IBM	9276	9476

7. Magnetic Stripe Control: Prerequisite #4900 if Magnetic Stripe Reader (#4910) is installed on any 5251 or 5252.
8. Multinational Control: Prerequisite #4905 if Multinational Character Set (#4905) is installed on any 5251, 5252, or 5256.

Note:

1. I/O Unit Attachments: Appropriate special features are required to attach some I/O units ... see "Special Features."
2. System Support Program Product: 5726-SS1 should be ordered at equipment order entry time ... see "System Support Program Product," 5726-SS1 for additional information.
3. Refer to *IBM System/34 Installation Manual—Physical Planning*, GA21-9242 for physical installation requirements.

Prices: See Price List

Special Features

1255 Attachment (#1100): Required to attach IBM 1255 Magnetic Character Reader Models 1, 2 or 3. **Maximum:** One. **Field Installable:** Yes. **Prerequisites:** Processor Unit Expansion A and/or E may be required on certain models. See Processor Unit Expansion Feature Configurator. **Limitation:** Cannot operate concurrently with 2nd Communications Adapter (#3500). See *IBM System/34 Installation Manual—Physical Planning*, GA21-9242 for cabling information.

Keylock (#4655): Replaces on/off power switch to protect against unauthorized use. See Accessories above for information concerning additional keys. **Maximum:** One. **Field Installation:** Yes.

Internal Clock (#4703): Generates synchronizing and timing signals for BSC or SDLC operation when they are not provided by the modem on either Communications Adapter (#2500 or #3500). Clocking speeds available with this feature are 600 bps and 1200 bps. Selection of full or half speed is indicated via a system utility program. When this feature is installed on System/34, all other BSC or SDLC stations attached to the same data link must also be equipped with a similar IBM Internal Clock feature. See *IBM Data Communications Handbook*

Maximum: One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#2500 or #3500), EIA Interface (#3701 or #3702) or 1200 BPS Integrated Modem (#5500, 5501, 6500 or 6501).

Work Station Control Expansion A (#4900): Required if Magnetic Stripe Reader (#4910) is installed on any 5251 or 5252 that is directly attached to the 5340. **Maximum:** One. **Field Installable:** Yes.

Multinational Control (#4905): Required if Multinational Character Set (#4905) is installed on any 5251, 5252, or 5256 attached to the 5340. **Maximum:** One. **Field Installable:** Not recommended for field installation.

Processor Unit Expansion A (#5732): This is a feature I/O board required for 1255 Attachment (#1100). Not required on xx3 (27.1MB) models. **Maximum:** One. **Field Installable:** Yes. See Processor Unit Expansion Feature Configurator.

Processor Unit Expansion B (#5733): Additional power for communications. Required for 2400 BPS Integrated Modem (#5600, #6600, #5601, #6601, #5602, #6602, #5610, #6610). Not required on xx4 and xx5 models. **Maximum:** One. **Field Installable:** Yes. See Processor Unit Expansion Feature Configurator.

Processor Unit Expansion C (#5734): I/O modem regulator required for EIA Interface (#3701 or #3702), or 1200 BPS Integrated Modem, (#5500, #5501, #6500, #6501). Not required on xx4 and xx5 models. Not required if Processor Unit Expansion B (#5733) is already installed. **Maximum:** One. **Field Installable:** Yes. See Processor Unit Expansion Feature Configurator.

Processor Unit Expansion D (#5735): Gate Assembly required for 2400 BPS Integrated Modem (#5600, #6600, #5601, #6601, #5602, #6602, #5610, #6610). **Maximum:** One. **Field Installable:** Yes. See Processor Unit Expansion Feature Configurator.

Processor Unit Expansion E (#5736): Additional power required for 1255 Attachment (#1100) on certain models. **Maximum:** One. **Field Installable:** Yes. See Processor Expansion Feature Configurator.



5211 Printer Attachment (#5810): Required to attach a 5211 Printer Model 1 or 2. A translation capability provides for use of translation tables for substituting characters when the characters to be printed are not contained on the print belt. Maximum: One. Field Installable: Yes. Prerequisite: See "Specify" No. 5 above.

5211 Translation Feature: Provides the capability in the 5211 Printer Attachment for use of translation tables for substituting characters when the characters to be printed are not contained on the print belt. Maximum: One Field Installable: Yes Prerequisite: 5211 Printer Attachment (#5810)

Special Feature Prices: See Price List.

Processor Unit Expansion Feature Configurator

	5340		x14			
	Models		x15			
	x11		x24			
	x12		x25			
Attachments	x21	x13	x34	x31		
	x22	x23	x35	x32	x33	
1255	A	—	A, E	A, E	E	
EIA/1200 BPS	C*	C*	—	C*	C*	
2400 BPS	B, D	B, D	D	B, D	B, D	

*"C" is not required if "B" is installed.

Note: Processor Unit Expansion Features required for communications features (EIA Interface or Integrated Modems) are required only once per system regardless of whether one or two Communications Adapters are installed. If 2400 BPS Integrated Modem is installed on either Communication Adapter (#2500, #3500), order Processor Unit Expansion Feature B and D. If 2400 BPS Integrated Modem is not installed on either Communications Adapter, order Processor Unit Expansion C for EIA or 1200 BPS Integrated Modem. No Processor Unit Expansion Feature is required if DDSA is installed on both Communications Adapters.

Communications Adapter—BSC/SDLC (#2500, #3500):

Two Communications Adapters can be attached to System/34. One communications line is connected (via appropriate interface or modem) to each adapter. In conjunction with stored program control, this feature permits System/34 to function on a switched, non-switched public or private communications line. Each adapter provides both BSC or SDLC. The proper line protocol is loaded into the control processor at program execution time.

Two Communications Adapters are available: #2500 is the first Communications Adapter. #3500 is the second Communications Adapter. #2500 is a prerequisite for #3500. Maximum: One #2500 and one #3500. Field Installation: Yes. Prerequisite: For #2500—one of the Integrated Modems (#5500, 5501, 5600, 5601, 5602 or 5610) or EIA Interface (#3701) or DDSA (#5650 or #5651); For #3500—the first Communications Adapter (#2500), one of the Integrated Modems (#6500, 6501, 6600, 6601, 6602, 6610) or EIA Interface (#3702) or DDSA (#5652 or 5653). Note: See "Specify" for required modem cable. SDLC supported by SSP (5726-SS1) requires 48K bytes of main storage (5340 Model B or larger).

Below is a discussion of the communications hardware support: (1) common to both BSC and SDLC, (2) specific to BSC support, (3) specific to SDLC support.

1. Support Common to Both BSC and SDLC

Each Communications Adapter (#2500 or #3500) will allow System/34 to communicate on a non-switched point-to-point or multipoint line at speeds up to 9600 bps and on a switched point-to-point line at speeds up to 4800 bps. Each adapter operates independently under program control; however, the maximum aggregate bit rate for both adapters operating concurrently is 9,600 bps. See M2700 pages for information on communication facilities.

On a multipoint line, System/34 operates as a tributary station. No support is provided for System/34 to operate as a control station on a multipoint line, except for the 5251 Model 2 or 12 under SDLC; therefore, communication with other devices which do not provide control station capability must be done on a point-to-point line only.

Each Communications Adapter will operate in half-duplex mode over dial (switched network) facilities, and half-duplex mode over non-switched (or equivalent private) communication lines which may be duplex or half-duplex facilities. Operation of each feature will be overlapped at all transmission rates with processing and/or I/O device operations (see Additional Information). Units at each termination, or drop point, of a communication line to which the System/34 is attached must use the same clocking source (modem or business machine) and must be set to operate at the same transmission rate and to use the same transmission code. Compatible modems must be used at all terminations on a network.

Switched network versions include as a basic capability support of Manual Dial and Manual or Auto Answer (where the attached modem supports this capability) operations.

2. Support Specific to BSC Operations

The Communication Adapter allows operation in BSC mode as requested by the executing program.

In conjunction with stored program control, this feature permits System/34 to function on a switched or non-switched communications line as a processor/terminal communicating in binary synchronous mode with:

- Another System/34 equipped with #2500 or #3500
- A System/32 equipped with #2074
- A System/3 equipped with #2074 or #2084
- A System/360 Model 20 equipped with #2074
- A System/360 or System/370 (which is supported by OS or DOS BTAM; OS TCAM; OS/VS1 or OS/VS2 BTAM, TCAM or VTAM; DOS/VS BTAM or VTAM) via an Integrated Communications Adapter, a 2701 Data Adapter Unit, a 2703 Transmission Control Unit, a 3704/3705 Communications Controller with the Network Control Program (NCP) or the Partitioned Emulation Program (PEP), any of which are equipped with a binary synchronous adapter and appropriate sub-features
- A 3741 Data Station Model 2 or 3741 Programmable Work Station Model 4
- A 3747 Data Converter equipped with Communications Adapter (#1660)
- A 5110 Computer System equipped with BSCA #2074 (as a 3741 Model 2 or 4)
- A 5231 Model 2 equipped with BSCA (#2074) (Point-to-Point unidirectional transmission only)
- A System/7 equipped with BSCA (#2074)

See the System/34 programming pages for a description of the program support provided for this feature.



ASCII, EBCDIC, or EBCDIC Text Transparency are standard ASCII or EBCDIC transmission codes are selected at program compilation time.

3. Support Specific to SDLC Operations

The Communications Adapter allows operation in SDLC mode as requested by the executing program.

The System/34 SSP provides SDLC communications support for multipoint line control when the 5251 Model 2 or 12 Display Stations are attached to that Communications Adapter.

In conjunction with stored program control, this feature provides communications capability with System/370 Models 115 to 168 via a 3704 or 3705 Communications Controller equipped with appropriate features...see 3704, 3705. The System/370 must be operating under control of DOS/VS, OS/VS1 or OS/VS2 VTAM and the 3704/3705 under control of the Network Control Program/VS (NCP/VS). See the System/34 programming pages for a description of the program support provided on System/34 for this feature. ASCII support for 5251 Model 2 or 12 is by RPQ only.

Communications Features: For the first Communications Adapter (#2500).

EIA Interface (#3701): Provides a cable and interface for attachment of an IBM Modem or non-IBM Modem meeting RS-232-C characteristics. Non-IBM Modems may be attached subject to the Multiple Suppliers System Policy. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with 1200 BPS Integrated Modem (#5500, 5501), or 2400 BPS Integrated Modem (#5600, 5601, 5602, 5610), or DDSA (#5650, 5651). **Prerequisites:** Communications Adapter (#2500), and Processor Unit Expansion C (#5734). **Note:** This feature may also require Internal Clock (#4703) if the external modem does not provide its own clocking. See Modem/Interface Feature Configurator.

1200 BPS Integrated Modem (#5500, 5501): A modem for SDLC or BSC data transmission at 1200 bps over non-switched facilities or switched network. Half speed operation at 600 bps is indicated via a system utility program. Available in two different versions: #5500—Non-switched...#5501—Switched with Auto Answer. Attachment to the non-switched (2 or 4-wire) facilities is via an IBM provided cable directly to the line, Type 3002. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/34 must also be equipped with a 1200 BPS Integrated Modem. **Limitations:** Cannot be installed with EIA Interface (#3701) or 2400 BPS Integrated Modem (#5600, 5601, 5602, 5610), or DDSA (#5650, 5651). #5500 and 5501 cannot be installed together. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#2500), Processor Unit Expansion C (#5734) and Internal Clock (#4703). See Modem/Interface Feature Configurator.

2400 BPS Integrated Modem (#5600, 5601, 5602, 5610): A modem for BSC or SDLC data transmission at 2400 bps over non-switched facilities or switched network, equivalent to and compatible with similarly featured IBM 3872 modems. Available in four different versions: #5600—Non-switched Point-to-Point, #5601—Non-switched Multipoint Control, #5602—Non-switched Multipoint Tributary, #5610—Switched Network with Auto Answer.

Attachment to non-switched (2 or 4-wire) facilities is via IBM provided cable directly to the line, Type 3002. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/34 must also be equipped with a 2400 BPS Integrated Modem or IBM 3872 Modem. **Limitation:** Cannot be installed with EIA Interface (#3701) or 1200 BPS Integrated Modem (#5500, 5501), or DDSA (#5650, 5651). #5600, 5601, 5602, or 5610 cannot be installed together. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#2500), Processor Unit Expansion B (#5733) and Processor Unit Expansion D (#5735). See Modem/Interface Feature Configurator.

Switched Network Backup (SNUB) (#7951): Provided for backup attachment of System/34 to the public switched network when the 2400 BPS Integrated Modem (#5600, 5601, 5602) is used on a non-switched line as the prime facility. It can communicate with another 2400 BPS Integrated Modem or an IBM 3872 Modem when either is equipped with switched network capability. Selection of the primary or backup facility is via an operator invoked system utility program.

Attachment to the switched network is made via a common carrier arrangement type CDT or equivalent. Calls must be established and answered manually. Operator intervention, program modification, or both may be required on the using system/terminal. This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1, OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2. Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Backup feature. For additional information, see the *IBM 3872 Modem User's Guide*, GA21-3058. **Limitations:** Cannot be installed with Switched Network Backup with Auto Answer (#7952). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#2500) and 2400 BPS Integrated Modem (#5600, 5601, 5602).

Switched Network Backup with Auto Answer (SNBU/AA) (#7952): Same as Switched Network Backup (#7951) plus the added capability of automatically answering incoming calls when attached to a common carrier arrangement type CBS or equivalent. Selection of the prime or backup facility is via an operator invoked system utility program. Operation intervention, program modification, or both may be required on the using system/terminal. This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1 and OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2.

Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Backup feature. For additional information see the *IBM 3872 Modem User's Guide*, GA21-3058. **Limitations:** Cannot be installed with Switched Network Backup (#7951). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#2500) and 2400 BPS Integrated Modem (#5600, 5601, or 5602).

DDS Adapter—(DDSA) (#5650, 5651): An integrated adapter for BSC or SDLC data transmission at speeds of 2400, 4800 or 9600 bps over the AT & T non-switched Data-Phone* Digital Service network. The DDSA interfaces to a DDS channel service unit, the customer site termination of the DDS network. Available at three speeds: 2400, 4800 or 9600 bps. For point-to-point or multipoint control (#5650), for multipoint tributary (#5651). **Limitations:** Cannot be installed with EIA



interface (#3701) or 1200 BPS Integrated Modem (#5500, 5501) or 2400 BPS Integrated Modem (#5600, 5601, 5602, 5610). **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Communications Adapter (#2500).

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Communications Features: For second Communications Adapter (#3500)

EIA Interface (#3702): Provides a cable and interface for attachment of an IBM Modem or non-IBM Modem meeting RS-232-C characteristics. Non-IBM Modems may be attached subject to the Multiple Suppliers System Policy. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with 1200 BPS Integrated Modem (#6500, 6501) or 2400 BPS Integrated Modem (#6600, 6601, 6602, 6610) or DDSA (#5652, 5653). **Prerequisites:** Communications Adapter (#3500) and Processor Unit Expansion C (#5734). *Note:* This feature may also require Internal Clock (#4703) if the external modem does not provide its own clocking. See Modem/Interface Feature Configurator.

1200 BPS Integrated Modem (#6500, 6501): A modem for SDLC or BSC data transmission at 1200 bps over non-switched facilities or switched network. Half speed operation at 600 bps is indicated via a system utility program. Available in two different versions: #6500—Non-switched, #6501—Switched with Auto Answer. Attachment to the non-switched (2 or 4-wire) facilities via an IBM provided cable directly to the line, Type 3002. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/34 must also be equipped with a 1200 BPS Integrated Modem. **Limitations:** Cannot be installed with EIA Interface (#3702) or 2400 BPS Integrated Modem (#6600, 6601, 6602, 6610) or DDSA (#5652, 5653). #6500 and #6501 cannot be installed together. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#3500), Processor Unit Expansion C (#5734) and Internal Clock (#4703). See Modem/Interface Feature Configurator.

2400 BPS Integrated Modem (#6600, 6601, 6602, 6610): A modem for BSC or SDLC data transmission at 2400 bps over non-switched facilities or switched network, equivalent to and compatible with similarly featured IBM 3872 modems. Available in four different versions: #6600—Non-switched Point-to-Point, #6601—Non-switched Multipoint Control, #6602—Non-switched Multipoint Tributary, #6610—Switched Network with Auto Answer.

Attachment to non-switched (2 or 4-wire) facilities is via IBM provided cable directly to the line, Type 3002. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/34 must also be equipped with a 2400 BPS Integrated Modem or IBM 3872 Modem. **Limitations:** Cannot be installed with EIA Interface (#3702) or 1200 BPS Integrated Modem (#6500, 6501), or DDSA (#5652, 5653). #6600, 6601, 6602 or 6610 cannot be installed together. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#3500), Processor Unit Expansion B (#5733) and Processor Unit Expansion D (#5735). See Modem/Interface Feature Configurator.

Switched Network Backup (SNBU) (#7953): Provided for backup attachment of System/34 to the public switched network when the 2400 BPS Integrated Modem (#6600, 6601, 6602) is used on a non-switched line as the prime facility. It can communicate with another 2400 BPS Integrated Modem or

an IBM 3872 Modem when either is equipped with switched network capability. Selection of the primary or backup facility is via an operator invoked system utility program.

Attachment to the switched network is made via common carrier arrangement type CDT or equivalent. Calls must be established and answered manually. Operator intervention, program modification, or both may be required on the using system/terminal. This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1, OS/VS2, in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2. Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Backup feature. For additional information, see the *IBM 3872 Modem User's Guide*, GA21-3058. **Limitations:** Cannot be installed with Switched Network Backup with Auto Answer (#7954). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#3500) and 2400 BPS Integrated Modem (#6600, 6601, 6602).

Switched Network Backup with Auto Answer (SNBU/AA) (#7954): Same as Switched Network Backup (#7953) plus the added capability of automatically answering incoming calls when attached to a common carrier arrangement type CBS or equivalent. Selection of the prime or backup facility is via an operator invoked system utility program. Operation intervention, program modification, or both may be required on the using system/terminal. This feature can be used with BTAM programs for DOS, DOS/VS, OS, OS/VS1 and OS/VS2 in certain configurations or with TCAM/VTAM under OS/VS1 or OS/VS2.

Additional customer program routines will be required, in existing BTAM programming, to fully utilize the capabilities of the Switched Network Backup feature. For additional information see the *IBM 3872 Modem User's Guide*, GA21-3058. **Limitation:** Cannot be installed with Switched Network Backup (#7953). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Communications Adapter (#3500) and 2400 BPS Integrated Modem (#6600, 6601, 6602).

DDS Adapter—(DDSA) (#5652, 5653): An integrated adapter for BSC or SDLC data transmission at speeds of 2400, 4800 or 9600 bps over the AT & T non-switched Data-Phone* Digital Service network. The DDSA interfaces to a DDS channel service unit, the customer site termination of the DDS network. Available at three speeds: 2400, 4800 or 9600 bps. For point-to-point or multipoint control (#5652), for multipoint tributary (#5653). **Limitations:** Cannot be installed with EIA Interface (#3702) or 1200 BPS Integrated Modem (#6500, 6501) or 2400 BPS Integrated Modem (#6600, 6601, 6602, 6610). **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Communications Adapter (#3500).

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IBM Modems: One IBM Modem can be attached to each Communications Adapter. **Prerequisite:** Communications Adapter (#2500, 3500); EIA Interface (#3701, 3702), Processor Unit Expansion (#5734).

Modem	Speed (bps)
3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

Note: System/34 does not support Auto Call Originate (#1091) on the 3872 or 3874. For communications capabilities, product



utilization, and special features, see M2700, M3872, M3874, M3875 pages.

To verify the proper integrated or external modem interface configuration, refer to the chart below. Select one of the categories numbered from 1 to 3 and follow across for the required and optional special features.

Modem/Interface Feature Configurator:

Modem/Interface	Internal Clock (#4703)	Processor Unit Expansion B (1) (#5733)	Processor Unit Expansion C (1) (#5734)	Processor Unit Expansion D (1) (#5735)	SNBU or SNBU/AA (#7951, 7953) (#7952, 7954)
1. EIA Interface (#3701, 3702)	Optional	—	Required (2)	—	—
2. 1200 BPS Integrated Modem:					
A. Non-Switched (#5500, 6500)	Required	—	Required (2)	—	—
B. Switched W/Auto Answer (#5501, 6501)	Required	—	Required (2)	—	—
3. 2400 BPS Integrated Modem:					
A. Non-Switched Point-to-Point (#5600, 6600)	—	Required(3)	—	Required	Optional
B. Non-Switched Multipoint Tributary (#5602, 6602)	—	Required(3)	—	Required	Optional
C. Switched Network with Auto Answer (#5610, 6610)	—	Required(3)	—	Required	—
D. Non-Switched Multipoint Control (#5601, 6601)	—	Required(3)	—	Required	Optional

- Note: 1. See Processor Unit Expansion Feature Configurator.
 2. Not required if Processor Unit Expansion B (#5733) is installed. Not required on xx4 and xx5 models.
 3. Not required on xx4 and xx5 models.

Additional Information

I. Communication Facility Attachments

The Communications Adapter features operate at speeds up to 9600 bps on a non-switched point-to-point or multipoint common carrier facility or equivalent privately owned communication facility and up to 4800 bps on a switched point-to-point facility. However, the aggregate bit rate when both adapters are operating concurrently is 9,600 bps. The second Communications Adapter (#3500) may be physically attached to System/34 which also has the 1255 Attachment (#1100), but these two attachments (#1100 and #3500) cannot operate concurrently.

A system utility program is used for the selection of certain data communications characteristics such as: full speed or half speed, internal or external modem clocking, line type, station address, etc. See the *System/34 System Support Reference Manual*, SC21-5155 for a complete description of \$SETCF utility.

IBM Data Encryption Devices—An IBM 3845 or IBM 3846 Data Encryption Device may be attached between the System/34 communications adapter and the external modem. **Prerequisite:** EIA Interface #3701 or #3702.

Note: Refer to M2700, 3845, and 3846 pages for information on 3845 or 3846 configuration and communication capability. The IBM 3845 or 3846 device operating with SDLC will not operate with NRZI transmission mode.

II. References

1. See the host system programming pages
2. See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities, and customer responsibilities.
3. Refer to the *Data Communications Handbook*

This handbook also contains information related to common carrier facilities and tariffs.

4. Refer to *System/34 Installation Manual—Physical Planning*, GA21-9242 for physical installation requirements.

III. Customer Responsibilities

1. The customer must be advised, in writing, of certain responsibilities related to the installation and maintenance.



nance of common carrier facilities/services as well as the IBM equipment.

Communication Feature Prices: See Price List.

- 2. The IBM Marketing Representative must have the customer obtain a firm installation date for the start of transmission services (including any required modems) prior to processing the Order Confirmation card.

IV. Cables

A modem cable is required. See "Specify."

	8.6 MB	13.2 MB	27.1 MB	63.9 MB	128.4 MB
Bytes/Sector	256	256	256	256	256
Bytes/Cylinder	46,080	46,080	46,080	180,224	180,224
Disk Spindles	1	1	2	1	2
Cylinders	187 .00	288 .00	589 .33	354 .50	712 .50
Capacity	8,616,960	13,271,040	27,156,480	63,905,792	128,425,984
Access Time (ms)					
Cyl to Cyl	10	10	10	9	9
*Average	33	38	38	27	27
Maximum	55	70	70	46	46
	(201 cyl)	(302 cyl)	(302 cyl/ spindle)	(359 cyl)	(359 cyl/ spindle)
Rotational Speed (RPM)	2964	2964	2964	3125	3125
Data Transfer Rate (MB/SEC)	.889	.889	.889	1.031	1.031

*Average of all possible disk accesses.



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5381 SYSTEM UNIT

Purpose

Contains main storage, control storage, work station controllers, communications controller (optional), disk storage, diskette magazine drive, system console keyboard/display, operator/service panel, facilities for addressing main storage, arithmetic and logical processing circuits and control functions for I/O units on System/38.

Model**	Main Storage	Disk Storage
321	512K	64.5 MB
322	512K	129.0 MB
323*	512K	193.5 MB
324*	512K	258.0 MB
325*	512K	322.6 MB
326*	512K	387.1 MB
331	768K	64.5 MB
332	768K	129.0 MB
333*	768K	193.5 MB
334*	768K	258.0 MB
335*	768K	322.6 MB
336*	768K	387.1 MB
341	1024K	64.5 MB
342	1024K	129.0 MB
343*	1024K	193.5 MB
344*	1024K	258.0 MB
345*	1024K	322.6 MB
346*	1024K	387.1 MB
521	512K	64.5 MB
522	512K	129.0 MB
523*	512K	193.5 MB
524*	512K	258.0 MB
525*	512K	322.6 MB
526*	512K	387.1 MB
531	768K	64.5 MB
532	768K	129.0 MB
533*	768K	193.5 MB
534*	768K	258.0 MB
535*	768K	322.6 MB
536*	768K	387.1 MB
541	1024K	64.5 MB
542	1024K	129.0 MB
543*	1024K	193.5 MB
544*	1024K	258.0 MB
545*	1024K	322.6 MB
546*	1024K	387.1 MB
551	1280K	64.5 MB
552	1280K	129.0 MB
553*	1280K	193.5 MB
554*	1280K	258.0 MB
555*	1280K	322.6 MB
556*	1280K	387.1 MB
561	1536K	64.5 MB
562	1536K	129.0 MB
563*	1536K	193.5 MB
564*	1536K	258.0 MB
565*	1536K	322.6 MB
566*	1536K	387.1 MB

* Includes expansion enclosure.

** Model 5xx has approximately two times the internal performance of the Model 3XX.

Note: Model 551 through 566 available 2/22/80.

Model Changes: Field Installable

Highlights

- Interactive work station system.
- System architecture oriented to work station environment.
- Virtual storage for efficient management of main storage.

System Architecture

A primary feature of System/38 is the 5381 unit advanced instruction set which embodies many basic supervisory, resource and data base management functions. As an example of the power, the instruction set includes data base operations that retrieve, update, and logically order data records.

The 5381 has an object-oriented architecture fundamental to its overall design. Objects are structures such as programs, processes, and data base files, which are manipulated at a logical level through the unit's instruction set. The 5381 manages storage on an object basis reducing user dependence on main storage size, physical disk location, and internal implementation.

Access to objects is machine controlled providing a high level of integrity, automatic serialization of concurrent operations on an object, and effective authority enforcement.

Units of work are managed as independent processes (tasks) which share the machine resources (processor, storage, devices). Interprocess communication is accomplished through queues and event signals. Objects can be locked to control and serialize concurrent access to them by several processes.

All objects reside in virtual storage which is managed by the 5381 processing unit. Objects are allocated space on permanent disk storage and are brought into main storage (as needed) where they may be shared by all processes. Although system performance may be affected by main storage size, applications are not limited in the number or size of objects used. This allows additional disk or main storage to be added without a need to restructure applications.

Input/output operations offer improved device independence through the use of the 5381 device support (source/sink) functions which manage the channel, communications, and other asynchronous hardware operations.

This high level of function is standard on all System/38 models.

Microcode Main Storage Utilization

The System/38 accomplishes much of its advanced function using main storage resident microcode. The amount of main storage used depends on system size and configuration, and the number of system functions active at any specific time.

Hardware Features***

- Main Storage Capacity—512K bytes, 768K bytes, 1024K bytes. Model 5XX expandable to 1280K and 1536K bytes.
- Single Level Storage Management (manages main storage and disk storage as one logical storage resource which contains all programs and data).
- Two performance-level models (3XX and 5XX). Nominal main storage internal cycle time per 4 byte access is 1100 nanoseconds for Model 3XX and 600 nanoseconds for Model 5XX. Specific times may vary according to the instruction mix.



- From one to six spindles of disk storage (64.5-387.1 MB).
- Direct attachment capability of 5250 work station devices (40 maximum).
- Up to two 650 LPM printers may be attached.
- Diskette magazine drive—standard.
- System console/keyboard display—standard.
- Up to 4 SNA/SDLC communication lines.
- Main storage Error Checking and Correction.

- Instruction retry capability (except where "results" field is also an operand field).
- I/O controller retry
- Reliability, Availability, and Serviceability (RAS) features are implemented throughout the system and are all supported by new and improved diagnostic aids.

Note: In device operations, the nominal or rated throughputs represented in this publication may not be achieved in an actual customer environment when used with the customer's control program or application load.

System Unit Components

Processor Unit

Main storage on the Models 3XX and 5XX is available with 512K, 768K, and 1024K bytes. Model 5XX expandable to 1280K and 1536K bytes. 4K words (32-bit word) of control storage is standard on the Model 3XX. The Model 5XX has 8K words of control storage standard. The Model 5XX has an internal performance of approximately 2 times the Model 3XX. Average main storage internal cycle time per 4-byte access on the Model 5XX is 600 nanoseconds and on the Model 3XX is 1100 nanoseconds. (Actual timings may vary depending on the actual instruction mix.)

Virtual Address Translation (VAT) is a standard facility on the 5381. Virtual Address Translation converts virtual addresses to real addresses.

The VAT facilities include:

- **Primary Directory (PD)**—indicates the virtual address and status information of a page stored in a block of real storage called a page frame.
- **Hash Table (HT)**—a list of entries used to index the Primary Directory.
- **Lookaside Buffer (LB)**—is a high speed buffer storage which contains certain information specified in the primary directory. The translation process time is reduced if the referenced virtual address is listed in the LB.

Main Storage technology is dynamic Metal Oxide Semiconductor Field Effect Transistor (MOSFET). The processor unit uses LSI—Large Scale Integration for the logic circuitry.

The processor provides overlap operation of instruction fetch and execution functions. The Time-of-Day clock provides a measure of time suitable for elapsed time measurements and time-of-day indications.

The high-speed integrated channel has an instantaneous character transfer rate of up to 2.5 million bytes per second.

The System Control Adapter (SCA) provides the capability to initiate a power-on/off sequence and also, provides a central serviceability point to all system units. The SCA provides a dual interface between the Operator/Service panel and the console to the system. At initial power-on or Initial Microprogram Load (IMPL) time, the SCA performs functional testing of the processor and diagnostic check-out of main storage prior to loading the control store with microcode. Execution of the microcode initializes the system and control is then transferred to the operator. The SCA is an integral part of the hardware system.

The Operator/Service panel is located on the system where it is easily accessible to the operator and service personnel. The operator/service panel contains 24 indicators (LEDs), one LOAD pushbutton switch, one Power-on pushbutton switch, one display intensity switch, and two rotary switches. Three optional features may be included on the panel: An audible alarm and attention indicator; a power keylock switch, and an automatic IMPL switch.

System Console/Keyboard Display

System console functions are invoked by the standard CRT display and keyboard. They are physically integrated into the right top section of the system. The console display uses a 12" CRT, and contains 1024 character positions, 16 lines of 64 character positions each. The large characters improve readability for the operator. Upper/Lower case characters are standard, as well as four display indicators (attention, input inhibited, reset required, and upper shift).

Display attributes include protected fields, underscore, and nondisplay. The keyboard has a typewriter-like layout with 24 Command Function keys and a HEX key. The multinational character set provides the overstrike function. Overstrike is the capability to create, process, and output National Usage Characters. In addition, the multinational character set provides the capability for multicountry processing. See Type Catalog for character sets and keyboard layout. A 5251/5252 can be attached to serve as an alternate console should the user desire the console in a different location or require a desk top sitting position.

Diskette Magazine Drive

A diskette drive is standard on the System/38 and provides three significant functions; save/restore, diskette I/O, and CE servicing. The diskette drive is designed to accept two 10-diskette magazines which can be used for save/restore and other diskette I/O operations. Each magazine can contain up to 12 megabytes of data (2D format). In addition to the two magazines, the diskette drive contains 3 diskette slots which can be used for loading one to three diskettes manually. Diskette types 1, 2, and 2D may be read or written.

**Disk Storage**

The System Unit can contain from one to six spindles of integrated nonremovable disk storage. The following table provides capacity and access times.

Bytes/Sector	512	
Bytes/Cylinder	180,224	
Capacity	64,520,192	Bytes
Access Time (ms)		
Minimum (Cyl to Cyl) seek	9	
Maximum Average seek	27	
Maximum seek	46	
Latency (Average)	9.6 ms	
Rotational speed RPM	3,125	
Data Transfer Rate (MB/Sec)	1.031	
(Nominal)		

Data can be stored offline for security or backup purposes by copying the data to diskettes.

Work Station Controller

Direct local attachment of IBM 5250 Information Display System devices is provided by the Work Station Controller. One Work Station Controller is standard on all models of System/38. It provides 8 ports for attaching up to 12 work stations (Keyboard Displays and/or Printers) directly to the system in any combination.

Bibliography: *IBM System/38 Guide to Publications* GC21-7726.

Minimum Configuration: Any Model 3XX or 5XX.

Although a customer may order a System/38 without a line printer, he must be made aware that IBM's ability to diagnose the system without an attached line printer may be impaired and thus have an adverse effect on the system's availability.

Note: Diskettes and diskette magazines are not included with the 5381 System Unit.

Specify

- Voltage** (AC, 3-phase, 4-wire, 60Hz): #9903 for 208V, and #9905 for 230V.

- Accent Panel Color:** One must be specified.

Willow Green	(#9060)
Garnet Rose	(#9061)
Sunrise Yellow	(#9062)
Classic Blue	(#9063)
Charcoal Brown	(#9064)
Pebble Grey	(#9065)

(*Note:* The color for the base enclosure is Pearl White.)

- Up-Ending Kit (#9845):** This kit enables the 5381 to be up-ended for installation and moving purposes at the customer location. This kit is furnished only as necessary and remains the property of IBM.
- Character Set: (#9540)** provides the United States character set. See Type Catalog for details. (#9535) provides the multinational character set. See Type Catalog for details. **Maximum:** one. **Field Installation:** yes.
- I/O Attachments:** Appropriate special features are required to attach most I/O units. See special features.

Prices: See Price List.

Purchase Considerations

- The upgrade purchase prices for model changes may be greater than purchase price differentials. The customer should carefully evaluate his future requirements when purchasing a system.
- Replaced parts from any model upgrade become the property of IBM.

Notes:

- Refer to *IBM System/38 Installation Manual—Physical Planning*, GA21-9293 for physical installation requirements.
- The Installation and Service Facility (ISF) is optionally available for installation of System/38s and to support diagnostics and analysis.

The Installation and Service Facility is provided on an "as required" basis. ISF is available from Customer Engineering as an Engineering Change (EC). To order, specify to Customer Engineering either the EC number or EC name.

For those customers who have the CPF Licensed Program, the Concurrent Service Monitor provides support for installation, support of diagnostics, and analysis in the post-installation period.

Special Features**First 5211/3262 Printer Attachment (#1100)**

To attach the first 5211/3262 printer, one of the following feature codes must also be specified: 5211-2 (#1204), 3262-A1 (#1207), and 3262-B1 (#1208). **Maximum:** one. **Field Installation:** yes.

Second 5211/3262 Printer Attachment (#1110)

Required to attach the second 5211/3262 printer, one of the following feature codes must also be specified: 5211-2 (#1232) and 3262-B1 (#1234). **Maximum:** one. **Field Installation:** yes. **Prerequisite:** Processor Unit Expansion 2 and 3 (#6301 and #6302) are required. See "Processor Unit Expansion Feature Configurator" to determine requirements. **Limitation:** The 3262-A1 cannot be a second printer to another 3262-A1. If the first printer attached is a 5211-2 or 3262-B1 and the user requires a 3262-A1 as a second printer, then an MES is needed to move the first attached printer to the second attach position, and install the 3262-A1 to the first attachment position.

Multifunction Card Unit Attachment 250/60/60 CPM (#1220)

To attach a 5424 MFCU Model A1. **Maximum:** one 5424 per system. **Field Installation:** yes. **Prerequisite:** Processor Unit Expansion 2 and 3 (#6301 and #6302) are required. See "Processor Unit Expansion Feature Configurator" to determine requirements. Also, System/38 Attachment feature (#6500) is required on the 5424.

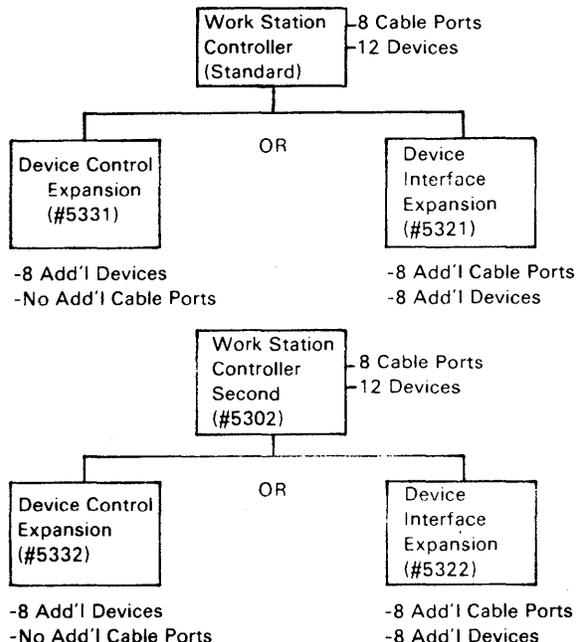
Multifunction Card Unit Attachment 500/120/120 CPM (#1221)

To attach a 5424 MFCU Model A2. **Maximum:** one 5424 per system. **Field Installation:** Yes. **Prerequisite:** Multifunction Card Unit Attachment - 250/60/60 (#1220). Also, Processor Unit Expansion 2 and 3 (#6301 and #6302) are required. See "Processor Unit Expansion Feature Configurator" to determine



Work Station Controller, Second (#5302). The maximum number of 5250 devices that can be attached to each appropriately featured Work Station Controller is 20. (The 5252 Model 1 is counted as two devices.)

WORK STATION CONTROLLER CONFIGURATOR



MAXIMUM OF 20 DEVICES PER CONTROLLER

MAXIMUM OF 40 DEVICES PER SYSTEM

UP TO 7 DEVICES MAY BE ATTACHED TO A SINGLE CABLE PORT VIA TWINAX CABLING 5250 CABLE-THROUGH FEATURE

UP TO 2 DEVICES MAY BE ATTACHED TO A SINGLE CABLE PORT VIA COAX CABLING 5250 CABLE-THROUGH FEATURE

Note: The 5252 Model 1 is counted as 2 devices.

Special Features

Work Station Controller, Second (#5302)

Provides direct local attachment of additional 5250 devices (5251 Models 1 and 11, 5252 Model 1, 5256 Models 1, 2, and 3) in any combination. This feature (#5302) with expansion features described below extends the system maximum of locally attached 5250 devices to 40. This feature (#5302) includes basic control and 8 cable interfaces for attaching additional work stations. Up to 12 work stations can be attached using the Cable Thru features on the 5250 devices.

Cabling provisions are the same as the basic Work Station Controller described above. For further expansion of 5250 devices (maximum of 20 for this controller), see Device Interface Expansion (#5322), or Device Control Expansion (#5332). Programming support for the attached devices is provided by the Control Program Facility Licensed Program. (*Note:* The 5252 represents 2 devices.) **Maximum:** one. **Limitation:** none. **Prerequisite:** Processor Unit Expansion 1 (#6300) and Processor Unit Expansion 3 (#6302).

Device Control Expansion (#5331), (#5332)

Permits Work Station Controllers to support up to eight additional 5250 devices (5251 Models 1 and 11, 5252 Model 1, 5256 Models 1, 2, and 3). This feature does not provide any additional cable connectors but provides the necessary control storage to support additional devices attached via the cable connectors provided by Work Station Controllers.

(#5331) - for Basic Work Station Controller (Component of Base System) ... (#5332) - for Work Station Controller, Second (#5302). See 5250 sales pages (M5251, M5252, and M5256) for selection of appropriate 5250 features which permit multi-dropping devices on twinax cable facilities. (*Note:* The 5252 represents 2 devices.) **Maximum:** one per Work Station Controller. **Limitation:** Cannot be installed with Device Interface Expansion (#5321), (#5322) on the same Work Station Controller. **Prerequisite:** Work Station Controller, Second (#5302) for (#5332).

Device Interface Expansion (#5321), (#5322)

Provides the necessary control and eight twinax cable connectors for attachment of eight additional 5250 devices (5251 Models 1 and 11, 5252 Model 1, 5256 Models 1, 2, and 3) in any combination. This feature is always installed in conjunction with a Work Station Controller: (#5321) - for Basic Work Station Controller (Component of Base System) ... (#5322) - for Work Station Controller, Second (#5302). Refer to 5250 sales pages for information pertaining to device features, accessories, and cabling requirements. (*Note:* The 5252 represents 2 devices.) **Maximum:** one per Work Station Controller. **Limitation:** Cannot be installed with Device Control Expansion (#5331), (#5332) on the same Work Station Controller. **Prerequisite:** Work Station Controller, Second (#5302) for (#5322).

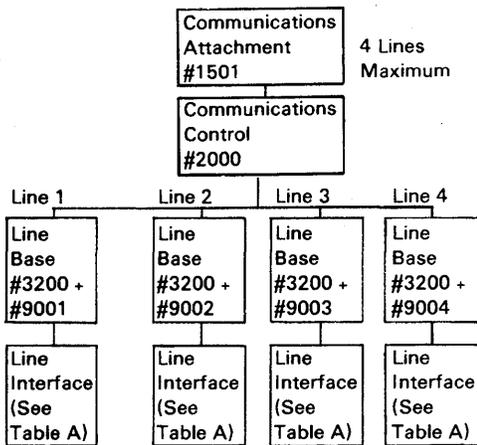
COMMUNICATIONS—GENERAL DESCRIPTION

Communications capability is provided by a multiline facility integrated in the 5381 System Unit. It is made up of several features to allow flexibility to best satisfy various communication application requirements. There are four basic building blocks (features), each being one or more features which can be selected to provide the function desired

1. Communications Attachment (#1501)
2. Communications Control (#2000)
3. Line Base(s) (#3200)
4. Line Interfaces



Communications Configurator



These features will allow System/38 to communicate on non-switched point-to-point or multipoint lines at speeds from 600 to 9600 BPS and on switched point-to-point lines at speeds from 600 to 4800 BPS. This communications controller operates in half-duplex mode over switched facilities, and in half-duplex mode over nonswitched communication lines which may be full-duplex or half-duplex facilities.

Units at each termination or drop point of a data link to which System/38 is attached must use the same clocking source (modem or business machine) and must be set to operate at the same transmission rate and to use the same transmission code. Compatible modems must be used at all terminations on a network.

Special Features

Communication Attachment (#1501)

Provides the basic control and common circuits for direct attachment of up to four communication lines. This feature in conjunction with the appropriate subfeatures allows System/38 to communicate on four lines concurrently, each operating at data rates up to 9600 BPS. Maximum: One. Field Installation: Yes. Prerequisites: Processor Unit Expansion (#6300) and Processor Unit Expansion (#6302).

Communication Control (#2000)

This feature is required with Communication Attachment - (#1501) to provide the basic control storage and common circuits for SDLC data link control. The Communication Control feature in conjunction with Communication Attachment feature (#1501) provides control for multiplexing up to four line appearances. Maximum: One. Field Installation: Yes. Limitation: Supports SNA/SDLC only. Prerequisites: Communication Attachment (#1501).

Line Base (#3200)

This feature provides the interface and control between the Line Interface features and the Communication Control (#2000). This feature is required for each line appearance and provides the necessary control required for each of the unique Line Interface types. Line Interfaces supported via this feature are: EIA (#3701), DDSA (#5650, #5651), 1200 BPS Integrated Modems (#5500, 5501, 5502, 5508), and Auto Call (#5760). Maximum: One per line position or four for system with Communication Attachment (#1501). Limitations: None. Prerequisites: Communication Control (#2000). Specify: Line

Position Code for installation (see Table A). Also specify appropriate Line Position Code if Internal Clocking (1200 BPS) is required.

LINE INTERFACES

One of the following line interface features must be ordered for each Line Base depending on the type of communication facility and modem to be used.

EIA Interface (#3701) Provides an interface for attachment of an IBM Modem or nonIBM Modem meeting RS-232-C characteristics. Non-IBM Modems may be attached subject to the Multiple Suppliers System Policy. Maximum: One per line position. Field Installation: Yes. Limitations: Cannot be installed on same line position with any other line interface type. Prerequisites: Line Base (#3200). Requires appropriate cable order. See IBM System/38 Installation Manual—Physical Planning, GA21-9293. Specify: Required that one code be specified from each of the following tables: Line Position Codes (Table A), Line Speed Codes (Table B), and Device Attachment Codes (Table C).

Digital Data Service Adapter (DDSA) (#5650, 5651) An integrated data link adapter for data transmission at speeds of 2400, 4800 or 9600 BPS over the AT&T nonswitched Dataphone* Digital Service network. The DDSA interfaces to a DDS channel service unit, the customer site termination of the DDS network. For point-to-point and multipoint control (#5650), for multipoint tributary (#5651). Available at three speeds: 2400 BPS, 4800 BPS, or 9600 BPS. Maximum: One per line position. Field Installation: Yes. Limitation: Cannot be installed on same line position with any other line interface type. Prerequisites: Line Base (#3200). Requires appropriate cable order. See IBM System/38 Installation Manual—Physical Planning, GA21-9293. Specify: Required that one code be specified from each of the following tables: Line Position Codes (Table A), Line Speed Codes (Table B), and Device Attachment Codes (Table C).

1200 BPS Integrated Modem (#5500, 5501, 5502, 5508) A modem for data transmission at 1200 BPS over switched or nonswitched facilities. Half speed operation at 600 BPS is optional via a Control Program Facility parameter. Available in 4 different versions: (#5500) - Nonswitched, (#5501) - Switched with Auto Answer, (#5502) - Switched with Manual Answer, (#5508) - Nonswitched (primary mode) with Switched Network Backup Auto Answer capability. The Nonswitched version (#5500) provides for a cable attachment directly to a nonswitched (2 or 4 wire) facility, Type 3002. The Switched with Auto Answer versions, (#5501 and 5508) provides for a cable attachment to a common carrier arrangement type CBS or equivalent. The Switched Network Manual Answer version (#5502) provides for a cable attachment to a common carrier arrangement type CDT or equivalent. The devices communicating with System/38 must also be equipped with a 1200 BPS Integrated Modem. Limitations: Cannot be installed with EIA Interface (#3701) or DDSA (#5650, 5651). Maximum: One per line position. Field Installation: Yes. Prerequisites: Line Base (#3200). Internal Clocking must be specified on Line Base (Table A). Requires appropriate cable order. See IBM System/38 Installation Manual—Physical Planning, GA21-9293. Specify: Required that one code be specified from each of the following tables: Line Position Codes (Table A), Line Speed Codes (Table B), and Device Attachment Codes (Table C).

* Registered Trademark of AT & T.



Auto Call Adapter (#5760) Permits the System/38 when attached to a switched network facility via an appropriate modem and Auto Call Unit, to initiate a data link connection to a remote station. Provides automatic dialing under program control. An Auto Call Adapter (#5760) must always be installed in conjunction with an EIA Interface (#3701) for each line to automatically originate calls on switched network facilities. Each line featured with Auto Call Adapter (#5760) takes two (2) line positions, therefore, reducing the maximum number of lines which can be supported. **Maximum:** Two. **Field Installation:** Yes. **Limitations:** Cannot be installed on same line position with any other line interface type. Installable in Line Position 2, 3, or 4 only. **Prerequisites:** Line Base (#3200). Requires appropriate cable order. See *IBM System/38 Installation Manual—Physical Planning*, GA21-9293. **Specify:** Required that one code be specified from each of the following tables: Line Position Codes (Table A), Line Speed Codes (Table B), and Device Attachment Codes (Table C). The Line Position Code specified must be the next higher order position relative to the modem it is associated with.

Table A
Line Bases & Line Interface Codes

Line Position	1	2	3	4
Line Base (#3200)	#9001	#9002	#9003	#9004
Internal Clocking	#9021	#9022	#9023	#9024
Line Interface Type:				
EIA (#3701)	#9101	#9102	#9103	#9104
1200 BPS Int Modem:				
Nonswitched (#5500)	#9111	#9112	#9113	#9114
Switched-AA (#5501)	#9121	#9122	#9123	#9124
Switched-MA (#5502)	#9131	#9132	#9133	#9134
SNBU-AA (#5508)	#9141	#9142	#9143	#9144
DDS Adapt-P/P & M/PC (#5650)	#9151	#9152	#9153	#9154
DDS ADAPT-M/PT (#5651)	#9161	#9162	#9163	#9164
AUTO CALL (#5760)	NA	#9172	#9173	#9174

Table B
Line Speed Codes

Line Position	1	2	3	4
Line Speed:				
1200 BPS	#9201	#9202	#9203	#9204
2000 BPS	#9211	#9212	#9213	#9214
2400 BPS	#9221	#9222	#9223	#9224
4800 BPS	#9231	#9232	#9233	#9234
7200 BPS	#9241	#9242	#9243	#9244
9600 BPS	#9251	#9252	#9253	#9254

Table C
Device Attachment Codes

Line Position	1	2	3	4
S/370	#9301	#9302	#9303	#9304
5250	#9381	#9382	#9383	#9384
Other Non-IBM	#9411	#9412	#9413	#9414

Customer Responsibilities

See M2700 pages for customer responsibilities regarding communications facilities and services.

Communications Facilities:

See M2700 pages for communications facility requirements for these features.

IBM Modems: Each line position featured with EIA Interface (#3701) requires an external modem which meets the requirements desired. IBM Modems which can be attached to Sys em/38 via EIA Interface (#3701) are as follows:

Modem	Data Rate (BPS)
3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

See M2700, 3872, 3874, 3875 pages for information on modem features, communication capabilities and product utilization.

ACCESSORIES

Keylock Keys

The 5381 with Power Keylock (#3210) is shipped with two keys. Additional keys (PN 2546418) may be purchased from IBM. (Vendor will supply additional keys only to the original purchaser.)



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requirements. Also, System/38 Attachment feature (#6500) is required on the 5424.

Automatic Initial Microprogramming Load (#1300)

Auto - IMPL enables the system to automatically initiate a power-on sequence following the restoration of commercial (utility) AC power after a commercial power failure. The primary use is for unattended operations; therefore, manual intervention is not required. A manually controlled toggle switch located on the Operator/Service panel permits the user to enable or disable the feature. **Maximum:** one. **Field Installation:** yes.

Audible Alarm And Attention Indicator (#2100)

Provides, in addition to the attention indicator on the display, a backlighted indicator, an audible alarm, and a volume control to alert the operator of an outstanding message requiring attention. **Maximum:** one. **Field Installation:** yes.

Power Keylock (#3210)

A key controlled switch, in series with the power-on pushbutton, will inhibit the power-on cycle if the keylock switch is "Off." The keylock cannot power the system down. The key lock is located on the Operator/Service panel. See Accessories for key ordering information. **Maximum:** one **Field Installation:** yes.

Processor Unit Expansion 1 (#6300)

This is a feature I/O board/power supply and is required for any of the following I/O devices: (1) attaching Communications Attachment (1-4) (#1501), (2) attaching Second Work Station Controller (#5302). **Maximum:** one. **Field Installation:** yes. **Prerequisite:** Processor Unit Expansion 3 (#6302).

Processor Unit Expansion 2 (#6301)

This is a feature I/O board/power supply and is required for any of the following I/O devices: (1) attaching the 5424 Multifunction Card Unit (#1220/1221), (2) attaching the 3411 Magnetic Tape Unit (#7960), (3) attaching the second 5211/3262 printer (#1110). **Maximum:** one. **Field Installation:** yes. **Prerequisite:** See Processor Unit Expansion Feature Configurator.

Processor Unit Expansion 3 (#6302)

This is a feature air circulating/cable assembly and is required for any of the following I/O devices: (1) Communications Attachment (1-4) (#1501), (2) attaching Work Station Controller #2 (#5302), (3) attaching the 5424 Multifunction Card Unit (#1220/1221), (4) attaching the 3411 Magnetic Tape Unit (#7960), (5) attaching the second 5211/3262 printer (#1110). **Maximum:** one. **Field Installation:** yes. **Prerequisite:** See Processor Unit Expansion Feature Configurator.

Processor Unit Expansion 4 (#6303)

This is a feature power expansion assembly required to attach the 3411 Magnetic Tape Unit (#7960). **Maximum:** one. **Field Installation:** yes. **Prerequisite:** Processor Unit Expansion 2 (#6301) and Processor Unit Expansion 3 (#6302).

**Processor Unit Expansion Feature Configurator
(Maximum Required—one each)**

**PROCESSOR UNIT EXPANSION
REQUIRED**

I/O Function Required	#1	#2	#3	#4
	#6300	#6301	#6302	#6303
Communications Attachment (#1501)	X		X	
Work Station Controller, Second (#5302)	X		X	
5424 MFCU (#1220/#1221)		X	X	
3411 Magnetic Tape (#7960)		X	X	X
Second 5211/3262 Printer Attachment (#1110)		X	X	

3411 Magnetic Tape Attachment (#7960 available 2/22/80)

To attach a 3411 Magnetic Tape Unit and Control. **Maximum:** one. **Field Installation:** yes. **Prerequisite:** Processor Unit Expansion #6301, #6302, and #6303 are required. Feature # 7003 is required on the 3411. See "Processor Unit Expansion Feature Configurator" to determine overall requirements.

Special Feature Prices: See Price List.

LOCAL WORK STATION CONTROLLER

Work Station Controller

Provides direct local attachment of IBM 5250 Information Display System devices to System/38. One Work Station Controller is standard on all models of System/38. It provides 8 ports for attaching work stations (Keyboard Displays and/or Printers) directly to the system in any combination. These 8 ports permit attachment of up to 12 devices with twinax cabling using the Cable Thru feature on the 5250 devices. It is also possible to use coax cabling (see below). Devices supported via the Work Station Controller are:

- 5251 Model 1, Display Station (960 Character)
- 5251 Model 11, Display Station (1920 Character)
- 5252 Model 1, Dual Display Station (960 Character per Display)
- 5256 Model 1, Printer (40 CPS)
- 5256 Model 2, Printer (80 CPS)
- 5256 Model 3, Printer (120 CPS)

The Work Station Controller provides support for device attachment cabling via both 5250 twinax and 3270 compatible coax. Twinax cable provides for multipoint cable connections at distances up to 1525m (5000 feet). Up to seven devices may be attached to a single port via twinax.

Devices can be attached via individual coax cable at distances up to 610m (2000 feet) from the 5381. For attachment to coax cable a special adapter is required and is available as a 5250 accessory. Refer to 5250 Information Display System Sales Pages (M5251, M5252, or M5256) for selection of appropriate features, accessories, and cables for attachment of 5250 devices.

For attachment of additional 5250 devices, see Device Interface Expansion (#5321), Device Control Expansion (#5331), or

**5404 PROCESSING UNIT**

Purpose: Contains main storage, a keyboard console, and maintenance console, and facilities for addressing main storage, arithmetic and logical processing of data, and controlling I/O devices in a System/3 Model 4.

Model	Processor Storage (bytes)
A18	65,536

Highlights: The CPU uses highly integrated Monolithic Systems Technology (MST) for logical circuitry. Memory is Metal Oxide Semiconductor Field Effect Transistor (MOSFET). Data and instructions are stored as EBCDIC characters ... each EBCDIC character is stored in an 8-bit byte ... a ninth bit is added for parity checking. Main cycle time is 1.52 microseconds. Instruction execution and I/O data handling utilizes the "Cycle Steal" technique, providing overlap of I/O and processing.

3270 Information Display System devices (3277's, 3284's, 3286's, 3287's and 3288's) used as local work stations are attached directly to the processing unit. Attachment capability for three 3270 Model 1 devices is standard. Attachment provisions for 3 additional 3270 devices and for 3270 model 2 devices (e.g. 3277 model 2) is available by special feature.

Communications with remotely located systems or terminals may be performed through the use of the Binary Synchronous Communications Adapter (BSCA) over data communications transmission facilities.

The system console uses a message display unit for simplified direct operator/system communication. The keyboard consists of three groups of keys: eight command keys; alpha-numeric and function keys; and 10-key numeric keyboard.

Maximum: Only one 5404 can be attached to a System/3 Model 4.

Configuration: 5404 Processing Unit, 5213 Printer Model 3 (#3960 required), and 5447 Disk Storage and Control Model A1 or A2. For displaying CCP messages, a 3277 Display Station Model 1 is required. From one to five locally attached work stations may be selected from this list: 3277 Display Station Model 1 or 2, 3284 Printer Model 1 or 2, 3286 Printer Model 1 or 2, and 3288 Line Printer Model 2.

Bibliography: GC20-8080. **Metering:** Base Unit.

Specify

1. Voltage AC, 1-phase, 60 Hz—#9902 for 208V, or #9904 for 230 V: AC, 3-phase, 60 Hz—#9903 for 208V, or #9905 for 230V.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. Disk configuration: #9120 if 5447-A2 is attached.
4. I/O Unit Attachments: Appropriate special features are required to attach most I/O units ... see "Special Features."
5. For Binary Synchronous Communications Adapter (#2074), see "Specifications" under "Additional Information."
6. System Control Programming, 5703-SC1, and the Communications Control Program, 5703-SC1 Feature 6033, should be ordered at equipment order entry time ... See Programs/SCP section for additional information.

7. For information relative to Upending Kit, Feature #9840, see Specify section of M5447 page.

Special Features

5213 Model 3 Enhanced Print Rate Attachment (#3960): Required to attach a 5213 Printer Model 3. Drives the Printer at a nominal rate of 115 characters per second. **Maximum:** One.

Display Increment (#4704): Provides for attachment of three additional 3270 devices in any combination to the processing unit. **Maximum:** One. **Field Installation:** Yes.

3270 Model 2 Attachment (#4705): Provides for attachment of 3270 Model 2 devices (i.e., 3277-2, 3284-2, 3286-2, or 3288-2) to the processing unit. This is required if any of the locally attached devices is a Model 2 (1920 Character Buffer). **Maximum:** One. **Field Installation:** Yes.

Serial I/O Channel (#7081): Provides a means of attaching special units that may be required by the customer. **Maximum:** One. **Field Installation:** Yes.

Communication Features

Binary Synchronous Communications Adapter (#2074): This feature in conjunction with program control permits System/3 Model 4 to communicate in binary synchronous mode with other IBM systems and terminals. System/3 Model 4 can operate on a multipoint line as either a control station or a tributary station, or on a point-to-point switched or leased communications line. Transmission rates are available from 600 bps to 50,000 bps. Auto answer capability is standard (to be effective, the modem must also have this capability) in switched network version. Any version can be selected to operate in EBCDIC or ASCII transmission code, but not both. Also, see "Modems" at end of this section.

Specify: See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One per 5404. **Field Installation:** Yes.

In addition to the basic functions of #2074, the following special features may be added ... all of them can be field installed.

Auto Call (#1315): Permits the System/3 Model 4, when attached to a switched network (#9483) via an appropriate modem and Auto Call Unit, to initiate (dial) through stored program control, a data link connection to a remote BSC station. **Limitation:** Cannot be installed with Station Selection (#7477). **Maximum:** One. **Prerequisites:** BSC Adapter (#2074), Network Attachment (#9483), and one voice grade Transmission Rate from 600 to 4800 bps. Requires appropriate cable order. See *Installation Planning Manual*, GA21-9084.

Internal Clock (#4703): Generates synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. When this feature is installed, all other terminals attached to the same data link must also be equipped with a similar IBM Internal Clock. Will service one of the following transmission rates: 600 bps, 1200 bps, 2000 bps or 2400 bps. **Maximum:** One. **Prerequisites:** BSC Adapter (#2074) and one of the voice grade Transmission Rates from 600 to 2400 bps.

Station Selection (#7477): Permits the System/3 Model 4 to operate as a compatible member of the IBM family of BSC terminals on a multipoint communications line as a tributary station. **Limitation:** Cannot be installed with Auto Call (#1315). **Maximum:** One. **Prerequisites:** BSC Adapter



(#2074), Network Attachment (#9482 or 9484), Line Facility Attachment (#9392) and one of the voice grade Transmission Rates from 1200 to 9600 bps.

Text Transparency (#7850): Permits the System/3 Model 4 to transmit or receive "8-bit binary data" or EBCDIC coded data. **Limitation:** Cannot be installed with ASCII Transmission Code (#9061) ... limitations exist on the use of this facility for the transmission of data and are referenced in publications GA27-3004. **Maximum:** One. **Prerequisites:** BSC Adapter (#2074) and EBCDIC Transmission Code (#9060).

Note: Configuration requirements for IBM Programming Support must satisfy the minimum machine requirements stated in the programming sections of the *Sales Manual*.

For information on optional selections, attachment to communications lines, customer responsibilities, etc., see "Additional Information" below.

Modems One IBM modem can be attached to a 5404. **Prerequisite:** BSC Adapter (#2074).

Modem	Speed(bps)
3872 Model 1	2400
3874 Model 1	4800
3875 Model 1	7200

For communication capabilities, product utilization and special features, see M2700, 3872, 3874 and 3875 pages.

Additional Information

I. **Specifications** One selection must be specified from each of the following five categories:

A. Transmission Code

EBCDIC	#9060
ASCII	9061

B. Transmission Rate (1)

600 bps	#9750
1200 bps	9751
2000 bps	9752
2400 bps (2)	9753
4800 bps	9754
7200/3600 bps	9757
9600 bps	9759
High Speed (19,200 to 50,000 bps)	9755

C. Network Attachment

Point-to-point (non-switched)	#9481
Multipoint (tributary)	9482
Switched Network	9483
Multipoint Control Station (3)	9484

D. Line Facility Attachment (4)

Full Duplex (4-wire only)	#9391
Half Duplex	9392

E. One (or more if necessary) optional selection code must be specified from the following list as determined by planned device attachments to BSCA.

S/360 (Model 22 and up) or S/370	#9570
S/360 Model 20	9571
1130 System	9572
2770 System	9573
2780	9574
3270 System	9577
3735	9578
3741 Model 2 or Model 4	9579
System/3	9580
System/7	9590
System/32	9591
5231 Model 2	9592
System/34	9593
Series/1	9594

Notes:

1. Refer to *U.S. Data Communications Handbook*

2. See publication GA27-3004 for potential problem areas and possible restrictions to application data when using certain modems at this or higher speeds.

3. If Multipoint Tributary Station use (with #7477) is to be implemented alternately with Multipoint Control Station use on the same adapter, specify code #9484 must be used.

4. When BSCA is used as a Control Station adapter or when attached to a point-to-point (non-switched) data link, the facility may be duplex (4-wire only) or half-duplex. Half-duplex facility must be specified for Switched Network attachments and for adapters implementing Multipoint Tributary Station only operation.

II. **Special Features**

A. Available with Voice Grade (600 to 9600 bps) and High Speed (19,200 to 50,000 bps) Adapters.

Text Transparency #7850

B. Available with Voice Grade Adapters only.

Internal Clock	#4703
Station Selection	7477
Auto Call	1315

III. **Communications Facility Attachments** The System/3 Model 4 BSCA is designed to operate on transmission facilities such as:

A. Common carrier leased telephone line services (Voice Grade).

AT & T or Western Union Class 3002—600 bps.

AT & T or Western Union Class 3002 with C1 conditioning—to 4800 bps.

AT & T or Western Union Class 3002 with C2 conditioning—to 7200 bps.

B. Private (customer owned) communications facilities equivalent to the above common carrier facilities.



- C. Voice Grade (common carrier or private) lines supporting a 9600 bps transmission rate. Channel requirements may vary according to the various types of data sets selected. The data set manufacturer should be consulted by the customer for this information.
 - D. Common carrier switched network telephone (Voice Grade) service at 600 bps to 4800 bps.
 - E. Common carrier Wideband Communications Services at 19,200 bps, 40,800 bps, or 50,000 bps.
- IV. **Reference** See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities, and customer responsibilities.
- V. **Customer Responsibilities** The customer must be advised that: (1) he is responsible for making arrangements for installation, pricing, and charges of the data communication facility and attachment of selected data sets ... (2) Toll charges, if required for installation and/or maintenance of the BSCA, are to be paid by the customer ... (3) the IBM marketing representative must have the customer obtain a firm installation date for transmission services (including modems) before the order can be confirmed ... for further information, see "Teleprocessing Systems" in the "General Information" section and reference (IV) above.
- VI. **Cables** BSCA (#2074) always requires an appropriate cable order. See *Installation Manual—Physical Planning*, GA21-9084.

**5406 PROCESSING UNIT**

Purpose: Contains main storage, a keyboard console and maintenance console, and facilities for addressing main storage, arithmetic and logical processing of data, and controlling I/O devices in a System/3 Model 6.

Models:

Model	Main Storage (bytes)
B2	8,192
B3	12,288
B4	16,384

Model Changes: Field installable.

Highlights: The keyboard console provides all indications and controls necessary for the operator. Field/operation and command key indicators inform the operator of status and progress in a job. Control of the CPU and all I/O is from the console. The keyboard has standard typewriter layout, a 10-key numeric section, and eight command keys ... eight additional command keys are available (see "Special Features"). Special characters for interactive programs are conveniently located. TAB and BACKSPACE keys have typematic as standard.

Uses the new highly integrated Monolithic Systems Technology (MST). Data and instructions are stored as EBCDIC characters. Each EBCDIC character is stored in an 8-bit byte (a ninth bit is added for parity checking). Main cycle time is 1.52 microseconds. Instruction execution and I/O data handling utilize the "Cycle Steal" technique, providing overlap of I/O and processing. Main storage capacity changes and all I/O device attachments are field installable.

Maximum: Only one 5406 can be attached to a System/3 Model 6.

Minimum Configuration: In addition to a 5406 model B2, the system requires, for minimum configuration, a 5444 Disk Storage Drive and a 5213 or 2222 Printer. IBM program support of a 2265 Display Station model 2 and/or 1255 Magnetic Character Reader requires a 5406 model B3 or B4.

Supplies: Blank System/3 Model 6 Keyboard Indicator Templates, GX 34-0004, can be marked by the operator to identify the meanings of the field/operation and command key indicators according to individual application requirements.

Bibliography: GC20-8080. **Metering:** Base Unit.

Specify

- Voltage [AC, 1-phase, 60 Hz]: #9902 for 208V, or #9904 for 230V. [AC, 3-phase, 4-wire, 60 Hz]: #9903 for 208V, or #9905 for 230V.
 - Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
 - I/O Unit Attachments: Appropriate special features are required to attach most I/O units ... see "Special Features."
 - For Binary Synchronous Communications Adapter (#2074), see "Specifications" under "Additional Information."
 - All Systems: Specify one of the following—#9201 for 5444 model 1, #9202 for 5444 model 2, #9203 for 5444 model 2 and model 3, or #9204 for two 5444 model 2's. **Field Installation:** Yes.
- System Control Programming, 5703-SC1, should be ordered at equipment order entry time ... see "System Control Programming" for System/3 model 6 in "Systems" for additional information.
 - Upending Kit; #9840, for use with the 5406 I/O unit. Up-Ended dimensions will be 29-1/2" wide, 42" long, 73" high. This kit is furnished only as necessary and remains the property of IBM.

Special Features

Command Keys (#1550): Provides eight command keys (9-16) in addition to the eight which are standard. *Note:* #1550 is required when the 2265 model 2 is supported by System/3 BASIC (Program Product 5703-XM1). **Field Installation:** Yes.

Data Recorder Attachment (#3210): To attach either a 129 Card Data Recorder equipped with Card Input/Output Attachment (#7503) or a 5496 Data Recorder model 1 equipped with a System/3 Model 6 Attachment (#7501). **Specify:** #9112 for use with 5496, or #9113 for use with 129. **Maximum:** One. **Field Installation:** Yes.

5213 Printer Attachment (#3901, 3902, 3903): To attach a 5213 Printer.

#3901	—	to attach a 5213 Printer model 1
#3902	—	to attach a 5213 Printer model 2
#3903	—	to attach a 5213 Printer model 3

Limitation: Only one printer attachment feature can be installed on a system. **Field Installation:** Yes.

5213 Model 3 Enhanced Print Rate Attachment (#3960): To attach a 5213 Printer model 3 and drive it at a nominal print rate of 115 cps. **Limitation:** Cannot be installed with #3901, #3902 or #3903. **Field Installation:** Yes.

Local Communications Adapter (#4765): Permits local attachment of one 3741 model 2 or 4, one 5231 model 2 equipped with BSCA (#2074) (Point-to-point unidirectional transmission only) or one System/7 equipped with a binary synchronous communications adapter (#2074) to a System/3 model 6. The external modem cable of the device will attach directly to the 5406 when this feature is installed. Data transfer rate is 2400 bps only. Operates in EBCDIC Code. Programming support is provided by the RPG II Telecommunications Feature. The 5231 Model 2 is supported as a 3741 Model 2 or 4. **Limitations:** Cannot be installed with BSCA (#2074). Data exchange with attached device is non-transparent only. For data transparent operation contact GSD Special Product Marketing for RPQ detail and approval. **Maximum:** One per 5406. **Field Installation:** Yes. **Prerequisite:** Processing Unit Expansion (#5732).

Processing Unit Expansion (#5732): Provides additional processing unit capacity for Serial I/O Channel (#7081) and/or Binary Synchronous Communications Adapter (#2074) and/or Local Communications Adapter (#4765) and/or 3741 Attachment (#8220). **Maximum:** One. **Field Installation:** Yes.

Second Disk Attachment (#6378): To attach a 5444 Disk Storage Drive model 3 or a second 5444 model 2. **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** A 5444 model 2.

Serial I/O Channel (#7081): To attach a 1255 Magnetic Character Reader. **Maximum:** One. **Limitation:** IBM Program Support available only for 5406 models B03 and B04. Cannot be installed with 3741 Attachment (#8220). **Field Installation:** Yes. **Prerequisite:** Processing Unit Expansion (#5732).



2222 Printer Attachment (#7951, 7952): To attach a 2222 Printer.

- #7951 To attach a 2222 Printer model 1
- #7952 To attach a 2222 Printer model 2

Limitations: Cannot be installed with a 2265 Display Station Model 2 Attachment (#7960) ... only one printer attachment feature can be installed on a system. **Field Installation:** Yes.

2265 Display Station Model Attachment (#7960): To attach a 2265 Display Station model 2. **Maximum:** One. **Limitations:** IBM Program Support available only on 5406 model B3 or B4 ... cannot be installed with a 2222 Printer. *Note:* See requirements for Command Keys (#1550). **Field Installation:** Yes.

3741 Attachment (#8220): To directly attach a 3741 model 1, 2, 3 or 4. **Maximum:** One. **Limitations:** Cannot be installed with SIOC (#7081). IBM Programming Support available only for 5406 models B3 and B4. For a 3741 model 3 or 4, System/3 does not support the Application Control Language (ACL). **Field Installation:** Yes. **Prerequisites:** Processing Unit Expansion (#5732) on 5406 ... I/O Adapter (#3265/3266) on 3741.

Binary Synchronous Communications Adapter (#2074): This feature in conjunction with program control permits System/3 Model 6 to communicate in binary synchronous mode with other IBM systems and terminals. System/3 Model 6 can operate on a multipoint line as a tributary station, or on a point-to-point switched or leased communications line. Transmission rates are available from 600 bps to 50,000 bps. Auto answer capability is standard (to be effective, the modem must also have this capability) in switched network version. Any version can be selected to operate in EBCDIC or ASCII transmission code, but not both. Also, see "Modems" at end of this section.

Specify:

See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One per 5406. **Field Installation:** Yes. **Prerequisites:** Processing Unit Expansion (#5732).

In addition to the basic functions of #2074, the following special features may be added ... all of them can be field installed.

Auto Call (#1315): Permits the System/3 Model 6, when attached to a switched network (#9483) via an appropriate modem and Auto Call Unit to initiate (dial) through stored program control, a data link connection to a remote BSC station. **Limitation:** Cannot be installed with Station Selection (#7477). **Maximum:** One. **Prerequisites:** BSC Adapter (#2074), Network Attachment (#9483) and one voice grade Transmission Rate from 600 to 4800 bps. Requires appropriate cable order. See *Installation Planning Manual, GA21-9084*.

Internal Clock (#4703): Generates synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. When this feature is installed, all other terminals attached to the same data link must also be equipped with a similar IBM Internal Clock. To determine if this feature is required, see "Additional Information" below. It will service one of the following transmission rates: 600 bps, 1200 bps, 2000 bps, or 2400 bps. **Maximum:** One. **Prerequisites:** BSC Adapter (#2074) and one of the voice grade Transmission Rates from 600 to 2400 bps.

Station Selection (#7477): Permits the System/3 Model 6 to operate as a compatible member of the IBM family of BSC

terminals on a multi-point communications line as a tributary station. **Limitation:** Cannot be installed with Auto Call (#1315). **Maximum:** One. **Prerequisites:** BSC Adapter (#2074), Network Attachment (#9482), Line Facility Attachment (#9392) and one of the voice grade Transmission Rates from 1200 to 9600 bps.

Text Transparency (#7850): Permits the System/3 Model 6 to transmit or receive "8-bit binary data" or EBCDIC coded data. **Limitation:** Cannot be installed with ASCII Transmission Code (#9061) ... limitations exist on the use of this facility for the transmission of data and are referenced in SRL A27-3004. **Maximum:** One. **Prerequisites:** BSC Adapter (#2074) and EBCDIC Transmission code (#9060).

Note: Configuration requirements for IBM Programming Support must satisfy the minimum machine requirements stated in the "Program Products" and "Systems" sections

For information on optional selections, attachment to communications lines, customer responsibilities, etc., see "Additional Information" below.

Modems: One IBM modem can be attached to a 5406, any model. **Prerequisite:** BSC Adapter (#2074).

Modem Speed (bps)

3872 model 1	2400
3874 model 1	4800
3875 model 1	7200

Note: For communication capabilities, product utilization and special features, see M2700, 3872, 3874, 3875, pages.

Additional Information

I. **Specifications:** One selection must be specified from each of the following five categories:

A. Transmission Code	
EBCDIC	#9060
ASCII	9061
B. Transmission Rate	
600 bps	9750
1200 bps	9751
2000 bps	9752
2400 bps	9753
4800 bps	9754
7200/3600 bps	9757
High Speed (19,200 to 50,000 bps)	9755
9600 bps	9759
C. Network Attachment	
Point-to-point (non-switched)	9481
Multi-point (tributary)	9482
Switched Network	9483
D. Line Facility Attachment (1)	
Full duplex (4-wire only)	9391
Half duplex	9392



E. Modem or Data Set Interface—from the list below specify the facility to which the BSCA will attach.

C4	(600 or 1200 bps)	#9101
D3	(600 or 1200 bps)	9102
D4M	(2000 bps)	9103
C5,D4,D4M,D4SB	(2400 bps) (2)	9104
E2	(50,000 bps)	9105
E3	(19,200 bps)	9106
E1	(40,800 bps) (2)	9107
C6,D5, or D5SB	(4800 bps) (3)	9108
D6 or D6SB	(7200 or 3600 bps) (3)	9109

Notes:

1. Where modem is used on a point-to-point (non-switched) type data link, the facility must be Full duplex (4-wire only) or Half duplex. Multi-point tributary or Switched Network attachments must specify Half-duplex.
2. See SRL GA27-3004 for problem areas and possible restrictions to application data.
3. For information on above communication facilities, see M2700 pages.

II. Special Features

- A. Available with Voice Grade (600 to 9600 bps) and High Speed (19,200 to 50,000 bps) Adapters.
Text Transparency (#7850)
- B. Available with Voice Grade Adapters only.
Internal Clock (#4703)
Station Selection (#7477)
Auto Call (#1315)

III. Communications Facility Attachments: The System/3 Model 6 BSCA is designed to operate on transmission facilities such as:

- A. Common carrier leased telephone line services (Voice Grade).
AT & T or Western Union Class 3002—to 600 bps.
AT & T or Western Union Class 3002 with C1 conditioning—to 4800 bps.
AT & T or Western Union Class 3002 with C2 conditioning—to 7200 bps.
- B. Private (customer owned) communications facilities equivalent to the above common carrier facilities.
- C. Voice Grade (common carrier or private) lines supporting a 9600 bps transmission rate. (Channel requirements may vary according to the various types of data sets selected. The data set manufacturer should be consulted by the customer for this information.)
- D. Common carrier switched network telephone (Voice Grade) service at 600 bps to 4800 bps.
- E. Common carrier Wideband Communications Services at 19,200 bps, 40,800 bps, or 50,000 bps.

IV. Reference: See pages M2700, this section, for additional information concerning modems, communications

facilities, machine attachment requirements, terminal intermix, operating capabilities, and customer responsibilities.

V. Customer Responsibilities: The customer must be advised that:

- A. He is responsible for making arrangements for installation, pricing, and charges of the data communications facility and attachment of selected data sets.
- B. Toll charges, if required for installation and/or maintenance of the BSCA, are to be paid by the customer.
- C. The IBM Marketing Representative must have the customer obtain a firm installation date for transmission services (including modems) before the order can be confirmed ... for further information, see "Teleprocessing Systems" in the "General Information" section and reference (IV) above.

VI. Cables: BSCA (#2074) always requires an appropriate cable order. See Installation Manual—Physical Planning, GA21-9084.

**5408 PROCESSING UNIT**

Purpose: Contains main storage and facilities for addressing main storage, arithmetic and logical processing of data, and controlling I/O units for System/3 Model 8. Also includes a housing for one or two 5444 Disk Storage Drives.

Model	Processor Storage (bytes)
A14	16,384
A16	32,768
A17	49,152
A18	65,536

Model Changes: Field Installable.

Highlights: The CPU uses highly integrated Monolithic Systems Technology (MST) for logical circuitry. Memory is Metal Oxide Semiconductor Field Effect Transistor (MOSFET). Data and instructions are stored as EBCDIC characters ... each EBCDIC character is stored in an 8-bit byte ... a ninth bit is added for parity checking. Main cycle time is 1.52 microseconds. Instruction execution and I/O data handling utilizes the "Cycle Steal" technique, providing overlap of I/O and processing.

The direct attachment of the 3741 Data Station or Programmable Work Station provides high speed input and output via magnetic media.

The 5448 Disk Storage Drive can be added to the system to provide an additional 9.8 million bytes of disk storage.

The system console uses an alphameric halt indicator for simplified direct operator/system communication.

The Local Display Adapter provides local attachment of any mix of up to twelve 3277 Model 1 or 2 Display Stations and/or 3284/86/87/88 Printers.

Communication with remotely located systems or terminals may be performed through the use of the Integrated Communications Adapter or the Binary Synchronous Communications Adapter over Data Communications Transmission facilities.

Maximum: Only one 5408 can be attached to a System/3 Model 8.

Minimum Configuration: In addition to the 5408, a System/3 Model 8 requires a 5203 Printer, 5444 Disk Storage Drive and either ... (a) a 5471 Printer-Keyboard, or, (b) a 3741 Data Station directly attached to the system.

Bibliography: GC20-8080. **Metering:** Base Unit.

Specify

- Voltage (AC, 3-phase, 4-wire, 60 Hz): #9903 for 208V, or #9905 for 230 V.
- Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
- Print Position Attachment: #9495 for 5203 with 120 print positions, or #9496 for 5203 with 132 print positions.
- I/O Attachments: Appropriate special features are required to attach most I/O units ... see "Special Features."
- Disk Storage: Specify one of the following—#9205 for 5444 model A1 ... #9206 for one 5444 model A2 ... #9207 for model A2 and model A3 ... #9208 for two 5444 model A2s.

6. System Control Programming, 5702-SC1, should be ordered at equipment order entry time ... see "System Control Programming" section for additional information.

7. Printer Attachments: Specify #9180 for 5203 Model 1 ... #9181 for 5203 Model 2.

8. Upending Kit: #9840. This kit is furnished only as necessary and remains the property of IBM.

Special Features

Dual Feed Carriage Control (#3480): Required for Dual Feed Carriage (#3475) on a 5203 Printer. **Prerequisite:** 5203 Printer Base Attachment (#3960) and appropriate 5203 Printer Speed Attachment (#3970 or #3972). **Field Installation:** Yes.

Dual Program (#3500): Provides the capability to independently load and process two programs simultaneously. Independent operator control of each program is provided so that either program may be initiated, restarted after a program halt, run to completion, or terminated without regard to the other program other than availability of memory and I/O units. **Field Installation:** Yes.

5203 Printer Base Attachment (#3960): Required to attach a 5203 Model 1, 2 or 3. **Prerequisite:** #9221 on the 5203. **Maximum:** One. **Field Installation:** Yes. *Note:* A Model 8 displacing an installed Model 10 must submit an MES requesting Specify Feature #9221 on the 5203 Printer to receive a new printer cable.

5203 Printer Speed Attachment—100 lpm/200 lpm (#3970): To attach a 5203 Printer Model 1 or Model 2. **Maximum:** One. **Limitation:** Cannot be installed with #3972. **Prerequisite:** #3960 on the 5408. **Field Installation:** Yes.

5203 Printer Speed Attachment—300 lpm (#3972): To attach a 5203 Printer Model 3. **Maximum:** One. **Limitation:** Cannot be installed with #3970. **Prerequisite:** #9221 on the 5203. **Field Installation:** Yes.

Note: A Model 8 displacing an Installed Model 10 must submit an MES requesting Specify Feature #9221 on the 5203 printer to receive a new printer cable.

5448 File Attachment (#4040): To attach a 5448 Disk Storage Drive Model A1. **Limitation:** Cannot be installed with SIOC (#7081). **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Processing Unit Expansion A (Feature #5732) on the 5408, 5444 Disk Storage Drive Model A2 and Specify #9056 on the 5448 Disk Storage Drive.

5471 Printer-Keyboard Attachment (#4110): To attach a 5471 Printer-Keyboard. **Maximum:** One. **Field Installation:** Yes.

Basic Attachment Feature (#4701): To attach either the Local Display Adapter (#4702) or the 3411 Magnetic Tape Attachment (#7960) or both (#4702 and #7960 must be specified). **Maximum:** One. **Limitations:** Cannot be installed with the Integrated Communications Adapter (#4645). **Field Installable:** Yes.

Local Display Adapter (#4702): Permits direct local attachment (up to 2000 feet) of up to three 3277-1 Display Stations, 3284-1 Printers, 3286-1 Printers or 3287 Printers in any combination. The 3271 Control Unit is not required. The 3270 device cables will be attached directly to the Local Display Adapter (#4702). For attachment of additional 3270 devices (maximum of 12) see Display Increment (#4704). For attachment of the 3270 Model 2 devices (1920 Character Buffer) see



Model 2 Attachment (#4705). **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Basic Attachment Feature (#4701) and a minimum of 32K bytes of storage (Model A16) on the 5408. Specify EBCDIC Character Set (#9089) on attached 3270 devices.

Display Increment (#4704): Provides for attachment of three additional 3270 devices in any combination to the Local Display Adapter (#4702). **Maximum:** Three. **Field Installable:** Yes. **Prerequisite:** Local Display Adapter (#4702).

Model 2 Attachment (#4705): Required if any 3277 Model 2 Display Stations and/or 3284/86/88 Model 2 Printers and/or 3287 Printers (with 1920 Character Buffer) are to be attached to the Local Display Adapter (#4702). **Maximum:** One. **Field Installation:** Yes. **Prerequisite:** Local Display Adapter (#4702).

Processing Unit Expansion (#5732): Provides additional connectors and mounting space for the 5448 File Attachment (#4040), Serial I/O Channel (#7081) or BSCA (#2074). **Maximum:** One. **Field Installation:** Yes.

Processing Unit Expansion B (#5733): Provides additional power for attaching both BSCA (#2074) and SIOC (#7081) or both the 5448 File Attachment (#4040) and BSCA (#2074). **Prerequisite:** Processing Unit Expansion A (#5732). **Maximum:** One. **Field Installation:** Yes.

Processing Unit Expansion Feature Configurator

I/O Unit	Communications	
	None	BSCA
None	—	#5732
SIOC	#5732	#5733
5448	#5732	#5733

Note: #5732 is a prerequisite for #5733. If BSCA is attached on a system with #4040, Processing Unit Expansion A (#5732) and Processing Unit Expansion B (#5733) are both required.

Second Disk Attachment (#6378): To attach a 5444 Disk Storage Drive model A3, or a second 5444 model A2. **Maximum:** One. **Prerequisite:** A first 5444 model A2. **Field Installation:** Yes.

Serial I/O Channel (#7081): To attach a 1255 Magnetic Character Reader or a 3881 Optical Mark Reader. **Maximum:** One. **Limitation:** Cannot be installed with 5448 File Attachment (#4040). **Prerequisite:** Processing Unit Expansion A (#5732); both processing Unit Expansion A (#5732) and B (#5733) if attached with BSCA (#2074). **Field Installation:** Yes.

3411 Magnetic Tape Attachment (#7960): To attach a 3411 Magnetic Tape Unit and Control. **Maximum:** One **Field Installable:** Yes. **Prerequisite:** Basic Attachment Feature (#4701).

3741 Attachment (#8220): To attach a 3741 Data Station model 1 or 2 or 3741 Programmable Work Station model 3 or 4. **Maximum:** One. **Limitation:** For 3741 models 3 and 4, System/3 does not support the Application Control Language (ACL). **Prerequisite:** I/O Adapter (#3265) on the 3741 models 1 and 2, I/O Adapter (#3266) on the 3741 models 3 and 4. **Field Installation:** Yes.

Universal Character Set Control (#8642): Required if any Interchangeable Chain Cartridge or Interchangeable Train

Cartridge with more than 48 different characters is to be used on the 5203 Printer. **Maximum:** One. **Prerequisite:** Universal Character Set Attachment (#8639) on the 5203 Printer. **Maximum:** One. **Prerequisite:** Universal Character Set Attachment (#8639) on the 5203. **Field Installation:** Yes.

Communication Features

Integrated Communications Adapter (#4645): This feature in conjunction with its sub-features provides up to three (3) communications interfaces, two (2) local, and one (1) remote. When more than one interface is present, only one can be active at a time as selected by the operator through a manual switch control. See description of interface features (#4801, 4802 and 6202) below. **Specify:** #9070 for EBCDIC transmission code, or #9071 for ASCII. **Maximum:** One per 5408. **Limitation:** Cannot be installed with the Basic Attachment Feature (#4701). **Field Installation:** Yes.

8000 BPS Local Interface (#4801): Permits local attachment of one 3271 Control Unit model 1 or 2 or one 3275 Display Station model 1 or 2 or one System/7 equipped with a binary synchronous communications adapter (#2074) to the 5408 without use of a communications line or modems. The external modem cable of the attached Device connects directly to the 5408 when this feature is installed. The feature provides clocking for the 8000 bps data transfer rate. **Limitation:** Data transfer rate is 8000 bps only. **Maximum:** One. **Prerequisites:** Integrated Communications Adapter (#4645). The attached 3271 or 3275 must have #7821 installed. **Field Installation:** Yes.

2400 BPS Local Interface (#4802): Permits local attachment of one binary synchronous IBM terminal, e.g., 3741 model 2 or 4, one 5231 model 2 (point-to-point unidirectional transmission only), or one System/7 equipped with a binary synchronous communications adapter (#2074) to the 5408 without the use of a communications line or modems. The external modem cable of the attached Device connects directly to the 5408 when the feature is installed. The feature provides clocking for the 2400 bps data transfer rate. **Limitations:** Data transfer rate is 2400 bps only

Specify: See "Additional Information" at end of this section for device attachment code. **Maximum:** One. **Prerequisite:** Integrated Communications Adapter (#4645). **Field Installation:** Yes.

Synchronous Line, Medium Speed (#6202): Provides one medium speed BSC line interface to an external modem. The communications network attachment may be point-to-point (switched), point-to-point (non-switched), or multipoint (control station). Maximum transmission rate is 4800 bps for switched operation and 9600 bps for non-switched operation. The attached modem must provide the necessary data clocking. See "IBM Modem" in "Additional Information" at end of this section. Devices attached to the Synchronous Line, Medium Speed, have the same requirements as when attached to System/3 via BSCA (Feature #2074) with equivalent communications facilities and line speeds. (*Note:* For attached device prerequisites see appropriate machines pages.) **Limitations:** Cannot function as a multipoint tributary station. Modem clocking only.

Specify: See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One. **Prerequisites:** Integrated Communications Adapter (#4645) ... see appropri-



ate "Machines" pages for device prerequisites. **Field Installation:** Yes.

Text Transparency (#7851): Permits the ICA to transmit or receive "8 bit binary data" and EBCDIC coded data. **Limitations:** Cannot be installed with ASCII Transmission Code (#9071). Limitations on the use of this facility are described in SRL GA27-3004. **Maximum:** One. **Prerequisite:** Integrated Communications Adapter (#4645) and Transmission Code (#9070). **Field Installation:** Yes.

Binary Synchronous Communications Adapter (#2074): This feature in conjunction with program control permits System/3 model 8 to communicate in binary synchronous mode with other IBM systems and terminals. System/3 can operate on a multipoint line as either a control station or a tributary station, or on a point-to-point switched or leased communication line. Transmission rates are available from 600 bps to 50,000 bps. Auto answer capability is standard (to be effective, modem must also have this capability) in switched network version. Any version can be selected to operate in EBCDIC transmission code or ASCII code, but not both. A 1200 BPS Integrated Modem is available as a special feature. Also see "IBM Modems" in "Additional Information" at end of this section.

Specify: See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One per 5408. **Prerequisite:** Processing Unit Expansion A (#5732); both Processing Unit Expansion A (#5732) and B (#5733) if attached with the 5448 File Attachment (#4040) or SIOC (#7081). **Field Installation:** Yes.

The following special features may be added to #2074.

Auto Call (#1315): Permits the System/3 when attached to a switched network (option #9483) via an appropriate modem and Auto Call Unit to initiate (dial) through stored program control, a data link connection to a remote BSC station. **Limitation:** Cannot be installed with Station Selection (#7477), or 1200 BPS Integrated Modem (#4781, 4782). **Maximum:** One. **Prerequisites:** BSCA (#2074), one Voice Grade Transmission Rate from 600 to 4800 bps, and Network Attachment (#9483). Requires appropriate cable order. See *Installation Planning Manual*, GA21-9084. **Field Installation:** Yes.

EIA Local Attachment (#3601): Permits attachment of one 3271 Control Unit, one 3275 Display Station, one 3274-1C Control Unit, one 3276-2 Control Display Station, one System/7 equipped with a binary synchronous communications adapter (#2074), 5231 model 2, or one 2972 GBTS Control Unit to System/3 without the use of a data communications line and modems at either device. This attachment may be used where the device's control unit or System/7 is located within a distance to the 5408 that is reached by the Device's EIA attachment cable (i.e., the cable normally used to attach to any external modem). This feature provides the clocking signals for the System/3 BSCA and for the attached control unit's adapter; therefore, the System/3's Internal Clock (#4703) cannot be installed on the same adapter with this feature. Data transfer rates of 2400, 4800 and 8000 bps are supported by this feature and are specified by the Transfer Rates (#9753, 9754, 9758) respectively. **Limitations:** Cannot be installed with Internal Clock (#4703), or Auto Call (#1315). **Maximum:** One. **Prerequisites:** BSCA (#2074, Transfer Rate (#9753, 9754, 9758), Network Attachment (#9484) and Line Facility

(#9391). For 8000 bps operation, #7821 is required on the 3271 or 3275. **Field Installation:** Yes.

Internal Clock (#4703): Generates synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. When this feature is installed on System/3, all other BSC stations attached to the same data link must also be equipped with a similar IBM Internal Clock feature. See *IBM Data Communications Handbook*

Will service rates of 600 bps, 1200 bps, 2000 bps or 2400 bps. **Maximum:** One. **Prerequisites:** BSCA (#2074) and one of the above serviced transmission rate options. **Field Installation:** Yes.

1200 BPS Integrated Modem (#4781, 4782): A modem for BSC data transmission at 1200 bps over non-switched facilities or switched network. Available in two different versions: #4781—Non-switched ... #4782—Switched with Auto Answer. Attachment to non-switched (2 or 4-wire) facilities is via an IBM provided cable directly to the line, type 3002 facility. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS equivalent. The device communicating with System/3 must also be equipped with an IBM 1200 bps integrated modem/line adapter. **Limitations:** Cannot be installed with sub-features Auto Call (#1315) or EIA Local Attachment (#3601). #4781 and #4782 cannot be installed together on the same BSCA. **Maximum:** One. **Prerequisite:** BSCA (#2074), Modem Base (#5201), Internal Clock (#4703), Transfer Rate (#9751). **Field Installation:** Yes.

Modem Base (#5201): Provides for mounting of one 1200 BPS Integrated Modem (#4781, 4782). **Maximum:** One. **Prerequisite:** BSCA (#2074). **Field Installation:** Yes.

Station Selection (#7477): Permits the System/3 to operate as a compatible member of the IBM family of BSC terminals on a multipoint communications line as a tributary station. **Limitation:** Cannot be installed with Auto Call (#1315). **Maximum:** One. **Prerequisites:** BSCA (#2074), Network Attachment (#9482 or #9484), Line Facility Attachment (#9392) and one of the Voice Grade Transmission Rates 600—9600 bps. **Note:** Control station operation on a System/3 BSCA with Station Selection installed is possible, but such operation cannot be performed concurrently with tributary station operation on that adapter. Additionally, a change in modems or in modem operation may be required to utilize the same adapter (at different periods of time) as a tributary station and as a control station adapter. Also, the network attachment option (#9484) must be specified when control station operation is to be performed whether Station Selection (#7477) is installed or not. **Field Installation:** Yes.

Text Transparency (#7850): Permits the System/3 to transmit or receive "8-bit binary data" and EBCDIC coded data. **Limitations:** Cannot be installed with ASCII Transmission Code (#9061) ... limitations on the use of this facility exist and are described in SRL GS27-3004. **Maximum:** One. **Prerequisites:** BSCA (#2074) and EBCDIC Transmission Code (#9060). **Field Installation:** Yes.

**Additional Information**

- I. **Optional Specifications:** The following 5 categories of specify codes apply to the ICA (#4645) and BSCA (#2074).

For ICA (#4645):

Category A and E applies to all configurations.

Categories B thru D do not apply unless #6202 is installed.

For BSCA (#2074) one selection must be specified from each of the 5 categories.

	#4645	#2074
A. Transmission Code		
EBCDIC	#9070	#9060
ASCII	9071	9061
B. Transfer Rate (1)		
600 bps	#9850	#9750
1200 bps	9851	9751
2000 bps	9852	9752
2400 bps (2)	9853	9753
4800 bps	9854	9754
7200/3600 bps	9857	9757
8000 bps	N/A	9758
High Speed (19,200 to 50,000 bps)	N/A	9755
9600 bps	9859	9759
C. Network Attachment		
Point-to-Point (non-switched)	#9581	#9481
Point-to-Point (switched)	9583	9483
Multipoint Tributary (3)	N/A	9482
Multipoint Control Station	9584	9484
D. Line Facility Attachment (4)		
Duplex (4-wire only)	#9381	#9391
Half-Duplex	9382	9392
E. One (or more) selections must be specified from the following list depending on planned device attachments:		
S/360 (mdl 22 and up) or S/370	#9670	#9570
S/360 mdl 20	9671	9571
1130 System	9672	9572
2770 System	9673	9573
2780	9674	9574
2972/2980	9676	9576
3270 System	9677	9577
3735	9678	9578
3741 mdl 2 or 4	9679	9579
5231 Mdl 2	9692	9592
System/3	9680	9580
System/7	9690	9590
System/32	9691	9591
System/34	9693	9593
Series/1	9694	9594

Notes:

1. Refer to *Data Communications Handbook*

2. See SRL GA27-3004 for potential problem areas and possible restrictions to application data when using certain modems at this or higher speeds.

3. If Multipoint Tributary Station use (with #7477) is to be implemented alternately with Multipoint Control Station use on the same adapter, specify code #9484 must be used.

4. Where BSCA is used as a Control Station adapter or when attached to a point-to-point (non-switched) data link, the facility may be duplex (4-wire only) or half-duplex. Half-duplex facility must be specified for Switched Network attachments and for adapters implementing Multipoint Tributary Station only operation.

II. Special Features (BSCA)

- A. Available with Medium Speed (600—9600 bps) and with Wideband attachments (19,000—50,000 bps):

Text Transparency (#7850)

- B. Available with Medium Speed adapters only:

Internal Clock (#4703)

Station Selection (#7477)

Auto Call (#1315)

EIA Local Attachment (#3601)

1200 BPS Integrated Modem (#4781, 4782).

III. Communication Facility Attachments: The ICA and BSCA are designed to operate on transmission facilities such as:

- A. Common carrier leased telephone services (voice grade)

AT & T or Western Union Class 3002—600 bps (1200 bps with 1200 BPS Integrated Modem).

AT & T or Western Union Class 3002 with C1 conditioning to 2400 bps.

AT & T or Western Union Class 3002 with C2 conditioning to 7200 bps.

- B. Private (customer owned) communications facilities equivalent to the above common carrier facilities.

- C. Common carrier switched network telephone (voice grade) service at 600 bps to 4800 bps.

- D. Common carrier wideband communication services at 19,200 bps, 40,800 bps, or 50,000 bps (BSCA only).

- E. Private carrier organizations providing equivalent to above (1 through 4) data transmission services.

IV. Reference: See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities and customer responsibilities.**V. Customer Responsibilities**—the customer must be advised that:

- A. He is responsible for making arrangement for installation, pricing and charges of the data communications facility and attachment of selected data sets (modems).



B. Toll charges, if required for installation and/or maintenance of the BSCA or ICA, are to be paid by the customer.

C. The IBM Marketing Representative must have from the customer a firm installation date for transmission services (including modems) before the order can be confirmed ... for further information see "Teleprocessing Systems" in "General Information" and consult "Reference IV" above.

VI. **IBM Modems:** One IBM modem can be attached to the ICA (with #6202 installed) and to the BSCA as follows:

Modem	Speed (bps)
3872 model 1	2400/1200
3874 model 1	4800/2400
3875 model 1	7200/3600

See M2700 pages, 3872, 3874, 3875 in "Machines" for information on modem features, prices, communications capabilities and product utilization.

VII. **Cables:** BSCA (#2074) always requires an appropriate cable order [unless EIA Local Attachment (#3601) is ordered]. ICA (#4645) requires a cable order only when #6202 is also ordered. See *Installation Manual—Physical Planning*, GA21-9084.

**5410 PROCESSING UNIT**

Purpose: Contains core storage and facilities for addressing main storage, arithmetic and logical processing of data, and controlling I/O units for System/3 Model 10.

Model		Core Storage (bytes)
*A2		8,192
A3		12,288
A4	Card System	16,384
A5		24,576
A6		32,768
**A7		49,152
***A12		8,192
A13		12,288
A14	Disk System	16,384
A15		24,576
A16		32,768
A17		49,152

* IBM Programming Systems for the 3410/3411 Magnetic Tape Subsystem on System/3 model 10 requires a 5410 Processing Unit with a minimum of 12,288 bytes of core storage. IBM's ability to service a disk oriented System/3 with 8,192 bytes of core storage will be impaired with an effect on systems availability.

** IBM Programming Systems for card oriented systems will not utilize core storage in excess of 32,768 bytes.

***IBM Programming Systems for a disk oriented System/3 model 10 require a minimum of 12,288 bytes of core storage. IBM's ability to service a disk oriented System/3 model 10 with 8,192 bytes of core storage may be impaired with an effect on systems availability.

Model Changes: Field installable.

Highlights: Uses the highly integrated Monolithic Systems Technology (MST). Data and instructions are stored as EBCDIC characters ... each EBCDIC character is stored in an 8-bit byte ... a ninth bit is added for parity checking. Main cycle time is 1.52 microseconds. Instruction execution and I/O data handling utilizes the "Cycle Steal" technique, providing overlap of I/O processing.

The systems console uses an alphameric halt indicator for simplified, direct operator/system communication.

Core storage capacity changes and most I/O unit attachments are field installable.

Communication with remotely located systems or terminals may be performed through the use of a Binary Synchronous Communications Adapter over Data Communications Transmission facilities.

Maximum: Only one 5410 can be attached to a System/3 model 10.

Minimum Configuration: In addition to a 5410, a System/3 model 10 requires a printer (5203 or 1403) and either—(a) a 5424 Multi-Function Card Unit, or (b) a 1442 model 6 or 7 Card Punch and a 5422 Disk Enclosure with at least one 5444 Disk Storage Drive.

The 5422 Disk Enclosure is "not recommended for field installation" on System/3 model 10 unless the 5410 has a printed circuit board rather than discrete wiring on the primary power box sequence control relay panel.

Bibliography: GC20-8080. **Metering:** Base Unit.

Specify

1. Voltage [AC, 3-phase, 4-wire, 60Hz (cps)]: #9903 for 208 V, or #9905 for 230 V.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. Print Position Attachment: #9495 for a 5203 with 120 print positions, or #9496 for a 5203 with 132 print positions.
4. I/O Unit Attachments: Appropriate special features are required to attach most I/O units ... see "Special Features."
5. Disk Systems (models A12-A17 only): Appropriate codes are required on the 5424 or 5422 ... see "Specify" under 5424, 5422.
6. Disk Systems (models A12-A17 only): Specify one of the following: #9201 for 5444 Model 1, #9202 for 5444 Model 2, #9203 for 5444 Model 2 and Model 3, or #9204 for two 5444 Model 2's, #9205 for 5444 Model A1, #9206 for 5444 Model A2, #9207 for 5444 Model A2 and Model A3, or #9208 for two 5444 Model A2's or #5300 for no 5444.
7. For Binary Synchronous Communications Adapter (#2074) see "Special Features."
8. System Control Programming, 5701-SC1, for card systems, or 5702-SC1 for disk systems, should be ordered at equipment order entry time ... see "System Control Programming" section for additional information.

Note: For a 5410 to 5412 or 5415 Model B, C or D conversion where installed 5424 is to be moved to the new system, an MES must be submitted to remove the 5444(s) from the 5424. This MES must also delete #9400, and if a second 5444 is installed, #9401 or #9402 (all from the 5424).

Special Features

Dual Feed Carriage Control (#3480): Required for Dual Feed Carriage (#3475) on a 5203 Printer. **Field Installable:** Yes. **Prerequisite:** 5203 Printer Attachment—100 lpm (#3970), —200 lpm (#3971), or—300 lpm (#3972).

Dual Program (#3500): Provides the capability to independently load and process two programs simultaneously. Independent operator control of each program is provided so that either program may be initiated, restarted after a programmed halt, run to completion, or terminated without regard to the other program other than availability of core and I/O units. **Field Installable:** Yes. **Limitations:** (1) IBM Programming Systems for this feature require a disk oriented System/3 model 10 with a minimum of 12,288 bytes of core storage ... (2) IBM's ability to service a card oriented System/3 model 10 equipped with this feature may be impaired with an effect on systems availability.

First 5445 Disk Attachment (#3901): To attach a 5445 model 1, or with #3902 below. **Maximum:** One. **Field Installable:** Yes. **Limitations:** Cannot be installed with the 5448 File Attachment (#4040). **Prerequisites:** Processing Unit Expansion—A (#5732). Processing Unit Expansion—B, C and D (#5733, 5734, 5735) may be required if certain features are specified ... refer to "Processing Unit Expansion Features Configurator" below to determine requirements.



Second 5445 Disk Attachment (#3902): To attach a 5445 model 2 or model 3. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** First 5445 Disk Attachment (#3901).

5203 Printer Attachment 100 lpm (#3970): To attach a 5203 Printer model 1. **Maximum:** One. **Limitation:** Cannot be installed with #3971, #3972, #4140, or #4150. **Field Installable:** Yes. **Prerequisite:** #9222 on the 5203.

5203 Printer Attachment 200 lpm (#3971): To attach a 5203 Printer model 2. **Maximum:** One. **Limitation:** Cannot be installed with #3970, #3972, #4140, or #4150. **Field Installable:** Yes. **Prerequisite:** #9222 on the 5203.

5203 Printer Attachment 300 lpm (#3972): To attach a 5203 Printer model 3. **Maximum:** One. **Limitation:** Cannot be installed with #3970, #3971, #4140, or #4150. **Field Installable:** Yes. **Prerequisite:** #9222 on the 5203.

5448 File Attachment (#4040): To attach a 5448 Disk Storage Drive Model A1. **Limitations:** Cannot be installed with First 5445 Disk Attachment (#3901). **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** 5444 Disk Storage Drive Model 2 or A2, Processing Unit Expansion A (#5732) on the 5410 and Specify #9057 on the 5448 Disk Storage Drive. Refer to the Processing Unit Expansion Features Configurator to determine if other expansion features are required.

Multi-Function Card Unit Attachment—250/60/60 cpm (#4100): To attach a 5424 Multi-Function Card Unit model A1. **Maximum:** One. **Limitation:** Cannot be installed with #4101 or #4130. **Field Installable:** Yes.

Multi-Function Card Unit Attachment—500/120/120 cpm (#4101): To attach a 5424 Multi-Function Card Unit model A2. **Maximum:** One. **Limitation:** Cannot be installed with #4100 or #4130. **Field Installable:** Yes.

5471 Printer-Keyboard Attachment (#4110): To attach a 5471 Printer-Keyboard. **Maximum:** One. **Limitation:** Cannot be installed with #4120. **Field Installable:** Yes.

1442 Model 6/7 Card Read Punch Attachment (#4130): To attach a 1442 model 6 or 7. **Limitation:** Cannot be installed with #4100 or #4101. **Maximum:** One. **Field Installable:** Yes. **Prerequisites:** A 5422 Disk Enclosure and a minimum of one 5444 ... 5410/5412/5415 Coupling (#3950) on the 1442.

1403 Model 2 Printer Attachment 600 lpm (#4140): To attach a 1403 Printer model 2. **Maximum:** One. **Limitation:** Cannot be installed with #3480, #3970, #3971, #3972, #4150, #8642. **Field Installable:** Yes.

1403 Model N1 Printer Attachment 1100 lpm (#4150): To attach a 1403 Printer model N1. **Maximum:** One. **Limitation:** Cannot be installed with #3480, #3970, #3971, #3972, #4140, #8642. **Field Installable:** Yes.

Higher Performance 1st Disk Attachment (#4501): (Models A12 thru A17 only) To attach a 5444 model A1 or first 5444 model A2. Not required to attach a 5444 model 1 or first 5444 model 2. **Maximum:** One. **Field Installable:** Yes. **Prerequisites:** If a MLTA RPQ is present on the 5410, the Power Supply Expansion (#5501) is required. #9400 is also required on the 5424 Multi-function Card Unit ... see "Specify" under 5424.

Higher Performance 2nd Disk Attachment (#4502): (Models A12 thru A17 only) To attach a 5444 model A3 or second 5444 model A2. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Second Disk Attachment (#6378).

Local Communications Adapter (#4765): (Models A12 thru A17 only) Permits local attachment of one 3741 Data Station model 2, or Programmable Work Station model 4, one 5231 model 2 equipped with BSCA (#2074) (Point-to-point unidirectional transmission only), one 3271 Control Unit, or one 3275 Display Station or one 3274-1C Control Unit or one 3276-2 Control Unit Display Station or one System/7 equipped with a binary synchronous communications adapter (#2074) to a disk oriented System/3 model 10. The external modem cable of the device will attach directly to the 5410 when this feature is installed. Data transfer rate is 2400 bps only. EBCDIC Transmission Code must be specified where applicable on the attached device. Programming support for the 3741 model 2 or 4 and 5231 model 2, is provided by the RPG II Telecommunications Feature and the Communications Control Program feature of Disk SCP. Programming support for the 3271, 3274, 3275, and 3276 is provided by the Multiline/Multipoint and Communications Control Program features of the Disk SCP. Programming support for the System/7 is provided by the RPG II Telecommunications feature or by the Multiline/Multipoint or the Communications Control Program features of the disk SCP. (Host programs must be point-to-point mode and a CCP program must use data mode only.) **Limitations:** Cannot be installed with BSCA-1 (#2074) ... Data exchange with attached device is non-transparent only. For data transparent operation contact GSD Special Product Marketing for RPQ detail and approval. **Specify:** One of the following: #9577 for attachment of the 3270 devices ... #9597 for attachment of the 3741 model 2 or 4 ... #9592 for 5231 model 2 ... #9590 for attachment of the System/7. **Maximum:** One per 5410. **Field Installation:** Yes. **Prerequisites:** Processing Unit Expansion—A (#5732). Requires same Processing Unit Expansion features as BSCA-1. See Processing Unit Expansion Configurator for possible requirements for additional expansion features.

Power Supply Expansion (#5501): (Models A12 thru A17 only) Provides additional processing unit 6 volt power. Required when a MLTA RPQ and Higher Performance 1st Disk Attachment (#4501) both are desired. **Maximum:** One. **Field Installable:** Yes.

Processing Unit Expansion A (#5732): Provides additional processing unit power supply, connectors, and mounting space when required. Contact Special Product Marketing for details. **Maximum:** One. **Note:** Refer to Processing Unit Expansion Feature configurator below to determine requirements. **Field Installable:** Yes.

Processing Unit Expansion B (#5733): Provides additional processing unit power supply and connections. Refer to Processing Unit Expansion Feature configurator below to determine requirements. May be required when certain RPQ's are ordered. Contact Special Product Marketing for details. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Processing Unit Expansion—A (#5732).

Processing Unit Expansion C (#5734): Provides additional processing unit power supply and connections. Refer to Processing Unit Expansion Feature configurator below to determine requirements. May be required when certain RPQ's are ordered. Contact Special Product Marketing for details. **Maximum:** One. **Field Installable:** Yes. **Prerequisites:** Processing Unit Expansion A (#5732) and Processing Unit Expansion B (#5733).

Processing Unit Expansion D (#5735): Provides additional processing unit power supply and connections. Refer to Proc-



essing Unit Expansion Feature configurator below to determine requirements.

Maximum: One. **Field Installable:** Yes. **Prerequisites:** Processing Unit Expansion A (#5732), B (#5733), and C (#5734).

PROCESSING UNIT EXPANSION FEATURES CONFIGURATOR COMMUNICATIONS

I/O Unit Attachments	BSCA-1		MLTA	BSCA-2	BSCA-2 & MLTA
	None	or LCA	RPQ	with either BSCA-1 or LCA	with either BSCA-1 or LCA
None	—	#5732	#5732	#5733	#5733
1442*	#5732	#5732	#5733	#5733	#5734
5445/5448	#5732	#5733	#5733	#5734	#5735
3411	#5732	#5732	#5733	#5733	#5733
1442* & 5445/5448	#5732	#5733	#5733	#5734	#5735
1442* & 3411	#5732	#5732	#5733	#5733	#5734
5445/5448 & 3411	#5732	#5733	#5733	#5734	#5735
1142* & 5445/5448 & 3411	#5732	#5733	#5733	#5734	#5735
3741 (#8220)	#5732	#5732	#5733	#5733	#5733
3741 & 1442*	#5732	#5732	#5733	#5733	#5734
3741 & 5445/5448	#5732	#5733	#5733	#5734	#5735
3741 & 3411	#5732	#5732	#5733	#5733	#5733
3741 & 1442*	#5732	#5733	#5733	#5735	#5735
& 5445/5448	#5732	#5733	#5733	#5733	#5734
3741 & 1442* & 3411	#5732	#5733	#5733	#5735	#5735
3741 & 1442* & 5445/5448 & 3411	#5732	#5733	#5733	#5735	#5735
3741 & 1442* & 5445/5448 & 3411	#5732	#5733	#5733	#5735	#5735

Notes:

- #5732 is a prerequisite for #5733.
- #5733 is a prerequisite for #5734.
- #5734 is a prerequisite for #5735.

* RPQ—1442 in addition to 5424.

Second Disk Attachment (#6378). (Models A12 thru A17 only) To attach a 5444 Disk Storage model 3 or model A3, or a second 5444 model 2 or model A2. **Maximum:** One. **Field Installable:** Yes. **Prerequisites:** A 5444 model 2 or model A2 ... #9401 or #9402 is also required on the 5422 Disk Enclosure or 5424 Multi-function Card Unit. See "Specify" under 5422 or 5424.

Serial I/O Channel (#7081): To attach a 1255 Magnetic Character Reader or a 3881 Optical Mark Reader. **Maximum:** One. **Field Installable:** Yes.

3411 Magnetic Tape Attachment (#7951): To attach a 3411 Magnetic Tape Unit and Control. **Maximum:** One. **Field Installable:** Yes. **Prerequisites:** Processing Unit Expansion—A (#5732). Processing Unit Expansion—B (#5733) is required when the MLTA RPQ is also installed on system. Refer to "Processing Unit Expansion Features Configurator" above to determine requirements. *Note:* IBM Programming Systems for the 3410/3411 Magnetic Tape Subsystem on System/3 model 10 requires a 5410 Processing Unit with a minimum of 12,288 bytes of core storage. IBM's ability to service a magnetic tape subsystem with 8,192 bytes

of core storage will be impaired with an effect on systems availability.

3741 Attachment (#8220): To directly attach a 3741 model 1, 2, 3 or 4. **Limitation:** IBM Programming Support requires a disk oriented 5410 with a minimum of 12,288 bytes of storage. For 3741 models 3 and 4, System/3 does not support the Application Control Language (ACL). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Processing Unit Expansion A (#5732). See Processing Unit Expansion Features Configurator for possible requirements for additional expansion features. I/O Adapter (#3265/3266) on 3741.

Universal Character Set Control (#8642): Required if any Interchangeable Chain Cartridge or Interchangeable Train Cartridge with more than 48 different characters is to be used on the 5203 Printer. **Field Installable:** Yes. *Note:* This feature is not required if a 1403 model 2 or N1 with UCS feature is attached to the 5410 thru a 5421 Printer Control Unit. **Prerequisites:** Universal Character Set Attachment (#8639) on the 5203 Printer.

Binary Synchronous Communications Adapter (#2074): This feature in conjunction with program control permits System/3 Model 10 to communicate in binary synchronous mode with other IBM systems and terminals. System/3 Model 10 can operate on a multipoint line as either a control station or a tributary station, or on a point-to-point switched or leased communications line. Transmission rates are available from 600 bps to 50,000 bps. Auto answer capability is standard (to be effective, the modem must also have this capability) in switched network version. Any version can be selected to operate in EBCDIC or ASCII transmission code, but not both. A 1200 BPS Integrated Modem is available as a special feature. Also, see "Modems" at the end of this section.

Specify: See

"Additional Information" at end of this section for applicable specify codes. **Maximum:** One per 5410. **Field Installation:** Yes. **Limitations:** Cannot be installed with Local Communications Adapter (#4765). **Prerequisites:** Installation of #2074 requires Processing Unit Expansion A (#5732). Refer to "Processing Unit Expansion Features Configurator" for possible requirement for additional Processing Unit Expansion features, B, C, D.

Binary Synchronous Communications Adapter, Second (#2084): Permits operation of two BSCA's simultaneously on System/3 model 10 and/or in two different configurations (speed, network attachments, line facility attachments, codes, etc.). First BSCA (#2074) or LCA (#4765) is a prerequisite for installation of this feature. Their prerequisite, Expansion Feature (#5732) serves also for #2084 and need not be ordered twice. See the "Processing Unit Expansion Features Configurator" for possible requirements for additional Processing Unit Expansion Features, B, C, D. This second adapter (#2084) is functionally identical to the first adapter (#2074). It will support the same subfeatures, which require the same prerequisites (except #5732) as the first BSCA. The same options and limitations also apply to the second BSCA, with the following exception: #2084 is provided only in the medium speed version (600 to 7200 bps) and does not support attachment to a Wideband data link (feature #9755). Provision of a second adapter does not limit in any way the options on the first adapter, including #9755. **Limitations:** No wideband



attachment capability. **Maximum:** One per System/3 model 10. **Prerequisites:** First BSCA (#2074) and its prerequisite (#5732) or the Local Communications Adapter (#4765) and its prerequisite (#5732). See "Processing Unit Expansion Configurator" for possible requirement of additional Processing Unit Expansion Features. See the following section on "Additional Information" for optional selection codes and the price list for subfeature code numbers applicable to the Second BSCA (#2084). **Field Installation:** Yes.

In addition to the basic functions of #2074 and #2084 described above, the following special features may be added:

Auto Call (#1315, 1325): Permits the System/3 when attached to a switched network (option #9483 or #9583) via an appropriate modem and Auto Call Unit to initiate (dial) through stored program control, a data link connection to a remote BSC station. #1315 for #2074 ... #1325 for #2084. **Limitations:** Cannot be installed with Station Selection (#7477 or 7487), or 1200 BPS Integrated Modem (#4781, 4782). **Maximum:** One per BSCA. **Prerequisites:** As appropriate BSCA (#2074 or 2084), one Voice Grade Transmission Rate from 600 to 4800 bps, and Network Attachment (#9483, 9583). Requires appropriate cable order. See *Installation Planning Manual*, GA21-9084. **Field Installation:** Yes.

EIA Local Attachment (#3601, 3602): Permits attachment of one 3271 Control Unit, one 3274-1C Control Unit, one 3275 Display Station, one 3276-2 Control Unit Display Station, one 5231 Model 2, or one 2972 GBTS Control Unit, or one System/7 equipped with a binary synchronous communications adapter (#2074) to System/3 without the use of a data communications line and modems at either device. This attachment may be used where the device's control unit or System/7 is located within a distance to the 5410 that is reached by the Device's EIA attachment cable (i.e., the cable normally used to attach to an external modem). This feature provides the clocking signals for the System/3 BSCA and for the attached control unit's adapter; therefore, the System/3's Internal Clock (#4703 or 4723) cannot be installed on the same adapter with this feature. Data transfer rates of 2400, 4800 and 8000 bps are supported by this feature. #3601 for #2074 ... #3602 for #2084. **Limitations:** Cannot be installed with Internal Clock (#4703 or 4723), or Auto Call (#1315 or 1325). **Maximum:** One per BSCA. **Prerequisites:** As appropriate—#2074 or 2084, Transfer Rate (#9753, 9754, 9758 or #9853, 9854, 9858), Network Attachment (#9484 or #9584) and Line Facility (#9391 or #9381). For 8000 bps operation, #7821 is required on the 3271 or 3275. **Field Installation:** Yes.

Internal Clock (#4703, 4723): Generates synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. When this feature is installed on System/3, all other BSC stations attached to the same data link must also be equipped with a similar IBM Internal Clock feature. See *IBM Data Communications Handbook*

#4703 for #2074 ... #4723 for #2084. Will service rates 600 bps, 1200 bps, 2000 bps or 2400 bps. **Maximum:** One per BSCA. **Prerequisites:** As appropriate BSCA (#2074 or 2084), and one of the above serviced transmission rate options. **Field Installation:** Yes.

1200 BPS Integrated Modem (#4781, 4782): A modem for BSC data transmission at 1200 bps over non-switched facilities or switched network. Available in two different versions: #4781 Non-switched ... #4782 Switched with Auto Answer. Attachment to non-switched (2 or 4-wire) facilities is via an

IBM provided cable directly to the line, type 3002 facility. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/3 must also be equipped with an IBM 1200 bps integrated modem/line adapter. **Limitations:** Cannot be installed with sub-features Auto Call (#1315 or 1325) or EIA Local Attachment (#3601, 3602). #4781 and 4782 cannot be installed together on the same BSCA. **Maximum:** One per BSCA. **Prerequisites:** As appropriate BSCA (#2074 or 2084), Modem Base (#5201 or 5202), Internal Clock (#4703 or 4723), Transfer Rate (#9751 or 9851). **Field Installation:** Yes.

Modem Base (#5201, 5202): Provides for mounting of one 1200 BPS Integrated Modem (#4781, 4782). #5201 for #2074 ... #5202 for #2084. **Maximum:** One per BSCA. **Prerequisite:** As appropriate—BSCA (#2074, or 2084). **Field Installation:** Yes.

Station Selection (#7477, 7487): Permits the System/3 to operate as a compatible member of the IBM family of BSC terminals on a multipoint communications line as a tributary station. #7477 for #2074 ... #7487 for #2084. **Limitation:** Cannot be installed with Auto Call (#1315, 1325). **Maximum:** One per BSCA. **Prerequisites:** As appropriate BSCA (#2074 or 2084), Line Facility Attachment (#9392 or 9382) and one of the Voice Grade Transmission Rates 600 to 9600 bps. *Note:* Control station operation on a System/3 BSCA with Station Selection installed is possible, but such operation cannot be performed concurrently with tributary station operation on that adapter. Additionally, a change in modems or in modem operation may be required to utilize the same adapter (at different periods of time) as a tributary station and as a control station adapter. Also, the network attachment option (#9484 or 9584) must be specified when control station operation is to be performed whether Station Selection (#7477 or 7487) is installed or not. **Field Installation:** Yes.

Text Transparency (#7850, 7851): Permits the System/3 to transmit or receive "8-bit binary data" and EBCDIC coded data. **Limitations:** Cannot be installed with ASCII Transmission code (#9061 or 9071) ... limitations on the use of this facility exist and are described in SRL GA27-3004. #7850 for #2074 ... #7851 for #2084. **Maximum:** One per BSCA. **Prerequisite:** As appropriate BSCA (#2074 or 2084) and Transmission Code (#9060 or 9070). **Field Installation:** Yes.

IBM Modems: One IBM modem can be attached to the BSCA (#2074) and/or one to the second BSCA (#2084) as follows:

Modem	Nominal Speed (bps)
3872 model 1	2400
3874 model 1	4800/2400
3875 model 1	7200/3600

See M2700, 3872, 3874, 3875 pages for information on modem features, prices, communications capabilities and product utilization.

Note: Configuration requirements for IBM Programming Support must satisfy the minimum machine requirements stated in the "Program Products" and "Systems" sections

For information on optional selections, attachment to communications lines, customer responsibilities, etc., see "Additional Information"



Additional Information

I. **Optional Specifications:** One selection must be specified from each of the following five categories for each adapter.

	#2074	#2084
A. Transmission Code		
EBCDIC	#9060	#9070
ASCII	9061	9071
B. Transfer Rate (1)		
600 bps	#9750	#9850
1200 bps	9751	9851
2000 bps	9752	9852
2400 bps (2)	9753	9853
4800 bps	9754	9854
7200/3600 bps	9757	9857
8000 bps	9758	9858
High Speed (19,200 to 50,000 bps)	9755	NA
9600 bps	9759	9859
C. Network Attachment		
Point-to-point (non-switched)	#9481	#9581
Point-to-point (switched)	9483	9583
Multi-point (Tributary)	9482	9582
Multi-point Control Station(3)	9484	9584
D. Line Facility Attachment (4)		
Duplex (4-wire only)	#9391	#9381
Half Duplex	9392	9382
E. One (or more if necessary) optional selection code must be specified from the following list, contingent upon planned device attachments:		
S/360 (mdl 22 and up) or S/370	#9570	#9670
S/360 mdl 20	9571	9671
1130 System	9572	9672
2770 System	9573	9673
2780	9574	9674
2980	9576	9676
3270 System	9577	9677
3735	9578	9678
3741 mdl 2, 3741 mdl 4	9579	9679
5231 Mdl 2	9592	9692
System/3	9580	9680
System/7	9590	9690
System/32	9591	9691
System/34	9593	9693
Series/1	9594	9694

Notes:

1. Refer to *Data Communications Handbook*
2. See SRL GA27-3004 for potential problem areas and possible restrictions to application data when using certain modems at this or higher speeds.
3. If Multi-point Tributary Station use (with #7477/7478) is to be implemented alternately with Multi-point Control Station use on the same adapter, specify code #9484/9584 must be stated.

4. Where BSCA is used as a Control Station adapter or when attached to a point-to-point (non-switched) data link, the facility may be duplex (4-wire only) or half-duplex. Half-duplex facility must be specified for Switched Network attachments and for adapters implementing Multipoint Tributary Station only operation.

II. Special Features

- A. Available with Medium Speed (600-9600 bps) and with Wideband attachments (19,200-50,000 bps).
Text Transparency (#7850/7851).
- B. Available with Medium Speed adapters only.
Internal Clock (#4703/4723)
Station Selection (#7477/7487)
Auto Call (#1315/1325)
EIA Local Attachment (#3601/3602)
1200 BPS Integrated Modem (#4781/4782)

III. Communications Facility Attachments: The BSCA is designed to operate on transmission facilities such as:

- A. Common carrier leased telephone line services (Voice Grade).
AT & T or Western Union Class 3002—600 bps (1200 bps with 1200 BPS Integrated Modem)
AT & T or Western Union Class 3002 with C1 conditioning to 4800 bps.
AT & T or Western Union Class 3002 with C2 conditioning to 7200 bps
- B. Private (customer owned) communications facilities equivalent to the above common carrier facilities.
- C. Common carrier switched network telephone (Voice Grade) service at 600 to 4800 bps.
- D. Common carrier Wideband Communications Services at 19,200 bps, 40,800 bps, or 50,000 bps.
- E. Private carrier organizations providing equivalent to above (A through D) data transmission services.

IV. Reference

See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities, and customer responsibilities.

V. Customer Responsibilities

- The customer must be advised that:
- A. He is responsible for making arrangements for installation, pricing, and charges of the data communications facility and attachment of selected data sets (modems).
 - B. Toll charges, if required for installation and/or maintenance of the BSCA, are to be paid by the customer.
 - C. The IBM Marketing Representative must have from the customer a firm installation date for transmission services (including modems) before the order can be confirmed ... for further information, see



"Teleprocessing Systems" in "General Information"

VI. Cables

BSCA (#2074/2084) always requires an appropriate cable order (unless EIA Local Attachment #3601/3602 is ordered). See *Installation Manual—Physical Planning*, GA21-9084.

**5412 PROCESSING UNIT**

Purpose: Contains main storage and facilities for addressing main storage, arithmetic and logical processing of data, and controlling I/O units for System/3 Model 12. Also includes the attachment for 3340 Direct Access Storage Facility Model C2.

Model	Processor Storage (Bytes)
B16	32,768
B17	49,152
B18	65,536
*C19	81,920
*C20	98,304

Model Changes: Field installable.

Purchase Considerations: Replaced parts from any model upgrade becomes the property of IBM.

Highlights: CPU uses highly integrated Monolithic Systems Technology (MST) for logical circuitry. Memory is Metal Oxide Semi-conductor Field Effect Transistor (MOSFET). Data and instructions are stored as EBCDIC characters ... each EBCDIC character is stored in an eight bit byte, a ninth bit is added for parity checking. Main cycle time is 1.52 microseconds. Instruction execution and I/O handling utilizes the "Cycle Steal" technique, providing overlap of I/O and processing.

The direct attachment of the 3741 Data Station or 3741 Programmable Work Station provides input and output via magnetic media. This feature may reside with or without Card I/O.

The Local Display Adapter provides local attachment of any mix of up to twelve 3277 Model 1 or 2 Display Stations and 3284/3286 (Model 1 or 2) and 3288 (Model 2) Printers. The 3271 Control Unit is not required if the devices are attached via the Local Display Adapter.

Communication with remotely located systems or terminals may be performed through the use of the Integrated Communications Adapter (ICA) or the Binary Synchronous Communications Adapter (BSCA) over data communications transmission facilities.

The system console uses a message display unit for simplified direct operator/system communication.

Maximum: Only one 5412 can be attached to a System/3 Model 12.

Minimum Configuration: In addition to the 5412, a System/3 Model 12 requires a 5203 or 1403 Printer, a 3340 Direct Access Storage Facility Model C2, two 3348 Model 70 Data Modules and one of ... (a) 5424 Multi-Function Card Unit, (b) 1442 Card Read Punch, or (c) 3741 Data Station directly attached. Support for Models C19 and C20 additionally requires Dual Program Feature*.

Note: When the Model 12 SCP option of Print Spooling is used, either Dual Program (No. 3500) or the 5471 Printer-KeyBoard must be ordered.

* IBM Programming Systems support for the 5412 C19 and 5412 C20 requires the Dual Program Feature (Feature #3500). IBM's ability to service a 5412 C19 or 5412 C20 without the Dual Program Feature will be impaired with an effect on systems availability.

Bibliography: GC20-8080.

Specify

1. Voltage: AC, 3-Phase, 4-Wire, 60Hz (CPS): #9903 for 208V, or #9905 for 230V.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. Print Position Attachment: #9495 for 5203 with 120 print positions, or #9496 for a 5203 with 132 print positions.
4. I/O Unit Attachments: Appropriate special features are required to attach most I/O units ... see "Special Features."
5. System Control Programming: 5705-SC1 should be ordered at equipment order entry time ... see "System Control Programming" section for additional information.
6. System Attachment Adapter: #9180 for 5203 Model 1, #9181 for 5203 Model 2.
7. 3741 Direct Attachment: #9500 if either a 5424 or a 1442 are present, #9501 if neither are present.
8. Upending Kit: #9840. This kit is furnished only as necessary and remains the property of IBM.
9. 5412/5415 Frame Separation Kit: #9190
Frame separation may be required at installation time at those locations where building dimensions (doorways, hallways, stairways, etc.) do not allow movement of the Central Processor as one unit.
The local Installation Planning Representative can determine if this kit is required.
The Frame Separation Kit is not to be ordered when the Upending Kit (#9840) will suffice.
10. For a 5410 to 5412 conversion where an installed 5424 is to be moved to the new system, an MES must be submitted to remove the 5444(s) from the 5424. This MES must also delete #9400, and if a second 5444 is installed, #9401 or #9402 (all from the 5424).

Special Features

Dual Feed Carriage Control (#3480): Required for Dual Feed Carriage (#3475) on a 5203 Printer. **Field Installable:** Yes. **Prerequisite:** 5203 Printer Base Attachment (#3960), and appropriate 5203 Printer Speed Attachment (#3970 or #3972).

Dual Program (#3500): Provides the capability to independently load and process two programs concurrently. Independent operator control of each program is provided so that either program may be initiated, restarted after a program halt, run to completion, or terminated without regard to the other program other than availability of main storage and I/O units. **Field Installable:** Yes.

5203 Printer Base Attachment (#3960): Required to attach a 5203 Printer Model 1, 2 or 3. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** #9224 on the 5203 Printer. **Limitation:** Cannot be installed with #4160.

5203 Printer Attachment 100 lpm/200 lpm (#3970): To attach a 5203 Printer Model 1 or Model 2. **Maximum:** One. **Limitation:** Cannot be installed with #3972. **Field Installable:** Yes. **Prerequisite:** #3960 on the 5412.

5203 Printer Attachment 300 lpm (#3972): To attach a 5203 Printer Model 3. **Maximum:** One. **Limitation:** Cannot be



installed with #3970. **Field Installable:** Yes. **Prerequisite:** #3960 on the 5412.

Multi-Function Card Unit Attachment 250/60/60 CPM (#4100): To attach a 5424 Multi-Function Card Unit Model A1. **Maximum:** One. **Limitation:** Cannot be installed with #4130. **Field Installable:** Yes.

Multi-Function Card Unit Attachment 500/120/120 CPM (#4101): To attach a 5424 Multi-Function Card Unit Model A2. **Maximum:** One. **Limitation:** Cannot be installed with #4130. **Field Installable:** Yes. **Prerequisite:** Multi-Function Card Unit Attachment—250/60/60 CPM (#4100).

5471 Printer-Keyboard Attachment (#4110): To attach a 5471 Printer-Keyboard. **Maximum:** One. **Field Installable:** Yes.

1442 Model 6/7 Card Read Punch Attachment (#4130): To attach a 1442 Model 6 or 7. **Maximum:** One. **Limitation:** Cannot be installed with #4100. **Field Installable:** Yes. **Prerequisites:** 5410/5412/5415 Coupling (#3950) on the 1442 and Power Supply Expansion II (#5502) on the 5412.

1403 Printer Base Attachment (#4160): To attach a 1403 Printer Model 5, 2, or N1 (#4135, #4140 or #4150 must be specified). **Maximum:** One. **Field Installable:** Yes. **Limitation:** Cannot be installed with #3960. **Prerequisite:** A 5421 Printer Control Unit.

1403 Model 5 Printer Attachment 465 lpm (#4135): To attach a 1403 Printer Model 5. **Maximum:** One. **Limitation:** Cannot be installed with #4140 or #4150. **Field Installable:** Yes. **Prerequisite:** 1403 Printer Base Attachment (#4160) on the 5412 and (#9185) on the 5421.

1403 Model 2 Printer Attachment 600 lpm (#4140): To attach a 1403 Printer Model 2. **Maximum:** One. **Limitation:** Cannot be installed with #4135 or #4150. **Field Installable:** Yes. **Prerequisite:** A 1403 Printer Base Attachment (#4160) on the 5412.

1403 Model N1 Printer Attachment 1100 lpm (#4150): To attach a 1403 Printer Model N1. **Maximum:** One. **Limitation:** Cannot be installed with #4135 or #4140. **Field Installable:** Yes. **Prerequisite:** A 1403 Printer Base Attachment (#4160) on the 5412.

Basic Attachment Feature (#4701): To attach either the Local Display Adapter (#4702) or 3411 Magnetic Tape Attachment (#7960) or both (#4702 and #7960 must be specified). **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Processing Unit Expansion A (#5732). See Processing Unit Expansion Configurator Tables for possible requirements for additional expansion Feature(s).

Local Display Adapter (#4702): Permits direct local attachment (up to 2000 feet) of up to three 3277-1 Display Stations, 3284-1 Printers, 3286-1 Printers, or 3287 Printers in any combination. A 3271 Control Unit is not required. The 3270 device cables will be attached directly to the Local Display Adapter. For attachment of additional 3270 devices (maximum of 12) see Display Increment (#4704). For attachment of the 3270 Model 2 (1920 Character Buffer) devices see Model 2 attachment (#4705). **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Basic Attachment Feature (#4701). **Limitations:** Cannot be installed with the Integrated Communications Adapter (#4645) or with the second Binary Synchronous Communications Adapter (#2084).

Model 2 Attachment (#4705): Required if any 3277 Model 2 Display Stations and/or any 3284/3286/3288 Model 2 Printers and/or 3287 Printers (with 1920 Character Buffer) are to be attached to the Local Display Adapter. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Local Display Adapter (#4702).

Display Increment (#4704): Permits attachment of up to three more devices to the Local Display Adapter. **Maximum:** Three. **Field Installable:** Yes. **Prerequisite:** Local Display Adapter (#4702).

Power Supply Expansion I (#5501): Provides additional processing unit 6 volt power. Required when an MLTA RPO is desired. **Maximum:** One. **Field Installable:** Yes.

Power Supply Expansion II (#5502): Provides additional processing unit 24 volt power. Required when 5424 is not attached. **Maximum:** One. **Field Installable:** Yes.

Processing Unit Expansion A (#5732): Provides additional processing unit power supply, connectors and mounting space when required. Refer to Processing Unit Expansion Configurator Tables to determine requirements. May be required when certain RPO's are ordered.

Maximum: One. **Field Installable:** Yes.

Processing Unit Expansion B (#5733): Provides additional processing unit power supply and connections. Refer to Processing Unit Expansion Configurator Tables to determine requirements. May be required when certain RPO's are ordered.

Maximum: One. **Field Installable:** Yes. **Prerequisite:** Processing Unit Expansion A (#5732).

Processing Unit Expansion C (#5734): Provides additional processing unit power supply and connections. Refer to Processing Unit Expansion Configurator Tables to determine requirements. May be required when certain RPO's are ordered.

Maximum: One. **Field Installable:** Yes. **Prerequisites:** Processing Unit Expansion A (#5732) and Processing Unit Expansion B (#5733).

Processing Unit Expansion D (#5735): Provides additional processing unit power supply and connections. Refer to Processing Unit Expansion Configurator Tables to determine requirements. May be required when certain RPO's are ordered.

Maximum: One. **Field Installable:** Yes. **Prerequisites:** Processing Unit Expansion A (#5732), B (#5733), and C (#5734).

3411 Magnetic Tape Attachment (#7960): To attach a 3411 Tape Unit and Control. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Basic Attachment Feature (#4701). See Processing Unit Expansion Configurator Tables for possible requirement for additional Expansion Features.

Serial I/O Channel (#7081): To attach a 1255 Magnetic Character Reader or a 3881 Optical Mark Reader. **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Processing Unit Expansion A (#5732). See Processing Unit Expansion Configurator Tables for possible requirement for additional Expansion Features.

3741 Attachment (#8220): To attach a 3741 Model 1, 2, 3 or 4. **Limitation:** For 3741 Model 3 or 4, System/3 does not support the Application Control Language (ACL). **Maximum:** One. **Field Installable:** Yes. **Prerequisite:** Power Supply Expansion II (#5502) on the 5412 is required if the 5424 is not



installed on the system. If attached with the 5424 Multi-Function Card Unit or the 1442 Card Read Punch, Processing Unit Expansion A (#5732) is required. See Processing Unit Expansion Configurator Tables for possible requirements for additional Expansion Features.

Universal Character Set Control (#8642): Required if any Interchangeable Train Cartridge with more than 48 different characters is to be used on the 5203 Printer. **Field Installable:** Yes. *Note:* This feature is not required if a 1403 Model 2, 5 or N1 with UCS feature is attached to the 5412 through a 5421 Control Unit. **Prerequisite:** Universal Character Set Attachment (#8639) on the 5203 Printer.

Communication Features

Integrated Communications Adapter (#4645): This feature, in conjunction with its sub-features, provides up to three (3) communications interfaces: two (2) local and one (1) remote. When more than one interface is present, only one can be active at a time as selected by the operator through a manual switch control. See description of interface features (#4801, 4802 and 6202) below: At least one must be specified. **Limitation:** Cannot be installed with Local Display Adapter (#4702) or BSCA 2 (#2084). **Specify:** #9070 for EBCDIC transmission code, or #9071 for ASCII. **Maximum:** One per 5412. **Prerequisite:** Processing Unit Expansion A (#5732). See Processing Unit Expansion Configurator Tables for possible requirement for additional Expansion Feature(s). **Field Installable:** Yes.

8000 BPS Local Interface (#4801): Permits local attachment of one 3271 Control Unit Model 1 or 2, or one 3275 Display Station Model 1 or 2 to the 5412 without use of a communications line or modems. The external modem cable of the attached terminal connects directly to the 5412 when this feature is installed. The feature provides clocking for the 8000 bps data transfer rate. **Limitation:** Data transfer rate is 8000 bps only. **Specify:** See "Additional Information" at end of this section for device attachment code. **Maximum:** One. **Prerequisites:** Integrated Communications Adapter (#4645). The attached 3271 or 3275 must have #7821 installed. **Field Installable:** Yes.

2400 BPS Local Interface (#4802): Permits local attachment of one binary synchronous IBM terminal; e.g., 3741 Model 2 or 4, or 5231 Model 2, to the 5412 without the use of a communications line or modems. The external modem cable of the attached terminal connects directly to the 5412 when this feature is installed. The feature provides clocking for the 2400 bps data transfer rate. **Limitations:** Data transfer rate is 2400 bps only.

Specify: See "Additional Information" at end of this section for device attachment code. **Maximum:** One. **Prerequisite:** Integrated Communications Adapter (#4645). **Field Installable:** Yes.

Synchronous Line, Medium Speed (#6202): Provides one medium speed BSC line interface to an external modem. The communications network attachment may be point-to-point (switched), point-to-point (non-switched), or multipoint (control station). Maximum transmission rate is 4800 bps for switched operation, and 7200 bps for non-switched operation. The attached modem must provide the necessary data clocking. See "IBM Modem" in "Additional Information" at end of this section. Devices attached to the Synchronous Line, Medium Speed, have the same requirements as when attached to

System/3 via BSCA (Feature #2074) with equivalent communications facilities and line speeds. (*Note:* For attached device prerequisites, see appropriate "Machines" pages.) **Limitations:** Cannot function as a multipoint tributary station. Modem clocking only.

Specify: See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One. **Prerequisites:** Integrated Communications Adapter (#4645) ... see appropriate "Machines" pages for device prerequisites. **Field Installable:** Yes.

Text Transparency (#7851): Permits the ICA to transmit or receive "8 bit binary data" and EBCDIC coded data. **Limitations:** Cannot be installed with ASCII Transmission Code (#9071). Limitations on the use of this facility are described in SRL GA27-3004. **Maximum:** One. **Prerequisite:** Integrated Communications Adapter (#4645). **Field Installable:** Yes.

Binary Synchronous Communications Adapter (#2074): This feature in conjunction with program control permits System/3 Model 12 to communicate in binary synchronous mode with other IBM systems and terminals. System/3 Model 12 can operate on a multipoint line as either a control station or a tributary station, or on a point-to-point switched or leased communications line. Transmission rates are available from 600 bps to 50,000 bps. Auto answer capability is standard (to be effective, the modem must also have this capability) in switched network version. Any version can be selected to operate in EBCDIC or ASCII transmission code, but not both. A 1200 BPS Integrated Modem is available as a special feature. Also, see "Modems" at end of this section.

Specify: See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One per 5412. **Prerequisites:** Processing Unit Expansion A (#5732). See Processing Unit Expansion Configurator Tables for possible requirement for additional Expansion Feature(s). **Field Installation:** Yes.

Binary Synchronous Communications Adapter, Second (#2084): Permits operation of two BSCA's simultaneously on System/3 Model 12 and/or in two different configurations (speed, network attachments, line facility attachments, codes, etc). First BSCA (#2074) is a prerequisite for installation of #2084. See Processing Unit Expansion Configurator Table for possible requirements for additional Expansion Feature(s). This second adapter (#2084) is functionally identical to the first adapter (#2074). It will support the same sub-features, which require the same prerequisites as the first BSCA. The same options and limitations also apply to the second BSCA, with the following exception: #2084 is provided only in the medium speed version (600 to 7200 bps) and does not support attachment to a Wideband data link (option #9755). Provision of a second adapter does not limit in any way the options on the first adapter. **Limitation:** Cannot be installed with Local Display Adapter (#4702) or ICA (#4645), no Wideband attachment capability. **Maximum:** One. **Prerequisites:** First BSCA (#2074). See Processing Unit Expansion Configurator Tables for possible requirement of additional Expansion Feature(s). See the following section on "Additional Information" for optional selection codes and the price list for subfeature code numbers applicable to the Second BSCA (#2084). **Field Installable:** Yes.



In addition to the basic functions of #2074 and #2084 described above, the following special features may be added.

Auto Call (#1315, 1325): Permits the System/3 Model 12, when attached to a switched network (option #9483 or #9583), via an appropriate modem and Auto Call Unit to initiate (Dial) through stored program control, a data link connection to a remote BSC station. #1315 for #2074 ... #1325 for #2084. **Limitations:** Cannot be installed with Station Selection (#7477 or #7487), or 1200 BPS Integrated Modem (#4781, 4782). **Maximum:** One per BSCA. **Prerequisites:** As appropriate BSCA (#2074 or #2084), one Voice Grade Transmission Rate from 600 to 4800 bps, and Network Attachment (#9483, 9583). Requires appropriate cable order. See *Installation Planning Manual, GA21-9084*. **Field Installable:** Yes.

EIA Local Attachment (#3601, 3602): Permits attachment of one 3271 Control Unit (Model 1 or 2), one 3275 Display Station (Model 1 or 2), one 3274 Model 1C Control Unit, one 3276 Model 2 Control Unit Display Station, one 5231 Model 2, or one 2972 GBTS Control Unit to System/3 Model 12 without the use of a data communications line and modems at either device. This attachment may be used where the device's control unit or System/7 is located within a distance to the 5412 that is reached by the device's EIA attachment cable (i.e., the cable normally used to attach to an external modem). This feature provides the clocking signals for the System/3 Model 12's BSCA and for the attached control unit's adapter; therefore, the System/3's Internal Clock (#4703 or #4723) cannot be installed on the same adapter with this feature. Data transfer rates of 2400, 4800, and 8000 bps are supported by this feature. #3601 for #2074, and #3602 for #2084. **Limitations:** Cannot be installed with Internal Clock (#4703 or #4723), or Auto Call (#1315 or #1325). **Maximum:** One per BSCA. **Prerequisites:** As appropriate #2074 or #2084, Transfer Rate (#9753, 9754, 9758 or #9853, 9854, 9858), Network Attachment (#9484 or #9584) and Line Facility (#9391 or #9381). For 8000 bps operation, #7821 is required on the 3271 or 3275. **Field Installable:** Yes.

Internal Clock (#4703, 4723): Generates synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. When this feature is installed on System/3 Model 12, all other BSC stations attached to the same data link must also be equipped with a similar IBM Internal Clock feature. See *IBM Data Communications Handbook*.

#4703 for #2074, #4723 for #2084. Will service rates 600 bps, 1200 bps, 2000 bps or 2400 bps. **Maximum:** One per BSCA. **Prerequisites:** As appropriate #2074 or #2084, and one of the above serviced transmission rate options. **Field Installable:** Yes.

1200 bps Integrated Modem (#4781, 4782): A modem for BSC data transmission at 1200 bps over non-switched facilities or switched network. Available in two different versions: #4781 non-switched and #4782 switched with Auto Answer. Attachment to non-switched (2- or 4-wire) facilities is via an IBM provided cable directly to the line, type 3002 facility. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/3 Model 12 must also be equipped with an IBM 1200 bps integrated modem/line adapter. **Limitations:** Cannot be installed with sub-features Auto Call (#1315 or 1325) or EIA Local Attachment (#3601, #3602). #4781 and 4782 cannot be installed together on the same BSCA. **Maximum:** One per BSCA. **Prerequisites:** As

appropriate #2074 or #2084, Modem Base (#5201 or 5202), Internal Clock (#4703 or 4723) Transfer Rate (#9751 or 9851). **Field Installable:** Yes.

Modem Base (#5201, 5202): Provides for mounting of one 1200 BPS Integrated Modem (#4781, 4782). #5201 for #2074 and #5202 for #2084. **Maximum:** One per BSCA. **Prerequisite:** As appropriate #2074 or #2084. **Field Installable:** Yes.

Station Selection (#7477, 7487): Permits the System/3 Model 12 to operate as a compatible member of the IBM family of BSC terminals on a multipoint communications line as a tributary station. #7477 for #2074 ... #7487 for #2084. **Limitation:** Cannot be installed with Auto Call (#1315, 1325). **Maximum:** One per BSCA. **Prerequisites:** As appropriate #2074 or #2084, Line Facility Attachment (#9392 or 9382) and one of the Voice Grade Transmission Rates 600—9600 bps. *Note:* Control station operation on a System/3 Model 12 BSCA with Station Selection installed is possible, but such operation cannot be performed concurrently with tributary station operation on that adapter. Additionally, a change in modems or in modem operation may be required to utilize the same adapter (at different periods of time) as a tributary station and as a control station adapter. Also, the network attachment option (#9484 or 9584) must be specified when control station operation is to be performed whether Station Selection (#7477 or 7487) is installed or not. **Field Installable:** Yes.

Text Transparency (#7850, 7851): Permits the System/3 Model 12 to transmit or receive "8-bit binary data" and EBCDIC coded data. **Limitations:** Cannot be installed with ASCII Transmission Code (#9061 or 9071) ... limitations on the use of this facility exist and are described in SRL GA27-3004. #7850 for #2074 and #7851 for #2084. **Maximum:** One per BSCA. **Prerequisite:** As appropriate #2074 or #2084 and Transmission Code (#9060 or 9070). **Field Installable:** Yes.

IBM Modems: One IBM modem can be attached to the First BSCA (#2074) and/or one to the Second BSCA (#2084) or ICA (#4645) with Synchronous Line, Medium Speed (#6202) as follows:

Modem	Nominal Speed (bps)
3872 Model 1	2400/1200
3874 Model 1	4800/2400
3875 Model 1	7200/3600

See M2700, 3872, 3874 and 3875 pages for information on modem features, communications capabilities and product utilization.

Note: Configuration requirements for IBM programming support must satisfy the minimum machine requirements stated in the "Program Products" and "Systems" sections

For information on optional selections, attachment to communications lines, customer responsibilities, etc., see "Additional Information"



Additional Information

I. **Optional Specifications**—one selection must be specified for each of the following five categories for either BSCA 1 (#2074) or BSCA 2 (#2084). For ICA (#4645), categories A and E apply to all configurations, categories B through D do not apply unless #6202 is installed.

#2074 #2084 #4645

A. Transmission Code

EBCDIC	#9060	#9070	#9070
ASCII	9061	9071	9071

B. Transfer Rate (1)

600 bps	#9750	#9850	#9850
1200 bps	9751	9851	9851
2000 bps	9752	9852	9852
2400 bps (2)	9753	9853	9853
4800 bps	9754	9854	9854
7200/3600 bps	9757	9857	9857
8000 bps	9758	9858	N/A
High speed (19,200 to 50,000 bps)	9755	N/A	N/A
9600 bps	9759	9859	9859

C. Network Attachment

Point-to-point (non-switched)	#9481	#9581	#9581
Point-to-point (switched)	9483	9583	9583
Multipoint Tributary	9482	9582	N/A
Multipoint Control Station (3)	9484	9584	9584

D. Line Facility Attachment (4)

Duplex (4-wire only)	#9391	#9381	#9381
Half-Duplex	9392	9382	9382

E. One (or more if necessary) optional selection code must be specified from the following list, contingent upon planned device attachments:

#2074 #2084 #4645

S/360 or S/370(Mdl 22 and up)	#9570	#9670	#9670
S/360 Mdl 20	9571	9671	9671
1130 System*	9572	9672	9672
2770 System	9573	9673	9673
2780	9574	9674	9674
2980	9576	9676	9676
3270 System	9577	9677	9677
3735	9578	9678	9678
3741 Mdl 2, Mdl 4	9579	9679	9679
5231 Mdl 2	9592	9692	9692
System/3	9580	9680	9680
System/7	9590	9690	9690
System/32	9591	9691	9691
System/34	9593	9693	9693
Series/1	9594	9694	9694

* Requires a no-charge RPQ.

Notes:

1. Refer to *Data Communications Handbook*

2. See SRL GA27-3004 for potential problem areas and possible restrictions to application data when using certain modems at this or higher speeds.

3. If Multipoint Tributary Station use (with #7477/7487) is to be implemented alternately with Multipoint Control Station use on the same adapter, specify code #9484/9584 must be used.

4. Where BSCA is used as a Control Station adapter, or when attached to a point-to-point (non-switched) data link, the facility may be duplex (4-wire only) or half-duplex. Half-duplex facility must be specified for Switched Network attachments and for adapters implementing Multipoint Tributary Station only operation.

5. Cables BSCA (#2074/2084) always requires an appropriate cable order [unless EIA Local Attachment (#3601/3602) is ordered]. ICA (#4645) requires a cable order only when #6202 is also ordered. See *Installation Manual—Physical Planning*, GA21-9084.

II. **Special Features**

A. Available with Medium Speed (600—9600 bps) and with Wideband attachments (19,200—50,000 bps);

Text Transparency (#7850/7851)

B. Available with Medium Speed adapters only:

Internal Clock (#4703/4723)

Station Selection (#7477/7487)

Auto Call (#1315/1325)

EIA Local Attachment (#3601/3602)

1200 BPS Integrated Modem (#4781/4782)

III. **Communication Facility Attachments:** The BSCA/ICA is designed to operate on transmission facilities such as:

A. Common carrier leased telephone services (voice grade)

AT & T or Western Union Class 3002—600 bps. (1200 bps with 1200 BPS Integrated Modem)

AT & T or Western Union Class 3002 with C1 conditioning to 4800 bps.

AT & T or Western Union Class 3002 with C2 conditioning to 7200 bps.

B. Private (customer owned) communications facilities equivalent to the above common carrier facilities.

C. Common carrier switched network telephone (voice grade) service at 600 to 4800 bps.

D. Common carrier wideband communications services at 19,200 bps, 40,800 bps, or 50,000 bps.

E. Private carrier organizations providing equivalent to above (A through D) data transmission services.

IV. **Reference:** See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities, and customer responsibilities.



- V. **Customer Responsibilities:** The customer must be advised that:
- A. He is responsible for making arrangements for installation, pricing, and charges of the data communications facility and attachment of selected data sets (modems).
 - B. Toll charges, if required for installation and/or maintenance of the BSCA or ICA, are to be paid by the customer.
 - C. The IBM Marketing Representative must have from the customer a firm installation date for transmission services (including modems) before the order can be confirmed ... for further information, see "Teleprocessing" in "General Information" and consult "Reference IV" above.



PROCESSING UNIT EXPANSION CONFIGURATOR

TABLE A: To be used when either the 5424 MFCU or 1442 is attached.

I/O UNIT ATTACHMENTS	COMMUNICATIONS											
	NONE	MLTA	BSCA 1	#4702*	ICA	MLTA & BSCA 1	MLTA & #4702*	MLTA & ICA	BSCA 1 & #4702*	BSCA 1 & BSCA 2 OR ICA	MLTA & BSCA 1 & #4702*	MLTA & BSCA 1 & BSCA 2 OR ICA
No additional above base **	-----	#5732	#5732	#5732	#5732	#5733	#5733	#5733	#5732	#5732	#5733	#5733
3741	#5732	#5733	#5732	#5732	#5732	#5733	#5733	#5733	#5733	#5733	#5733	#5733
3411	#5732	#5733	#5732	#5732	#5732	#5733	#5733	#5733	#5733	#5732	#5733	#5733
3741 & 3411	#5732	#5733	#5732	#5732	#5732	#5733	#5733	#5733	#5733	#5733	#5735	#5733
SIOC	#5732	#5733	#5732	#5732	#5732	#5733	#5733	#5733	#5733	#5733	#5733	#5733
3741 & SIOC	#5732	#5733	#5732	#5732	#5732	#5733	#5733	#5733	#5733	#5733	#5735	#5734
3411 & SIOC	#5732	#5733	#5732	#5732	#5732	#5733	#5733	#5733	#5733	#5733	#5734	#5733
3741, 3411 & SIOC	#5732	#5733	#5733	#5733	#5733	#5733	#5733	#5733	#5733	#5733	#5735	#5734

* Local Display Adapter

** Base system includes CPU, printer, disk file and a card reader (5424 or 1442).

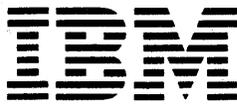
CHART A

TABLE B: To be used with cardless system (3741 directly attached and no card I/O)

I/O UNIT ATTACHMENTS	COMMUNICATIONS											
	NONE	MLTA	BSCA 1	4702*	ICA	MLTA & BSCA 1	MLTA & 4702*	MLTA & ICA	BSCA 1 & 4702*	BSCA 1 & BSCA 2 OR ICA	MLTA & BSCA 1 4702*	MLTA & BSCA 1 BSCA 2 OR ICA
No Additional above base ***	---	5732	5732	5732	5732	5733	5733	5733	5732	5732	5733	5733
3411	5732	5733	5732	5732	5732	5733	5733	5733	5733	5732	5733	5733
SIOC	5732	5733	5732	5732	5732	5733	5733	5733	5733	5733	5733	5733
3411 & SIOC	5732	5733	5732	5732	5732	5733	5733	5733	5733	5733	5734	5733

* Local Display Adapter

*** Base system includes the CPU, printer, disk file and the 3741 directly attached (no card I/O).

**5415 PROCESSING UNIT**

Purpose: Contains main storage and facilities for addressing main storage, arithmetical and logical processing of data, and controlling I/O units for System/3 Model 15.

Model	Processor Storage (bytes)
A17 or B17	49,152
A18 or B18	65,536
A19 or B19 or D19	98,304
A20 or B20 or D20	131,072
C21 or D21	163,840
C22 or D22	196,608
C23 or D23	229,376
C24 or D24	262,144
D25	393,216
D26	524,288

Model Changes: Field Installable.

Purchase Considerations: Replaced parts from any model upgrade become the property of IBM.

Highlights: CPU uses Monolithic Systems Technology (MST) for logical circuitry. Memory is Metal Oxide Semiconductor Field Effect Transistor (MOSFET) with error correction and checking. Data and instructions are stored as EBCDIC characters. Each EBCDIC character is stored in an 8-bit byte. Main cycle time is 1.52 microseconds (on model 15D, instruction cycle time for certain non-I/O instructions is faster). Instruction execution and I/O data handling uses the "Cycle Steal" technique. 5415 A Model Processors support attachment of 5444 and 5445 Disk Storage Drives. 5415B or C Model Processors support attachment of the 3340 Direct Access Storage Facility. 5415D Model Processors support attachment of the 3340 Direct Access Storage Facility and the 3344 Direct Access Storage.

Additional standard features supporting a multiprogramming environment include:

- Three additional instructions.
- 512K memory addressing using Address Translation Table (ATT).
- Write/Fetch CPU storage protection in 2K byte segments.
- Program Check Interrupt.
- Interval Timer
- Eight levels of Interrupt.
- Mask interrupt capability.
- Privileged Mode Operation.
- Memory Error Correction
 - Corrects single bit errors.
 - Detects double bit errors.
- Dual byte data channel for disks.
- Operation end interrupt for all I/O.
- Complete overlap of I/O operation.
- Additional Customer Engineer controls.

The required 3277 Display Station with 78 key Operator Console Keyboard (#4632) provides enhanced operator-machine communications. An optional console printer (3284 or 3287) is also available via 3284 attachment (#7901).

The Display Adapter feature (#4601) provides direct local attachment of up to thirty 3270 devices (CRT's and printers).

Communications with remotely located systems or terminals may be performed through the use of binary synchronous communications. See BSCA (#2074/2084) and BSCC (#2094) features.

- On the 5415A, B, C, two lines maximum
- On the 5415D, four lines maximum.

The Local Communications Adapter provides direct local attachment of the 3741 Data Station model 2 or 3741 Programmable Work Station model 4, or 3271 Control Unit, or 3275 Display Station, or System/7.

Maximum: Only one 5415 can be attached to a System/3 Model 15.

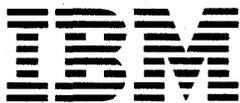
Minimum Configuration: In addition to a 5415 Processing Unit Model A17 through A20, a System/3 Model 15 requires a 3277 Display Station model 1 with 78 key Operator Console Keyboard (#4632), a printer (1403 model 5, 2 or N1), a 5421 Printer Control Unit, a minimum of one 5444 Disk Storage Drive model A2, and either—(a) a 5424 Multi-Function Card Unit, or (b) a 1442 Card Read Punch model 6 or 7, or (c) a 2560 Multi-Function Card Machine together with necessary prerequisites. System/3 Model 15s with 5415 Processing Units B17 through B20 or C21 through C24 or D19 through D26 require the same devices with exception of the 5444 Disk Storage Drive, which is not available on B, C or D Model Processors. Model 15's with B, C or D Model Processors require a 3340 Direct Access Storage Facility.

Cardless System/3 Model 15's require the same devices as shown above for the appropriate CPU models with the exception of the 5424 or 2560 or 1442. Additionally, all Cardless Systems require channel Terminator Feature #1601. A cardless Model 15A requires a 5422 Disk Enclosure and Maintenance Support Package #9440. A cardless Model 15B or 15C requires a 3741 Model 1, 2, 3 or 4 with Feature #3265 or #3266, 3741 Attachment Feature #8220. Power Supply Expansion B Feature #5502, and Maintenance Support Package #9441. A cardless Model 15D has the same requirements as a cardless 15C, except the Maintenance Support Package #9445 is required instead of #9441.

Bibliography: GC20-8080.

Specify

1. Voltage (AC, 3-phase, 4-wire, 60 Hz (cps): #9903 for 208V, or #9905 for 230V.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. Disk Configuration: Specify one of the following if a second 5444 is ordered—#9207 for 5444 Model A3, or



#9208 for 5444 Model A2.

4. 5445 Attachment/Specify Configurator.

Attachment/Specify Configurator

5445 Mdl's attached	Total Drives	Total Capacity million bytes	CPU Attachment Features	CPU Specify Features
1	1	20.48	#3901	None
1+2	2	40.96	#3901	#9182
3	2	40.96	#3901	#9182
3+1	3	61.44	#3901+3903	#9182
1+2+1	3	61.44	#3901+3903	#9182
1+2+1+2	4	81.92	#3901+3903	#9182+9184
1+2+3	4	81.92	#3901+3903	#9182+9184
3+3	4	81.92	#3901+3903	#9182+9184

5. 3340/3344 Specify Configurator.

Specify Configurator

5415	Mdl's Attached		Total Drives	Storage Capacities (MB)		Specify Features
	3340	3344		Main Data Area	Simulation Area	
B,C,D	A2	—	2	81.59	19.66	#9781
B,C	A2 + B1	—	3	122.39	29.49	#9781 & #9782
D	A2 + B1	—	3	122.39	24.58	#9781 & #9782
B,C	A2 & B2	—	4	162.18	39.32	#9781 & #9783
D	A2 & B2	—	4	162.18	29.49	#9781 & #9783
D	A2	B2	4	447.23	58.98	#9781 & #9784

- I/O Attachments: Appropriate special features are required to attach most I/O units ... see "Special Features."
- Appropriate codes are required on the 5424 or 5422 dependent upon the 5444 configuration ... see "Specify" under 5424 or 5422.
- System Control Programming, 5704-SC1 or 5704-SC2, should be ordered at equipment order entry time ... see "System Control Programming" section for additional information.
- For a 5410 or 5415A to 5415B, 5415C, or 5415D conversion where an installed 5424 is to be moved to the new system, an MES must be submitted to remove the 5444(s) from the 5424. This MES must also delete #9400, and if a second 5444 is installed, #9401 or #9402 (all from the 5424).
- Upending Kit: #9840. This kit is furnished only as necessary and remains the property of IBM.
- 5412/5415 Frame Separation Kit: #9190—Frame separation may be required at installation time at those locations where building dimensions (doorways, hallways, stairways, etc.) do not allow movement of the Central Processor as one unit.

The local installation Planning Representative can determine if this kit is required. The Frame Separation Kit is not to be ordered when the Upending Kit (#9840) will suffice.

Card Print Control (#1580): Controls necessary for an attached 2560 Multi-Function Card Machine model A1 equipped with Card Print (#1575, 1576, 1577). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** 2560 Attachment (#8100) on the 5415, plus Card Print (#1575) on the 2560.

Channel Terminator (#1601): Terminates Channel Bank No. 1 which eliminates the requirement for a 1442, 2560 or 5424. Provides cardless capability for Model 15. **Prerequisites:** On 5415A Models ... 5422 Disk Enclosure and Maintenance Support Package for Cardless Model 15A (Specify #9440). On 5415B or C Models ... 3741 Attachment Feature #8220. Power Supply Expansion B Feature #5502, and Maintenance Support Package for Cardless Model 15B and Cardless Model 15C (Specify Feature #9441). On 5415D Models ... 3741 Attachment Feature #8220. Power Supply Expansion B Feature #5502, and Maintenance Support Package for Cardless Model 15D (Specify #9445). **Limitations:** Cannot be installed with #4100, #4101, #4130, or #8100. **Maximum:** One. **Field Installation:** Yes.

First 5445 Attachment (#3901): To attach the first and second 5445 drive(s) ... see (4) under "Specify." **Maximum:** One. **Limitation:** Not available on B17 through B20 or C21 through C24 or D19 through D26 Processor Models. **Field Installation:** Yes.

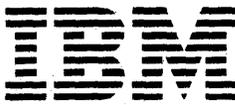
Second 5445 Attachment (#3903): To attach the third and fourth 5445 drive(s) ... see (4) under "Specify." **Maximum:** One. **Limitation:** Not available on B17 through B20 or C19 through C24 or D19 through D26 Processor Models. **Field Installation:** Yes. **Prerequisite:** First 5445 Attachment (#3901).

Multi-Function Card Unit Attachment 250/60/60 CPM (#4100): To attach a 5424 Multi-Function Card Unit model A1. **Maximum:** One. **Limitation:** Cannot be installed with #1601, #4130 or #8100. **Field Installation:** Yes.

Multi-Function Card Unit Attachment 500/120/120 CPM (#4101): To attach a 5424 Multi-Function Card Unit model A2. **Maximum:** One. **Limitation:** Cannot be installed with #1601, #4130 or #8100. **Field Installation:** Yes. **Prerequisite:** Multi-Function Card Unit Attachment 250/60/60 (#4100).

1442 Model 6/7 Card Read Punch Attachment (#4130): To attach a 1442 model 6 or 7. **Maximum:** One. **Limitation:** Cannot be installed with #1601, #4100, #4101 or #8100. **Field Installation:** Yes. **Prerequisites:** A 5422 Disk Enclosure with 5415 Processing Units A17 through A20 ... 5410/5412/5415 Coupling (#3950) on the 1442. Power Supply Expansion B (#5502) must be ordered with B, C, or D Model Processors.

1403 Model 5 Printer Attachment 465 LPM (#4135): To attach a 1403 Printer model 5. **Maximum:** One. **Limitation:** Cannot be installed with #4140 or #4150. **Field Installation:** Yes. **Prerequisite:** A #4160 Basic Attachment Control and a 5421 Printer Control Unit with #9185.



1403 Model 2 Printer Attachment 600 LPM (#4140): To attach a 1403 Printer model 2. Maximum: One. Limitation: Cannot be installed with #4135 or #4150. Field Installation: Yes. Prerequisite: A #4160 Basic Attachment Control and a 5421 Printer Control Unit.

1403 Model N1 Printer Attachment 1100 LPM (#4150): To attach a 1403 Printer model N1. Maximum: One. Limitation: Cannot be installed with #4135 or #4140. Field Installation: Yes. Prerequisite: A #4160 Basic Attachment Control and a 5421 Printer Control Unit.

1403 Basic Attachment Control (#4160): To attach all models of a 1403 printer. Maximum: One.

Display Adapter (#4601): For direct local attachment of 3270 devices (3277 models 1 and 2, 3284 Models 1 and 2, 3286 Models 1 and 2, 3287 Models 1 and 2, 3288 Model 2) in any combination. Includes the basic control and interface for three devices. The 3270 device cables (maximum length 2000 ft.) plug directly into the 5415 when this feature is installed. For attachment of additional 3270 devices (maximum of 30) see Device Interface (#4602). Programming support for the attached devices is provided by the Multiline/Multipoint interface and the Communication Control Program feature of the SCP. Maximum: One. Limitations: Cannot be installed with BSCA-2 (#2084). Field Installation: Yes. Prerequisite: Processing Unit Expansion 1 (#5733). See Processing Unit Expansion Features Configurator for possible requirements for additional expansion features. EBCDIC Character Set (#9089) required on attached 3270 devices. See applicable machines pages for 3270 device ordering details.

Device Interface (#4602): Provides for attachment of three additional 3270 devices (3277 Models 1 and 2, 3284 Models 1 and 2, 3286 Models 1 and 2, 3288 Model 2) in any combination to the Display Adapter (#4601). Maximum: Nine ... for a maximum of 30 attached devices. Field Installation: Yes. Prerequisite: Display Adapter (#4601).

Local Communications Adapter (#4765): Permits local attachment of one 3741 Data Station model 2, one 3741 Programmable Work Station model 4, one 5231 model 2 equipped with BSCA (#2074), one 3271 Control Unit, or one 3275 Display Station or one 3274-1C Control Unit, or one 3276-2 Control Unit Display Station, or one System/7 equipped with a binary synchronous communications adapter (#2074) to a System/3 model 15. The external modem cable of the device will attach directly to the 5415 when this feature is installed. Data transfer rate is 2400 bps only. EBCDIC transmission code must be specified when applicable on the attached device. Programming support for the 3741 model 2 or 4 and the 5231 model 2, is provided by the RPG II Telecommunications Feature and the Communications Control Program feature of Disk SCP. Program support for the 3271, 3274, 3275, and 3276 is provided by the Multiline/Multipoint and Communications Control Program features of the Disk SCP. Programming support for the System/7 is provided by the RPG II Telecommunications feature or by the Multiline/Multipoint or the Communications Control Program features of the disk SCP. (Host programs must be point-to-point mode and a CCP program must use data mode only.) Specify: One of the following—#9577 for attachment of 3270 devices, or #9579 for attachment of the 3741 model 2 or 4 ... #9592 for attachment of the 5231 model 2 ... #9590 for attachment of the System/7. Maximum: One per 5415. Limitations: Cannot be installed with BSCA-1 (#2074). Data exchange with attached device is non-transparent only. For data transparent operation contact GSD

Power Supply Expansion B (#5502): Provides additional processing unit 24V power. Required on B, C, and D models when 5424 is not attached, or if Channel Terminator Feature #1601 is installed. Maximum: One. Field Installation: Yes.

Processing Unit Expansion 1 (#5733): Provides additional processing unit power supply and connections. Refer to the "Processing Unit Expansion Features Configurator" below to determine requirements. May be required when certain RPQs are ordered.

Processing Unit Expansion 2 (#5734): Provides additional processing unit power supply and connections. May be required when certain RPQs are ordered.

Processing Unit Expansion 3 (#5735): Provides additional processing unit power supply and connections. May be required when certain RPQs are ordered.

Processing Unit Expansion Features Configurator (All Models except D with BSCC

I/O Unit Attachment	Communications						DA(4601) plus SIOC either BSCA-1 or LCA
	None	BSCA-1 with (#2074) or LCA (#4765) or LCA	with BSCA-1 or LCA	with BSCA-1 or LCA	BSCA-2 plus SIOC	BSCA-2 with SIOC	
Neither							
2501 (#8090) nor 3411 (#7951) nor 3741 (#8220)	—	#5733	#5733	#5733	#5733	—	#5733
2501 (#8090)	—	#5733	#5733	#5733	#5733	—	#5733
2501 & 3411 (#8090 & #7951)	—	#5733	#5733	#5733	#5733	#5733	#5733
2501 & 3411 & 3741 (#8090 & #7951 & #8220)	#5733	#5733	#5733	#5733	#5733	#5733	#5734
3411 (#7951)	—	#5733	#5733	#5733	#5733	—	#5733
3411 & 3741 (#7951 & #8220)	—	#5733	#5733	#5733	#5733	#5733	#5733
3741 (#8220)	—	#5733	#5733	#5733	#5733	—	#5733
3741 & 2501 (#8220 & #8090)	—	#5733	#5733	#5733	#5733	#5733	#5733

Model D Configurator: See page M5415.8 (if BSCC (#2094) in on System).

Second 5444 Attachment (#6378): To attach a 5444 Disk Storage model A3 or a second 5444 model A2. Maximum:



One. Field Installation: Yes. **Prerequisite:** A 5444 model A2. **Limitation:** Not available on B17 through B20 or C21 through C24 or D21 through D26 Processor Models.

Serial I/O Channel (#7081): To attach a 1255 Magnetic Character Reader or a 3881 Optical Mark Reader. **Maximum:** One. **Field Installation:** Yes.

3284 Attachment (#7901): To attach a 3284 Printer model 1 or a 3284 Printer Model 1 or Model 2. **Maximum:** One. **Field Installation:** Yes.

3411 Magnetic Tape Attachment (#7951): To attach a 3411 Magnetic Tape Unit and Control. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Processing Unit Expansion 1 (#5733), 2 (#5734) or 3 (#5735) may be required dependent upon other features. Refer to "Processing Unit Expansion Features Configurator" to determine requirements.

2501 Attachment (#8090): To attach a 2501 Card Reader model A1 or A2. **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** Processing Unit Expansion 1 (#5733), 2 (#5734) or 3 (#5735) may be required dependent upon other features. Refer to "Processing Unit Expansion Features Configurator" to determine requirements ... 2501 Coupling (#3630) on the 2501. **Limitation:** 2501 must be in addition to a 5424, a 2560 or a 1442, or Channel Terminator Feature #1601.

2560 Multi-Function Card Machine Attachment (#8100): To attach a 2560 Multi-Function Card Machine. **Maximum:** One. **Field Installation:** Yes. **Limitations:** Cannot be installed with #1601, #4100, #4101 or #4130. **Specify:** #9801 if a 2560 model A1 is to be attached. **Prerequisite:** A 5422 Disk Enclosure with 5415 Processing Units A17 through A20. Power Supply Expansion B (#5502) must be ordered with B, C or D Model Processors.

3741 Attachment (#8220): To directly attach a 3741 model 1, 2, 3 or 4. **Limitation:** For 3741 models 3 and 4, System/3 does not support the Application Control Language (ACL). **Maximum:** One. **Field Installation:** Yes. **Prerequisites:** See Processing Unit Expansion Configurator for possible requirements for additional expansion features. I/O Adapter (#3265/3266) on 3741. Channel Terminator Feature #1601 required on 5415 B, C or D Model Cardless Systems.

Binary Synchronous Communications Adapter (#2074): This feature in conjunction with program control permits System/3 Model 15 to communicate in binary synchronous mode with other IBM systems and terminals. System/3 Model 15 can operate on a multipoint line as either a control station or a tributary station, or on a point-to-point switched or leased communications line. Transmission rates are available from 600 bps to 50,000 bps. Auto answer capability is switched network version. Any version can be selected to operate in EBCDIC or ASCII transmission code, but not both. A 1200 BPS Integrated Modem is available as a special feature. Also, see "Modems" at end of this section.

Specify: See "Additional Information" at end of this section for applicable specify codes. **Maximum:** One per 5415. **Field Installation:** Yes. **Limitation:** Cannot be installed with Local Communications Adapter (#4765). **Prerequisites:** Refer to "Processing Unit Expansion Features Configurator" above for possible requirement for additional Processing Unit Expansion features, 1, 2, 3.

Binary Synchronous Communications Adapter, Second (#2084): Permits operation of two BSCA's simultaneously on System/3 model 15 and/or in two different configurations (speed network attachments, line facility attachments, codes, etc.). 1st BSCA (#2074) or LCA (#4765) is a prerequisite for installation of #2084. See the "Processing Unit Expansion Features Configurator" for possible requirements for additional Processing Unit Expansion Features, 1, 2, 3. This second adapter (#2084) is functionally identical to the first adapter (#2074). It will support the same sub-features which require the same prerequisites as the first BSCA. The same options and limitations also apply to the second BSCA, with the following exception: #2084 is provided only in the medium speed version (600 to 7200 bps) and does not support attachment to a Wideband data link (option #9755). Provision of a second adapter does not limit in any way the options on the first adapter. **Limitation:** No Wideband attachment capability. Cannot be installed with Display Adapter (#4601). **Maximum:** One per System/3 mdl 15. **Prerequisites:** First BSCA (#2074) or LCA (#4765). See "Processing Unit Expansion Features Configurator" for possible requirement of additional Processing Unit Expansion features. See the following section on "Additional Information" for optional selection codes for sub-feature code numbers applicable to the Second BSCA (#2084).

In addition to the basic functions of #2074 and #2084 described above, the following special features may be added.

Auto Call (#1315, 1325): Permits the System/3 model 15 when attached to a switched network (option #9483 or #9583) via an appropriate modem and Auto Call Unit to initiate (dial) through stored program control, a data link connection to a remote BSC station. #1315 for #2074 and #1325 for #2084. **Limitations:** Cannot be installed with Station Selection (#7477 or #7487), or 1200 BPS Integrated Modem (#4781, 4782). **Maximum:** One per BSCA. **Prerequisites:** As appropriate BSCA (#2074 or 2084), one Voice Grade Transmission Rate from 600 to 4800 bps, and Network Attachment (#9483, 9583). Requires appropriate cable order. See *Installation Planning Manual* (GC21-9084). **Field Installation:** Yes.

EIA Local Attachment (#3601, 3602): Permits attachment of one 3271 Control Unit, one 5231 Model 2 (pt-to-pt unidirectional transmission only), one 3274-1C Control Unit, one 3275 Display Station, one 3276-2 Control Unit Display Station, one 2972 GBTS Control Unit or one System/7 equipped with a binary synchronous communications adapter (#2074) to System/3 model 15 without the use of a data communications line and modems at either device. This attachment may be used where the device's control unit or System/7 is located within a distance reached by the device's EIA attachment cable (i.e., the cable normally used to attach to an external modem). This feature provides the clocking signals for the System/3 model 15's BSCA and for the attached control unit's adapter; therefore, the System/3's Internal Clock (#4703 or #4723) cannot be installed on the same adapter with this feature. Data transfer rates of 2400 4800 and 8000 bps are supported by this feature. #3601 for #2074 and #3602 for #2084. **Limitations:** Cannot be installed with Internal Clock (#4703 or #4723), or Auto Call (#1315 or #1325). **Maximum:** One per BSCA. **Prerequisites:** As appropriate #2074 or #2084, Transfer Rate (#9753, 9754, 9758 or #9853, 9854, 9858), Network Attachment (#9484 or #9584), and Line Facility (#9391 or #9381). For 8000 bps operation, #7821 is required on the 3271 or 3275. **Field Installation:** Yes.



Internal Clock (#4703, 4723): Generates synchronizing and timing signals for BSCA operation when they are not provided by the attached modem. When this feature is installed on System/3 model 15, all other BSC stations attached to the same data link must also be equipped with a similar IBM Internal Clock feature. See *IBM Data Communications Handbook*

#4703 for #2074 and #4723 for #2084. Will service rates 600 bps, 1200 bps, 2000 bps or 2400 bps. **Maximum:** One per BSCA. **Prerequisites:** As appropriate—#2074 or #2084, and one of the above serviced transmission rate options. **Field Installation:** Yes.

1200 BPS Integrated Modem (#4781, 4782): A modem for BSC data transmission at 1200 bps over non-switched facilities or switched network. Available in two different versions: #4781 Non-switched and #4782 Switched with Auto Answer. Attachment to non-switched (2 or 4-wire) facilities is via an IBM provided cable directly to the line, type 3002 facility. Attachment to the switched network is via an IBM provided cable to a common carrier arrangement type CBS or equivalent. The device communicating with System/3 model 15 must also be equipped with an IBM 1200 bps integrated modem/line adapter. **Limitations:** Cannot be installed with sub-features Auto Call (#1315 or 1325) or EIA Local Attachment (#3601, 3602). #4781 and 4782 cannot be installed together on the same BSCA. **Maximum:** One per BSCA. **Prerequisites:** As appropriate—#2074 or #2084, Modem Base (#5201 or 5202), Internal Clock (#4703 or 4723), Transfer Rate (#9751 or #9851). **Field Installation:** Yes.

Modem Base (#5201, 5202). Provides for mounting of one 1200 BPS Integrated Modem (#4781, 4782). #5201 for #2074 and #5202 for #2084. **Maximum:** One per BSCA. **Prerequisite:** As appropriate #2074 or #2084. **Field Installation:** Yes.

Station Selection (#7477, 7487): Permits the System/3 model 15 to operate as a compatible member of the IBM family of BSC terminals on a multipoint communications line as a tributary station. #7477 for #2074 and #7487 for #2084. **Limitation:** Cannot be installed with Auto Call (#1315, 1325). **Maximum:** One per BSCA. **Prerequisites:** As appropriate #2074 or #2084, Line Facility Attachment (#9392 or #9382) and one of the Voice Grade Transmission Rates 600—9600 bps. *Note:* Control station operation on a System/3 model 15 BSCA with Station Selection installed is possible, but such operation cannot be performed concurrently with tributary station operation on that adapter. Additionally, a change in modems or in modem operation may be required to utilize the same adapter (at different periods of time) as a tributary station and as a control station adapter. Also, the network attachment option (#9484 or #9584) must be specified when control station operation is to be performed whether Station Selection (#7477 or 7487) is installed or not. **Field Installation:** Yes.

Text Transparency (#7850, 7851): Permits the System/3 model 15 to transmit or receive "8-bit binary data" and EBCDIC coded data. **Limitations:** Cannot be installed with ASCII Transmission Code (#9061 or 9071) ... limitations on the use of this facility exist and are described in SRL GA27-3004. #7850 for #2074 and #7851 for #2084. **Maximum:** One per BSCA. **Prerequisite:** As appropriate #2074 or #2084 and Transmission Code (#9060 or 9070). **Field Installation:** Yes.

IBM Modems: One IBM modem can be attached to the First BSCA (#2074) and/or one to the Second BSCA (#2084) as follows:

Modem	Nominal Speed (bps)
3872 model 1	2400/1200
3874 model 1	4800/2400
3875 model 1	7200/3600

See M2700, 3872, 3874, 3875 pages for information on Modem features, communications capabilities, and product utilization.

Note: Configuration requirements for IBM programming support must satisfy the minimum machine requirements stated in the "Program Products" and "Systems" sections

For information on optional selections, attachment to communications lines, customer responsibilities, etc., see "Additional Information" below.

Additional Information (BSCA-1 and BSCA-2)

I. **Optional Specifications:** One selection must be specified from each of the following five categories for each adapter.

	#2074	#2084
A. Transmission Code		
EBCDIC	#9060	#9070
ASCII	9061	9071
B. Transfer Rate (1)		
600 bps	#9750	#9850
1200 bps	9751	9851
2000 bps	9752	9852
2400 bps (2)	9753	9853
4800 bps	9754	9854
7200/3600 bps	9757	9857
8000 bps	9758	9858
High Speed (19,200 to 50,000 bps)	9755	N/A
9600 bps	9759	9859
C. Network Attachment		
Point-to-point (non-switched)	#9481	#9581
Point-to-point (switched)	9483	9583
Multipoint Tributary	9482	9582
Multipoint Control Station (3)	9484	9584
D. Line Facility Attachment (4)		
Duplex (4-wire only)	#9391	#9381
Half-Duplex	9392	9382



E. One (or more if necessary) optional selection code must be specified from the following list, contingent upon planned device attachments:

S/360 or S/370 (mdl 22 and up)	#9570	#9670
S/360 mdl 20	9571	9671
1130 System	9572	9672
2770 System	9573	9673
2780	9574	9674
2980	9576	9676
3270 System	9577	9677
3735	9578	9678
3741 mdl 2, mdl 4	9579	9679
5231 mdl 2	9592	9692
System/3	9580	9680
System/7	9590	9690
System/32	9591	9691
System/34	9593	9693
Series/1	9594	9694
3600*	9595	9695

* Requires a no-charge RPQ.

Notes:

1. Refer to *Data Communications Handbook*

2. See SRL GA27-3004 for potential problem areas and possible restrictions to application data when using certain modems at this or higher speeds.

3. If Multipoint Tributary Station use (with #7477/7487) is to be implemented alternately with Multipoint Control Station use on the same adapter, specify code #9484/9584 must be used.

4. Where BSCA is used as a Control Station adapter or when attached to a point-to-point (non-switched) data link, the facility may be duplex (4-wire only) or half-duplex. Half-duplex facility must be specified for Switched Network attachments and for adapters implementing Multipoint Tributary Station only operation.

II. Special Features

A. Available with Medium Speed (600 to 9600 bps) and with Wideband attachments (19,200—50,000 bps):

Text Transparency (#7850/7851)

B. Available with Medium Speed adapters only:

Internal Clock (#4703/4723)

Station Selection (#7477/7487)

Auto Call (#1315/1325)

EIA Local Attachment (#3601/3602)

1200 BPS Integrated Modem (#4781/4782)

III. Communication Facility Attachments: The BSCA is designed to operate on transmission facilities such as:

A. Common Carrier leased telephone services (voice grade)

AT & T or Western Union Class 3002-600 bps (1200 bps with 1200 BPS Integrated Modem)

AT & T or Western Union Class 3002 with C1 conditioning to 4800 bps.

AT & T or Western Union Class 3002 with C2 conditioning to 7200 bps.

B. Private (customer owned) communications facilities equivalent to the above common carrier facilities.

C. Common carrier switched network telephone (voice grade) service at 600 to 4800 bps.

D. Common carrier wideband communications services at 19,200 bps, 40,800 bps, or 50,000 bps.

E. Private carrier organizations providing equivalent to above (A through D) data transmission services.

IV. Reference: See M2700 pages for additional information concerning modems, communications facilities, machine attachment requirements, terminal intermix, operating capabilities and customer responsibilities.

V. Customer Responsibilities: The customer must be advised that:

A. He is responsible for making arrangements for installation, pricing and charges of the data communications facility and attachment of selected data sets (modems).

B. Toll charges, if required for installation and/or maintenance of the BSCA, are to be paid by the customer.

C. The IBM Marketing Representative must have from the customer a firm installation date for transmission services (including modems) before the order can be confirmed ... for further information see "Teleprocessing" in "General Information" and consult "Reference IV" above.

VI. Cables: BSCA (#2074/2084) always requires an appropriate cable order (unless EIA Local Attachment #3601/3602 is ordered). See *Installation Manual—Physical Planning*, GA21-9084.

Binary Synchronous Communications Controller (#2094)(System/3 Model 15D Only): Provides the controller base for attachment of two additional binary synchronous communications lines. One or two additional lines are ordered as separate features (see #4891 and 4892 below). This feature (BSCC) can also provide the terminal polling function (depending on the terminal type attached) for the 1 or 2 lines thereby reducing CPU loading. The BSCC can handle polling functions outboard of the Model 15D CPU. Both lines operate in multipoint control station mode over non-switched communication facilities at speeds up to 9600 bps. Text transparency is standard but applicable to EBCDIC coded data only. **Maximum:** One per 5415D. **Limitations:** Cannot be installed with the MLTA RPQ (S40028). Operation on non-switched facilities only. **Field Installation:** Yes. **Prerequisites:** See Processing Unit Expansion Configurator for possible expansion feature requirements.



Line Base, 1st (#4891): For attachment of the first communications line to the BSCC (\$2094) through one of the line interface features (#3703, #5803, #5813, or #3603) described below. Specify: See "Additional Information" below for selection of transmission codes, line speeds, etc. Maximum: One. Field Installation: Yes. Prerequisites: BSCC (#2094).

Line Base, 2nd (#4892): For attachment of the second communications line to the BSCC (#2094) through one of the line interface features (#3704, #5804, #5814, or #3604) described below. Specify: See "Additional Information" below for selection of transmission codes, line speeds, etc. Maximum: One. Field Installation: Yes. Prerequisites: BSCC (#2094) and Line Base, 1st (#4891).

Internal Clock (#4733, 4734): Provides business machine clocking at 1200 bps for the external or integrated modem operating at that line speed. This feature is always required for the 1200 BPS Integrated Modem (#5803 or 5804). Maximum: One per Line Base. Limitations: 1200 bps only. For use only when modem does not provide clocking. Field Installation: Yes. Prerequisites: As appropriate—#4891 for #4733, #4892 for #4734.

Line Interfaces: One of the following line interface features must be ordered for each Line Base depending on the type of communication facility and modem to be used.

EIA Interface (#3703, 3704): Provides an interface for attachment of an external modem meeting EIA RS 232C characteristics. Non-IBM modems may be attached subject to the Multiple Supplier System Policy. Maximum: One per Line Base. Limitations: Cannot be installed on the same Line Base with the 1200 BPS Integrated Modem (#5803 or 5804) or DDSA (#5813 or 5814) or EIA Local (#3603 or 3604). Field Installation: Yes. Prerequisites: Line Base, as appropriate—#4891 for #3703, #4892 for #3704. See "Cables" under "Additional Information."

1200 BPS Integrated Modem (#5803, 5804): A modem for data transmission at 1200 bps over non-switched (2 or 4 wire) facilities. Attachment to the communication facility is via an IBM provided cable directly to the common carrier type 3002 channel or equivalent. All devices communicating with System/3 must be equipped with a compatible IBM 1200 bps integrated modem/line adapter. Maximum: One per Line Base. Limitations: Cannot be installed on the same Line Base with the EIA Interface (#3703 or 3704) or DDSA (#5813 or 5814) or EIA Local (#3603 or 3604). Non switched facilities only. Field Installation: Yes. Prerequisites: Internal Clock, as appropriate—#4733 for #5803, #4734 for #5804. Line Base, as appropriate—4891 for #5803, #4892 for #5804. See "Cables" under "Additional Information."

DDS Adapter (#5813, 5814): An integrated adapter for attachment to the AT & T nonswitched Data-Phone* Digital Service network. The DDSA interfaces to a DDS channel service unit at the customer site termination of the DDS network. Line speeds of 2400 bps, 4800 bps, and 9600 bps are available. Maximum: One per Line Base. Limitations: Cannot be installed on the same Line Base with EIA Interface (#3703 or 3704) or 1200 BPS Integrated Modem (#5803 or 5804) or EIA Local (#3603 or 3604). Field Installation: Yes. Prerequisites: Line Base as appropriate #4891 for #5813, #4892 for #5814. One of the three line speeds: 2400 bps, 4800 bps, or 9600 bps, must be specified on the applicable Line Base. Line Facility Attachment—4 wire. (#9311 or #9411). See "Cables" under "Additional Information."

* Registered Trademark of AT & T.

EIA Local (#3603, 3604): Permits local attachment of one IBM binary synchronous device eq, 3271, to the 5415 without the use of communications line or modem. The external modem cable of the attached device connects directly to the 5415 when this feature is installed. Data clocking for transfer rates of 2400 bps, 4800 bps, 7200 bps, and 9600 bps is provided by this feature for both the 5415 and the attached device. The device must be capable of functioning as a multipoint tributary station at the transfer rate provided by this feature. Maximum: One per Line Base. Limitations: Cannot be installed on the same Line Base with EIA Interface (#3703 or 3704) or 1200 BPS Integrated Modem (#5803 or 5804) or DDS Adapter (#5813 or 5814). Field Installation: Yes. Prerequisites: Line Base, as appropriate #4891 for #3603, #4892 for #3604. One of four transfer rates: 2400 bps, 4800 bps, 7200 bps, or 9600 bps must be specified on the applicable Line Base.

Additional Information (BSCC).

Optional Specifications: One selection must be specified for each of the following four categories for each Line Base:

	#4891	#4892
1. Transmission Code		
EBCDIC	#9080	#9090
ASCII	9081	9091
2. Line Speed		
600 bps	#9300	#9400
1200 bps	9301	9401
2000 bps	9302	9402
2400 bps	9303	9403
4800 bps	9304	9404
7200 bps	9305	9405
9600 bps	9306	9406
3. Line Facility Attachment		
2 Wire	#9310	#9410
4 Wire	9311	9411
4. Device Attachment (1 or more)		
3270	#9320	#9420
3600**	9321	9421
3735	9322	9422
3740	9323	9423
5230	9324	9424
S/3	9325	9425
S/7	9326	9426
S/32	9327	9427
S/34	9330	9430
Series/1	9331	9431
Other IBM	9328	9428
Other Non-IBM	9329	9429

IBM Modems: One IBM modem can be attached to each Line Base (#3703/3704 required):

Modem	Data Rate
3872 Model 1	2400 bps
3874 Model 1	4800 bps
3875 Model 1	7200 bps

See M2700, M3872, M3874, and M3875 pages for information on modem features, communications capabilities and product utilization.



Communication Facility Attachments: The BSCC is designed to operate on communication facilities such as:

1. Common carrier leased telephone services (voice grade)

Class 3002 (600 bps)

1200 bps with Integrated Modem (#5803/5804)

2400 bps with IBM 3872

Class 3002 with C1 conditioning (4800 bps)

Class 3002 with C2 conditioning (7200 bps)

2. Private or private carrier facilities equivalent to the above.

3. AT & Ts Private Line Dataphone* Digital Service

(#5813/5814) to 9600 bps.

Reference: See M2700 pages and *Data Communications Handbook*.

Customer Responsibilities: The customer must be advised of certain responsibilities related to the installation and maintenance of common carrier facilities/services as well as the IBM equipment.

Cables: Each line of the BSCC requires an appropriate cable order unless EIA Local (#3603/3604) is ordered. See *Installation Manual—Physical Planning*, GA21-9084.

* Registered Trademark of AT & T

** Requires no-charge RPQ.

**5421 PRINTER CONTROL UNIT**

Purpose: Control unit for a 1403 Printer model 2 or N1 in a System/3 model 10 and for a 1403 Printer model 5, 2 or N1 in a System/3 model 12 or 15.

Highlights: The 5421 provides the necessary controls for attaching a 1403 Printer model 2 or N1 to the appropriate 1403 Printer Attachment (#4140 or #4150) on the 5410 Processing Unit. It also provides the necessary controls for attaching a 1403 Printer model 5, 2 or N1 to the appropriate 1403 Printer Attachment (#4135, 4140 or 4150) on the 5412 or 5415 Processing Unit.

The control unit replaces the 5203 Printer in the basic System/3 model 10 or 12 configuration. It may be field installed to replace the 5203 Printer in the System/3 model 10 or 12 system. **Limitation:** The 5421 cannot be installed with a 5203 Printer in the same System/3 model 10 or 12. **Maximum:** Only one 5421 can be attached to a system. **Prerequisite:** A 1403 Printer Attachment (#4140 or #4150) on the 5410 Processing Unit or (#4135, 4140 or 4150) on the 5412 or 5415 Processing Unit.

Note: A 5421 is required in a System/3 model 12 or 15.

Bibliography: GC20-8080. **Metering:** I/O Unit (Online...meter on 1403).

Specify

1. Voltage (AC, 3-phase, 4-wire, 60 Hz): #9903 for 208V, or #9905 for 230V.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. 1403 model 5 Compatibility: #9185 ... required when a 1403 model 5 is attached to a System/3 model 12 or 15.

5422 DISK ENCLOSURE

Purpose: Unit for enclosure of one or two 5444 Disk Storage Drives on System/3 model 10 or model 15 when a 5424 MFCU is not attached.

Highlights: The 5422 provides for the attachment of one or two 5444's. It replaces the 5424 in the basic System/3 model 10 or model 15 configuration and makes available a convenient work table area. **Limitations:** Cannot be installed on a system equipped with a 5424 MFCU ... The 5422 Disk Enclosure is "not recommended for field installation" on System/3 model 10 unless the 5410 has a printed circuit board rather than discrete wiring on the primary power box sequence control relay panel. The 5422 cannot be installed with 5415 B or C Model Processors. **Maximum:** One 5422 can be attached to a system.

Prerequisites: For System/3 model 10—a 1442 Model 6/7 Card Read Punch Attachment (#4130) is required on the 5410 Processing Unit ... a minimum of one 5444 is required.

For System/3 model 15: A 1442 model 6/7 Card Read Punch Attachment (#4130), or a 2560 MFCM Attachment (#8100) is required on the 5415 Processing Unit ... a minimum of one 5444 model A2 is required.

Bibliography: GC20-8080.

Specify

1. Voltage (AC, 3-phase, 4-wire, 60 Hz): #9903 for 208V, or #9905 for 230V ... must be consistent with system voltage.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. Front Covers: #9400 if one 5444 is to be installed ... #9401 if two 5444's are to be installed ... #9402 if a second 5444 is to be added to an installed system. **Note:** #9400 or #9401 can be plant installed ... #9402 is for field installation only. When ordering MESs, also specify color of installed 5422 ... see (2) above. MES orders for #9400, #9401 or #9402 on a System/3 model 10 require the serial no. of 5410 Processing Unit. **Removal:** If two 5444s are installed and one is to be removed from the system, the MES must indicate deletion of #9401 or #9402 and installation of #9400 (one disk drive only).

**5424 MULTI-FUNCTION CARD UNIT**

Purpose: A multi-function card input/output unit for System/3 model 10, 12, 15, or System/38 ... uses the 96-column card.

Model Speed (Read/Punch/Print)

A1	250/60/60* cpm
A2	500/120/120* cpm

***Print Speed:** Is at the maximum rate of 60 or 120 cards per minute when printing on any or all of the first three lines. Printing on the fourth (lower) line will cause reduction in throughput regardless of whether or not printing occurs on any or all of the first three lines. Resultant throughput is 48 cpm for a model A1 and 96 cpm for a model A2. Uses a cassette ribbon replaceable by the customer.

Model Changes: Field installable.

Highlights: Provides the combined functions of a card reader, punch, collator and interpreter in one unit. Permits collating, gangpunching, reproducing, summary punching, punching of calculated results, printing, and classifying of cards in a single pass of the cards. Card sorting is also possible using a multiple pass method under program control. In a disk oriented System/3 model 10 or a model 15A, the 5444 Disk Storage Drives are housed in drawers beneath the front of the 5424 ... see "Specify."

Input Section: Separate primary and secondary card hoppers, each with a 2000-card capacity, feed cards independently to a common read station and on into separate wait stations. Depending upon the model, rated serial reading is at 250 or 500 cards/minute from either hopper. The common reading unit is checked for proper functioning on each read cycle. The card code read is 6 rows consisting of B, A, 8, 4, 2, 1 punches representing a 64-character set.

Output Section: From separate wait stations, cards are fed to a common punch station, through the punch and cornering stations, to the print station, where up to 4 lines with up to 32 characters per line can be printed on the card. Line designation is determined by the stored program. Characters represented are the standard 64-character set corresponding to the 96-column card code. Printing is by engraved typewheel. Cards are then selected into any one of the 4 stackers, each with a 600-card capacity. Depending upon the model, rated serial punching is at 60 or 120 cards/minute.

Multi-Function: With the ability to move cards from either hopper under independent control to the punching station and with complete stacker selection flexibility, the common card functions of collating, reproducing, gangpunching, summary punching, and selective stacking can be accomplished.

Maximum: One 5424 can be attached to a System/3 Model 10, Model 12, Model 15, or System/38.

Prerequisite: A Multi-Function Card Unit Attachment (#4100 or 4101) on the 5410, 5412 or 5415 Processing Unit On System/38, an MFCU Attachment (#1220 or #1221) is required.

Limitations:

OCR type font for use with current line IBM Optical Character Reading equipment is not available.

Cannot be attached to a System/3 model 10 or model 12 when a 1442 Card Read Punch is attached.

Cannot be converted to a System/3 model 15 when a 1442 Card Read Punch or a 2560 MFCM is attached on the System/3 model 15.

Bibliography: GC20-8080. **Metering:** I/O Unit (Online).

Specify

1. Voltage [AC, 3-phase, 60Hz]: #9903 for 208V, or #9905 for 230V ... must be consistent with system voltage.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white ... must be consistent with 5410, 5412 or 5415 color. For 5424 ordered with System/38, #9066 (Pearl White) must be ordered.
3. Lower Covers (System/3 model 10 or a System/3 model 15 only if a 5444 is to be installed): #9400 if one 5444 is to be installed ... #9401 if two 5444's are to be installed ... #9402 if a second 5444 is to be added to an installed system.

Note: #9400 or #9401 can be plant or field installed ... #9402 is for field installation only. MES orders for #9400, #9401 or #9402 on a System/3 model 10 require the serial no. of the 5410 Processing Unit.

Removal: If two 5444s are installed and one is to be removed from the system, the MES must indicate deletion of #9401 or #9402 and installation of #9400 (one disk drive only). For conversion of a 5415A Model CPU to a 5415B, 5415C or 5415D model, or for conversion from a 5410 CPU, to a 5412 or 5415 the MES must indicate deletion of #9400, and if a second 5444 is installed, #9401 or #9402."

Special Features

System/38 Attachment (#6500): To attach a 5424 to System/38 (Feature #6500 is not recommended for field installation.) **Prerequisite:** MFCU Attachment (#1220/#1221) is required on System/38.



5440 DISK CARTRIDGE

Purpose: Interchangeable disk cartridge for all models of the 5444 Disk Storage Drive, the 5447 Disk Storage and Control, and for 5022 Disk Storage Module models 001 and 002.



5444 DISK STORAGE DRIVE

Purpose: Disk storage drive units for a System/3 model 6, 8, 10 or 15 with 5415 Processing Units A17 through A20.

Models: The A Series model drives (available on System/3 model 10 or 15 only) provide the system with faster disk access time ... see "Access Times" below.

Model	For Use With	Model	For Use With
1	S/3 mdl 6 or 10	A1	S/3 mdl 8 or 10
2	S/3 mdl 6 or 10	A2	S/3 mdl 8, 10 or 15
3	S/3 mdl 6 or 10	A3	S/3 mdl 8, 10 or 15

Model 1 or A1: single drive ... 2.45 million bytes or 4.90 million packed decimal digits ... accesses 100 cylinders on removable cartridge and 100 cylinders on its fixed non-removable disk.

Model 2 or A2: single drive...4.90 million bytes or 9.80 million packed decimal digits ... accesses 200 cylinders on removable cartridge and 200 cylinders on its fixed non-removable disk.

Model 3 or A3: single drive ... 2.45 million bytes or 4.90 million packed decimal digits ... accesses 200 cylinders on removable cartridge only.

Model Changes: can be made in the field. Limitations: (1) Models 1, 2 and 3 can be changed to "A" series (A1, A2, A3) and vice versa only if the 5444 serial no. is 30101 or above ... (2) 5444 models 1, 2 or 3 cannot be intermixed with models A1, A2 or A3 in the same system.

Highlights: Removable Disk Cartridges—each 5444 uses a removable 5440 Disk Cartridge that provides virtually unlimited off-line disk storage. 5440's must be ordered separately...see 5440. Limitations: The 5440 Disk Cartridge is interchangeable between all 5444 models. However, data recorded on the second 100 cylinders of a 5440 by a 5444 model 2, model A2, model 3 or A3 is not available for reading by a 5444 model 1 or model A1. A 5440 initialized on a 5444 model 1 or model A1 will not be initialized on the second 100 cylinders.

Cylinder Concept: On 5444 models 1, A1, 2 or A2, the access mechanism, with four vertically aligned heads, gives access to the top and bottom tracks of both the removable 5440 and the 5444's fixed, non-removable disk. However, due to different functional uses, a cylinder is considered as the two opposite tracks on either the removable cartridge or the fixed disk. On either disk, 12,288 bytes or 24,576 packed decimal digits are available at one setting of the mechanism.

Formats: On either disk or cartridge, a cylinder is two tracks ... one on each disk surface. Each track consists of 24 sectors, each with a 3-byte identifying field and a fixed length 256-byte data field. The disk drive configurations possible on a System/3 yield the following capacities:

Bytes (in Millions)	Disk Storage Drive Combinations	Available On
2.45	5444 mdl 1	S/3 mdl 6 and mdl 10
4.90	5444 mdl 2	S/3 mdl 6 and mdl 10
7.35	5444 mdl 2 and 3	S/3 mdl 6 and mdl 10
9.80	Two 5444 mdl 2s	S/3 mdl 6 and mdl 10
2.45	5444 mdl A1	S/3 mdl 8 or 10
4.90	5444 mdl A2	S/3 mdl 8, 10 or 15
7.35	5444 mdl A2 and A3	S/3 mdl 8, 10 or 15
9.80	Two 5444 mdl A2s	S/3 mdl 8, 10 or 15

Functional Capabilities: A system with only one 5444 is viable because of the unique arrangement of two disks, one permanent and one removable, within a single housing.

On a 5410 or 5415: On a single drive system, the 5444 is located in a drawer beneath the 5424 Multi-function Card Unit or in the 5422 Disk Enclosure ... on a two disk drive system, the disk drives are located in two drawers beneath the 5424 or in the 5422. When ordering a 5444(s), see "Specify" under 5424 or 5422 for appropriate drawer arrangement.

On a 5406: The 5444's are located in the left pedestal of the operator console and need not be specified.

On a 5408: The 5444s are located to the right side of the system in a housing similar to the 5422 Disk Enclosure.

Access Times: On the 5444 model 1, minimum access time is 39 milliseconds, average is 153 milliseconds, and maximum is 395 milliseconds ... on the 5444 model 2 or 3, minimum access time is 39 milliseconds, average is 269 milliseconds, and maximum is 750 milliseconds ... on the 5444 model A1, minimum access time is 28 milliseconds, average is 86 milliseconds, and maximum is 165 milliseconds ... on the 5444 model A2 or A3, minimum access time is 28 milliseconds, normal average access time is 126 milliseconds, and maximum is 255 milliseconds. For specific average access length times, refer to timing charts. Times vary depending on area of the file over which access takes place and direction of access.

Data Transfer Rate: The disks rotate at 1500 rpm, yielding a data rate of up to 199,000 bytes or 398,000 packed decimal digits per second ... permits efficient sequential and random access processing.

Configurations: A disk oriented System/3 can have the following disk drive configurations:

One Disk Drive System One 5444 model 1 or one model 2 (on a System/3 model 6 or 10); or (on model 8 or 10) one 5444 model A1; or (on model 8, 10 or 15) one 5444 model A2.

Two Disk Drive System One 5444 model 2 and one model 3 or two 5444 model 2s (on a System/3 model 6 or 10); or (on model 8, 10 or 15) one 5444 model A2 and one model A3, or two 5444 model A2s.

Prerequisites: For System/3 model 6 or model 10 any disk oriented system requires a 5410 Processing Unit model A12*, A13, A14, A15, A16, or A17 or a 5406 Processing Unit model B2, B3 or B4 ... a second drive (5444 model 3 or 5444 model 2) requires a Second Disk Attachment (#6378) on the 5410 or 5406 ... a 5444 model 3 or second 5444 model 2 requires the presence of the first 5444 model 2. Any disk oriented system with 5444 models A1, A2 or A3 attached requires a 5410 Processing Unit model A12*, A13, A14, A15, A16 or A17. A first disk drive (5444 model A1 or A2) requires a Higher Performance 1st Disk Attachment (#4501); a second disk drive (5444 model A2 or A3) requires a Second Disk Attachment (#6378), the Higher Performance 2nd Disk Attachment (#4502), and the presence of a 5444 model A2 as the first drive.

For System/3 model 8: The 5444 "A" series (models A1, A2 or A3) can be attached to any 5408 Processing Unit. There are no prerequisites to attach the first disk drive (5444 model A1 or A2) to the 5408. A second disk drive (5444 model A2 or A3) requires a Second Disk Attachment (#6378).



Note: All System/3 model 15 systems with 5415 Processing Units A17 through A20 require the first disk drive (5444 model A2).

All 5444 models use 5440 Disk Cartridges, which are not included with the 5444, but must be ordered separately ... see 5440.

When 5444's are ordered for a 5410 or 5415 Processing Unit, an appropriate location code is required on the 5424 Multi-Function Card Unit or on the 5422 Disk Enclosure ... see "Specify" under 5424 or 5422.

* IBM Programming Systems for a disk oriented System/3 Model 10 require a minimum of 12,288 bytes of core storage. IBM's ability to service a disk oriented System/3 Model 10 with 8,192 bytes of core storage may be impaired with an effect on systems availability.

Bibliography: GC20-8080. **Metering:** Assignable Unit.

Specify

1. Voltage [AC, 1-phase, 60 Hz]: #9902 for 208V, or #9904 for 230V ... must be consistent with system voltage.
2. 5440 Disk Cartridges: Must be ordered separately ... see 5440.
3. Covers: If the 5444 is to be attached to a 5410 or 5415, the appropriate location codes for 5444's must be specified on the 5424 Multi-function Card Unit or on the 5422 ... see "Specify" under 5424 or 5422. For conversion of a 5415A Model CPU to a 5415B, 5415C or 5415D model or for conversion from a 5410 CPU to a 5412 CPU, see Specify under 5424 for deletion of the appropriate 5444 location codes for lower covers.
4. 5406, 5408, 5410, or 5415: The appropriate file capacity code must be specified on the Processing Unit ... see "Specify" under 5406, 5408, 5410 or 5415.



5445 DISK STORAGE

Purpose: Large capacity, high speed direct access storage for a System/3 model 10 or model 15A.

Model 1 20.48 million bytes, one drive ... contains a power supply for a model 1 and a model 2.

Model 2 20.48 million bytes, one drive ... attaches to a model 1

Model 3 40.96 million bytes, two drives ... equivalent to a model 1 and a model 2.

Model Changes: Not recommended for field installation.

Highlights: The 5445 attaches to a System/3 model 10 or 15 via attachment features on the 5410 or 5415 to provide additional capacity general purpose direct access storage.

Capacity: System/3 model 10 and 15—20.48 million bytes with a model 1; 40.96 million bytes with a model 3 or with a model 1 and a model 2.

System/3 model 15 61.44 million bytes with a model 1 and a model 3 or two model 1s and a model 2; 81.92 million bytes with two model 3s, or two model 1s and two model 2s, or one model 1 and one model 2 and one model 3.

The stated capacity assumes a 0 key, 256 byte data physical record format. Key length plus physical data length may never exceed 256 bytes. However, with System/3 programming support, the logical record size can be larger than 256 bytes.

Access Time (milliseconds): Average, 60 ... minimum, 25 ... maximum, 130.

Data Rate: 312,000 bytes/second, or 624,000 packed decimal digits/second.

Disk Pack: removable and interchangeable 2316 Disk Pack. By following System/3 programming conventions on System/360/370, data on a 2316 may be accessed by a System/3 model 10 or model 15 or a System/360/370.

Prerequisites:

For System/3 model 10:

- 1. The appropriate attachment feature(s) ... see configurator below.
2. At least one 5444 Disk Storage Drive must be attached to the 5410 when IBM System/3 Disk System Management Programs are being used.
3. Processing Unit Expansion—A (#5732) is required on the 5410 for #3901.
4. Processing Unit Expansion—B (#5733) and/or Processing Unit Expansion—C (#5734) and/or Processing Unit Expansion—D (#5735) may be required on the 5410 ... see "Processing Unit Expansion Features Configurator" under 5410 to determine requirements.
5. A 5445 model 1 is a prerequisite for a 5445 model 2.
6. Each 5445 must have a 2316 Disk Pack which must be ordered separately.
7. The 5445 model 2 is attached to the 5445 model 1. If a model 2 is ordered for other than attachment to a model 1, an RPQ must be submitted.

For System/3 model 15:

- 1. The appropriate attachment feature(s) and specify feature(s) on the 5415 (not B, C or D model processors) ... see the configurator below.
2. At least one 5444 model A2 must be attached to the 5415 (not on B, C or D model processors) when IBM System/3 Disk System Management Programs are being used.
3. A 5445 model 1 is a prerequisite for a 5445 model 2.
4. Each 5445 must have a 2316 Disk Pack, which must be ordered separately.
5. The 5445 model 2 is attached to the 5445 model 1. If a model 2 is ordered for other than attachment to a model 1, an RPQ must be submitted.

Limitations:

- 1. A maximum of two 5445 drives may be attached to a 5410.
2. A maximum of four 5445 drives may be attached to a 5415A.
3. If a disk oriented System/3 model 10 has a 5445 attached and is not using IBM Programming Systems, certain system configurations could result in I/O channel overruns. Refer to the System Components Reference Manual for detailed information.

ATTACHMENT/SPECIFY CONFIGURATOR

Table with 5 columns: 5445 Mdl attached, Total Drives, Total Capacity million bytes, CPU Attachment Features, CPU Specify Features. Rows for System/3 Model 10 configurations (1, 1+2, 3).

Table with 5 columns: 5445 Mdl attached, Total Drives, Total Capacity million bytes, CPU Attachment Features, CPU Specify Features. Rows for System/3 Model 15 configurations (1, 1+2, 3, 3+1, 1+2+1, 1+2+1+2, 1+2+3, 3+3).

Specify

- 1. Voltage (AC, 1-phase, 60 Hz); #9902 for 208V, or #9904 for 230V.
2. 1442/2560 Compatibility: #9751. Required when either 2560 MFCM or 1442 Card Read Punch and a 5445 Model 1 or 3 are in a System/3 Model 15 configuration ... order for each 5445 Model 1 or 3. Can be field installed.



5447 DISK STORAGE AND CONTROL

Purpose: Disk storage drive units and control for a System/3 Model 4.

Model A1: Single drive ... 4.90 million bytes or 9.80 million packed decimal digits ... accesses 200 cylinders on one removable cartridge and 200 cylinders on one fixed non-removable disk. (one access mechanism)

Model A2: Dual drive ... 9.80 million bytes or 19.60 million packed decimal digits ... accesses 200 cylinders on one removable cartridge and 600 cylinders on three fixed non-removable disks. (two access mechanisms)

Model Changes: Can be made in the field.

Highlights: Removable Disk Cartridges—Each 5447 uses removable 5440 disk cartridges, providing virtually unlimited offline disk storage. 5440's must be ordered separately ... see 5440.

The 5447 unit includes the disk storage facility (including enclosure) and its control. It also includes table top space for the 5213 Printer, the operator keyboard console, and a 3277 Display Station.

Cylinder Concept: The access mechanism, with four vertically aligned heads, gives access to the top and bottom tracks of both disks on a disk drive. However, due to different functional uses, a cylinder is considered as the two opposite tracks on either disk of a disk drive. On any disk, 12,288 bytes or 24,576 packed decimal digits are available at one setting of the mechanism.

Formats: On either disk or cartridge, a cylinder is two tracks ... one on each disk surface. Each track consists of 24 sectors, each with a 3-byte identifying field and a fixed length 256-byte data field.

Access Times—On the 5447 Model A1 or A2, minimum access time is 28 milliseconds, average access time is 126 milliseconds, and maximum is 255 milliseconds. For specific average access length times, refer to timing charts. Times vary depending on area of the file over which access takes place and direction of access.

Data Transfer Rate: The disks rotate at 1500 RPM, yielding a data rate of up to 199,000 bytes or 398,000 packed decimal digits per second ... permits efficient sequential and random access processing.

Prerequisite: A 5404 Model A18 Processing Unit.

Bibliography: GC20-8080.

Specify

1. Voltage (AC, 1-Phase, 60 Hz): #9902 for 208V, or #9904 for 230V ... must be consistent with system voltage.
2. Color: #9041 for red, #9042 for yellow, #9043 for blue, #9045 for gray, or #9046 for white.
3. 3277 Console Display #9760 if 3277 Console Display Station located on 5447 table top (3277-1 required on table top for CCP message display), #9761 if no 3277 Display Station located on table top.
4. 5440 Disk Cartridges: Must be ordered separately ... see 5440.
5. Up-Ending Kit: #9840. This kit is furnished only as necessary and remains the property of IBM.

**5448 DISK STORAGE DRIVE**

Purpose: Disk Storage Drive Unit for a System/3 Model 8 or Model 10.

Models: The 5448 Disk Storage Drive is available in one model, the A1, which provides 9.8 million bytes or 19.6 million packed decimal digits. The 5448 Model A1 accesses the data on two modules, each with 200 cylinders of nonremovable disk.

Highlights: The 5448 can be added to existing System/3 Model 8 systems to effectively double the maximum disk storage available. The 5448 can be added to existing System/3 Model 10 systems to provide an intermediate growth step.

Formats: The 5448 consists of four fixed disks, with eight recording surfaces. The drive is divided into two modules, D1 and D2, each having 200 cylinders and four vertically aligned heads. The 5448, when combined with the 5444 Disk Storage Drive, yields the following capacities on the System/3 Model 8 or Model 10:

Bytes (in millions)	Disk Storage Drive Combinations
14.70	5444 Model 2 or A2, plus 5448 Model A1
17.15	5444 Model 2 and 3, or A2 and A3, plus 5448 Model A1
19.60	Two 5444 Model 2 or A2 plus 5448 Model A1

Location: The 5448 Disk Storage Drive is housed in a separate unit cabled to the 5408 or 5410 Processing Unit.

Access Times: On the 5448 Model A1, minimum access time is 28 milliseconds, average is 126 milliseconds, and maximum is 255 milliseconds.

Data Transfer Rate: The disk rotates at 1500 RPM, yielding a data rate of 199,000 bytes or 398,000 packed decimal digits per second.

Cables: Power and Signal Cables are included with the 5448 Disk Storage Drive. See "Specify" for proper cable group.

Prerequisites: For System/3 Model 8—5444 Disk Storage Drive Model 2, 5448 File Attachment (Feature #4040) and Processing Unit Expansion A (Feature #5732) on the 5408 CPU. Mutually exclusive with the Serial Input/Output Channel (SIOC) (#7081). For System/3 Model 10—5444 Disk Storage Drive Model 2 or A2, 5448 File Attachment (Feature #4040) and Processing Expansion A (Feature #5732) on the 5410 CPU. Mutually exclusive with the 5445 Disk Attachment (#3901) on the 5410.

Note: The attachment of certain other I/O devices may require additional Processing Unit Expansion Features. See "Processing Unit Expansion Features Configurator" to determine possible additional features.

Bibliography: GC20-8080. **Metering:** None.

Specify

1. Voltage (AC, 1 phase, 60Hz): #9902 for 208V, or #9904 for 230V ... must be consistent with system voltage.
2. Cable Group: #9056 for attachment to System/3 Model 8, #9057 for attachment to System/3 Model 10.



5471 PRINTER—KEYBOARD

Purpose: A Selectric type printer-keyboard unit for attachment to System/3 Model 8, 10 or 12.

Highlights: Mounted on the console work table with a forms stand located on the floor behind it. Allows either independent or combined keyboard (input) and/or printer (output) functions. Serves primarily as an inquiry device and secondary printer.

The keyboard and printer operate independently under program control. Functions supported are inquiry, key entry of data, operator/system communication and use as a secondary printer.

The keyboard will accept data whenever the "Proceed" light is on, operating on an interrupt basis. It is typewriter style with 44 character keys, shift, space and carrier return. The top row of keys are used for numerics and special characters. Functional keys (Cancel, Request, End) and indicator lights (Request Pending, Proceed) are located to the right of the keyboard for easy operator use.

The printer operates at a rated speed of 15.5 characters per second. A 15-inch carriage provides a 12-1/2" writing line at 10 characters per inch. A 6 lines/inch pin feed platen (13-1/8" pin-to-pin) is standard. A maximum of an original and five carbon copies can be prepared, depending upon paper, carbon quality and thickness. A Data 1 Font, Mono Case printing element provides the 64 character set standard on System/3 (except for). See Feature #9592 on page TC 22 in "Type Catalog" for character layout and purchase price for additional elements.

Only those device functions which are useful and necessary in a systems environment are furnished. Functions such as tab, backspace, ribbon shift, end of line bell, tab set and clear, etc. are removed for reduced maintenance, increased accessibility and improved performance.

Maximum: Only one 5471 can be attached to a System/3 model 8, 10 or 12. **Prerequisite:** A 5471 Printer-Keyboard Attachment (#4110) on the 5408, 5410 or 5412 Processing Unit.

Limitations:

1. IBM Programming Systems require a disk oriented Model 10 with 12,288 bytes of main storage, or a minimum Model 8 or Model 12.
2. IBM's ability to service a card oriented System/3 equipped with a 5471 may be impaired with an effect on systems availability.
3. A 5471 cannot be attached with a 5475 Data Entry Keyboard.

Bibliography: GC20-8080.



5486 CARD SORTER

Purpose: To arrange 96-column punched cards in numeric or alphabetic sequence.

Model 1 1,000 cards/minute

Model 2 1,500 cards/minute

Model Changes: Can be made in the field.

Highlights: Has six stackers, each with a capacity of approximately 600 cards and an automatic stop. Hopper holds 2,000 cards. Six intermediate storage racks are attached with 1,500-card capacity in each stacker. Compactness affords choice of operator attendance in either a seated or standing position.

Numeric sorting requires a second pass for approximately one-half of the cards for each numeric column sorted. Alphabetic sorting requires one additional pass per column. An edit switch provides for separation of cards containing zone punches or special characters during a numeric sort.

Specify

1. Voltage [115V AC, 1-phase, 60Hz (cps), non-lock plug]: #9881.

Special Features

Alphabetic Sorting (#1225): Reduces the number of card passes for alphabetic sorting to two full passes per card column.

Auxiliary Card Counter (#2370): A 6-position unit counter. Switch controlled ... manually reset.

Sort Suppress/Digit Select (#7245): Sort Suppress—allows separation of unpunched cards into the "Reject" pocket without disturbing the sequence of the remaining cards. Digit Select—allows cards punched with selected digits to be sorted into the appropriate pockets without disturbing the sequence of the balance of the file.

**5496 DATA RECORDER**

Purpose: An operator oriented key entry unit used to create the 96-column card, as well as to verify data which has been previously recorded.

Model 1 Rated card read speed 20 columns per second.

Model 2 Rated card read speed 60 columns per second.
Minus right adjust standard.

When equipped with a 2772/3741/5320 Attachment (#7850), the model 1 can be attached to a 2770 Data Communication System for transmission and punching of 96-column card data or can be attached to a 3741 Data Station/Programmable Work Station as an auxiliary card reader or punch or to any model 5320 as an on-line card I/O device.

When equipped with a 3735 Attachment (#7801), the model 1 can be attached to a 3735 Programmable Buffered Terminal for transmissions, reading, and punching of 96-column card data.

When equipped with System/3 Model 6 Attachment (#7501), the model 1 can be attached to a System/3 Model 6 as an auxiliary card reader or punch.

Highlights: Buffered, key entry, punch and print areas ... 64-character keyboard ... auto skipping ... automatic duplicating at electronic speeds ... four program levels ... right adjust, size of field can be 96 columns ... field erase ... word erase ... record erase ... upper, lower and numeric shift control ... punches and prints at 20 columns per tier per second, equivalent to 60 characters per second ... engraved printing ... reading via photosensors ... backlighted, easy-to-read column indicator ... hopper and stacker capacity is 350 cards ... 410 square inch reading board work area ... rotational keyboard mobility ... auxiliary duplication is a standard operation ... feed check light indicates card misfeed or card jam ... stacker—full light.

Alphabetic, numeric and special character recording in cards can be key verified on the same machine.

Notches verified correct cards on trailing edge of card ... manually skipped columns verified as blanks ... programmed or manually keyed auto verified fields will be verified ... programmed skipped fields will not be verified for content ... right adjust fields are programmable for testing proper number of blanks inserted ... when an error is detected, keyboard locks and error light is lit ... depressing error reset unlocks keyboard ... after third try on column in error, memory is changed to reflect corrected data...at end of corrected field, control reverts to first manual column of corrected field for reverification ... completion of proper verify routine allows blank cards to be manually inserted in hopper and repunch operation provides a corrected card with verify notch. Incorrect card will be stacked without notching. Proper card formatting will enhance throughput when verifying ... see *Operator's Guide* for details.

Specify

1. Voltage [115V AC, 1-phase, 60 Hz (cps), non-lock plug]: #9881.
2. When ordered as a component of a 2770 System, 2772/3741/5320 Attachment (#7850) is required ... see "Special Features."
3. When ordered as a component of a System/3 Model 6 System, System/3 Model 6 Attachment (#7501) is required ... see "Special Features."
4. When ordered for attachment to a 3735 Programmable Buffered Terminal, 3735 Attachment (#7801) is required ... see "Special Features."
5. When ordered for attachment to a 3741 Data Station or Programmable Work Station, 2772/3741 Attachment (#7850) is required ... see "Special Features."
6. Print Wheel Arrangement: Slash zero (0) is the standard numeric character. If a non-slash zero (0) is desired, specify #9490. See Type Catalog TC 1 for field installation charge.

Model Changes: Model 1, with serial number 51221 or above, can be field upgraded to Model 2.

Special Features

8-Bit Read/Punch (#3666) (Model 1 only): Provides off-line capability to punch special 8-bit coded characters in 96-column cards. Dependent on C/D-Bit switch setting, 5496 operates in either conventional System/3 6-bit mode or Special 8-bit mode. C/D-Bit switch ON permits 96-column cards punched with 256-character set to be read into storage for subsequent punchout (duplication) or manual keyboard entry of combined bit structures to generate special 8-bit coded characters. Keyboard generated characters utilize the multi-punch key method. 8-bit characters are not printable regardless of print switch setting. In verify, the 8-bit mode of operation is inhibited regardless of the C/D-Bit switch setting, thereby preventing the verification of 8-bit coded characters. **Limitation:** Cannot be installed on machines equipped with System/3 Model 6 Attachment (#7501), 3735 Attachment (#7801), or 2772/3741/5320 Attachment (#7850). **Field installation:** Not recommended.

Self-Checking Number (#7061, 7062): Provides a means of verifying precoded alphameric information at the same time it is punched. Use of the feature requires that a check digit be added to the basic code number to produce a self-check number. The check digit is always placed in the units position of a self-checking number. More than one self-checking field can be checked per card. Correctly keyed cards are identified by "B" bit punch in the space adjacent to column 32 of tier 1. Self-check fields bypassed via skip key depression will not carry the "B" bit punch in the specified location. One of two versions of the feature can be installed: #7061—Modulus 10 ... factors (X2, X1 applied to alternate positions) are the arithmetic weighing factors used to arrive at the Modulus 10 check digit.

#7062—Modulus 11 ... factors (X7, X6, X5, X4, X3, X2 applied in that order) are the arithmetic weighing factors used to arrive at the Modulus 11 check digit. **Limitations:** Neither version



will operate on a left-based number ... Self-check numbers of Modulus 10 are not compatible with those of Modulus 11.

System/3 Model 6/5230 Attachment (#7501) (Model 1 only): (Available at time of manufacture only) To attach the 5496 to System/3 model 6 as an auxiliary card reader or punch or 5231 Model 1 as an auxiliary punch unit. With the "Data Recorder" switch on the console in the on-line position, the 5496 reads, punches, or prints and punches the cards under system control. Rated speed for reading/punching-printing is 22 cpm. With the "Data Recorder" switch in the off-line position the 5496 operates as a conventional data recorder. **Maximum:** One. **Limitation:** Cannot be installed with 8-Bit Read/punch (#3666). **Prerequisites:** Data Recorder Attachment (#3210 on the 5406 or Secondary Punch Attachment (#3210) on the 5231 control unit. Connecting cable is required.

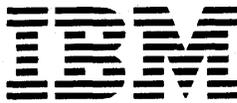
Secondary Punch Attachment (#3210) on the 5231 ... a 25 foot Connecting cable will be supplied with the 5231 as part of the feature. No cable order is required.

3735 Attachment (#7801) (Model 1 only): To attach the 5496 to the 3735 Programmable Buffered Terminal. Operation is under switch control on the 5496. When in "Terminal" position, the 5496 may be used as either a card reader or a card punch for punching of 96-column card data at 20 columns per tier per second, equivalent to 60 characters per second ... when in manual position, the 5496 operates as a standard machine. **Maximum:** One. **Limitation:** Cannot be installed with 8-Bit Read/Punch (#3666). **Specify:** If desired, #9674 for ASCII print wheel and keytops ... otherwise standard print wheel and keytops will be supplied. (Available at time of manufacture only.) **Prerequisite:** 5496 Attachment (#3950) on the 3735. **Note:** Signal cable and connector required to attach a 5496 to a 3735 are included with #3950 on the 3735.

2772/3741/5320 Attachment (#7850) (Model 1 only): Provides the ability to attach the 5496 Data Recorder model 1 to the 2772 Multi-Purpose Control Unit or the 3741 Data Station/Programmable Work Station or to any model 5320. Operation is under switch control on the 5496. When in manual position, the 5496 operates as a standard machine. When in "Terminal" position, the 5496 may be used either as a card reader or as a card punch for punching of 96-column card data. Attached on-line to the 2772, the 5496 reads, punches, or punch/prints card data at 20 columns per tier per second, equivalent to 60 characters per second. Attached on-line to the 3741, the 5496 reads, punches or punch/prints cards under control of the 3741 at the following rated speeds: card reading—21 cards per minute ... punch/print—17 cards per minute. Attached on-line to any model 5320, the 5496 reads, punches or punch/prints cards under control of the 5320 at the rated speed of 21 cards per minute. **Maximum:** One. **Limitation:** Cannot be installed with 8-Bit Read/Punch (#3666). (Available at time of manufacture only.) **Specify:** When ordered as a component of a 2770 system, if desired, specify #9674 for ASCII print wheel and keytops ... otherwise standard print wheel and keytops will be supplied. **Prerequisites:** 5496 Attachment (#3970) on the 2772 or Data Recorder Attachment (#3200) on the 3741 or 5320. **Note:** A signal cable and connector required to attach a 5496 to a 2772 is included in #3970 on the 2772. A 25 foot cable and connector required to attach a 5496 to a 3741 is included in #3200 on the 3741. A 10 foot cable and connector required to attach a 5496 to a 5320 is included in #3200 on the 5320.

Special Feature Combinations: Maximum combinations, indicated by "X" are shown in vertical columns.

	Model	
	1	2
8-Bit Read Punch	#3666 x	
Self Check Number Modulus 10 or 11	#7061/ #7062 x x x x x	
System/3 Model 6 Attachment	#7501 x	
3735 Attachment	#7801 x	
2772/3741/5320 Attachment	#7850	x



Order Entry—General

1. Items identified by a Feature Code:

For shipment with a machine, specify the feature code at the time of machine order entry via transaction OCORDER or after order entry and prior to shipment via OCALTER.

2. Items Not Identified by a Feature Code:

- Non-cable parts and bills-of-materials.

For both on-order and installed machines, order via transaction MSORDER using order category accessories/supplies under the appropriate group code specified by the individual ordering instructions.

If a part or bill number is not shown, enter part number = 0 and provide a complete description (Note: Price must be manually entered also).

- Cable hardware (parts), assemblies and bulk wire.

For both on-order and installed machines, order via transaction MSORDER using order category Bulk Cable. Connectors, etc., should be ordered as cable hardware, assembled cable as cable assemblies and bulk wire as bulk cable. Ensure that the machine type specified in these pages is used when entering the order.

For information on endorser plates for 802/803/1201/1203/1260, see Endorser Plate Specification Sheet, 120-1348. For 1210/1219/1241/1412/1419/1421, see Endorser Plate Specification Sheet, 120-0563. For Plant Installation on 803, 1201, 1203, 1219, 1241, 1260, 1412, or 1419, specify #3792 (or #3793 for Blank Endorser Plate where applicable) at prices listed below. A completed Endorser Plate Specification Sheet for each #3792 must be attached to the DPOW or IAC.

Specify

An Individual completed Endorser Plate Specification Sheet (102-1348 or 120-0563) ... see above, including machine and serial number, must accompany each order for an endorser plate. On mechanical and capacity replacement orders, also attach a sample endorsement.

Transceiver Selectors (67/68): One Telegraph Speed Selector is furnished with the 67 Telegraph Signal Unit. Additional selectors can be purchased.

- Additional Telegraph Speed Selector, each
Part No. 338398 60 words/minute
Part No. 338299 75 words/minute
Part No. 338300 100 words/minute

Table with 6 columns: 2-wire Operation Selector, Part #, Frequency, 4-wire Operation Selector, Part #, Frequency. Rows 21-24.

Pin Feed Platens (7900)

For feeding of continuous forms that have pre-punched feed holes. On any one machine, one pin feed platen may be ordered for plant installation in lieu of the standard solid platen. The platen becomes the property of the customer and cannot be returned for credit.

Pin Feed Platen Assembly (including one platen cylinder). (Plant Installation in lieu of standard solid platen)

Feature # Purchase

- For 12" Carriage #9506
For 16" Carriage #9507

Specify

- 1. One Feature #9506 or #9507 depending on carriage length desired ...
2. Line Spacing and Hole-to-hole Width: One feature # based on carriage length (see "Line Spacing" below) ...
3. Platen Cylinder Hardness: One of the following—#9523 for hard, #9524 for medium, or #9525 for soft. Limitation: The hard cylinder (#9523) is undercut 1/32" and should be specified when form is to be 5 or more parts ... it should never be used with fewer than 5 copies.

An RPQ is required for any of the following: (a) Change in line spacing on an installed machine ... (b) Change from pin feed to solid platen on an installed machine ... (c) Cutting down a platen cylinder (to other than standard length) ... (d) To install a solid platen with Automatic Carriage (#1721, 1722).



Line Spacing: Depending upon carriage length, one of the following Feature #s must be selected in accordance with line spacing and hole-to-hole width of forms which will be used. However, in this case, there is no limitation regarding hole-to-hole width.

Feature # for Line Spacing

Over-all Forms Width	Hole- to-hole Width	Writing Line	4 lines/inch spacing	6 lines/inch spacing
			12" Carriage-7900	12" Carriage-7900
5-3/4"	5-1/4"	4-3/4"	#9381	#9151
6-1/2"	6"	5-1/2"	#9382	#9152
8"	7-1/2"	7"	#9383	#9153
8-1/2"	8"	7-1/2"	#9384	#9154
9-7/8"	9-3/8"	8-7/8"	#9386	#9156
			16" Carriage-7900	16" Carriage-7900
9-7/8"	9-3/8"	8-7/8"	#9386	#9156
10-3/8"	9-7/8"	9-3/8"	#9387	#9157
10-5/8"	10-1/8"	9-5/8"	#9389	#9159
11-3/4"	11-1/4"	10-3/4"	#9390	#9160
13-5/8"	13-1/8"	12-5/8"	#9392	#9162

If shipped prior to June 1, 1963 on a Single-Use Charge Basis, maybe retained by rental customers at any time in the future if they so desire. Where shipped on and after June 1, 1963, the items are to be removed when rental machines are discontinued.



Information Records

80 Column Punched Cards—Standard Specifications

Dimensions: Width of all cards to be 3.250" with a tolerance of plus 0.007" or minus 0.003". The length of all cards to be as indicated below with a tolerance of plus or minus 0.005". (These dimensions apply to cards conditioned at 50% relative humidity and 73 degrees Fahrenheit.)

Dimensions

80 column card	=	7.375"
66 column card	=	6.157"
60 column card	=	5.635"
51 column card	=	4.852"
1/3 size card	=	2.458"
22 column stub card	=	2.329"

Corners may be square or round. Round corners have a 1/4" radius. All angles formed by adjacent sides or, in the case of round cornered cards, by extensions of the adjacent sides, are at right angles. All angles are to be free from creases. A corner may also be cut at 60 degrees angle, 1/4" along the top and approximately 3/8" along the side. Cards, when cut, are to have the grain of the paper running with the length of the card.

Paper Specifications: Coniferous chemical pulp or other pulp which produces paper of like characteristics; paper is to contain not more than 2% ash. Paper is to be free from defects due to residual chemicals, slime, carbon or other electrically conducting spots which would cause incorrect operation; and to be manufactured in a manner that will not necessitate increased servicing of the machines through the accumulation of deleterious matter from cards, will not cause incorrect operation of machines through improper electrical contacts or otherwise, nor interfere with the usual life of the cards. Paper or cards are to be tested electrically for conductive spots, and defective cards eliminated. Paper, when cut into cards, is to be free of curl or wrinkles that will interfere with feeding of cards in data processing machines. Paper stock is to be uniform in thickness, viz, .0070" with a tolerance of plus or minus .0004".

Printing: Impression is to be legible without excess ink, but in no circumstances to indent the card sufficiently to push any part of the surface on either side of the card out of its plane. Printed matter is to be accurately placed so that the columnar figures will appear properly when tested through appropriate gauges.

Special Purpose Cards: Many card scores have machine processing limitations. Usually, those limitations simply restrict machine processing to either before or after separation, and some apply only to corner cuts on a specific corner of the card. A few require engineering changes to the machine or prohibit use of the score on that machine. The use of aperture cards may also present limitations or require an engineering change to the machine.

96 Column Punched Cards Standard Specifications

The 96 column card is approximately one-third the size of the standard 80 column card. It accommodates 96 columns of punching into 3 horizontal tiers of 32 columns each.

The punching arrangement is:

- 32 columns in three horizontal tiers
- 18 rows vertically divided into 3 tiers of 6 rows (bits) each
- 64 character set
- 6-bit card code is utilized (B, A, 8, 4, 2, 1).

The printing arrangement is:

- Four (4) printing lines are provided for at the top of the card
- Each line may be printed with up to 32 characters for a total of 128 characters per card

Dimensions: Length of cards must be 3.250" with a tolerance of plus 0.007" or minus 0.003" and width must be 2.630" with a tolerance of plus 0.006" or minus 0.004". (These dimensions apply to cards conditioned at 50% relative humidity and 73 degrees Fahrenheit).

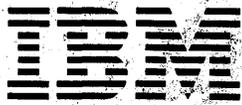
All corners are recommended to be leveled at 45 degree angle, 0.06" along the top and side with a tolerance of plus or minus 0.01". All angles formed by extensions of the adjacent sides must be right angles. Either an upper left or upper right corner may also be cut at a 60 degree angle. 0.200" along the top with a tolerance of plus or minus 0.015" and 0.346" along the side with a tolerance of plus or minus 0.015". Cards, when cut, should have the grain of the paper running with the 2.63" dimension of the card.

Paper Specifications: Paper should be composed of coniferous chemical wood pulp, or of other pulp which produces paper of like characteristics, and should contain not more than 2% ash. Paper must be free from holes, loose dust, abrasive materials, residual chemicals, static charges or translucent spots that may cause incorrect operation or necessitate increased servicing of the machines. Paper or cards should be tested optically and defective cards eliminated. Cards must be free of curl or wrinkles that will interfere with feeding of cards in data processing machines. Paper stock must be uniform in thickness viz, .0070" with a tolerance of plus or minus .0004". The opacity of the paper must be no less than that of current natural tabulating card stock.

Printing: Impression should be legible without excess ink, but in no circumstances should indent the card so as to push any part of the surface on either side of the card out of its plane. Printed matter must be accurately placed so that the columnar figures will appear properly when tested through appropriate gauges.

Badge Specifications

Magnetic badges and punched hole badges used with the 5230 System must meet IBM 5230 Data Collection System Badge Specifications (GA21-9259). This document is available through the IBM publication distribution centers. Badges which do not conform to these specifications may result in unsatisfactory machine performance on the 5230 Data Collection System.



Controlled Access Cards

Controlled Access Cards are used in support of the System/7 Controlled Access System. The IBM Magnetic Stripe Card Reader (RPC) on the System/7 reads and transmits the data encoded on the magnetic stripe of the card.

The person desiring entrance to a controlled area inserts the card into a reader. When the card reaches a positive stop, reading is complete and the person withdraws the card. Within a certain time span, determined by the customer's program, system load, and if the System/7 allows access, the door control mechanism is activated and unlocks the door. It remains released for the period of time determined by the program.

In addition to its primary functions, as a means of gaining entrance, the controlled access card may be used for additional applications.

Size	Description
3-1/4" x 2-3/8" (badge size)	Plastic
3-1/4" x 2-3/8" (badge size)	Polaroid Dual Bond Seal*
3-3/8" x 2-1/8" (Mr. size)	Plastic
3-3/8" x 2-1/8" (Mr. size)	Polaroid Dual Bond Seal*

*Registered trademark of the Polaroid Corporation.

Magnetic Stripe Environment

Effective immediately an improvement is being incorporated in the magnetic stripe of all Controlled Access plastic cards and badges which reduces the incidence of degaussing or magnetic erasures. When highlighting this improvement to customers or prospects, it must be communicated that the possibility of degaussing still exists when plastic cards come in contact with magnetic fields, and that the implementation of proper care and handling procedures is still the most effective means to prevent degaussing problems.

The Polaroid Dual Bond Seal Card must be used in conjunction with the Polaroid ID-2 or ID-3 Land Identification System. The following information should be included in any proposal or price quotation regarding these cards:

The quality of the seal of the Polaroid photo ID card is highly dependent on the use of the proper Polaroid or suitable substitute sealing equipment. (Our experience has been that a substitution in the sealing process or in the recommended equipment may affect the integrity of the seal.)

It is suggested that these cards be used in applications where periodic reissue is anticipated. Customers should also be advised that exposure to heat or humid conditions may affect the sealed badge. Under these conditions, the plastic flap may become separated from the photo insert. To protect the cards from climate conditions, it is suggested that they be placed in badge holders wherever possible.

Features

- Additional stripe (includes encoding of second stripe)
- Hot stamp printing**
 - One additional hot stamp printing
- Hot Stamp numbering (consecutive and horizontal only) and/or clip hole
- Punched card badge (includes up to 10 positions)

Signature panel

Clip with strap (requires clip hole)

Customer Supplied Plastics

IBM prefers to supply all plastics used for controlled access cards and data collection badges.

**Printing is limited to text or line printing and is not adaptable to customer logos. Black and blue provide the best print quality. Green and red are also available. A 1/8" color separation is required. A 3/4" clear is required across the top of the card. The top is defined as the edge closest to and parallel to the magnetic stripe. A 1/4" clear area is also required along the bottom edge. If 2 magnetic stripes are specified, a 3/4" clear area is required along both the bottom and top edges. This clear area requirement applies to both sides of the card.