IBM 3174/3274 Control Unit to Device Product Attachment Information

October 16th, 1986

PREFACE

This document is provided for use in conjunction with other relevant IBM publications, and IBM makes no warranty, express or implied, relative to its completeness or accuracy. The information in this document is current as of the date of its publication, but is subject to change by IBM at any time without notice. This document is not intended to be a manufacturing or engineering specification; the user is assumed to understand the interrelationship among any affected systems, machines, programs and media.

IBM may have patents or pending patent applications covering subject matter described in this document, including appearance design patents or applications. The furnishing of this document does not constitute or imply a grant of any license under any patents, patent applications, trademarks, copyrights or other rights of IBM or of any third party, or any right to refer to IBM in any advertising or other promotional or marketing activities. IBM assumes no responsibility for any infringement of patents or other rights that may result from use of this document or from the manufacture, use, lease or sale of apparatus described herein.

Licenses under IBM's utility patents are available on reasonable and nondiscriminatory terms and conditions. IBM does not grant licenses under its appearance design patents. Inquiries relative to licensing should be directed in writing to the IBM Director of Commercial Relations, International Business Machines Corporation, Armonk, New York, 10504.

RELATED PUBLICATIONS

IBM 3274 Control Unit Description and Programmer's Guide GA23-0061.

IBM 3174 Subsystem Control Unit Functional Description GA23-0218.

IBM 3270 Information Display System Character Set Reference GA27-2837

IBM 3270 Information Display System Data Stream Programmer's Reference GA23-0059

IBM 3274 Supplement for the 3180 Mod 1 GA23-0196

IBM 3270 Installation Manual and Physical Planning Guide (IMPP) GA27-2787

IBM 3174 Subsystem Control Unit Site Planning GA23-0213.

Systems Network Architecture Format and Protocol Reference Manual: Architectural Logic SC30-3112

TABLE OF CONTENTS

1.0 COAX ARCHITECTURE

1.1 GENERAL DESCRIPTION

Data is transmitted from a control unit to a device or device to control unit via a single coax line per device. The coax type is RG62AU with a maximum length of 1.5 kilometers, or approved equivalent as specified in the Installation Manual and Physical Planning Guide (IMPP), GA27 2787-x, and hereinafter refered to as just 'coax.'

Data is transmitted as serial bits using a binary dipulse technique. (See para. 3.0 for coax transmission protocol.) Data to be transmitted over the coax has a bit rate of 2.3587 MHz, in the following format:

Twelve (12) bits are assembled to form one (1) twelve (12) bit word for transmission in either direction over the coax. The first bit of the twelve (12) bit word is used to delimit successive words from the control unit,and is always a "one (1)" bit and will be referred to as the "Sync bit". The last bit of each twelve (12) bit word is the parity bit that will maintain even parity when added to the preceeding eleven (11) bits.

Word groups of twelve (12) bits each may be contiguous. In this case, the sync bit of the next word must directly follow the parity bit of the preceding word with no intervening pad bits. A word from the control unit to the device (display or printer) may be either a command or data word. Each Write type command will cause a Transmission Turnaround / Auto Response (TT/AR) following the last word of each group of contiguous words sent from the control unit, and the device responds with clean status (bits 1 and 12) if the word(s) was (were) received without a Transmit Check.

The contiguous words sent from the control unit may include both data and command words, with the restriction that if a read type command (including Poll) is included it must be the last word in the contiguous group.

A word from a device in response to a Read type command may be either data or a status word. The device must begin response (data, status or TT/AR) within 5.5 microseconds after receiving the ending sequence from the control unit (both read and write type commands.) The 5.5 usec. is measured from the end of the last bit time of the received ending sequence to the beginning of the first bit time of the transmitted starting sequence.

The 12 bit command word from the control unit to a device contains address bits and a command code. The address portion of the command word is three bits in length (Bits 2,3,4) when addressed to the device base unit and four bits in length (Bits 2,3,4,5) when addressed to a feature of the base unit. This provides five bits for command codes (Bits 5,6,7,8 and 9) to the base unit and four bits (Bits 6,7,8, and 9) for command code to a feature. Reserved bits in all commands and responses must be zero.

1.2 WORD FORMATS

1.2.1 COMMAND WORD TO BASE UNIT.

1	234	56789	10	11	12
SYNC	000	XXXXX	*	1	X
BIT	ADDR.	CMND		CMND.	Parity

* 3174: Bit 10 is a parity bit (odd) for the preceding eight bits.
3274: Bit 10 is 0 for commands to even numbered coax ports, and is 1 for commands to odd numbered coax ports.

1.2.2 COMMAND WORD TO FEATURE.

1	2345	6789	10	11	12
SYNC	XXXX	XXXX	X	1	1
BIT	ADDR.	CMND.	*	CMND.	Parity

* Bit 10 is a parity bit (odd) for the preceding eight bits.

1.2.3 DATA WORD TO BASE UNIT OR FEATURE

1	2345	6789	10	11	12
SYNC	XXXX	XXXX	X	0	0
BIT	DATA	WORD	*	Data	Parity

(Bit 2 is most significant)

* Bit 10 is a parity bit (odd) for the preceding eight bits.

Data Words of less than 8 significant bits will be right justified (by the control unit) and the high order bits set to zero.

1.2.4 STATUS WORD TO CONTROLLER

1	2345	6	7	8	9	10	11	12
SYNC	XXXX	X	0	X	X	0	0	X
BIT	ADDR	(		STATUS	BITS			) PARIT

OR:

1	2345	6789	10	11	12
SYNC	KEYBOARD		1	0	X
BIT	SCAN	CODE			PARITY

A status word is always sent (in response to a POLL command) from a device that has power on and has completed its POR sequence. (Prior to receiving POR Response from a device, the control unit holds the device 'deactivated.' The control unit will poll but ignore any response except POR Response.) A response of all zeros except for bits 1 and 12 indicates that there are no error conditions to be reported and no operator activity requiring service. This response will be refered to as "all zero" or "clean" response. If bit 11 is set, bits 2-10 are undefined.

1.2.5 DATA WORD TO CONTROLLER

1	2345	6789	10	11	12
SYNC	XXXX	XXXX	P	0	P
BIT	DATA	WORD	*		Parity

(Bit 2 is most significant)

*Bit 10 = Parity bit (odd) for the eight bit (2 thru 9) data word for Read Data and Read Mult. commands to the Base address, and any Read command (with bit 8 set to 1) sent to a feature.

Data Words of less than 8 significant bits will be right justified (by the device) and the high order bits set to zero.

1.3 ADDRESS BIT ASSIGNMENTS

1.3.1 ADDRESS BITS (2,3,4,5) FOR A COMMAND TO A DEVICE

2345		
000X	0,1	BASE OR KEYBOARD
0010	2	SELECTOR PEN
0011	3	Reserved
0100	4	MAG. SLOT READER OR WAND
0101	5	PC ADAPTER*
0110	6	3180 ADVANCED FUNCTION
0111	7	EXTENDED CHARACTER SET (ECS)
1000	8	Reserved
1001	9	Reserved
1010	A	Reserved
1011	B	CONVERGENCE FEATURE
1100	C	Reserved
1101	D	Reserved
1110	E	Reserved
1111	F	Reserved

*Not supported by 3174 or 3276 control units.

1.3.2 ADDRESS BITS (2,3,4,5) OF STATUS WORD FROM DEVICE

0000 BASE UNIT

All other features have the same address bits in a status word response as shown for command words to a device.

1.4 COMMANDS

1.4.1 DEVICE BASE ADDRESS COMMANDS

1.4.1.1 READ COMMANDS (XXXX1)

Bits 56789
XXX11: Response Parity Checked
XXX01: " Not " "

56789	
00001	POLL
00011	READ DATA
00101	READ ADDRESS COUNTER HIGH
10101	READ ADDRESS COUNTER LOW
01001	READ TERMINAL I.D.
10001	POLL/ACK
10011	Reserved
01101	READ STATUS (Security key and other switches)
11001	Reserved
01011	READ MULTIPLE
10111	Reserved
01111	Reserved
00111	READ EXTENDED TERMINAL ID
11011	Reserved
11101	"
11111	"

Note: In response to the Reserved read commands the device will return an all zero data word with bad parity (bits 2 thru 10 all zero) irregardless of bit 8 in the read command.

1.4.2 READ COMMAND FUNCTIONS (TO BASE)

1.4.2.1 00001-POLL AND 10001-POLL/ACK

The poll command (Hex 1) does not use the address portion of the command word for address. Bits in address portion are assigned as follows:

Bits 2 and 3 are encoded as follows:

For Display:	For Printer:
11= Enable keyboard clicker	11= Enable Operation*
01= Disable keyboard clicker	01= Disable Operation*
10= Sound alarm	10= Sound alarm**
00= None of the above	00= None of the above

* A "Special Poll" to the printer to control the half-duplex operation of the Line Adapter. "Disable Operation" will cause the printer to stop accessing his buffer as soon as possible (10 msec max), then return "Op. Complete" or other available status, and wait for subsequent control unit commands. The Printer will 'No-Op' the disable poll if the printer is already disabled. "Enable Operation" will revert the printer to internal operation. The printer will continue the operation in process prior to the "disable." Enable Operation must be sent upon completion of Control unit command sequences to allow new status to be presented to the control unit. The maximum disable time will not normally exceed 60 seconds. The printer must not load (or add) any poll status (except POR response) after becoming disabled. The device must be capable of accepting successive enable or disable polls. The control unit must not send 'enable' (or Start Op Command) while waiting for response to a previous 'disable'. If 'disable' state occurs prior to completion (or termination) of an order, the control unit is not allowed to alter the control unit output area or load a new order, except 'Abort'. If Abort order is loaded, Start Op, not Enable, must be sent

Note: The Printer is also enabled by 'Start Op' and 'Reset' commands (1.4.4) and disabled within 100 usecs of setting status bit 6,or 9 (Poll Response) or POR response (1.4.2.2).

Note also: Prior to disabling, the printer will set the printer Address Counter to '0000'.

Note Furthermore: If (when) the control unit disables while a 'Start Op' Cmd. is in process,

1. The control unit is not allowed to alter the PCIA or the portion of the Printer buffer that the current Start Op Cmd references (specified by MSA and ML), and

2. The Printer is allowed to continue accessing (reading and writing) the portion of the buffer that the current Start Op Cmd references provided he is able to do so without affecting the control unit's buffer operations. The Printer is allowed read access to the PCIA, but not write access as the control unit may be reading the PCIA during the Disable. The Printer will continue to adhere to the restriction (prohibition) concerning the loading of poll status while disabled.

To allow for control unit error recovery, the printer must appear enabled to the control unit immediately (within 20 usec) upon receiving the 'Enable' Special Poll. Exception: The Printer must no-op the 'Enable' function if the Poll Response register is non-zero. If the printer is already enabled, and the poll response reg is zero, the Enable function must be ignored by the printer.

** The Sound Alarm Poll will not alter the Enable/Disable state.

Bit 4= Reserved

Bit 5= ACKnowledge last input message to control unit.

1	2	3	4	5	6	7	8	9	10	11	12
SYNC	X	X	0	X	0	0	0	1	0	1	P
BIT	(see above)				(Poll cmnd)						

The response word to a poll is a one word status response. The Poll Response is returned for any combination of bits 2, 3, and 4 in the Poll Command. Since the poll is not addressed to the base unit or any feature, a priority for response is established by having the base unit respond with its status. If a non-zero status word is sent to the control unit, the device will anticipate receiving a Poll/Ack to acknowledge the acceptance of the first status word and cause the device to respond with "clean" status and reset the previously returned status bits. Upon receipt of the clean status response the control unit may issue another Poll, without the Ack bit, and the device will respond with the second status word. If the second poll does not have the ACK bit on, the device will respond with the first status word again even though higher priority status may have become available. Repetitive polling and poll acking of the device may continue until an all zero status response to a poll is received at the control unit or the Control unit reaches an error threshold. To prevent possible overruns at the control unit, a device should not return scan codes or other non-zero poll responses at an average rate greater than ten per second. Reset and Read Terminal ID Commands sent to a device after it has returned non-zero status but before the status was Ack'd will cause certain status bits to be reset. Refer to Reset and Read Terminal ID Cmds.

Note: 'Op complete' status and 'Feature Error' status can also be retreived by the 'Read Status' command. Op Complete status or Feature Error status will be reset by the 'Read Terminal ID' command, as well as the Poll, Poll/Ack sequence described above.

Note Also: The Control unit must issue the Poll/Ack Cmd. with bits 2,3 and 4 set to zero.

The Poll command is received and decoded in the base logic. The priority of Poll response in the 3278 and 3279 displays is:

0 Feature Error (Bit 11)
1 POR complete Special status code.
2 Base Status (Bits 6,8,9) *
3 Keyboard (including keyboard overrun) Scan Code
4 Any other Feature Status

* Multiple bits of base status may be returned in a poll response.

Other devices, including those that emulate 3278/3279 Displays, are permitted to establish alternate Poll response priorities. If a Base Status Bit is returned and not Ack'd, the same bit will be returned in the next Poll response. Other Base status bits will not be returned until the control unit Ack's the original returned status.

Exception: The Display will add bit 9 to previously returned base status bits if an Op Complete condition occurs and a poll is received prior to receipt of a Poll/Ack.

Exception: The Printer is allowed to add Base Status bits to previously returned Base Status.

If there is no base or feature status to send, an all zero poll response is sent from the base unit indicating that service is not required at the device.

Note:
While the Base Display is 'Busy', the display will suppress all Status. See 'Clear' Command. Upon completion of the Busy operation, bit 9 will be set in Base Status.

1.4.2.2 RESPONSE TO POLL (STATUS WORDS)

BASE Status

The status response word from the base unit is:

1	2345	6	7	8	9	10	11	12
SYNC BIT	0000 ADDR	STATUS TRANS	SPARE 0	DEVICE CHK	OP CPLT	KYBD IND	FEAT. ERROR	PARITY BIT

Bit 1 = Sync Bit
Bits 2, 3, 4, 5 = Base address
Bit 6 = For Displays: Status transistion has occurred. Refer to Read Status command.

For Printers: Status Available.
This bit is set by the printer when new status is loaded or when status bit 4 is cleared in the printer status register. Before setting this bit the printer will set the Address Counter to '0000'. After setting this bit the printer will go 'disabled.' The Control unit is responsible for reading 'status' (address '0000') prior to sending 'enable.' This bit is also set (and the above sequence occurs) periodically to test the communication link.

Bit 7 = Reserved

Bit 8 = 1 Parity error has been detected in storage.
When Ack'd, display will not respond with another Device Check until after the next Write Data, Clear, or Reset command; printer until after the next Command from Control unit.

For printers: Bit 8 set signifies that a parity error occurred during a search or clear command. Bit 9 will also be set.

Bit 9 = Operation Complete.
A. A search has been completed.
B. A clear command has been completed.
C. An Insert Byte command has been completed. (Display Only)
D. A 'Disable' Poll has been completed. (Printer Only)

Bit 10 = 1 Redefines bits 2 thru 9 as being a keyboard code or additional base status. Keyboard Scan Codes will be entered with Bit 2 the make/break bit, and Bit 3 the high order bit of the 7 bit scan code. See section 4.4 for specific code points. Non make/break keys will enter scan codes with bit 2=0.

Special status codes are:

2345 6789	
X000 0000	DISPLAY: Keyboard overrun.
X000 0001	Reserved
0000 0010	Device has powered on since last Poll. This code is sent only in response to a Poll received after a power on (or Reset Cmd.) sequence is complete. Also, for Printers: Following internal test operations during which control unit communication was suspended for a minimum of five seconds.
X000 0100	Reserved
X111 1111	Reserved for control unit ucode
1000 0010	Reserved

Bit 11 = Feature Error Bit.
This bit will be returned when a feature error is set. This bit will be reset by Poll/ACK or Read Terminal ID. When bit 11=1, bits 2-10 may contain meaningless data that should ignored by the control unit. Refer to 'Commands Applicab to Features' for additional description of the Feature Error Bit.

While set, the features are blocked. ACK will only reset the Feature Error Bit (other base status pending will not be reset). Bit 11 is not set by printers.

Bit 12 = Parity Bit - maintains even parity of the preceeding eleven (11) bits.

1.4.2.3 FEATURE POLL RESPONSE

Individual Status Bits will be returned until Ack'd by a subsequent Poll. Following receipt of the Ack, the feature will not return tha same status bit until positive action (Read, Reset, Clear, etc.) has been taken to service the status. (Printers will not generate any Feature Poll Response)

1.4.2.3.1 SELECTOR PEN Status

```
1     2345 6789 10   11   12
1     0010 X000  0    0   P
```

Bit 6 = Request Read
Bit 7 = Reserved
Bit 8 = Reserved
Bit 9 = Reserved

1.4.2.3.2 MAGNETIC SLOT READER Status

```
1     2345 6789 10   11   12
1     0100 X000  0    0    P
```

Bit 6 = Request Read
Bit 7 = Reserved
Bit 8 = Reserved
Bit 9 = Reserved

1.4.2.3.3 3180 Adv. Funct. Adapter Status

```
1     2345 6789 10   11   12
1     0110 000X  0    0    P
```

Bit 6 = Reserved
Bit 7 = Reserved
Bit 8 = Reserved
Bit 9 = Operation Complete

1.4.2.3.4 EXTENDED CHARACTER SET (ECS) Status (Display only)

```
1     2345 6789 10   11   12
1     0111 00XX  0    0    P
```

Bit 6 = Reserved
Bit 7 = Reserved
Bit 8 = Device Check (EAB parity error)
Bit 9 = Op Complete

Note: Printers will report parity error of EAB by bit 8 in 'base' Poll Response or bit 1 of the PCIA status byte

1.4.2.3.5 CONVERGENCE FEATURE

This feature does not request Poll service or generate a Poll Response.

1.4.3 OTHER READ COMMANDS (TO DEVICE BASE)

Each of these commands will cause the device to return one or more Data Words. The ending sequence will follow the 12th (P) bit of the last Response word.

1.4.3.1 00011 READ DATA

The read data command will cause the addressed device to respond with one data word from storage at the current I/O address counter value. The address counter steps up (increments) once at the completion of the command.

1.4.3.2 01011 READ MULTIPLE

This command will cause the device to respond with one or more data words from storage beginning at the current I/O address counter value. The read will terminate (with ending sequence) when the two low order bits of the I/O address counter step to 00. A maximum of four bytes will be returned.

This command will be no-op'd by the printer.

Note: This command will not be issued by the 3276 Control Unit.

Note also: The operation of this command may be affected by a preceeding 'Load Secondary Control Register' Command.

1.4.3.3 10101 READ I/O ADDRESS COUNTER LOW

This command will cause the device to respond with one data word. Bits 2 thru 9 of the data word contain the present value of the 8 low order bits of the address counter.

1.4.3.4 00101 READ I/O ADDRESS COUNTER HIGH

This command will cause the device to respond with one data word. Bits 2 thru 9 of the data word contain the present value of the high order bits of the address counter (right justified).

1.4.3.5 01001 READ TERMINAL I.D.

This command causes the device to respond with one data word.

Note: This command will reset Op Complete and Feature Error status (bits 9 and 11 in Poll Response.)

The format of the response data word is as follows:

DISPLAY

1	2	3	4	5	6	7	8	9	10	11	12
Sync Bit	Keyboard I.D.				Model			0	0	0	P

PRINTER

1	2	3	4	5	6	7	8	9	10	11	12
Sync bit	0	0	0	0	0	0	0	1	0	0	P
(	Printer							)			

Display (bit 9=0, bits 6,7,8 ≠ 0)

Bits 2345	
0000	Reserved
0001	APL, with numeric lock
0010	Text, " "
0011	Reserved
0100	"
0101	APL
0110	Text
0111	Reserved
1000	Data entry 2, numeric lock
1001	Data entry 1, " "
1010	Typewriter, " "
1011	Reserved
1100	Data entry 2, w/o numeric lock
1101	Data entry 1, " " "
1110	Typewriter, " " "
1111	No keyboard

Additional Terminal ID definition for Displays attached to a 3274 Control Unit using configuration support C or D, or to a 3174 Control Unit:

Newer keyboard ID table

Bits 2345	
0000	Reserved
0001	APL, numeric lock
0010	Text, " "
0011	Reserved, " "
0100	typewriter, PSHICO, or Overlay, PSHICO
0101	APL
0110	Text
0111	APL, PSHICO
1000	Data entry 2, numeric lock
1001	Data entry 1, " "
1010	Typewriter, " "
1011	Reserved
1100	Data entry 2
1101	Data entry 1
1110	Typewriter
1111	No keyboard

Note: Num lock for PSHICO keyboards handled by control unit customizatio

Model:

Bits 6,7,8		Chars.	Model No.
000-	Reserved		
001-	NDS Screen size	960	1
010-	" " "	1920	2
011-	" " "	2560	3
111-	" " "	3440	4
101-	" " "	Reserved	
110-	" " "	3564	5
100-	Reserved		

For devices that do not support Feature Address 6:

	W/O Convergence				W Convergence	
Bits 6,7,8 =	010	011	111	110	010	011
no. characters horz.	80	80	80	132	80	80
no. characters vert.	24	32	43	27	24	32
PEL space horz. ($x10^{-3}$)in.	14.6	14.6	14.6	11.4	13.5	13.5
PEL space vert. ($x10^{-3}$)in.	15	15	15	15	18	18
PELs/char horz.	9	9	9	9	9	9
PELs/char vert.	16	16	12	12	12	12

Note: Displays with EAB feature installed will support both Field and Character highlighting. Also, Displays with either Convergence feature or Colour (bit 9=1 in EAB Terminal ID) will support Field and Character Colour.

Printer

(bits 2 thru 8 = 0, bit 9=1)

Detailed Terminal ID of a printer will be obtained by reading the PCIA. Refer to Printer Control, Chapter 2.0.

1.4.3.6 00111 READ EXTENDED TERMINAL ID

The 3274 control unit, configuration support D or higher, and the 3174 Control Unit, will issue this command to all "dumb" devices, i.e. those that respond to Read Terminal ID with other than '0000 000 1'. Devices that support this command will return 4 bytes, as defined below, obeying the same rules as Read Multiple. READ EXTENDED TERMINAL ID command does not reset Op Complete and Feature Error status, though READ TERMINAL ID command does reset them.

The control unit promises to:

1. set the device address counter to 'XXX----XX00' prior to issuing this command.

2. not issue this command to devices that respond '0000 000 1' to Read Terminal ID.

3. not get upset if the device responds TT/AR to this command, unless the device responded '10000XXX000P' to Read Terminal ID.

4. not issue this command while the device is in 'Read Big' mode. See 'Load Secondary Control Register' Command.

The device:

1. must support this command with a 4 byte response if it responded '10000XXX000P' to Read Terminal ID.

2. is allowed to answer this command with TT/AR if it has provided keyboard ID in bits 2-5 of Read Terminal ID response.

3. is allowed to advance its address counter while generating the 4 byte response.

4. is allowed to return 32 bytes if 'Read Big' is set.

The four byte response is defined as follows:

Byte one: Keyboard Information

Bit 0=0: 3278 mode. Scancodes returned to the control unit are exact equivalents of the 3278 keyboard scancodes (see table 5.3.1.) Keyboard ID is in bits 2-5 of Read Terminal ID response. (Remainder of Byte one is undefined, need not be zeros.)

Bit 0=1: Native mode. Scancodes returned to the control unit are those defined for the 'Modifiable Keyboard'. Refer to Byte four. Remainder of Byte one defined as:

Bit 1=1: Numeric Lock

Bit 2=1: 'RYO' (Roll Your Own) in effect. Keyboard key functions have been relocated (redefined) via the 'Keyboard Definition Utility' (see User's Guide GA23-0187.)

Bits 3-7: Modifiable Keyboard ID

Bits 3-7:	Bit2=0 (no RYO)		Bit 2=1 (RYO on
	Byte 4, bit 7=0:	bit 7=1:	0 or 1:
00000	Reserved	Reserved	Reserved
00001	Typewriter	Typewriter	Roll A
00010	Data Entry	Reserved	Roll B
00011	APL	Reserved	Roll C
00100	Reserved	Reserved	Roll D
00101 thru 11111	Reserved	Reserved	Reserved

Bytes two and three: Device Type

Devices will return their four digit type number (packed decima

Device	Byte two	Byte three
3179	0000 0000	0000 0000
3180	0011 0001	1000 0000
3191	0011 0001	1001 0001

Byte four: Additional ID:

Bit 0=0: IBM Device
Bit 0=1: non-IBM Device

Bits 1-6: Reserved (Must be zero.)

Bit 7: Keyboard Type

=0 Typewriter Keyboard (122/124)
=1 IBM Enhanced Keyboard (102/103/104)

1.4.3.7 01101 READ STATUS

This command will cause the Device to respond with one data word as follows:
Bit

2=0 - Mono Case switch turned off
2=1 - " " " " on

3 Reserved

4=1 Not Busy* (Refer to Clear Command)

5=0 - Security key turned off
5=1 - " " " on

6 Reserved

7=1 Feature Error Bit ***

8=1 Op Complete**

9=0 - Security key turned on (display on)
9=1 - " " " off (display blanked)

5&9=0,0 - Security key not installed.
5&9=1,1 - Invalid code.

*Other bits are valid only when bit 4=1.
For Printers: Bit 4=0 when Busy or Enabled.

**Set when Op. Complete set in base status. Reset when ACK received to Op Complete poll status (Poll/Ack sequence) or Read Terminal ID Command received. For Printers: Op Complete Poll Status, set as a result of a disable Poll command, may or may not be returned as Read Status Op Complete.

*** Set when Feature Error Bit is set in base status. Reset when ACK received to Feature Error poll status (Poll/ACK sequence) or Read Terminal ID command received.

Transitions of bits 2,3, or 5 and 9 will cause the display to return bit 6 in Poll Response.

To Printer: Only bits 4 and 8 are implemented.

1.4.4 WRITE COMMANDS (TO DEVICE BASE)

1.4.4.1 WRITE COMMANDS (XXXX0)

56789

00000	Reserved
00010	RESET
00110	CLEAR
01100	WRITE DATA
01010	LOAD CONTROL REGISTER
00100	LOAD ADDRESS COUNTER HIGH
10100	LOAD ADDRESS COUNTER LOW
01000	START OPERATION
11010	LOAD SECONDARY CONTROL REGISTER
11100	Reserved
01110	INSERT BYTE
11000	Reserved
10000	SEARCH FORWARD
10010	SEARCH BACKWARD
10110	LOAD MASK
11110	Reserved

Note: The Reserved write commands will reset the previous command (unless busy.) If no other command or data word directly follows the reserved command, TT/AR takes place.

Note: Many of the Write Commands are defined as being followed by one (or more) bytes of data. The device will execute the command following receipt of the data byte. If a second command is received instead of the data byte for the first command, the first command is lost and the second command sequence started. This operation applies to Base and Feature commands. Write type commands will remain active until reset by the next command (including Poll) except while "busy." Refer to Clear command. Data sent while no command stored will be lost. TT/AR will occur, except in response to data sent to a busy display.

Note also: The Control unit owns the Regen Buffer and the Extended Attribute buffer. Any device that updates these buffers through independent action or depends on any sequence of the Control unit updating the Regen buffer or Extended Attribute buffer may get unpredictable results. Independent Action is defined as the altering of data in the device buffer by a device action that has not been initiated by commands or data sent to the device by the control unit.

1.4.4.2 00010 RESET

A 3X74 will send a byte of data following RESET.
A 3276 will send RESET alone.

For Displays:
The RESET command (whether followed by data or not) will cause a partial POR sequence in the display. Base and feature storage will not be cleared. The Mask Register will not be altered. The I/O Address Counter will be set to Hex '50' (Hex '40' in Mod 1.), which corresponds to the first character location on the screen. The device will execute the TT/AR sequence. POR Response will be returned to a subsequent Poll.

For Printers:
In a printer the RESET command will terminate any operation in process and cause the printer to respond to a Poll with the POR complete status code. The printer will then be able to accept and execute any valid command (i.e. the printer will be disabled.) The message buffer will not be cleared, and the control unit output area will be cleared. The Address

Counter will be set to '0000', and the Mask and Control Register will be reset. The following portion of the Printer Output Area will be initialized:

Byte 0: All bits except 4 & 7 must be zero.
Byte 1: All bits valid.
Bytes 2 thru 9: All zero.
Bytes A thru F: Terminal ID bytes initialized.

To allow for control unit error recovery, the printer must appear enabled to the control unit immediately (within 20 usec) upon receiving the Reset Command.

Note: Following Control unit initialization of the printer (Read Term. ID, Load Address Counter, Read Data, etc.), the Control unit must send 'Enable' Poll before sending a Start Op command to allow the printer to complete its initialization. Also, the Control unit will write a 4 character test message, as shown in the table below, beginning at address X'004A', prior to sending the first enable poll. This sequence is required after all POR responses.

Printer Test Message:

Control Unit:	PCIA Address: X'4A'	X'4B'	X'4C'	X'4D'
3276	X'AA	32	76	AA'
3274, pre-config. support C	X'AA	32	74	AA'
3274, config C or later, non-SNA	X'AA	32	74	AA'
3274, config C or later, SNA	X'AA	32	74	CC'
3174, non-SNA	port#	X'31	74	AA'
3174, SNA	port#	X'31	74	CC'

Note also: POR Complete will not be returned if the reset (either Command, Power On, or operator initiated) 'failed', that is, if the printer has Equipment Check set in Status.

The device must be capable of accepting two or more successive Reset commands (without intervening Poll-commands.) and respond with a single POR Response to a subsequent Poll. Prior to returning POR Response the device is allowed to terminate communication with the control unit.

1.4.4.3 10110 LOAD MASK

This command will cause the device to load the following data byte into the "Mask" register. The mask will be used in conjunction with subsequent Search and Clear commands. "1" bits in the mask will specify the bits in the buffer to be compared with the pattern byte. A mask of all "0" bits will prohibit a pattern test from being satisfied and cause the clear command to terminate at address 0* and a search forward command to terminate at address 0 (or the first address encountered with bad parity.)

*For printers: Lo order Address Counter bits equivalent to installed buffer will be zero.

For Displays.
The Mask byte must be reloaded following an Insert Byte command. For 3178 display, the control unit must set the Mask register to X'FF' prior to issuing an Insert command.

For Printers.
The Mask byte must be reloaded following a Start Print Order.

1.4.4.4 00110 CLEAR

The CLEAR command clears all or part of the printer storage or regen. buffer in the addressed device to nulls. A byte of data, called the pattern byte, is transmitted following the Clear command. The device uses the pattern, in conjunction with the previously loaded mask, to terminate the clear function. The address counter is used to indicate the point at which the Clear function starts. All locations including the starting address up to but not including the location containing the byte that satisfies the pattern and mask are tested and cleared. Upon completion the address counter will be pointing to the satisfying location. The command will terminate at address 0 (without clearing address zero) if no match occurs (For printers: Lo order Address Counter bits equivalent to installed buffer will be zero.) Corresponding locations of the extension attribute buffer will also be cleared to nulls (under control of the extension attribute buffer mask) when that feature is present.

This command may also be used to clear the storage area containing the indicator character codes or printer register space. Exception: The 3178 display does not support this command within the operator indicator area--address X'0000' to X'04F.' The Clear operation will not terminate prematurely if a buffer parity error is detected. Device Check will be set (if not inhibited due to a previous parity error) if a parity error is detected. Upon completion of the command the Operation Complete bit (bit 9) will be set in the poll response status word. Prior to setting Op. Complete the device will be "busy". Poll response while busy will be the Auto Response ("clean response"). Commands other than Poll and Reset sent to a device while the base is busy will be no-op'd. TT/AR will occur, except following data, chained or unchained, sent after a write type command to a display. While Busy, Reset command may be honored or no-op'd at the descretion of the device. While "busy" the Display will inhibit display of the cursor. Display of the cursor will be inhibited until the next Set Address Counter Low Command is received. While the cursor display is thus inhibited, commands to the features may be blocked by base hardware. "Busy" also applies to Search and Insert commands.

To prevent control unit timeout, the "busy" state of the device must not exceed 32 msec. (28 msec. when connected to some 3276 control units.) Printers with 4K base and 4K EAB will meet the 32 msec busy limitation only if no Load Mask (EAB) Command preceeded (since the last POR Response) the Clear Command. If a Load Mask (EAB) Command preceeded the Clear, 'busy' state may approach 64 msec.

To allow for control unit error recovery, the device must appear "busy" to the control unit immediately (within 20 usec) upon receiving the Clear Pattern Byte, unless the operation is completed and OP complete is posted in the poll status.

1.4.4.5 01100 WRITE DATA

The WRITE DATA command will cause the device to accept all following data words for storage, until another command is received. The data will be loaded at the location indicated by the address counter. The address counter will step up once for each data word received and stored. Codes for specific characters and attributes are defined in Device Buffer Code chapter. The control unit prevents address overflow while writing the device buffer.

1.4.4.6 01010 LOAD CONTROL REGISTER

This command will cause the device to load the following Data Word into the Device Control Register (double line transfer). The Control Register will be set to all zeros by POR and the Reset command, but otherwise not altered by the device. The Control Register bits are defined as follows:

Bits 234

000= 80 Characters/line
001= 40 " " (mod 1 only)
100=102 " " (mod 5 only)
110=132 " " (mod 5 only)
01X= Invalid
1X1= Invalid

5=1 Inhibit Feature Step of I/O Address Counter

When this bit is set the device will prevent the address counter from stepping during read and write commands to the features. This allows the control unit to read and write the extension attribute buffer at the cursor location without affecting the address counter and the cursor position on the screen. Printers that support the Extension Attribute Buffer (EAB) will implement this command and support bit 5 only.

6=1 Inhibit Display

When this bit is set the display screen, except for the cursor and indicator row, will be blanked.

7=1 Inhibit Cursor Display

When this bit is set, the cursor will not be displayed.

8=1 Reverse Image Cursor

This bit will cause the cursor to be displayed as a reversed image of the associated character box.

9=1 Blink Cursor

This bit will cause the cursor to blink.

(8&9=0 = Normal Cursor)

The printer will only implement bit 5 of this command.

1.4.4.7 10100 LOAD ADDRESS COUNTER LOW

This command, followed by one data word, will load the 8 bits of the data word into the 8 low order bits of the address counter. This command will enable cursor display (at the screen location associated with the value in the address counter) if the cursor had previously been blanked due to a "busy" condition.

1.4.4.8 00100 LOAD ADDRESS COUNTER HIGH

This command, when followed by one data word, will load the data word into the high order bits of the address counter.

1.4.4.9 11010 LOAD SECONDARY CONTROL REGISTER

This command will cause the device to load the following Data Word into the Secondary Control Register (double line transfer.) The Secondary Control Register will be set to all zeros by POR and the Reset command, but otherwise not altered by the device. The Secondary Control Register bits are defined as follows:

Bits 2 thru 8 = Reserved

Bit 9 = 0 Terminate Read Multiple when the two low order bits of the I/O address counter step to 00.

Bit 9 = 1 Read Big Mode: Terminate Read Multiple when the five low order bits of the I/O address counter step to 00000.

This command will be treated as 'Reserved' by printers and 'old iron' displays. The 3274 and 3276 control units promise not to send this command.

1.4.4.10 01000 START OPERATION

When this command is sent to a printer, the printer will go enabled. Upon completion (or termination) of the operation (as specified in the 8 bit order reg) the printer will return Status Available in Poll Response. Order Complete Status will be set. To prevent control unit timeout, the device must complete the operation, except for Print Order, within 500 milleseconds (excluding the duration of any intervening disable time) While the printer is enabled he must treat as invalid any command other than Poll and Reset. The printer will switch to the "disabled" state when Status Available is set.

To allow for control unit error recovery, the printer must appear enabled to the control unit immediately (within 20 usec) upon receiving the Start Op Command. Upon receiving the Start Op Command, the printer must test the Poll Response Register (bits 6,8,9,&10) for zero. If zero, the order will be executed; if non-zero, the printer must ignore the Start Operation command and remain disabled. TT/AR will occur.

This command will be no-op'd (treated as Reserved) by the Display.

1.4.4.11 01110 INSERT BYTE

This command will cause the display to accept the following data word and place it in the buffer storage at the location indicated by the current value of the address counter. The original contents of the storage location is shifted one location ahead. This sequence is continued for each successive location until a null character or attribute is found, or the I/O address counter steps to zero (in which case the character that formerly resided in the last addressable location of storage will be lost.) (For 3178 Display, this command will terminate at address X'7D0' if no null or attribute is found.) The extension attribute buffer is also shifted with the contents of the EAB mask register being inserted at the initial current address. Only one data word may follow this command. During the time that shifting takes place the display will be busy. Refer to Clear command. Op Complete is set when this command is completed. At this time the address counter is pointing to the last character moved unless the command terminated at an attribute, in which case the address

counter will be pointing to the attribute and the character which was located ahead of the attribute will be permanently lost. The insert operation will not terminate prematurely if a buffer parity error is detected. Upon completion of this command the Mask register (and pattern register) must be reloaded by the control unit prior to the next search or clear command.

This command will be no-op'd by the printer.

The control unit must set the address counter to within the displayable buffer prior to issueing Clear, Search, or Insert commands.

1.4.4.12 10000 SEARCH FORWARD

This command, when followed by a "pattern" data byte, will cause the device to search each buffer storage location starting at the current value of the address counter until a byte that satisfies the mask and pattern is found. The address counter will contain the value of the address in storage of the first satisfying byte found. If no satisfying bytes are found the search command will terminate at address 0. (For 3178 Display, this command will terminate at address X'7D0' if no satisfying bytes are found.) (For printers: Lo order Address Counter bits equivalent to installed buffer will be zero.) To allow for control unit error recovery, the device must appear "busy" to the control unit immediately (within 20 usec) upon receiving the Pattern Byte, unless the operation is completed and OP complete is posted in the poll status.

1.4.4.13 10010 SEARCH BACKWARD

This command operates in a similar manner as the above SEARCH command. If no satisfying bytes are found the search will terminate one location past address zero (all address bits implemented set to 1.) (For 3178 Display, this command will terminate at address X'04F' if no satisfying bytes are found.)

To allow for control unit error recovery, the device must appear "busy" to the control unit immediately (within 20 usec) upon receiving the Pattern Byte, unless the operation is completed and OP complete is posted in the poll status.

Note: The two search commands will indicate completion of the operation by setting bit 9 in the status response word to a Poll command. While the search is in progress the display will be busy. Refer to Clear command. A buffer parity error detected during a search memory cycle will cause the search to terminate. The address counter will be pointing to the location containing the byte with bad parity. Op. Complete (bit 9) will be set, and Device Check (bit 8) will be set if not inhibited due to a previous Device Chk.

Note also: When, in the course of a search (or clear) command, the address counter value exceeds the implemented buffer, the byte retrieved from the 'buffer' may be all ones (with good parity). If this byte satisfies the search (such as "search for any attribute" or "search for any attribute with MDT set") the search will terminate. Otherwise, the search will continue. For a display, address zero is reached (for forward search) immediately after address 8191 regardless of the actual buffer size.

1.4.5 COMMANDS APPLICABLE TO FEATURES

Note: Most printers will accept commands addressed to the Base address only. Printers with the APL feature will accept certain commands to the Ext. Attr. buffer.

For Displays:

The feature error latch is set for the following conditions;

1. A feature does not acknowledge a 'Write' type command or data.
2. A feature does not respond to a 'Read' type command.
3. A feature requesting Poll service does not respond to this Poll.

For case 1., the display will set bit 11 - 'Feature Error', but respond with TT/AR.

For case 2., the Base will respond with an 'all zeros' data word with bad parity (bit 10=0). (The 'all zeros' data word will actually contain the 9 bit byte from the feature bus and may be non-zero if the feature bus is inoperative due to one or more of the features malfunctioning.) The feature error bit will be set.

For case 3., Bit 11 is returned in poll response.

1.4.5.1 A/N KEYBOARD FEATURE

The keyboard will only respond to a POLL.

1.4.5.2 SELECTOR PEN FEATURE

0001 POLL (See status response)

0011 READ ROW COUNT
Following a Detect the selector pen will respond to this command with a row count (in bit positions 4 to 9) indicating the displayed row in which a detect occurred.

1111 READ SELECTOR PEN FIELD COUNT
Following a Detect the response to this command is a count in bit positions 6 thru 9 that indicates the Selector Pen field count at the time a detect occurred. (The field counter is reset to zero before the start of each row.) A Selector Pen field is a detectable attribute followed by a designator character.

Note: If either of the above two commands is issued after the Reset command but before a detect, a Feature Timeout will occur.

01X1 READ FEATURE ID
Responds with feature address in bits 2 thru 5 if feature is present.

0010 RESET
The RESET command will reset all latches and registers in the addressed device feature and must be sent to reenable the selector pen for another detect.

1.4.5.3 MAGNETIC READER FEATURE

0001 POLL (See status response)

0011 READ DATA
The READ DATA command is issued to the MAGNETIC READER when the poll response word indicates that the READER has data to send to the control unit. The first data word is sent in response to the first read command and the (Read-Response) sequence continues until terminated by the control unit. The Mag Reader buffer address counter will increment for each byte of data read from the buffer. The Mag Reader will determine when the last significant byte of data (EOM) has been read. EOM will be returned on all subsequent Read Data and/or Read Multiple commands until a Reset or Clear command is received.

If a Read Data (or Read Multiple) command is issued after a clear or reset command but before a card is read, a Feature Bus Timeout will occur.

1011 READ MULTIPLE
The feature will respond with four successive bytes of data. Same restrictions as for Read Data apply.

01X1 READ FEATURE ID
Responds with feature address in bits 2 thru 5 if feature is present.

0010 RESET (RETRY)
The RESET command is sent following a control unit detected error during the previous Mag Read command. The feature is re-enabled to the operator, hardware is reset, yellow and green lights extinguished, and the red light turned on.

0110 CLEAR
This command is normally sent to re-enable the feature to the operator. Hardware is reset, the yellow and red lights extinguished, and the green light turned on.

1.4.5.4 3180 ADVANCED FUNCTION (FEATURE ADDRESS 6)

Feature Buffer

The buffer used for the 3180 feature has the following attributes:

- 256 bytes for DCA Read/Write operations.
- Buffer addressed by using the base address counter.
- Buffer access (3180 in normal mode)

Ownership of the buffer is dedicated to the 3X74 at all times except when the feature is busy. The feature is made busy by the 3X74 issuing, and 3180 receiving, a Start Op command to the feature. While the feature is busy, ownership of the buffer is dedicated to 3180. When 3180 becomes not busy (i.e., completes an operation that was started by the 3X74), 3180 signals Op Complete to the 3X74, becomes not busy, and buffer ownership reverts to the 3X74.

Coax Commands

The following is a list of the commands that are directed to feature address 6. The code points are listed in hexadecimal as they appear in bits 2-9 of the coax word. The commands listed below with code points X'6X' have the same definition as the X'0X' code points for the base address commands.

Coax Commands	Code Point
• Read Data	X'63'
• Read ID (DCA does not check coax bit 10 parity)	X'65'
• Read ID (DCA checks coax bit 10 for odd parity on bits 2-9)	X'67'
• Start Op	X'68'
• Read Multiple	X'6B'
• Write Data	X'6C'
• Read Status	X'6D'

Status Register

In order for the control unit to perform error recovery on coax errors to Feature 6, the feature provides the following status in response to a Read Status command:

- BIT 0 : Reserved (='0')
- BIT 1 : Reserved (='0')
- BIT 2 : BUSY = '0'; NOT BUSY = '1'
- BIT 3 : Reserved (='0')
- BIT 4 : Reserved (='0')
- BIT 5 : Reserved (='0')
- BIT 6 : Op Complete Pending ='1'
- BIT 7 : Reserved (='0')

Note: The bits indicated above appear on the coax as bits 2-9.

Poll Response

When Feature 6 desires to signal Op Complete (to indicate to the 3X74 that a busy condition has completed), it will send the following poll response:

- BIT 0-3 : Feature address = '0110'
- BIT 4 : Reserved
- BIT 5 : Reserved
- BIT 6 : Reserved
- BIT 7 : Op Complete = '1'

Note: The bits indicated above appear on the coax as bits 2-9.

3180 Feature 6 Buffer Layout

	RESV	OPER	OPMOD/ STATUS	CMDL	CMD	DATA
Bytes	0-1	2	3	4-5	6	7-n

Where the above identified fields have the following meanings:

- RESV - Reserved - must be zero (both reads and writes.)
- OPER - Indicates the operation that has been "Start Op'ed" by the 3X74.
  - Operation types are:

EXEC (X'01') The 3X74 has written data into locations 4-n of the buffer for 3180 to execute. All write commands have two modes of execution: Immediate and deferred.

If an immediate EXEC is issued by the 3X74, 3180 validates the request and, if valid, performs the operation and issues Op Complete. If a deferred EXEC is issued by the 3X74, 3180 validates and calculates the values but takes no action until an UPDATE or an ABORT operation occurs. When a deferred EXEC is issued, the operation issued enters the operation pending state (e.g., pending SWNDO.)

An ABORT operation resets all pending states.

An immediate EXEC performs the CMD function and resets that particular pending state.

UPDATE (X'02') The 3X74 has instructed 3180 that it has received a valid message and the deferred data should be used. An UPDATE without a prior EXEC is treated as a NOP.

Multiple deferred operations may be issued prior to an UPDATE. Where multiple deferred operations that affect the same parameter are issued, the most recent value is used when the update is issued.

The data in bytes 4 through n is ignored.

ABORT (X'03') The 3X74 has received a bad transmission. 3180 should reset its "UPDATE Pending" states.

The data in bytes 4 through n is ignored.

- OPMOD - This field may be used to modify the outbound data operation.
  - The high order bit X'80' indicates this is a 3X74-to 3180 operation.
  - Set to X'80' by the 3X74 when it updates the buffer and prior to issuing a Start Op.
  - All other values are reserved (X'81'-X'FF').
  - Upon receiving a Start Op, 3180 checks the value of this field for X'80'. If the value is not X'80', 3180 responds with Program Check.

• STATUS- Set by 3180 prior to indicating Op Complete.
For status responses, the high-order bit is always a 0.
Values set by 3180 are:

OK (X'00') - Operation completed successfully

BAD (X'01') - Bad structured field data
(CMDL points to byte in error.)

PGMCK (X'02') (Program Check) - 3180 detected an error in bytes 0-3 of the buffer when given a Start Op (3X74 or 3180 has a bug.)

• CMDL - Set by:

- 3X74 to the length of the structured field.
length = CMDL+CMD+DATA

- 3180 when Op Complete status = BAD, as a pointer to the byte in error. (CMDL (byte 4) = 1)

- 3180 to the length of the structured field when the command is a Read command length = CMDL + CMD + DATA.

Note that for all fields the pointer will point to the first byte of the field in error.

- Examples:
  - A 3X74 operation that consists only of CMDL+CMD (bytes 4, 5, and 6 are valid). 3X74 sets CMDL = 3.
  - 3180 detects a length (CMDL) error. 3180 sets CMDL = 1, status = BAD.
  - 3180 detects an unsupported CMD value. 3180 sets CMDL = 3, status = BAD.

• CMD The operation the 3X74 wants 3180 to Start Op.
3180 does not change this field.

READS: 3180 updates length, loads data in buffer, and answers Op Complete. The low-order bit of a READ command is always set to 1. The deferred bit (high-order bit) is ignored.

WRITES: 3180 operates on the data the 3X74 has inserted in the buffer. When 3180 has completed the operation, 3180 inserts the appropriate ending status in STATUS and signals Op Complete.

All write commands have the low-order bit set to 0.

All write commands have two modes of operation. These two modes are: immediate and deferred. Immediate operations are validated by the device, the requested operation is performed (if valid) and an Op Complete response is returned to the 3X74. Immediate operations are specified by the high-order bit of CMD set to 0.

Deferred operations are validated by the device, the requested operation (and associated values, if any) is put into UPDATE pending state, and an Op Complete is returned to the 3X74. An UPDATE operation causes the device to act on all pending states (and their associated values, if any). A deferred operation is specified by the high order bit of CMD (X'80') set to 1.

CMD	CODE POINT	OPERATION
RDINFO (read)	X'01'	3180 inserts in buffer starting at location 7: • Data Type: 1 byte X'01'= for data as defined here • Reserved: 1 byte = X'00' • Machine Type: 4 bytes (EBCDIC numeric) For non-IBM devices, this field must be right-justified and padded with X'40'. X'00000000' indicates that the value returned by the device in the Read Extended ID command should be used. If not equal to X'00000000', the EBCDIC data will supersede the machine type read via the Read Extended ID command. • Flags = X'11' (1 byte) Bits 0-3 Hardware/software X'1' = Hardware or microcode X'E' = Programmed Machine Bits 4-7 IBM/non-IBM product X'1' = IBM X'9' = non-IBM = X'00' if unknown. • Model ID: 3 bytes AE characters, right-justified and padded with X'40'. X'000000' if unknown. • Plant of manufacture or origin: 2 bytes X'0000' if unknown. • Serial Number: 7 bytes AE characters, right-justified and padded with X'F0'. X'00..00' if unknown. • Release Level: 3 bytes AE characters, user-defined padding and justification. X'000000' if unknown. • EC Data: 16 bytes EBCDIC, user-defined padding and justification. X'00..00' if unknown. Note: The 3X74 issues this command as part of terminal POR processing and will validate that bytes 7-8 = X'0100'. The intent of the above information is for use in the Product Instance ID subvector X'00' of the 3X74 alert function. It is the device's responsibility to ensure that the proper EBCDIC data values and justification are inserted per SNA architecture. AE fields may contain EBCDIC 0-9, A-Z.
UAQRY (read)	X'03'	3180 updates length, loads data (bytes 4-n) of Usable Area Query Reply into buffer (starting at location 7), and sends Op Complete to the 3X74.
PRTQRY (read)	X'05'	3180 updates length, loads data (bytes 4-n) of Alphanumeric Partitions Query reply into buffer (starting at location 7), and sends Op Complete to the 3X74.

The following commands are all write commands. All have immediate and and deferred versions. The immediate code points are shown first (high-order bit = 0). The deferred code points are shown second (high-order bit = 1).

CMD	CODE POINT	OPERATION
CPAR	X'02' X'82'	The 3X74 has loaded bytes 3-n of a Create Partition structured field into the buffer. (Byte 3 of structured field is loaded in byte 7 of the buffer.) The control unit always supplies, as a minimum, bytes 3-9 of the structured field. If the parameter is omitted by the host, the default values shown in GA23-0196 are provided by the control unit. Bytes 9 through n are validated/defaulted by the device. 3180 will reset its window parameters to base state. Cursor locator state is not affected. The device will reset any Update Pending states and will ignore the Head Control Register for screen format while in partition state.
SWNDO	X'04' X'84'	The 3X74 has loaded bytes 3-n of a Set Window Origin structured field into the buffer. (Byte 3 of structured field is loaded in byte 7 of the buffer.) This command is issued by the 3X74 when keystroking operations require the window to be moved or when a Set Window Origin structured field is received from the host.
RESETP	X'06' X'86'	The 3X74 has encountered a condition where it requires the 3180 to reset its partition and window parameters to base (POR) state. Honor the Head Control Register for screen format on the basis of the model identified. The device will reset any Update Pending states. Cursor Locator state is not affected.

CMD	CODE POINT	OPERATION
CURSLOC	X'08' X'88'	Indicates R/C cursor offset and allows the indication to be turned off/on. This command contains 4 bytes of data, starting at byte 7 of the buffer. The first two bytes indicate the ROW OFFSET. This is the number of rows the cursor position is offset (X'0000' to X'FFFE'). The last two bytes indicate Column Offset. This is the number of columns the cursor position is offset (X'0000' to X'FFFE'). The display of the Cursor Locator is disabled if the ROW and/or the Column Offset are set to X'FFFF'. The display of the Cursor Locator is disabled when 3180 powers on and is only enabled when the 3X74 issues a CURSLOC command. The only values the 3X74 sends to 3180 for the level of function described in this document are X'00000000' or X'FFFFFFFF' to enable (with 0 offsets) or disable the display of the cursor locator. The Cursor Locator is disabled in the power-on state of the device and also following a DCA Reset to the base.

1.4.5.5 EXTENDED CHARACTER SET (ECS)

(Consists of Extension Attribute Buffer - EAB, APL, and Programmable Symbol Set - PSS)

Note: Read and Write commands to this feature will be affected by the setting of bit 5 in the Base Control Reg. Refer to Load Control Register Command.

0011 READ DATA (EAB) (Display and Printer)
This command operates the same as the base Read Data command.

1011 READ MULTIPLE (EAB) (Display only)
This command operates the same as the base Read Multiple command.

CLEAR (EAB)
Not applicable. Refer to Base Address Clear Cmd.

1100 WRITE UNDER MASK (EAB) (Display and Printer)
The "0" bits in each data byte from the control unit corresponding to the 'active' ("1") bits in the mask register are written into the EAB at the address specified by the Base I/O Address Counter. "1" bits in the data byte from the control unit are written into the EAB regardless of the Mask bits. "1" Bits in the EAB corresponding to zero bits of the mask are not modified.

1010 WRITE ALTERNATE (EAB) (Display and Printer)
Data bytes following this command are written to the Base refresh buffer and the EAB alternately, starting with the base refresh buffer. The Base I/O address counter is stepped after the byte is written into the EAB. The write to the EAB is 'under Mask' and operates the same as the Write Under Mask command. Any number of bytes of data may follow this command with no error detected if an odd number of bytes is written.

Note: Write Under Mask and Write Alternate Commands have the following restrictions when writing large blocks of data, in burst mode, to the printers.

1. If updates pass more than 512 bytes, they must be to contiguous storage locations. There is no limit to the size of these updates.

2. If an error results in retransmission of a buffer update, 600 usec must elapse between termination of the original attempt and a subsequent retry.

3. If the buffer updates are between 257 and 512 bytes in length with multiple address counter settings imbedded in the data, 600 usec must elapse between such buffer updates.

4. Buffer updates between 1 and 256 bytes have no restrictions placed upon them.

Note also:

The EAB Color Bits 4,5,6 at address 79 (column 80 in the indicator row) are defined as Color Switch Override Bits.

When any of these bits is set to 1, the display is forced to the state where the Base Color Suppression switch is on (mono position), and the switch is disabled.

When all these bits are set to 0's, the switch is enabled.

0110 LOAD MASK (Display and Printer)

The first data byte following this command will be stored in a register and used to designate the bits that will be cleared in the Extension Attribute Buffer when the base is executing a Clear command. "1" bits in the mask will clear the corresponding bit in the EAB byte as the base hardware clears the matching byte in the refresh buffer. This register must be restored by the control unit following an Insert Cmd to the Base.

The Mask register is also utilized by the feature hardware when executing the 'Write Under Mask' and 'Write Alternate' Commands. See above.

PS's 2-7 are selected by bits 7,8,9 of Mask register set to b'010'-b'111'. Selection of 'base' (b'000') or APL (b'001') or a non-implemented PS will yield the following:

PS Command:	Device Response:
Write	TT/AR
Clear	TT/AR, followed by Op. Complete

If a second data byte follows this command it will be loaded into the Suppress Skip Register. Bits in this register are defined as follows:

Data Bit	Function
2	Suppress Skip - Entire screen
3	" " PS Font #7
4	" " " " 6
5	" " " " 5
6	" " " " 4
7	" " " " 3
8	" " " " 2
9	" " (APL)

The raster skip following a character row will be suppressed whenever one or more of the symbols in that row is displayed from a PS font designated as Suppress Skip.

Note: Bit 2 = 1 is not supported by the 3174, 3274 or Architectura.

01X1 READ FEATURE ID (Display only)

Data Bit	Meaning
2 thru 5	Feature present (0111 returned)
6=1	APL installed
7,8=00	0 PS Fonts Installed
7,8=01	2 PS Fonts Installed
7,8=10	4 PS Fonts Installed
7,8=11	6 PS Fonts Installed
9=0	Monochrome
9=1	Colour

This command will reset Op Complete status in the feature.

0010 RESET (Display only)
The RESET command will reset the addressed device feature.

When the Display supports PSS, the following commands (to ECS feature) will be honored:

1101 READ STATUS
This command is sent by the control unit to determine if the feature is "busy" (see Clear PS command) or to read the ROS ID.

The one byte response is defined as:

Bit 4=0 Busy - Other bits are invalid
=1 Not Busy

Bit 8=1 Op Complete

Bits 2356 ROS Identifier:

0000 APL/Text
0001\
to Reserved
1110/
1111 Oper. Inds. only

1000 WRITE DATA (PS)
The Programmable Font Buffer contains 9 data bits for each location of storage. The high order bit of the 9 bit byte will display in column zero of the character box. Two consecutive data words from the control unit are combined to load one location in the buffer. The second (odd) word is the eight low order bits to be loaded in the location as indicated by the I.O. Address counter. The first(even) word contains the high order bit to be stored in the same location and is positioned in the low order bit position of the first word from the control unit. A data stream of even and odd words may be of any length and will load data into consecutive locations of the buffer, a store cycle and stepping of the base address counter occuring once for each even-odd pair of data words.

Note: The I/O address counter is used to address the Programmable Font buffer when writing (or clearing). The control unit must load the I/O address counter with the proper starting address before writing the 32 bytes (16 slices)* of each symbol. The address for the first (top) slice of each symbol will be the 8 bits of the refresh buffer code for that symbol shifted left 4 bit positions (multiplied by sixteen.) Higher order address bits will be ignored.

* 24 bytes (12 slices) will be written to devices that specify 12 PELS/Character vertically in Read Terminal ID response.

1110 OR DATA (PS)
Similar to WRITE DATA with the exception that the following bytes of data are or'd into the Programmable Font Buffer.

1111 READ DATA (PS)
The low order three bits of the mask register select the PS font to be read. One byte of data will be returned for each 'Read PS' command. The PS 'slice' will be read in the same order that it is written - leftmost bit in the first byte, remaining 8 bits in the next byte. The I/O address counter will be incremented following the read of the low order 8 bits, and the device will assign correct (odd) data parity to each byte returned to the control unit.

0100 CLEAR (PS)
This command is used to clear a symbol font buffer. The clear operation starts at the address specified by the address counter and terminates at the end of the 192 symbol programmable font RAM. Op. Complete status will be set in the feature at the end of the operation. It is recommended that the control unit set bit 7 in the Control Register prior to issuing this command, and that the control unit refrain from sending any commands (except Poll, and Read Status to this feature) to the display while the clear is in process because this command utilizes the Base Address Counter and any commands that alter the contents of the Address Counter will have a deleterous effect upon the PS Clear.

Note: The control unit is responsible for inhibiting display while issuing any write command to a PS font. Refer to Load Control Register command.

1.4.5.6 CONVERGENCE FEATURE COMMANDS

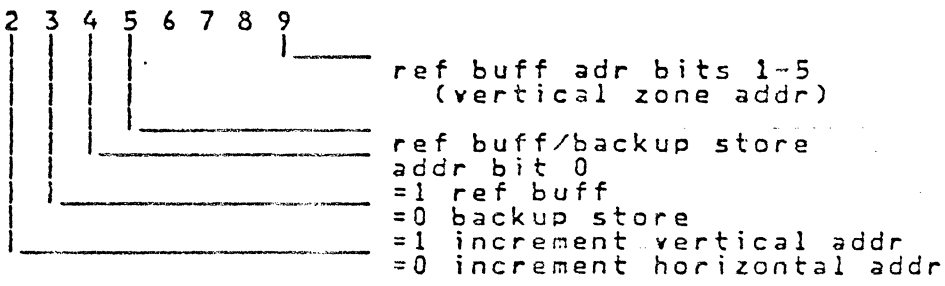
01X1 READ TERMINAL I.D.
Responds with feature address in bits 2 thru 5.

1101 READ STATUS

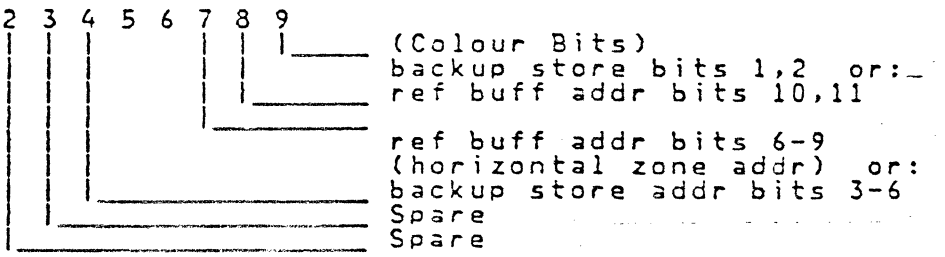
Bits 2,3,4,5= 1011 (feature address)
Bit 6=1 Enabled
Bit 7=1 Colour Default Switch active (monochrome)

0010 Reset This command will reset the feature status latches and I/O address registers.

0100 Write I/O Address Reg. High
The byte of data sent following this command will be interpreted as shown: (Only one byte of data will be accepted.)



0110 Write I/O Address Reg. Low The byte of data sent following this command will be interpreted as shown: (Only one byte of data will be accepted.)



1100 Write Data
This command will cause the succeeding bytes of data to be loaded into either the refresh buffer or the backup store depending on the setting of the select bit in the convergence I/O addr counter (see above.)

Data words sent to the Backup Store contain only 3 significant bits, plus parity (a nibble):

```
2345 6789 P
0000 0XXX P    Data word to Backup Store
XXXX XXXX P      "    "    " Refresh Buffer
```

A maximum of 64 bytes (128 nibbles) may be sent without overwriting the selected storage.

0011 Read Data
This command will return one byte (nibble) of data from the selected storage.

1011 Read Multiple
This command will return a maximum of four bytes (nibbles) of data from the selected storage, under control of the two least significant bits of the Convergence I/O Address Counter.

2.0 PRINTER CONTROL

2.1 GENERAL

This section defines the additional control provided for printers by means of preassigned register space in the printer buffer in conjunction with a subset of the above described coax commands for reading and writing this buffer.

2.2 COMMANDS

The commands recognized by the printer are:

READ		WRITE	
00001	Poll		
10001	Poll/Ack	00010	Reset
00011	Read data	01100	Write data
00101	Read Adr. Cntr. Hi	00100	Load Adr. Cntr. Hi
10101	" " " Lo	10100	" " " Lo
01001	Read Terminal ID	01000	Start Operation
01101	Read Status	00110	Clear
0011	Read Data (EAB)(Adr 0111)	10110	Load Mask
		10000	Search Forward
		10010	Search Backward
		1100	Write Under Mask (EAB)(Adr 0111)
		0110	Load Mask " "
		1010	Write Alternate " "

Note: Printers that support the EAB will implement the above commands described as (EAB).

The operation of these commands is described in preceeding sections of this document.

Other commands, including all other commands to other than the base address, are invalid. Invalid read type commands will return an all zeros data word (with bad parity: Bit 10),and invalid write type commands will (may) reset the previous command. If no other command or data word directly follows the invalid write command, TT/AR takes place following receipt of the ending sequence. Invalid commands include printer no-op commands. Commands other than Poll, Reset and Start Operation (Abort Order) will be treated as invalid while the printer is Enabled or Busy.

2.3 PRINTER CONTROL INFORMATION AREA (PCIA)

The first 80 bytes of the printer RAM are used as register space to store control information. The first sixteen bytes are used for printer output to the control unit. The next 64 bytes are used for control unit orders and instructions to the printer. Protocol prohibits the Control unit and the Printer from altering each others' Output Area (except at POR time.) The assignment is:

ADDRESS (hex)	LENGTH (bytes)	DEFINITION
Printer Output Area		
0000	1	Status
0001	1	Switch Status
0002	1	Key Input Code
0003	1	Sense
0004-0005	2	Message Length
0006	1	Extended Status
0007-0009	3	Reserved
000A-000F	6	Terminal ID
Controler Output Area		
0010-0011	2	Mode
0012-0013	2	Message Starting Address
0014-0015	2	Message Length
0016-0017	2	Order
0018	1	Maximum Presentation Position (MPP)
0019-0021	9	Reserved
0022	1	Extended Order Parameter
0023-002F	13	Reserved
0030-003F	16	Alias Table
0040-0049	10	Reserved
004A-004D	4	Test Message Area
004E-004F	2	Reserved for Control unit use.

Note: For the PCIA byte definitions, Bits 0 - 7 correspond to Interface Data Word Bits 2 - 9.

2.3.1 PRINTER OUTPUT AREA

2.3.1.1 STATUS

The Status Bits are defined as follows:

Bit 0	Extended Status Available
Bit 1	Data Check
Bit 2	Order complete
Bit 3	Equipment Check
Bit 4	Intervention Required
Bit 5	Sense Data Available
Bit 6	Input Code Available
Bit 7	Switch Transition (Valid)

- Extended status Available
  Bit 0 — Set when new status data is loaded into the extended status byte and reset when the printer is enabled.*

- Data Check
  Bit 1 — Set, with Order Complete, when the printer detects a data check in the message buffer (not the PCIA) while printing (or loading PS.) Reset when enabled. In LU1 mode, printer is allowed to set this bit while executing non-print data, and printing need not complete (but bit 2 must be set anyhow.)

- Order Complete
  Bit 2 — Set when the order, as specified in the two byte Order Register, has been completed or terminated. Reset when the printer is enabled.*

- Equipment Check
  Bit 3 — Set when a printer detects a 'Permanent Error' condition. Cleared by a successful POR. A permanent error results when the printer detects a parity error or invalid parameter in the control unit output area (Printer Register Space). If invalid parameter, Status Bit 5 will also be set, and Sense code '04' - Order Reject' will be loaded.

- Intervention Required
  Bit 4 — Set, after a device determined delay, when an operator recoverable (without POR response) condition occurs. Reset when the above condition is removed. Note: The control unit is not allowed to alter the printer print buffer or the Control Unit Output Area after receiving IR,OC status, until receiving IR Cleared status.

- Sense Data Available
  Bit 5 — Set when new sense data is loaded into the sense byte and reset when the printer is enabled.*

- Input Code Available
  Bit 6 — Set when new input code is loaded into the input code byte and reset when the printer is enabled.*

- Switch Transition
  Bit 7 — Set when any valid transition of the applicable switches on the printer operator panel occurs and reset when the printer is enabled.* New status of the operator panel switches is stored in the switch status byte.

*(Provided Poll Response is all zero. Refer to Start Op command.)

The Status Available Bit (in Poll Response) is set when any of the above status bits are set or when Intervention Required is reset. Transition of two or more status bits may occur for one Status Available Poll Response.

Defined combinations of status bits are:

	Status Bits	Occurence
•	2	Print, SSA or Abort Order with Print Order successfully completed.
•	1,2	Data Check while printing. Print completes.
	2,3	Printer Register Space Check following Start Op Command
•	4	IR condition while idle.
•	3	EC condition while idle.
•	2,4	Print Order terminated due to IR condition.
•	2,5	Print Order terminated due to Sense condition.
•	2	Print Order terminated by an Abort Order.
	2,3	Print Order terminated due to Equipment Check.
•	2,3,5	Print Order terminated due to invalid parameter in Control unit Output Area.

Multiple failures or other undefined error conditions may result other combinations of Status Bits being generated.

The print operation in process will be terminated whenever Equipment Check, Intervention Required, or Sense Data Available are set.

2.3.1.2 SWITCH STATUS

This byte contains the current status of certain operator panel switch positions. Whenever positions of MONO/DUAL Case, SINGLE/DOUBLE INDEX and 8/6 LPI switches are altered by an operator the Status Bit 7 (Switch transition) is set and new switch status is loaded into this byte.

Bit 0 thru 2 = Reserved

bit 3=0 Colour default switch on - Base Colour (Fld Attr)
=1 " " " off - Base Colour suppressed

bit 4=1 Colour cartridge resident (or no cartridge)
=0 Monochrome " "

Bit 5=1= MONO/DUAL SW in DUAL position
=0= MONO/DUAL SW in MONO position

Bit 6=1= SINGLE/DOUBLE SW in DOUBLE position
=0= SINGLE/DOUBLE SW in SINGLE position

Bit 7=1= 8/6 SW in 8 LPI position
=0= 8/6 SW in 6 LPI position

2.3.1.3 INPUT CODE

This byte will be loaded by the printer when a switch that initiates host and/or control unit intervention is actuated or timeout/no PA's installed condition occurs. The following four input codes are defined for the printer:

X'50' = Attention
X'5F' = PA 1
X'5E' = PA 2
X'5D' = No PA Keys Available/Actuated

Attn does not terminate the order in process or alter printer SLU (Secondary Logical Unit) send/receive state. Attn is allowable only in Printer SLU Receive state.

PA1, PA2, and No PA allowable only in printer SLU send state. Printer SLU will assume receive state upon disabling and returning the Input Code. No PA code may be sent after timeout in send state.

2.3.1.4 MORE INPUT CODE.

X'69' Query Reply.
This code indicates that the printer has received a Read Partition Query SF, and the control unit is directed to transmit a canned reply. The reply generated by the control unit will be identical to the LU3 version, and will be limited to Character Set, Hilite, Colour, and Usable Area.

X'6A' Query Reply, extended
Same as above, except that additional response parameters - in structured field format - have been loaded by the printer into the message buffer. The data will start at address X'50' with the length specified in address 0004,0005. A maximum of 256 bytes is allowed.

X'6B' Inbound Data Available.
This Input Code is provided for devices that support:

case 1: Read Partition Query Structured Field with their own response, or:

case 2: FMH1 inbound requests.

The entire Reply, commencing with the appropriate FM header, will start at address X'50' with the length specified in address 0004,0005. A maximum of 512 bytes is allowed.

Note: A '69', '6A', or '6B' input code must only occur with Order Complete and no error status bits (bits 2 and 6 only set in status register).
The printer will return Sense X'02' if:
1. The Read Partition Query Structured Field is not the last (or only) SF in the chain, or
2. The requesting FMH is not only in chain.

When LIC is not indicated on an otherwise acceptable Read Partition Query Structured Field Start Op, the printer must 'hold' the Sense or Input Code reply until the next Start Op, and:

1. Return the appropriate Input Code if this (or a subsequent) Start Op indicates LIC and the Read Partition Query SF is still the last SF (null RU case).

2. Return Sense '02' if additional data is received (with or without LIC).

3. Purge the Reply if FIC is received prior to LIC.

2.3.1.5 DSE/DSC INPUT CODE

X'6C' LU3 Query Reply, more to follow, or:
X'6D' LU3 Query Reply, last piece.

Refer to LU3 Query Order for description.

2.3.1.6 STILL MORE INPUT CODE

X'6E' Inbound Structured Fields Available (DSC mode only)

Used in DSC mode to indicate inbound structured fields are available from the printer - e.g., IPDS ACK Reply.

Only one input code X'6E' may be presented by the printer per "Load Structured Field" order. That is - consecutive X'6E' input codes are not allowed without an intervening "Load Structured Field" order.

If more than one input code X'6E' is received from the printer without an intervening "Load Structured Field" order, all but the first are ignored.

Note that this input code is not used for Query Reply which continue to use input code X'6C' and x'6D'.

The data will start at address 0050 (MSA) with its length specified in address 0004-0005 (ML). A maximum length of 512 bytes is allowed. The inbound structured fields may be solicited, for example via an IPDS "Sense Type and Model" (STM) structured field, or unsolicited to report printer detected exception conditions in a structured field format.

Note: In LU-1 mode, Input Code X'6B' (Inbound Data Available) or X'6F' (Inbound Data Available Without FM Header) is used to indicate inbound structured fields are available.

X'6F' Inbound Data Available Without FM Header (LU-1 mode only)

Used in LU-1 mode to indicate inbound data is available from the printer (e.g., structured fields) that does not contain an FM Header.

The data will start at address 0050 (MSA) with its length specified in address 0004-0005 (ML). A maximum length of 512 bytes is allowed.

The control unit will indicate "FM Header not present" in the Request Header (RH) that is sent to the host system.

2.3.1.7 SENSE DATA

This byte will be loaded by the printer when the printer has sense data to be sent to a host via a control unit. When this byte is available, status bits 5 and 2 will also be set.

X'01' Cancel
This code indicates that the Cancel key is depressed by an operator in order to cancel printing. The printer will immediately terminate printing in process. The Cancel key is only active between First Segment of First in Chain and Last Segment of Last in Chain. If a Print Order is in process the printer will return 'Cancel' and 'Order Complete'. If a print order is not in process, the printer will wait for the next Print Order and: If FSFIC, ignore the Cancel; If not FSFIC, abort the print and return Cancel, Order Complete. The control unit is responsible for purging the remainder of the chain after receiving Cancel. The next SCS Start Print sent to the printer will be FSFIC.

X'02' Invalid Parameter
This code indicates that an invalid control parameter has been found in the SCS data stream by the printer.

X'03' Invalid Structured Field
Set only during SCS FMH Print if the printer detects an invalid SF within a valid FMH.

X'04' Order Reject
Set when printer detects an invalid order or parameter in the Control unit Output Area. Status bits 2, 3 and 5 will be set. Printers are allowed to return Sense '04' (sans equipment check) in non-SCS mode if invalid parameters are detected in the Load PS header.

X'05' Illegal PS Selection
Set, in SCS mode, when byte 6 or 12 of the Load PS Header specifies a nonexistant PS RAM or Plane.

X'06' Illegal Alias Selected
Set, in SCS mode, when an SA (X'28') control code references a PS LCID which does not exist.

X'07' Invalid FMH
Set, in SCS-FMH mode, if the printer is unable to properly process the FM Header. (Invalid SF types within a valid FMH are rejected with X'03'.)

X'08' Invalid Structured Field (DSC mode only)

Used in DSC mode if the printer detects an invalid structured field (other than IPDS structured fields) that was passed to the printer via the "Load Structured Field" order (X'07').

2.3.1.8 EXTENDED STATUS

PCIA Address 0006, contains "Extended Status" if Status (Addr 0000) bit 0 = 1. Otherwise, it is reserved.

Extended Status:

Bit 0-6 "reserved"

Bit 7 = 0 "Order Complete Not-Deferred"

= 1 "Order Complete Deferred"

In DSC mode, when a Load SF Order (X'07') is sent to a printer, Extended Status bit 7 = 1 (Order Complete Deferred) is used with Status bit 2 = 1 (Order Complete) to indicate a deferred order complete condition.

This status can be used by a Printer to stop any further transfer of data from the Control Unit to the Printer until conditions within the Printer will allow it to resume.

Note: The following status cannot be included with "Order Complete Deferred". If they are included, they will be ignored.

- o Data Check (bit 1)
- o Intervention Required (bit 4)
- o Sense Data Available (bit 5)
- o Input Code Available (bit 6)

Following presentation of deferred order complete status, the Printer can allow data transfer to resume by returning Status bit 2 = 1 (Order Complete) with Extended Status bit 7 = 0 (Order Complete not-deferred).

If data transfer can continue without interruption following a Load SF Order, then "Order Complete not-deferred" (Status bit 2 = 1 and Extended Status bit 7 = 0) is returned by the Printer in response to the Load SF Order.

Note: "Order Complete not deferred" can also be presented by returning Status bit 0 = 0 (No Extended Status) and Status bit 2 = 1 (Order Complete).

2.3.1.9 PRINTER ID

These bytes, loaded by the printer, contain the unique device parameters that are significant to the control unit and/or the application program. Definition of these bytes is as follows:

'000B'

bits 0-3 Printer 'Type'

='0000'	Old Type	
='0001'	ADII 3287	or equivalent
='0010'	4250	" "
='0100'	3268	" "
='0101'	3230	" "
='0111'	3262	" "
='1001'	5210	" "

bits 4-7 Character set ID for font 001

= '0000' APL.
all other codes Reserved.

Printer 'Type' definition:

bits 0-3	0001	0100	0101	0111
Type	Matrix	Matrix	Matrix	Non-matrix
MPP	132	132	132	132
MPL	102	127	127	127
PEL space horz. ($x10^{-3}$)in.	10	10	6.25	00
PEL space vert. ($x10^{-3}$)in.	15	15.625	6.25	00
PELs/cell horz	10	10	12	00
PELs/cell vert	8	8	18	00

Note: Printer type 0000, with EAB - same definition as 0001, above.
Printer type XXXX, without EAB - Don't Care Condition.

Note also: Printers of Type 0010 and above will implement an additional byte of ID as follows:

byte 000A: (other bits reserved, must be zero)

bits 0,1,2 = 000 No EAB highlighting supported.
= XX1 b'01' highlight (blink) supported.
= X1X b'10' highlight (reverse) supported.
= 1XX b'11' highlight (underline) supported.

bit 3=1 Translate Table Req'd.*
bit 4=1 DCA-L2 Supported
bit 5=1 FMH Subset 4 Supported
bit 6=1 'Local' Save/Restore SF and Query List SF supporte
bit 7=1 LU3 Query supported.

*The control unit will only test this bit if it (the control unit) is configured for EDS.

Printer type 0000, with or wihtout EAB, and printer type 0001, without EAB, do not support DSE/DSC highlighting.

'000C'

Bit 0=1= Extention Attribute Buffer installed
=0= Not installed

Bit 1=1= APL/3289 Text Print feature installed
=0= Not installed

Note: Bits 0,1 = 1,1 indicate full APL capability via the Extension Attribute Buffer (a la 3287) and
Bits 0,1 = 0,1 indicates 3289 'Text Print Feature'.

Bit 2=1= PS feature installed
=0= Not installed

Bit 3=1= SCS EBCDIC feature installed
=0= Not installed

Bit 4,5 and 6 Display Screen Size
001= 960
010= 1920
011= 2560
111= 3440
110= 3564
000= Reserved
100= Reserved
101= Reserved

Bit 7=1= Printer (Unit ID)
=0= Other (Unit ID)

'000D' Buffer Size ('base' buffer)

X'08'= 2K Buffer
X'10'= 4K Buffer

This byte will be set to the equivalent value of the high order byte when the size of the printer buffer installed (plus 1) is counted in 2 byte binary format. The EAB, when installed, will be of equal size as the 'base' buffer.

'000E' Extended ID

bit 0 = Reserved
bit 1 = Reserved
bit 2 = 1 colour supported

If bit 0 of byte '0C' is also set (EAB installed), then Extended Colour is supported.

bit 3 = 1 LU1 FMH Supported

bit 4 = 0 Load Structured Field order is not supported
= 1 Load structured field order is supported

Bits 5,6,&7: Reserved

'000F' PS Characteristics

bits 0-1 single/triple configuration
00 Reserved
01 2 PS installed (2 and 3).
10 4 PS installed (2,3,4,5).
11 6 PS installed (2,3,4,5,6,7).

bits 2-7 triple plane addresses by bit:
1xxxxx triple installed on PS number 2
x1xxxx triple installed on PS number 3
xx1xxx triple installed on PS number 4
xxx1xx triple installed on PS number 5
xxxx1x triple installed on PS number 6
xxxxx1 triple installed on PS number 7

2.3.2 CONTROL UNIT OUTPUT AREA

2.3.2.1 MODE ('0010', '0011')

The mode bytes define in which data stream mode the NDS Subsystem is operating. The mode remains in effect until overlayed with a new mode. The modes are defined as follows:

LU 2/3 Mode

The 3270 Data Stream is supported under SNA.

3270 Mode

This mode allows usage of the 3270 Data Stream over BSC and 3272 local channel attachment.

LU1 Mode

This mode allows usage of SCS, DCA-L2, IPDS, or Structured Field data streams.

Mode Byte 0 ('0010'):

```
Bits 0 - 4   Reserved
Bit  5 = 0   For Print Order SCS mode: SA control code ('28')
             to be treated as invalid by the printer.
Bit  5 = 1   For Print Order SCS mode:  Printer to execute all the
             control codes it understands.
Bit  6 =     Reserved
Bit  7 = 0   Enable Base Colour switch
     7 = 1   Disable Base Colour (switch override)
```

Note: The control unit will set Bit 5 = 1 for Print SCS-FMH.

Mode Byte 1 ('0011'):

Bits 0 thru 2 = Reserved

Bits 3 and 4:
00=Host Direct Print
01=Host Initiated Local Copy (including BSC Copy command)
10=Operator Initiated Local Copy
Note: Either 00 or 01 may be used for BSC Copy Cmd.

Bits 5 thru 7:
000= No Mode (Refer to Section 2.3.3 for use of this code).

001=3270 Mode (Control unit Output Area from X'0010' to X'0018' used)*
101=LU3 Mode (Control unit Output Area from X'0010' to X'0018' used)*
110=SCS Mode (Control unit Output Area from X'0010' to X'0022' used)
For LU1/FMH, Output Area '0030'-'003F' also used if ID '000C' bit 2 and '000E' bit 3 set.

* The data stream for these two modes appears the same to the printe

The validity of the control unit output area and supported functions vary among modes. The dependencies are summerized below:

Cancel Key
Active only in LU1 Mode (see last note under 'print parameter'.)

Program Attention Keys (PA 1 & 2)
Active only in LU1 Mode

X Print Function
Active in LU3 and 3270 Modes only.

2.3.2.2 MSA AND ML

The Message Starting Address Bytes specify the buffer address where the message buffer starts from and the message Length Bytes specify the size of the message buffer to be operated on by the printer. In LU1 Mode print data will wrap from the end of the implemented buffer to address X'0050'.

If ML = zero for Print Order, the printer will suppress any printing and return order complete.

2.3.2.3 ORDERS

Two bytes are used as the order bytes to specify what operation will be performed by the printer. The first byte contains an order and its parameters are specified in the second byte if applicable. Order complete status will be set upon completion of the operation. The order will remain loaded until overwritten by the next order. The Order will be examined and executed following a Start Op Command, providing there is no pending Poll Response Status. Refer to Start Op Command.

The printer must test the mode byte prior to executing the order. The following mode changes have unique significance:

any --> No Mode — PA & Cancel keys deactivated, printer SLU enters or remains in receive state. SCS parameters loaded by SHF, SVF, or SLD will be saved, pending PA input reset. Unique conditions associated with the previous mode will be reset.

LU1 --> LU3,3270: — Previous SCS parameters saved, PA saved.

any --> LU1: — Previous SCS parameters, if any, restored.

Byte 0:
- X'01'=Abort
- X'02'=System Status Available
- x'03'=Print
- x'04'=Load PS
- x'05'=Load Translate Table(s)
- x'06'=LU3 Query
- x'07'=Load Structured Field

2.3.2.3.1 Abort ('01')

This order causes the printer to terminate the print (or other) order in process. No parameters are available for this order. Following receipt of this order the device must respond with one and only one, Order Complete. The printer will ignore an abort order (and remain enabled) if no print (or other) operation is in process. The control unit may only send this order following a 'Start Print' (or other) Start Operation and prior to receiving Order Complete. The control unit may not change the Mode when sending this order.

The control unit is responsible for resetting the aliases for all PS's affected by the Abort. The printer is responsible for executing deferred clears (if any) from previous load PS orders.

2.3.2.3.2 System Status Available ('02')

X'00' — May be used by control unit to indicate Mode change.

Note: Used with Mode = No Mode (Byte 11, Bits 5-7 = '000') to indicate that conditions associated with the previous mode should be reset. For example, if the data stream mode is IPDS, it is reset to the default data stream mode.

X'02' — Indicates that the printer SLU enters the send state.

X'03' — Indicates that the printer SLU enters the receive state.

Note: Outstanding PA indication will be cleared whenever the printer SLU returns to receive state.

Note also: '02' and '03' will only be sent in LU1 mode.

2.3.2.3.3 Print ('03')

Printing of the message buffer specified by the MSA and ML will be performed by the printer. Refer to 5.1.1 for code points.

3270 like print function will take place in any modes other than the LU1 & No Modes. Refer to 3274 Description and Programmer's Guide, GA23-0061. If the message starting address does not contain an attribute character, a backward search for an attribute must be performed, commencing from end of the current message buffer.

In the LU1 Mode the message buffer contains both control characters (with or without their parameters) and graphic characters. The printer will access I/O codes from the beginning of the message buffer to the end of the message buffer sequencially. A character will be printed if it is a graphic character and the control function will be performed if the control character is supported.

If No mode is specified, printer will suppress any printing. Order complete will be returned.

The following parameters are defined for the print order:

Bit 0=1 Extended Order Parameter byte valid.
0=0 " " " " not used; all zero value assumed.

Bit 1=1 First Segment of First in Chain

Bit 2=1 Last Segment of Last in Chain

Bit 3=1 Reserved
=0= SCS EBCDIC Data Code

Bit 4=1= Print with Extension Attribute Buffer
=0= Print without Extension Attribute Buffer

Bit 5 & 6 Dual/Monocase
00= Machine Default as configured
01= Monocase
10= Dualcase

Bit 7*=1= Ignore NL, EM and CR and print space for them
=0= Honor NL, EM and CR (3270 non line length format)

* NOTE: MPP does not effect honor of NL, EM and CR. Honor is only defined by Bit 7. FF is honored regardless of Bit 7 setting, but only when it is encountered at the left margin print position. Refer to 3274 Description and Programmer's Guide, 'VFC Operations' paragraph. When FF is not honored, a space is printed.

Note Also: Bits 4,5 & 6 valid in non-LU1 modes only. (Control unit will set bits 5,6 to '1,0' (dualcase) for LU1).

Note further: Bits 1&2 are used to control the operation of the Cancel Key. Cancel is allowed, in LU1 mode, from Start Print of First segment of First in Chain until Order Complete on Last segment of Last in Chain.

Note in addition: When bit 4 of the Print Order Parameter is set to '1' (Print with extension attribute buffer), bits 1, 2, and 3 are redefined as follows:

Bit 1= Reserved

Bit 2=0 Use EAB value (bits 7,8,9) to select character set.
=1 Use EAB value and EACT to select character set.

Bit 3= 0 Base buffer codes '01' to '07' may be interpreted as control codes regardless of EAB value.

Bit 3= 1 Base buffer codes '01' to '07' to be interpreted as control codes only when EAB equals XXXXX001 (APL).

Code '00' - Null - is valid regardless of any character or field attributes.

The control unit will not issue a Start Print with bit 4=1 if the device does not have an EAB (ID byte 0, bit 0).

Print Parameter, FMH Data Stream

Bit 7, previously set to '0' in LU1 mode, will be used to indicate FMH data stream.

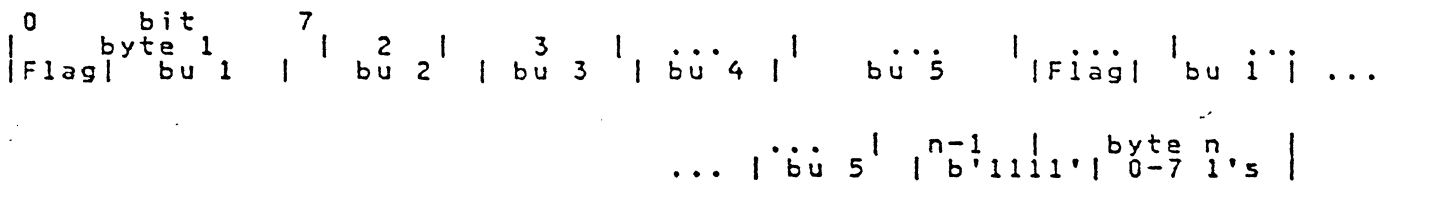
Print Order, LU1 mode, FMH, will be loaded only if the printer has indicated support via ID byte '0E', bit 3. LU1 mode rules apply, except as noted herein. ASCII is not allowed.

If FIC, the FMH is located at MSA. If not FIC, the printer will continue processing the data stream. One and only one FMH is allowed per chain, and the first FMH Print Order after a mode change or previous EOC will specify FIC. The control unit promises to perpetuate the the FIC bit 7 setting (either '0' or '1') for all print orders in that chain.

If LIC indicated, the printer will return order complete, sense '07' if the data in this chain is insufficient to constitute a valid FMH.

A mode change, FIC Start Op, or Abort without a previous EOC Start Op is valid. The printer will terminate any parameter, header, or data processing without generating error status.

If the type 0001 or 0100 printer encounters a Load PS header with bits 4-7 of byte 3 containing a X'6' while executing an LU1 mode Print order with FMH specified, the PS data is to be decompressed as follows:



(where bu indicates bunch, not bushel.)

Each bunch represents two vertical slices, starting at the upper left of the character cell. Each bunch expands to 4 digits of 4 bits each as directed by the variable length flag:

Flag

0	Compare each digit to all zero
10	Compare each digit to 2nd previous digit, first two to zero
110	Compare each digit to 4th previous digit, first four to zero
1110	Entire cell is zero
1111	End flag. Set Sense '02' and quit if remainder of byte is not padded with 1's.

If the first bit of a bunch is '0', every digit in that bunch is to be derived by copying its comparison digit and the bunch terminates following the first bit. If the first bit of a bunch is a '1', the four digits follow.

If the first bit of a digit is a '0', the digit is to be derived by copying its comparison and the digit is terminated following the first bit. If the first bit of a digit is a '1', the four bit valu of the digit follows.

Examples:

Compressed Data (Hex representation omitted as data doesn't understand byte boundries)	Character
b'1110'	blank
b'000000'	blank
b'11000000'	blank
b'10111111111101100110010011100000001100001000000'	fat E

2.3.2.3.4 Load PS ('04')

PS Structured Fields (modified) will be passed to the printer in segments not exceeding 256 bytes and loaded in the data buffer. Each segment loaded will be stored by the printer upon receiving Start Operation. Synchronization will be acheived by the printer posting status available--order complete. This process will be repeated until all Load PS structured fields are transferred to the printer. Load PS Headers may occur at other than the MSA. The host data stream may contain many Load PS structured fields to multiple PSs or planes in a "scatter load" application, and these structured fields will be concatenated in the buffer for one Start Op. with multiple headers.

Load PS Header (and data)

BYTE	BIT	CONTENT	MEANING	KEY
0	0	Basic/Ext b'1'	Basic or extended form - Extended form (10 byte hdr)	C
	1	CLEAR b'0' b'1'	Clear PS RAM/Plane -Do Not Clear PS RAM -Clear The PS RAM Specified	P
	2	Skip b'0' b'1'	Skip Suppress -Suppression off -Suppression on	P
	3-7 3 4-7	TYPE b'0' X'5','6' other	PS Data Format Type Printer unique type: - Column loading (from left to right, hi order bit at top) - Reserved or not supported	C
1		LCID (ALIAS)	Local Coded Graphic Char. Set ID - X'40' thru X'EF' - X'FF' indicates RAM associated with this LCID is free - Others are reserved (X'F0' - X'FE' for ROS sets)	C
2		CHAR	Beginning EBCDIC Code Point X'41' thru X'FE' (inclusive) are valid.	C
3		RAM	PS set RAM number (X'02' - X'07')	C/P

KEY:

C - The control unit is responsible for checking the validity of these bits/bytes.

P - These bits/bytes have significance to the printer.

C/P - Both of the above.

BYTE	BIT	CONTENT	MEANING	KEY
4		p-length X'06'	Length of parameters for extended form. This includes the length parameter itself.	C
5	0	APA	=0 All Points available =1 Not all points available	P
	1	CB	=0 LCID compare =1 No LCID compare	C
	2	OB	=0 PS set is KBD selectable =1 PS set is not KBD selectable	C
	3-7	RES	RESERVED (must be zeros)	
6		X	Number of X-units (10) in cell	C
7		Y	Number of Y-units (8) in cell	C
8		X'00'	one byte codes	C
9	0-4	Reserved	Must be zero	
	5-7	Color B'000' B'001' B'010' B'100' Other	Color planes - Single or all planes - Blue - Red - Green - Reserved	C/P

This is the end of header.

BYTE	BIT	CONTENT	MEANING	KEY
n x c+10s		Data	Character (internal code) followed by 10 vertical slices	C/P
last		'FF'	End of structured field	C/P

All LPSs are to be executed and the last LPS to a PS RAM defines the state of that RAM relative to APA, LCID, etc. The last LPS to a triple plane will define APA, etc. for all planes of that PS set.

Description of Printer significant bytes:

Byte 0

Bit 0 - specifies extended header.

When bit 1 of byte 0 is set to a 1, any portion of the PS RAM not updated will be cleared prior to executing a print order. If the bit is set to 0, the selected PS RAM is not cleared. Thus characters can be added to an existing character set. For a triple plane set, only the plane(s) indicated is cleared.

Bit 2 (SKIP SUPPRESS) controls the vertical positioning of a line of characters. The next line will be positioned vertically adjacent to the current line, if the current line contains one or more characters from a PS set having SKIP SUPPRESS on.

Byte 2

Successive "characters" (11 byte groups) will be in ascending EBCDIC order.

Byte 3

The RAM number indicates the physical RAM to be loaded. Each RAM number is related to an attribute selection key defined for PS. These relations are RAM number 02 thru 07 equate to attribute selection key PS A thru PS F respectively.

Byte 5

The APA bit, when set to a 1 implies that fewer than all points may be displayed or printed to allow a performance gain for specific devices. For example, 3287 NOT APA will attempt to print all characters in one head sweep across the print line, (used with 4 of 7x8 PS font).

Byte 9

For a triple plane PS, if 'PLANES' is omitted, or specified with a value b'000', then for each code point, the character is loaded into each plane of the PS.

For a triple plane PS, if 'PLANES' is specified with a value b'001', b'010', or b'100', then the PS data is loaded into the specified PS plane. Other values are reserved. The control unit will send only b'000' if the printer ID specifies no triple plane for the RAM designated in byte 3.

The PS buffers will be cleared by the printer before responding POR.

The control unit will process DSE/DSC Load PS headers for exception responses. The control unit will maintain a current PS buffer/Alias table for each device configured.

Significant fields in the PCIA are:
- mode = host direct load DSC, 3270
- Message Length = variable
- Message Start Address = variable
- Order = Load PS (x'04')
  Parameters:

  Bit 1 = 1 Beginning of first SF (Load PS Hdr at MSA)
  = 0 Continuation of previous Load PS order, or start of a new SF if previous ended in 'FF', or maybe just 'FF'.

  Bit 3 = 1 Character specified in EBCDIC
  = 0 " " " Internal Code

  Bit 4 = 1 Character code in header only
  = 0 " " preceeds each bunch of slices

  Bit 5 = 1 ML and MSA refer to Extension Buffer
  = 0 " " " " " Base "

  (Bits 3,4,5 = 0,0,0 for DSC and DSE)

  Other bits are reserved (must be zero)

Note: A load PS order with bit 1 = 1 or any other order will cause the printer to terminate a prior load PS order without forcing error status to be set.

Each load PS order must complete within 2 sec. To maintain subsystem performance, load PS orders containing 3K bytes of data should complete (as far as the control unit is concerned) within one second.

The 'Load PS Header' will preceed the slice data. The control unit promises not to split up either the header or the character/slices groups when the structured field continues from one buffer load/Start Op. to the next. The end of the structured field data will be flagged by 'FF' in the n+1 character position.

If a parity error occurs while reading in the header or data, 'data check' status will be set and the load PS order terminated. Deferred clears for previously affected RAMS are not to be lost.

The printers are allowed to terminate with Order Complete/Order Reject, sans Equipment Check, if (when) they detect invalid parameters within the Load PS header, or invalid character addresses or incomplete slice fields within the data. Also, printers are allowed to return sense '04' in non-SCS mode if invalid parameters are detected in the Load PS header.

Host direct (and BSC Copy) print modes:
- 3270 E data stream (internal code):
The interface is similar to the APL support:

- mode = DSE or DSC
- message length
- message start address
- order = print (x'03')
  parameters:
  bit 2 = 0 Don't use EACT
  bit 3 = 1 AD-2 implementation of control codes stored as APL characters to support up to 191 PS character definition.
  = 0 AD-1 implementation of control codes stored as base characters.
  bit 4 = 1 Print with EAB. Character attribute references character sets 1 to 7 or color
  bit 7 unchanged (may be 1 or 0)

Local copy operations (per option A 10x8 format):
(either host or operator initiated)

The control unit will determine whether PS buffers from the display are loaded in the printer, and based on where they are loaded construct the EACT table in the EAB buffer at location x'10' to x'17'. In other respects the PCIA area will not be changed from the AD-1 addendum except for the inclusion of the order parameter indicating whether the printer control codes are stored in the base character set or the APL character set (EAB= 001). All useable PS symbol sets must be pre-stored in the printer in 10x8 format.

-mode = local copy DSE or DSC
-message length
-message start address
-order = print (x'03')
parameters:
bit 2 = 1 use EACT
bit 3 = 1 control codes stored as APL characters.
bit 4 = 1 Print with EAB buffer
bits 5-7 process as currently defined.

Note: If a tri-plane is referenced on a color printer, the color attributes of each pel must be determined on the planes referenced by the color attribute. If color is not featured then all pels in the planes selected will print in monochrome.

2.3.2.3.5 Load Translate Table(s) ('05')

The Configuration Support C control unit will load this order instead of the initial enable after a POR response if (and only if) the printer has specified "Translate Table Req'd" in Printer ID byte '000A'. Commencing at address X'0050', the control unit will load the 191 internal code points corresponding to EBCDIC X'40' thru X'FE'. Commencing at address X'010F' the control unit will load the 191 EBCDIC code points corresponding to internal codes X'01' thru X'BF'. The printer will save whichever table it likes and return Order Complete. The translate table loaded will reflect the language for which the control unit is currently customized.

The control unit will set:

Print parameter = X'00'
Mode = No
MSA = X'0050'
ML = X'017E'

The Load Translate Table order must complete within 1 second.

2.3.2.3.6 LU3 Query ('06')

The Config. Support D control unit will load this order when it receives a Query/Query List Structured Field from the Host while operating in LU3 mode. This order will only be loaded if the printer has set bit 7 of ID byte '000A' (to '1'.) The control unit will have loaded a Query/Query List Structured Field at the end of the data buffer and MSA will point to the first byte. ML will be set to indicate the maximum number of bytes the control unit wants returned at a time and will be equal to or greater than 256.

Mode = DSE or DSC
Message Length: for reply. May change for continuation.
Parameter bits:

Bit 1 = 1 Beginning of Query/Query List.
(Query/Query List SF located at MSA.)
Bit 1 = 0 Continuation of Query/Query List.
(Leftover Reply data at MSA.)

The printer will load Query Reply Structured Field(s) beginning at MSA. Order Complete, Input Code Available will be set in Status. PCIA bytes 0004, 0005 will contain the length of the Reply. Byte 0002 (Input Code) will contain:

X'6C' LU3 Query Reply, more to follow, or:
X'6D' LU3 Query Reply, last piece.

The control unit promises to issue X'06' Start Ops (with parameter bit 1 = 0) until he receives the X'6D' Input Code.

The control unit will append 'Implicit Partition Query Reply Structured Field' and any other Query Reply Structured Fields for which it assumes responsibility due to subsystem efficiency.

The control unit may test the Query Reply Structured Fields returned by the printer against the current configuration support and change to 'null reply' any that exceed said configuration support.

Prior to returning Status Available, the printer is allowed to access the designated Query Reply area even tho 'disabled' by the control unit.

2.3.2.3.7 Load Structured Field ('07')

(DSC mode only)

In DSC mode, used to indicate that structured fields are available. The data will start at the address specified in address 0012-0013 (MSA) with its length specified in address 0014-0015 (ML).

Parameter: x'00' No parameters are defined for the Load SF order.

Note: Load PS and Read Partition Query (or Query List) continue to use Orders X'04' and X'06', respectively. All other structured fields will be passed to the printer using Order X'07'.

Timing: The Load Structured Field order must complete within one second. To avoid exceeding this value due to extended printer processing, Order Complete-Deferred should be sent prior to expiration of the time out period. Completion of

structured field processing and/or a print operation can then be indicated asynchronously by sending Order Complete-Not Deferred.

2.3.2.4 MAXIMUM PRESENTATION POSITION (MPP)

The MPP specifies the maximum print position per line. If zero, print full width as determined by hardware. The MPP byte is loaded by the control unit in all modes except LU1 Mode.

2.3.2.5 EXTENDED ORDER PARAMETER

Bits 0&1= Reserved

bit 2=1 Begin Bracket Flag. Valid only in LU1 mode and only if device has indicated support of FMH Subset 4 (bit 5 of ID byte '000A').

Note: The control unit will set bit 2 (to 1) when the outbound RH carries Begin Bracket and first-in-chain (LU1 session only).

Bits 3 thru 7: Reserved

2.3.2.6 EXTENSION ATTRIBUTE CORRELATION TABLE (EACT).

The EACT, used only in LU2/3 or 3270 mode when bit 2 of print parameter is set to 1, tells the printer how to correlate PS buffers with the PS address in the EAB buffer. It is updated by the Control Unit for all local copy prints. The EACT is located in the EAB buffer from hex location 10 to 17.

location	EAB value	Default Correlation value
0010	B'xxxxx000'	B'00000000'
0011	001	00000000 if APL/TN not installed 00000001 if APL/TN is installed
0012	010	00000000
0013	011	00000000
0014	100	00000000
0015	101	00000000
0016	110	00000000
0017	111	00000000

Note: If control codes are indicated from the APL character attribute the printer will honor control codes when EAB=b'xxxxx001' regardless of the correlation value for APL graphics. The control unit will not load correlation values other than b'00000xxx' or correlate to a non-installed PS set.

2.3.2.7 ALIAS TABLE (ADDRESS 0030-003F)

The Alias Table consists of 8 half words, assigned to Base, APL, and PS's 2-7 in asscending order. The even byte contains the Alias (byte 4 of the Load PS hdr.) and the odd byte contains parameter bits (byte 8 of the Load PS hdr.) This table is used by the printer to equate the alias in an SA order to a physical PS ram. It is created by the control unit prior to the first SCS Start Op of each session. The alias of the Base character set will always be X'00', and the alias of the APL set (if installed) will be X'F1'.

The printer is required to form an "internal" table from the Alias Table at each FIC SCS Print Order Start Op. whether FMH or not. The printer must update the Alias Table (from his "internal" ta-

ble) following completion (or termination) of each FMH Start Op, prior to returning Order Complete. The printer is allowed to update the alias table following completion of a non-FMH SCS Start Op. The alias of a PS will be updated to its new value when the entire Ld PS header is processed error free. Simultaneously, any other PS set with an identical alias would have its alias "reset" (set to 'FF'.)

Both the control unit and the printer are required to set the Alias to X'FF' for unassigned or non-installed PS rams when they write (update) the alias table.

Note: The printer is not required to correct mistakes in the parameter bits sent from the host.

2.4 EXTENDED TRANSLATE TABLES

The following tables, one for each World Trade Language, will be used by printers that support both internal code PS and LU1 (EBCDIC) PS, as a PS set loaded in one mode may be referenced while printing in the other mode.

2.4.1 US, KATAKANA, AND CANADIAN FRENCH

U.S. INTERNAL CODE		EBCDIC CODE		KATAKANA INTERNAL CODE	CANADIAN FRENCH INTERNAL CODE
X'10'	--	40	--	X'10'	X'10'
X'0A'	--	41	--	X'6F'	X'0A'
X'0B'	--	42	--	X'70'	X'55'
X'1C'	--	43	--	X'71'	X'1C'
X'1D'	--	44	--	X'72'	X'1D'
X'1E'	--	45	--	X'73'	X'1E'
X'1F'	--	46	--	X'74'	X'1F'
X'2A'	--	47	--	X'75'	X'2A'
X'2B'	--	48	--	X'76'	X'9D'
X'37'	--	49	--	X'77'	X'37'
X'1B'	--	4A	--	X'1C'	X'40'
X'32'	--	4B	--	X'32'	X'32'
X'09'	--	4C	--	X'09'	X'09'
X'0D'	--	4D	--	X'0D'	X'0D'
X'35'	--	4E	--	X'35'	X'35'
X'16'	--	4F	--	X'16'	X'19'
X'30'	--	50	--	X'30'	X'30'
X'38'	--	51	--	X'78'	X'38'
X'39'	--	52	--	X'79'	X'56'
X'3A'	--	53	--	X'7A'	X'51'
X'3C'	--	54	--	X'7B'	X'3B'
X'3E'	--	55	--	X'7C'	X'1B'
X'3F'	--	56	--	X'7D'	X'57'
X'40'	--	57	--	X'0A'	X'52'
X'41'	--	58	--	X'7E'	X'0E'
X'42'	--	59	--	X'0B'	X'42'
X'19'	--	5A	--	X'19'	X'3E'
X'1A'	--	5B	--	X'1D'	X'1A'
X'BF'	--	5C	--	X'BF'	X'BF'
X'0C'	--	5D	--	X'0C'	X'0C'
X'BE'	--	5E	--	X'BE'	X'BE'
X'36'	--	5F	--	X'36'	X'3A'
X'31'	--	60	--	X'31'	X'31'
X'14'	--	61	--	X'14'	X'14'
X'43'	--	62	--	X'0E'	X'75'
X'44'	--	63	--	X'0F'	X'17'
X'45'	--	64	--	X'15'	X'60'
X'46'	--	65	--	X'17'	X'46'
X'47'	--	66	--	X'1B'	X'47'
X'48'	--	67	--	X'1E'	X'48'
X'49'	--	68	--	X'1F'	X'BD'
X'05'	--	69	--	X'2A'	X'05'
X'17'	--	6A	--	X'2B'	X'44'
X'33'	--	6B	--	X'33'	X'33'
X'2E'	--	6C	--	X'2E'	X'2E'
X'2F'	--	6D	--	X'2F'	X'2F'
X'08'	--	6E	--	X'08'	X'08'
X'18'	--	6F	--	X'18'	X'18'
X'4B'	--	70	--	X'38'	X'4B'
X'4C'	--	71	--	X'39'	X'7B'
X'4D'	--	72	--	X'3A'	X'76'
X'4E'	--	73	--	X'3B'	X'71'
X'4F'	--	74	--	X'3C'	X'61'
X'50'	--	75	--	X'3D'	X'50'
X'51'	--	76	--	X'3E'	X'77'
X'52'	--	77	--	X'3F'	X'72'
X'53'	--	78	--	X'7F'	X'53'
X'3D'	--	79	--	X'80'	X'3D'

X'34'	--	7A	--	X'34'	X'34'
X'2C'	--	7B	--	X'2C'	X'2C'
X'2D'	--	7C	--	X'2D'	X'2D'
X'12'	--	7D	--	X'12'	X'12'
X'11'	--	7E	--	X'11'	X'11'
X'13'	--	7F	--	X'13'	X'13'
X'54'	--	80	--	X'81'	X'7F'
X'80'	--	81	--	X'40'	X'80'
X'81'	--	82	--	X'41'	X'81'
X'82'	--	83	--	X'42'	X'82'
X'83'	--	84	--	X'43'	X'83'
X'84'	--	85	--	X'44'	X'84'
X'85'	--	86	--	X'45'	X'85'
X'86'	--	87	--	X'46'	X'86'
X'87'	--	88	--	X'47'	X'87'
X'88'	--	89	--	X'48'	X'88'
X'55'	--	8A	--	X'49'	X'0B'
X'56'	--	8B	--	X'82'	X'39'
X'57'	--	8C	--	X'05'	X'36'
X'58'	--	8D	--	X'4B'	X'7A'
X'59'	--	8E	--	X'4C'	X'7E'
X'5A'	--	8F	--	X'4D'	X'5A'
X'5B'	--	90	--	X'4E'	X'0F'
X'89'	--	91	--	X'4F'	X'89'
X'8A'	--	92	--	X'50'	X'8A'
X'8B'	--	93	--	X'51'	X'8B'
X'8C'	--	94	--	X'52'	X'8C'
X'8D'	--	95	--	X'53'	X'8D'
X'8E'	--	96	--	X'54'	X'8E'
X'8F'	--	97	--	X'55'	X'8F'
X'90'	--	98	--	X'56'	X'90'
X'91'	--	99	--	X'57'	X'91'
X'5C'	--	9A	--	X'58'	X'5C'
X'5D'	--	9B	--	X'83'	X'5D'
X'5E'	--	9C	--	X'84'	X'5E'
X'5F'	--	9D	--	X'59'	X'5F'
X'60'	--	9E	--	X'5A'	X'45'
X'61'	--	9F	--	X'5B'	X'4F'
X'62'	--	A0	--	X'85'	X'62'
X'3B'	--	A1	--	X'37'	X'3C'
X'92'	--	A2	--	X'5C'	X'92'
X'93'	--	A3	--	X'5D'	X'93'
X'94'	--	A4	--	X'5E'	X'94'
X'95'	--	A5	--	X'5F'	X'95'
X'96'	--	A6	--	X'60'	X'96'
X'97'	--	A7	--	X'61'	X'97'
X'98'	--	A8	--	X'62'	X'98'
X'99'	--	A9	--	X'63'	X'99'
X'63'	--	AA	--	X'64'	X'63'
X'64'	--	AB	--	X'86'	X'49'
X'65'	--	AC	--	X'65'	X'65'
X'66'	--	AD	--	X'66'	X'66'
X'67'	--	AE	--	X'67'	X'67'
X'68'	--	AF	--	X'68'	X'68'
X'69'	--	B0	--	X'87'	X'69'
X'6A'	--	B1	--	X'88'	X'6A'
X'6B'	--	B2	--	X'89'	X'6B'
X'6C'	--	B3	--	X'8A'	X'6C'
X'6D'	--	B4	--	X'8B'	X'6D'
X'6E'	--	B5	--	X'8C'	X'6E'
X'6F'	--	B6	--	X'8D'	X'6F'
X'70'	--	B7	--	X'8E'	X'70'
X'71'	--	B8	--	X'8F'	X'4E'
X'72'	--	B9	--	X'90'	X'16'
X'73'	--	BA	--	X'69'	X'73'
X'74'	--	BB	--	X'6A'	X'BC'
X'75'	--	BC	--	X'6B'	X'43'
X'76'	--	BD	--	X'6C'	X'4D'
X'77'	--	BE	--	X'6D'	X'15'
X'78'	--	BF	--	X'6E'	X'9C'
X'0F'	--	C0	--	X'91'	X'5B'
X'A0'	--	C1	--	X'A0'	X'A0'
X'A1'	--	C2	--	X'A1'	X'A1'
X'A2'	--	C3	--	X'A2'	X'A2'

X'A3'	--	C4	--	X'A3'	X'A3'
X'A4'	--	C5	--	X'A4'	X'A4'
X'A5'	--	C6	--	X'A5'	X'A5'
X'A6'	--	C7	--	X'A6'	X'A6'
X'A7'	--	C8	--	X'A7'	X'A7'
X'A8'	--	C9	--	X'A8'	X'A8'
X'79'	--	CA	--	X'92'	X'BB'
X'7A'	--	CB	--	X'93'	X'58'
X'7B'	--	CC	--	X'94'	X'4C'
X'7C'	--	CD	--	X'95'	X'7C'
X'01'	--	CE	--	X'01'	X'01'
X'02'	--	CF	--	X'02'	X'02'
X'0E'	--	D0	--	X'96'	X'41'
X'A9'	--	D1	--	X'A9'	X'A9'
X'AA'	--	D2	--	X'AA'	X'AA'
X'AB'	--	D3	--	X'AB'	X'AB'
X'AC'	--	D4	--	X'AC'	X'AC'
X'AD'	--	D5	--	X'AD'	X'AD'
X'AE'	--	D6	--	X'AE'	X'AE'
X'AF'	--	D7	--	X'AF'	X'AF'
X'B0'	--	D8	--	X'B0'	X'B0'
X'B1'	--	D9	--	X'B1'	X'B1'
X'7D'	--	DA	--	X'97'	X'7D'
X'7E'	--	DB	--	X'98'	X'59'
X'7F'	--	DC	--	X'99'	X'54'
X'03'	--	DD	--	X'03'	X'03'
X'04'	--	DE	--	X'04'	X'04'
X'05'	--	DF	--	X'05'	X'05'
X'15'	--	E0	--	X'1A'	X'3F'
X'9A'	--	E1	--	X'9A'	X'9A'
X'B2'	--	E2	--	X'B2'	X'B2'
X'B3'	--	E3	--	X'B3'	X'B3'
X'B4'	--	E4	--	X'B4'	X'B4'
X'B5'	--	E5	--	X'B5'	X'B5'
X'B6'	--	E6	--	X'B6'	X'B6'
X'B7'	--	E7	--	X'B7'	X'B7'
X'B8'	--	E8	--	X'B8'	X'B8'
X'B9'	--	E9	--	X'B9'	X'B9'
X'9B'	--	EA	--	X'9B'	X'9B'
X'9C'	--	EB	--	X'9C'	X'78'
X'9D'	--	EC	--	X'9D'	X'2B'
X'06'	--	ED	--	X'06'	X'06'
X'07'	--	EE	--	X'07'	X'07'
X'9E'	--	EF	--	X'9E'	X'9E'
X'20'	--	F0	--	X'20'	X'20'
X'21'	--	F1	--	X'21'	X'21'
X'22'	--	F2	--	X'22'	X'22'
X'23'	--	F3	--	X'23'	X'23'
X'24'	--	F4	--	X'24'	X'24'
X'25'	--	F5	--	X'25'	X'25'
X'26'	--	F6	--	X'26'	X'26'
X'27'	--	F7	--	X'27'	X'27'
X'28'	--	F8	--	X'28'	X'28'
X'29'	--	F9	--	X'29'	X'29'
X'BA'	--	FA	--	X'BA'	X'BA'
X'BB'	--	FB	--	X'BB'	X'79'
X'BC'	--	FC	--	X'BC'	X'74'
X'BD'	--	FD	--	X'BD'	X'64'
X'9F'	--	FE	--	X'9F'	X'9F'

2.4.2 TABLE V COUNTRIES

EBCDIC	'73 US ENGLISH	'76 AUS/GER	'70 AUS/GER	'73 DEN/NOR	'70 DEN/NOR	'73 FIN/SWE	'70 FIN/SWE	'73 FRENCH	'73S ITALIAN	'73 PORTUGAL	'70 SPANISH	'76 SPANISH	'73 UK	'73 BELGIAN	'73 BRAZIL	'73 SPAN SPK	'73 INT'L	'73 JAPAN ENG
41	0A								1B	1B			1B		1B	1B		
42	0B								16	19			16		19	16		
43	1C							2C	2C			1B					1B	
44	1D																15	
45	1E									1A	1A							
46	1F			1B		16												
47	2A	3B	17															
48	2B	2D				1B		16	2D									
49	37											3B					3B	
4A	1B	70	53	2C	9B	2B	53	38	38	0A	0A		1A	0A	7B	0A	0A	1C
4F	16	19		19		19		19	19	19				19	19		19	
51	38							1B	1B									
53	3A	36		36		36		36	36	36				36	36		36	
54	3C							3B			3B			3B		3B		
55	3E									0E								
5A	19	74	54	1F	9C	1F	9C	2B	4A	0B	0B			0B	1A	0B	0B	
5B	1A		74	BC	BC	BC	BC				1E	1E	1C		BD			1D
5F	36	3A		3A		3A		3A	3A	3A				3A	3A		3A	
64	45									0F					3D			
65	46									17					0F			
67	48							2D	0F					2D				
68	49							0E	0E					0E				
69	4A							0F	16					0F				
6A	17	53	2A	9B		53		4D	4C	46	5F			4D	9D	5F		
70	4B								3B									
71	4C								17									
72	4D							17	3D					17				
73	4E			3B		3B												
74	4F							15	15					15				
75	50	0F	13			0F	13											
78	53	17	1B			17	1B											
79	3D					5B			4D						45			
7B	2C		70	BA	BA	70	70	1C	1C	65	7F	7F			66	7F		
7C	2D	2B	73	BB	BB	73	73	48	2B	66				48	65			
7F	13		50		9A		50					5F						
80	54	0E	19															
90	5B					3D									0E			
9D	5F										17	13				17		

EBCDIC	'73 US ENGLISH	'76 AUS/GER	'70 AUS/GER	'73 DEN/NOR	'70 DEN/NOR	'73 FIN/SWE	'70 FIN/SWE	'73 FRENCH	'73 ITALIAN	'73S PORTUGAL	'73 SPANISH	'70 SPANISH	'76 UK	'73 BELGIAN	'73 BRAZIL	'73 SPAN SPK	'73 INT'L	'73 JAPAN ENG
A1	3B	2A		4E		4E		3C	4B	9D	3C		37	3C		3C		37
AC	65									2C					2D			
AD	66									2D					2C			
B7	70	1B	2C			2C	2C											
BA	73	15	2D			2D	2D											
BB	74	16	1A															
C0	0F	50		9A		50		4A	48	45			4A	46				
CC	7B					15								1B				
D0	0E	54		9C		9C		49	49	3E			49	5B				
DC	7F										2C	2C				2C		
E0	15	73				7B		4F	4F	BD			4F					1A
E1	9A			0F	13													
EA	9B			17	1B													
EB	9C			0E	19	0E	19											
EC	9D									3B					17			
FA	BA			16	2C													
FB	BB			2D	2D													
FC	BC			1A	1A	1A	1A											
FD	BD									15					16			

Note: Use US English table as 'base'; i.e. for EBCDIC codes other than listed in the above table and also where blanks appear in the table.

2.4.3 MORE EXTENDED TRANSLATE TABLES

US (ref), CANADIAN BILINGUAL, FRENCH AZERTY 105 Character, PORTUGUESE ALTERNATE, SWISS FRENCH (SWISS GERMAN), INTERNAL CODES

U.S. INTRNL CODE	EBCDIC CODE	CANADIAN BILING INTRNL CODE	FRENCH INTRNL CODE	PORTUGESE INTRNL CODE	SWISS FRENCH INTRNL CODE
X'10'	40	X'10'	X'10'	X'10'	X'10'
X'0A'	41	X'0A'	X'0A'	X'1B'	X'1D'
X'0B'	42	X'55'	X'55'	X'16'	X'55'
X'1C'	43	X'1C'	X'50'	X'1C'	X'50'
X'1D'	44	X'40'	X'1D'	X'1D'	X'48'
X'1E'	45	X'1E'	X'1E'	X'1E'	X'1E'
X'1F'	46	X'1F'	X'1F'	X'1F'	X'1F'
X'2A'	47	X'2A'	X'2A'	X'2A'	X'2A'
X'2B'	48	X'9D'	X'16'	X'2B'	X'4F'
X'37'	49	X'37'	X'37'	X'37'	X'37'
X'1B'	4A	X'1B'	X'38'	X'0A'	X'0A'
X'32'	4B	X'32'	X'32'	X'32'	X'32'
X'09'	4C	X'09'	X'09'	X'09'	X'09'
X'0D'	4D	X'0D'	X'0D'	X'0D'	X'0D'
X'35'	4E	X'35'	X'35'	X'35'	X'35'
X'16'	4F	X'16'	X'19'	X'19'	X'19'
X'30'	50	X'30'	X'30'	X'30'	X'30'
X'38'	51	X'5B'	X'1B'	X'38'	X'4A'
X'39'	52	X'56'	X'56'	X'39'	X'56'
X'3A'	53	X'51'	X'51'	X'36'	X'51'
X'3C'	54	X'41'	X'3B'	X'3C'	X'49'
X'3E'	55	X'69'	X'3E'	X'0E'	X'3E'
X'3F'	56	X'57'	X'57'	X'3F'	X'57'
X'40'	57	X'52'	X'52'	X'40'	X'52'
X'41'	58	X'4D'	X'41'	X'41'	X'4B'
X'42'	59	X'42'	X'42'	X'42'	X'2B'
X'19'	5A	X'19'	X'2B'	X'0B'	X'0B'
X'1A'	5B	X'1A'	X'1A'	X'1A'	X'1A'
X'BF'	5C	X'BF'	X'BF'	X'BF'	X'BF'
X'0C'	5D	X'0C'	X'0C'	X'0C'	X'0C'
X'BE'	5E	X'BE'	X'BE'	X'BE'	X'BE'
X'36'	5F	X'36'	X'3A'	X'3A'	X'3A'
X'31'	60	X'31'	X'31'	X'31'	X'31'
X'14'	61	X'14'	X'14'	X'14'	X'14'
X'43'	62	X'75'	X'43'	X'43'	X'36'
X'44'	63	X'7C'	X'44'	X'44'	X'70'
X'45'	64	X'60'	X'45'	X'0F'	X'45'
X'46'	65	X'46'	X'46'	X'17'	X'46'
X'47'	66	X'47'	X'05'	X'47'	X'47'
X'48'	67	X'48'	X'2D'	X'48'	X'38'
X'49'	68	X'BD'	X'0E'	X'49'	X'39'
X'05'	69	X'4A'	X'0F'	X'4A'	X'5B'
X'17'	6A	X'17'	X'4D'	X'46'	X'17'
X'33'	6B	X'33'	X'33'	X'33'	X'33'
X'2E'	6C	X'2E'	X'2E'	X'2E'	X'2E'
X'2F'	6D	X'2F'	X'2F'	X'2F'	X'2F'
X'08'	6E	X'08'	X'08'	X'08'	X'08'
X'18'	6F	X'18'	X'18'	X'18'	X'18'
X'4B'	70	X'4B'	X'4B'	X'4B'	X'42'
X'4C'	71	X'7B'	X'4C'	X'4C'	X'43'
X'4D'	72	X'76'	X'17'	X'4D'	X'3F'
X'4E'	73	X'71'	X'4E'	X'4E'	X'4E'
X'4F'	74	X'61'	X'15'	X'4F'	X'40'
X'50'	75	X'50'	X'2C'	X'50'	X'41'
X'51'	76	X'77'	X'36'	X'51'	X'44'
X'52'	77	X'72'	X'40'	X'52'	X'6A'
X'53'	78	X'53'	X'7B'	X'53'	X'76'
X'3D'	79	X'3D'	X'39'	X'3D'	X'3D'
X'34'	7A	X'34'	X'34'	X'34'	X'34'
X'2C'	7B	X'2C'	X'1C'	X'65'	X'2C'
X'2D'	7C	X'2D'	X'48'	X'66'	X'2D'
X'12'	7D	X'12'	X'12'	X'12'	X'12'
X'11'	7E	X'11'	X'11'	X'11'	X'11'

X'13'	7F	X'13'	X'13'	X'13'	X'13'	X'13'	X'13'
X'54'	80	X'7F'	X'7F'	X'80'	X'54'	X'7A'	X'7A'
X'80'	81	X'80'	X'80'	X'81'	X'80'	X'80'	X'80'
X'81'	82	X'81'	X'81'	X'82'	X'81'	X'81'	X'81'
X'82'	83	X'82'	X'82'	X'83'	X'82'	X'82'	X'82'
X'83'	84	X'83'	X'83'	X'84'	X'83'	X'83'	X'83'
X'84'	85	X'84'	X'84'	X'85'	X'84'	X'84'	X'84'
X'85'	86	X'85'	X'85'	X'86'	X'85'	X'85'	X'85'
X'86'	87	X'86'	X'86'	X'87'	X'86'	X'86'	X'86'
X'87'	88	X'87'	X'87'	X'88'	X'87'	X'87'	X'87'
X'88'	89	X'88'	X'88'	X'0B'	X'88'	X'88'	X'88'
X'55'	8A	X'0B'	X'0B'	X'39'	X'55'	X'7B'	X'7B'
X'56'	8B	X'39'	X'3D'	X'5F'	X'56'	X'7C'	X'7C'
X'57'	8C	X'5F'	X'3F'	X'7A'	X'57'	X'7E'	X'7E'
X'58'	8D	X'7A'	X'7A'	X'7E'	X'58'	X'7F'	X'7F'
X'59'	8E	X'7E'	X'7E'	X'5A'	X'59'	X'9D'	X'9D'
X'5A'	8F	X'5A'	X'5A'	X'38'	X'5A'	X'5A'	X'5A'
X'5B'	90	X'38'	X'5B'	X'89'	X'5B'	X'BC'	X'BC'
X'89'	91	X'89'	X'89'	X'8A'	X'89'	X'89'	X'89'
X'8A'	92	X'8A'	X'8A'	X'8B'	X'8A'	X'8A'	X'8A'
X'8B'	93	X'8B'	X'8B'	X'8C'	X'8B'	X'8B'	X'8B'
X'8C'	94	X'8C'	X'8C'	X'8D'	X'8C'	X'8C'	X'8C'
X'8D'	95	X'8D'	X'8D'	X'8E'	X'8D'	X'8D'	X'8D'
X'8E'	96	X'8E'	X'8E'	X'8F'	X'8E'	X'8E'	X'8E'
X'8F'	97	X'8F'	X'8F'	X'90'	X'8F'	X'8F'	X'8F'
X'90'	98	X'90'	X'90'	X'91'	X'90'	X'90'	X'90'
X'91'	99	X'91'	X'91'	X'5C'	X'91'	X'91'	X'91'
X'5C'	9A	X'5C'	X'5C'	X'5D'	X'5C'	X'5C'	X'5C'
X'5D'	9B	X'5D'	X'5D'	X'5E'	X'5D'	X'5D'	X'5D'
X'5E'	9C	X'5E'	X'5E'	X'3F'	X'5E'	X'5E'	X'5E'
X'5F'	9D	X'3F'	X'5F'	X'45'	X'5F'	X'5F'	X'5F'
X'60'	9E	X'45'	X'60'	X'4F'	X'60'	X'60'	X'60'
X'61'	9F	X'4F'	X'61'	X'62'	X'61'	X'61'	X'61'
X'62'	A0	X'62'	X'62'	X'3B'	X'62'	X'62'	X'62'
X'3B'	A1	X'3B'	X'3C'	X'92'	X'9D'	X'3B'	X'3B'
X'92'	A2	X'92'	X'92'	X'93'	X'92'	X'92'	X'92'
X'93'	A3	X'93'	X'93'	X'94'	X'93'	X'93'	X'93'
X'94'	A4	X'94'	X'94'	X'95'	X'94'	X'94'	X'94'
X'95'	A5	X'95'	X'95'	X'96'	X'95'	X'95'	X'95'
X'96'	A6	X'96'	X'96'	X'97'	X'96'	X'96'	X'96'
X'97'	A7	X'97'	X'97'	X'98'	X'97'	X'97'	X'97'
X'98'	A8	X'98'	X'98'	X'99'	X'98'	X'98'	X'98'
X'99'	A9	X'99'	X'99'	X'63'	X'99'	X'99'	X'99'
X'63'	AA	X'63'	X'63'	X'49'	X'63'	X'63'	X'63'
X'64'	AB	X'49'	X'64'	X'65'	X'64'	X'64'	X'64'
X'65'	AC	X'65'	X'65'	X'66'	X'2C'	X'65'	X'65'
X'66'	AD	X'66'	X'66'	X'67'	X'2D'	X'66'	X'66'
X'67'	AE	X'67'	X'67'	X'68'	X'67'	X'67'	X'67'
X'68'	AF	X'68'	X'68'	X'3A'	X'68'	X'68'	X'68'
X'69'	B0	X'3A'	X'69'	X'6A'	X'69'	X'69'	X'69'
X'6A'	B1	X'6A'	X'6A'	X'6B'	X'6A'	X'1C'	X'1C'
X'6B'	B2	X'6B'	X'6B'	X'6C'	X'6B'	X'6B'	X'6B'
X'6C'	B3	X'6C'	X'6C'	X'6D'	X'6C'	X'6C'	X'6C'
X'6D'	B4	X'6D'	X'6D'	X'6E'	X'6D'	X'6D'	X'6D'
X'6E'	B5	X'6E'	X'6E'	X'6F'	X'6E'	X'6E'	X'6E'
X'6F'	B6	X'6F'	X'6F'	X'70'	X'6F'	X'6F'	X'6F'
X'70'	B7	X'70'	X'70'	X'4E'	X'70'	X'1B'	X'1B'
X'71'	B8	X'4E'	X'71'	X'1D'	X'71'	X'71'	X'71'
X'72'	B9	X'1D'	X'72'	X'73'	X'72'	X'72'	X'72'
X'73'	BA	X'73'	X'73'	X'BC'	X'73'	X'BD'	X'BD'
X'74'	BB	X'BC'	X'74'	X'43'	X'74'	X'16'	X'16'
X'75'	BC	X'43'	X'75'	X'3C'	X'75'	X'75'	X'75'
X'76'	BD	X'3C'	X'76'	X'3E'	X'76'	X'3C'	X'3C'
X'77'	BE	X'3E'	X'77'	X'9C'	X'77'	X'77'	X'77'
X'78'	BF	X'9C'	X'78'	X'0F'	X'78'	X'78'	X'78'
X'0F'	C0	X'0F'	X'4A'	X'A0'	X'45'	X'0F'	X'0F'
X'A0'	C1	X'A0'	X'A0'	X'A1'	X'A0'	X'A0'	X'A0'
X'A1'	C2	X'A1'	X'A1'	X'A2'	X'A1'	X'A1'	X'A1'
X'A2'	C3	X'A2'	X'A2'	X'A3'	X'A2'	X'A2'	X'A2'
X'A3'	C4	X'A3'	X'A3'	X'A4'	X'A3'	X'A3'	X'A3'
X'A4'	C5	X'A4'	X'A4'	X'A5'	X'A4'	X'A4'	X'A4'
X'A5'	C6	X'A5'	X'A5'	X'A6'	X'A5'	X'A5'	X'A5'
X'A6'	C7	X'A6'	X'A6'	X'A7'	X'A6'	X'A6'	X'A6'
X'A7'	C8	X'A7'	X'A7'		X'A7'	X'A7'	X'A7'

X'A8'	--	C9	--	X'A8'	X'A8'	X'A8'	X'A8'
X'79'	--	CA	--	X'BB'	X'79'	X'79'	X'79'
X'7A'	--	CB	--	X'58'	X'58'	X'7A'	X'58'
X'7B'	--	CC	--	X'4C'	X'53'	X'7B'	X'53'
X'7C'	--	CD	--	X'03'	X'7C'	X'7C'	X'4C'
X'01'	--	CE	--	X'01'	X'01'	X'01'	X'01'
X'02'	--	CF	--	X'02'	X'02'	X'02'	X'02'
X'0E'	--	D0	--	X'0E'	X'49'	X'3E'	X'0E'
X'A9'	--	D1	--	X'A9'	X'A9'	X'A9'	X'A9'
X'AA'	--	D2	--	X'AA'	X'AA'	X'AA'	X'AA'
X'AB'	--	D3	--	X'AB'	X'AB'	X'AB'	X'AB'
X'AC'	--	D4	--	X'AC'	X'AC'	X'AC'	X'AC'
X'AD'	--	D5	--	X'AD'	X'AD'	X'AD'	X'AD'
X'AE'	--	D6	--	X'AE'	X'AE'	X'AE'	X'AE'
X'AF'	--	D7	--	X'AF'	X'AF'	X'AF'	X'AF'
X'B0'	--	D8	--	X'B0'	X'B0'	X'B0'	X'B0'
X'B1'	--	D9	--	X'B1'	X'B1'	X'B1'	X'B1'
X'7D'	--	DA	--	X'7D'	X'7D'	X'7D'	X'7D'
X'7E'	--	DB	--	X'59'	X'59'	X'7E'	X'59'
X'7F'	--	DC	--	X'54'	X'54'	X'7F'	X'54'
X'03'	--	DD	--	X'44'	X'03'	X'03'	X'4D'
X'04'	--	DE	--	X'04'	X'04'	X'04'	X'04'
X'05'	--	DF	--	X'05'	X'47'	X'05'	X'05'
X'15'	--	E0	--	X'15'	X'4F'	X'BD'	X'15'
X'9A'	--	E1	--	X'9A'	X'9A'	X'9A'	X'9A'
X'B2'	--	E2	--	X'B2'	X'B2'	X'B2'	X'B2'
X'B3'	--	E3	--	X'B3'	X'B3'	X'B3'	X'B3'
X'B4'	--	E4	--	X'B4'	X'B4'	X'B4'	X'B4'
X'B5'	--	E5	--	X'B5'	X'B5'	X'B5'	X'B5'
X'B6'	--	E6	--	X'B6'	X'B6'	X'B6'	X'B6'
X'B7'	--	E7	--	X'B7'	X'B7'	X'B7'	X'B7'
X'B8'	--	E8	--	X'B8'	X'B8'	X'B8'	X'B8'
X'B9'	--	E9	--	X'B9'	X'B9'	X'B9'	X'B9'
X'9B'	--	EA	--	X'9B'	X'9B'	X'9B'	X'9B'
X'9C'	--	EB	--	X'78'	X'9C'	X'9C'	X'9C'
X'9D'	--	EC	--	X'2B'	X'9D'	X'3B'	X'73'
X'06'	--	ED	--	X'06	X'06'	X'06'	X'06'
X'07'	--	EE	--	X'07	X'07'	X'07'	X'07'
X'9E'	--	EF	--	X'9E	X'9E'	X'9E'	X'9E'
X'20'	--	F0	--	X'20'	X'20'	X'20'	X'20'
X'21'	--	F1	--	X'21'	X'21'	X'21'	X'21'
X'22'	--	F2	--	X'22'	X'22'	X'22'	X'22'
X'23'	--	F3	--	X'23'	X'23'	X'23'	X'23'
X'24'	--	F4	--	X'24'	X'24'	X'24'	X'24'
X'25'	--	F5	--	X'25'	X'25'	X'25'	X'25'
X'26'	--	F6	--	X'26'	X'26'	X'26'	X'26'
X'27'	--	F7	--	X'27'	X'27'	X'27'	X'27'
X'28'	--	F8	--	X'28'	X'28'	X'28'	X'28'
X'29'	--	F9	--	X'29'	X'29'	X'29'	X'29'
X'BA'	--	FA	--	X'BA'	X'BA'	X'BA'	X'BA'
X'BB'	--	FB	--	X'79'	X'BB'	X'BB'	X'BB'
X'BC'	--	FC	--	X'74'	X'BC'	X'BC'	X'74'
X'BD'	--	FD	--	X'64'	X'BD'	X'15'	X'03'
X'9F'	--	FE	--	X'9F'	X'9F'	X'9F'	X'9F'

3.0 COAX TRANSMISSION PROTOCOL

3.1.1 GENERAL

The Control Unit to Device Interface is a single wire coaxial cable (coax) interface using type RG62AU coaxial cable with serial by bit data transferred in either direction but in only one direction at at time. The control unit operates as a master, and the attached device operates as a slave. Each device attached directly to the control unit receives and sends data addressed only to that device.

Bits on the coax appear as positive and negative going pulses. Binary data is phase encoded such that a 212 nanosecond (ns) up-level followed by a 212 ns down-level, represents a binary 0. Similarly, a 212 ns down-level, followed by a 212 ns up-level, represents a binary 1. A predistortion pulse is generated for every transition from an up-level to a down-level or vice versa. (See waveforms in 3.0 (A) and 3.0 (B).)

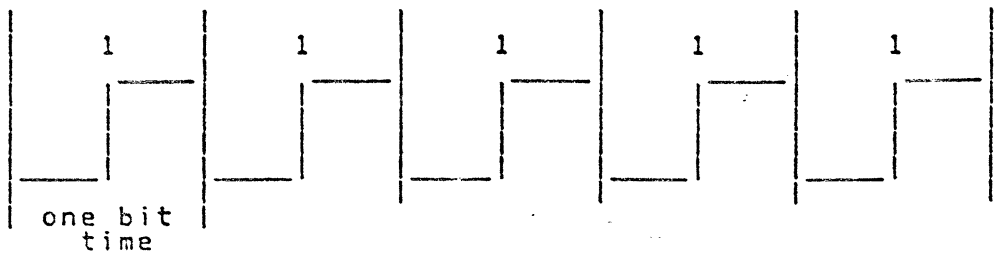
The waveforms shown in 3.0 (A) and 3.0 (B) are the signals measured across the coax at the transmitting unit (either control unit or device).

The waveforms shown in 3.0 (C) and 3.0 (D) show the signal across the coax at the receiving end of 1.5km of coax.

The dipulse technique is used to provide a voltage transition of the coax at mid-bit time. Prior to valid data being transmitted, the coax must be conditioned to ensure that bit and byte synchronization may be achieved. This requires the transmission of a line quiesce and code violation pattern.

3.1.2 LINE QUIESCE PATTERN

It is necessary to establish an equilibrium switching condition on the line after the null condition of line turn around before valid data can be properly detected at the receiver. Each data sequence from either control unit or device will therefore be preceded by a quiesce pattern of at least 5 "1" bits of biphase encoded data. (Early models of the 3174 control unit have been found to transmit the first line quiesce bit with the initial transistion having a pulse width of 350 nsec instead of 212 nsec. This anomoly occurs at the four NDCA ports only; the TMA outputs are as herein defined.)



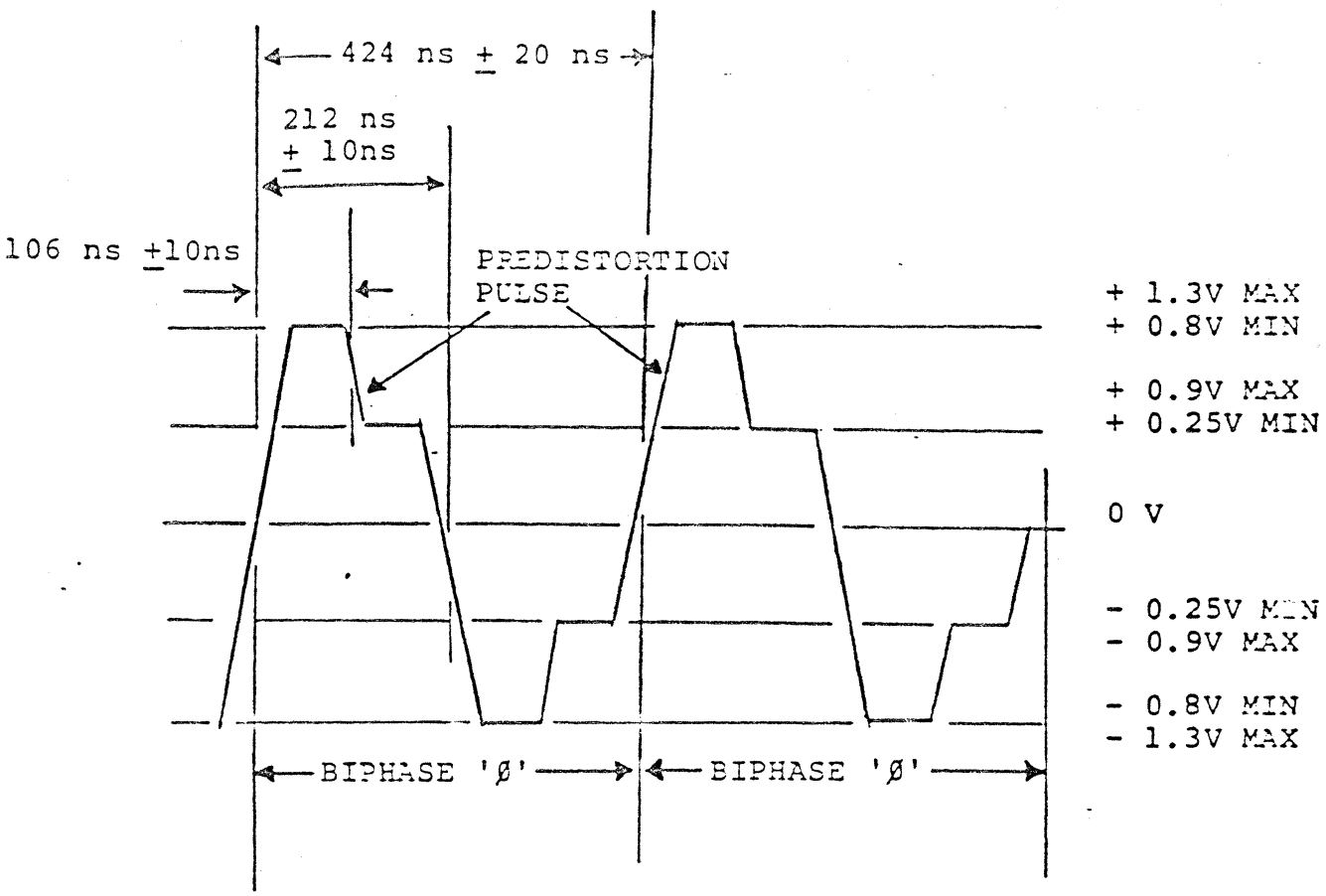


Figure 3.0 (A)

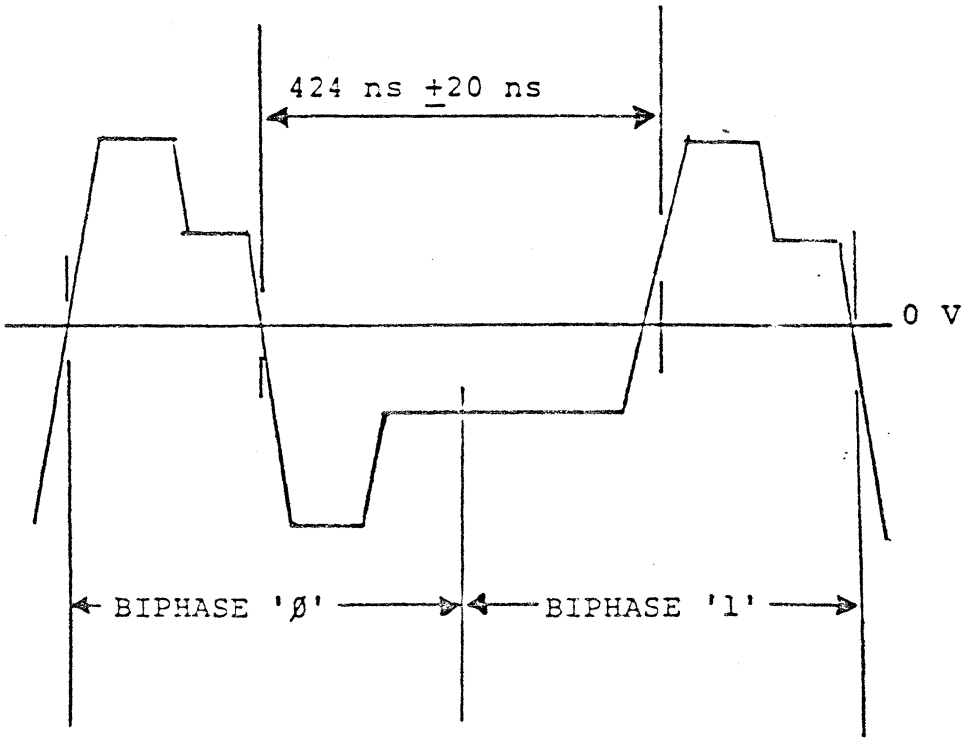


Figure 3.0 (B)

ALL RISE AND FALL TIMES 30 ns MAX.
RISE AND FALL TIMES ARE EXAGGERATED FOR CLARITY.

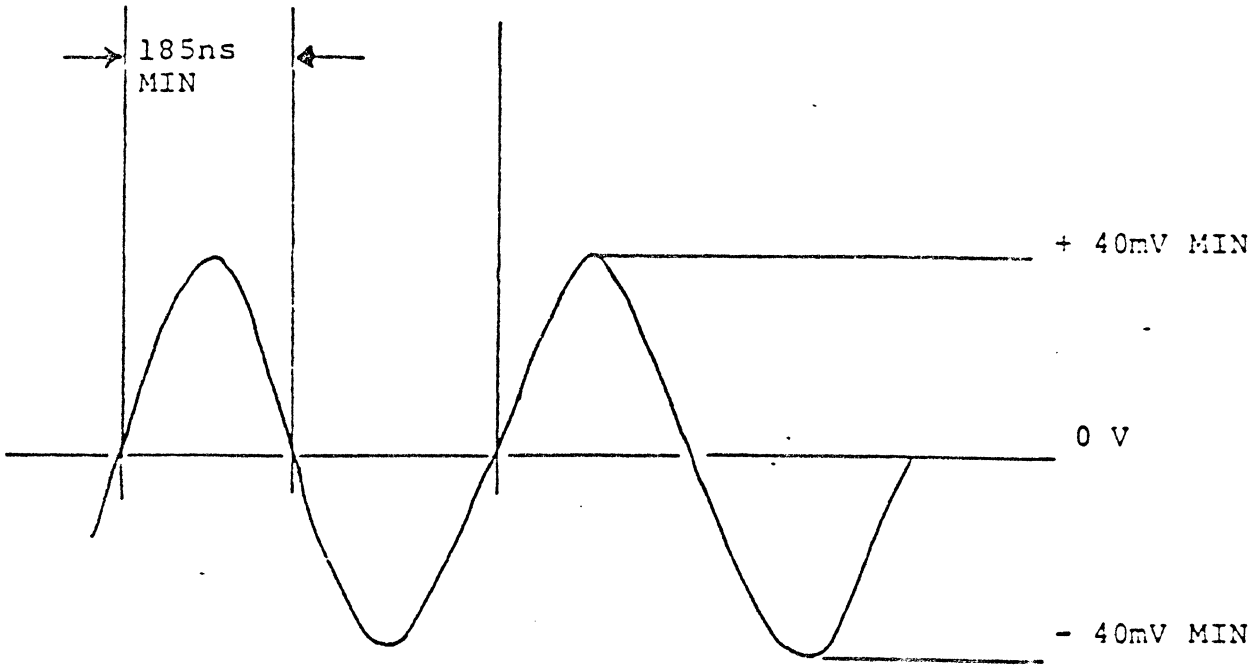


Figure 3.0 (C)

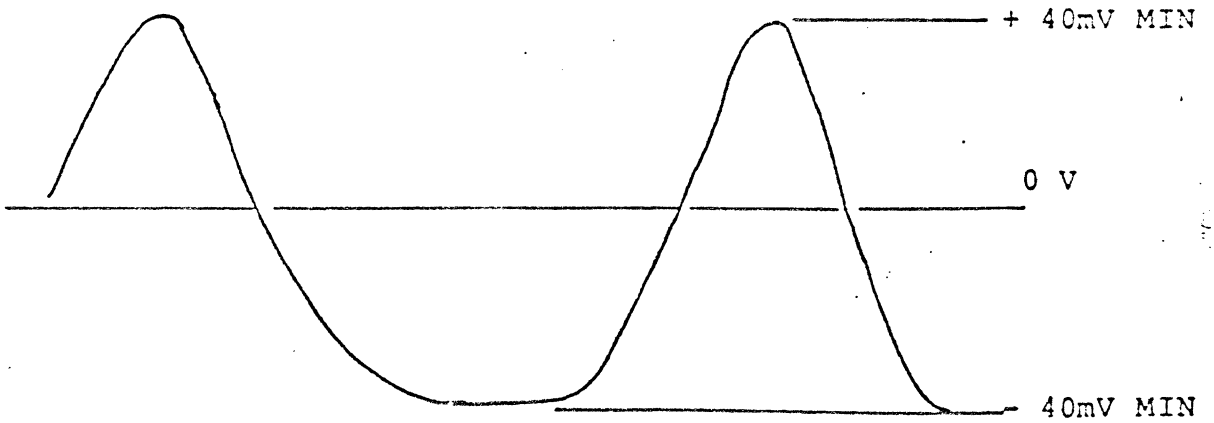
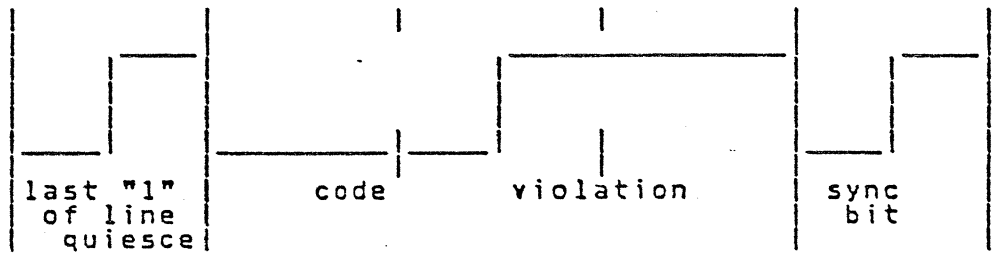


Figure 3.0 (D)

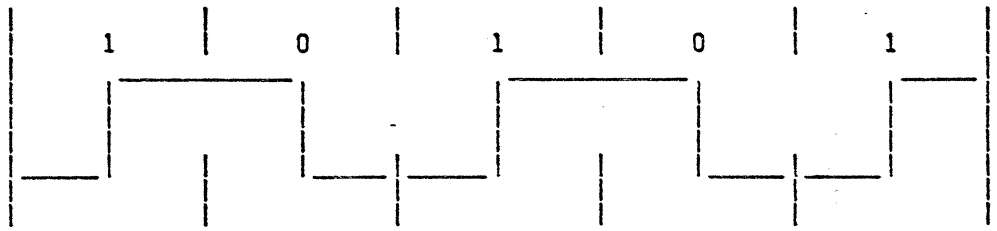
3.1.3 UNIQUE CONTROL CODE VIOLATION

A code violation will follow the line quiesce pattern to differentiate between the quiesce pattern and the start of the valid data following the code violation. This is necessary because, due to varying line lengths, it is not possible to predict where the received data will become valid. However the code violation will be received properly and provides a clean reference mark for start of transmission.

A unique balanced code violation sequence containing leading and trailing buffer bits to eliminate history dependence on adjacent data would appear as follows:



The trailing buffer bit is actually the sync bit of the following data byte. This code violation is unique in that it contains pulse widths (1 1/2 bit pulse widths) not present in normal biphase data (1/2 or 1 bit pulse widths) shown here for comparison.

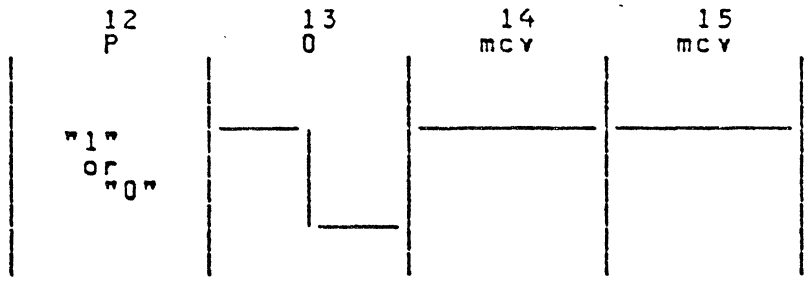


Note that each bit has mid bit transition.

Thus, once decoded, this code violation provides, in addition to a reference mark for start of transmission, a definition of bit boundaries.

3.1.4 TRANSMISSION TERMINATION SEQUENCE

In order that the receiver demodulation logic is reset at the end of a transmission, so that a subsequent transmission may be properly demodulated, a special termination sequence is used:



The last byte of data transmitted shall have twelve bits followed by a three-bit Ending Sequence. The preceding 12-bit word is as previously defined (starting with sync and ending with a parity bit). The first bit of the Ending Sequence shall be a zero followed by two bit times without a mid-bit transition. (These are refered to as mini code violations.) The first mini code violation is always used to reset the receiver logic. The second merely guarentees that the line does not discharge and generate a spurious clock pulse while the logic is detecting the first mcv. The zero in the first bit position allows for discriminating a transmit check condition, generated as a result of illegally padded zero bits between bytes, from a normal ending sequence.

3.2 TRANSMIT CHECK

A Transmit check is defined as follows:

1. A 0 in the sync bit location not followed by the mini code violation.
2. The loss of mid bit transition detected at other than normal ending sequence time.
3. A transmission parity error (bit 12 not being even.)

When a transmit check is sensed in the device, the device will cease accepting data and all commands and suppress the TT/AR. The stored command, if any, will not be reset. Normal operations will resume upon receipt of the next Line Quiesce/Code Violation.

The control unit will also test the same three conditions and provide for error recovery. Control units that only implement 1 byte Read commands need not perform the complete ending sequence test (Item 1 above.)

4.0 3299 TERMINAL MULTIPLEXER

The IBM 3299 Terminal Multiplexer, model 1, 2, or 3, is a stand-alone fanout box that contains circuitry to interface a single coaxial cable from the 3X74 Control Unit with eight device cables. The 3299 Terminal Multiplexer (1,2,3) attaches to the 3274 via a modified terminal multiplexer adapter, that is, the 8-port IBM 3274 Type A Terminal Adapter (D/R card) is replaced by a 3299 1-port Terminal Multiplexer Adapter (3299 D/R card) which multiplexes the data streams of eight devices onto a single coaxial cable. (The 3299 Terminal Multiplexer Adapter will not replace the IBM Terminal Adapter Type B in the 3274.) The 3299 (1,2,3) attaches to the 3174 through one of the four dual purpose coax ports of the New Device Cluster Adapter (NDCA). The 3174 Terminal Multiplexer Adapters (TMAs) are equivalent to 3299 mod 2s.

4.1 OUTGOING TRANSMISSION

When the 3299 (1,2,3) is attached to a 3X74, the Control Unit inserts an 8-bit address byte between the Start Sequence and the (first) coax word (Command or Data) for each outbound transmission to the 3299. This address byte is used by the 3299 to select one of its eight coaxial cable ports. The 3299 strips this address byte from the bit stream prior to retransmitting the remainder to the addressed device.

Trailing Leading

Parity Bit (Even)	Diag. wrap*	Spare = 0	Spare = 0	Adr 4	Adr 2	Adr 1	Busy (Sync) Bit = 1
Bit: 7	6	5	4	3	2	1	0

Figure 1. 8-bit Address Byte

*When Bit 6 is set (to one), the 3299 2,3 will wrap the following coax word back to the (3174) control unit (and send the coax word on to the device.) The 3274 control unit will not set bit 6, and when the 3174 sets bit 6 in a transmission to a 3299 mod 1, the 3299 will sense a xmit check (due to his not including bits 4,5,6 in his parity check), refuse to answer or pass the transmission to the addressed device, and the 3174 will 'timeout.'

This 8-bit address byte is inserted between the Start Sequence and the first data byte as shown in Figure 2. The Busy (Sync) bit is set to 1. The two spare bits are each set to 0. The parity bit is set to maintain even byte parity (including the busy bit.)

Leading

Data	8-bit Address Byte	Start Sequence*

Figure 2. Address Byte Insertion

*Start Sequence = five 1-bits (quiesce pattern) followed by a 1-bit and a 0-bit (code violation). The duration of each code violation bit is equal to one-and-one-half bit times. Total Start Sequence equals eight bit times.

4.2 TIMEOUT TIMER

4.2.1 3274 CONTROL UNIT

The duration of the Coax Response Timeout Timer located on the DCA card has been changed from 56 microseconds to 98 microseconds to allow for the additional propagation delay caused by the internal 3299 circuitry (approx. 7.5 usec outbound, 3.5 usec inbound), and the additional coaxial cable lengths permitted (1.5 km, or 15 usec round trip, worst case.) The modified DCA card (PN 4752335) will be factory- and field-installed as a Field Feature Bill of Material (FFBM) RPQ on models 1, 21, and 31. The card will be factory-installed on models 41 and 61 as part of the base 3274.

The timeout period starts when the 3274 sends the first bit of the line quiese pattern. The last bit of the mcv of the response must reach the DCA before the timeout elapses. If the 3274 contains the original DCA card (PN 6016034) with the 56 usec timeout and the device is 1.5km of worst case coax away from the control unit, and the control unit sends a Read Multiple Cmd., the device must begin its 4 byte response within 5.5 usec after receiving the last bit of the mcv from the control unit to insure that the 3274 does not 'timeout'.

4.2.2 3174 CONTROL UNIT

The duration of the 3174 timeout is 50 usec. The timeout period starts when the NDCA sends the last bit of the mcv following either data or command, and ends when the NDCA receives the Busy Bit of the reply. In the worst case scenario, 1.5km of coax (15 usec round trip), 3299 delay (11 usec r.t.), and another 1.5km (15 usec r.t.), plus the time for the Start Sequence to flow (3.5 usec), yields an equivalent time, 5.5 usec, at the device.

4.3 DATA STREAM ARCHITECTURE

All data is passed through using the normal 3274 architecture. A 1-bit immediately following a bit 12 (parity-bit) indicates the start of a coax word (data or command); a 0-bit indicates an Ending Sequence.

4.4 INCOMING TRANSMISSION

The 3299 Terminal Multiplexer retransmits the response received on the addressed port to the 3X74 without altering the bit stream.

5.0 CODE POINTS

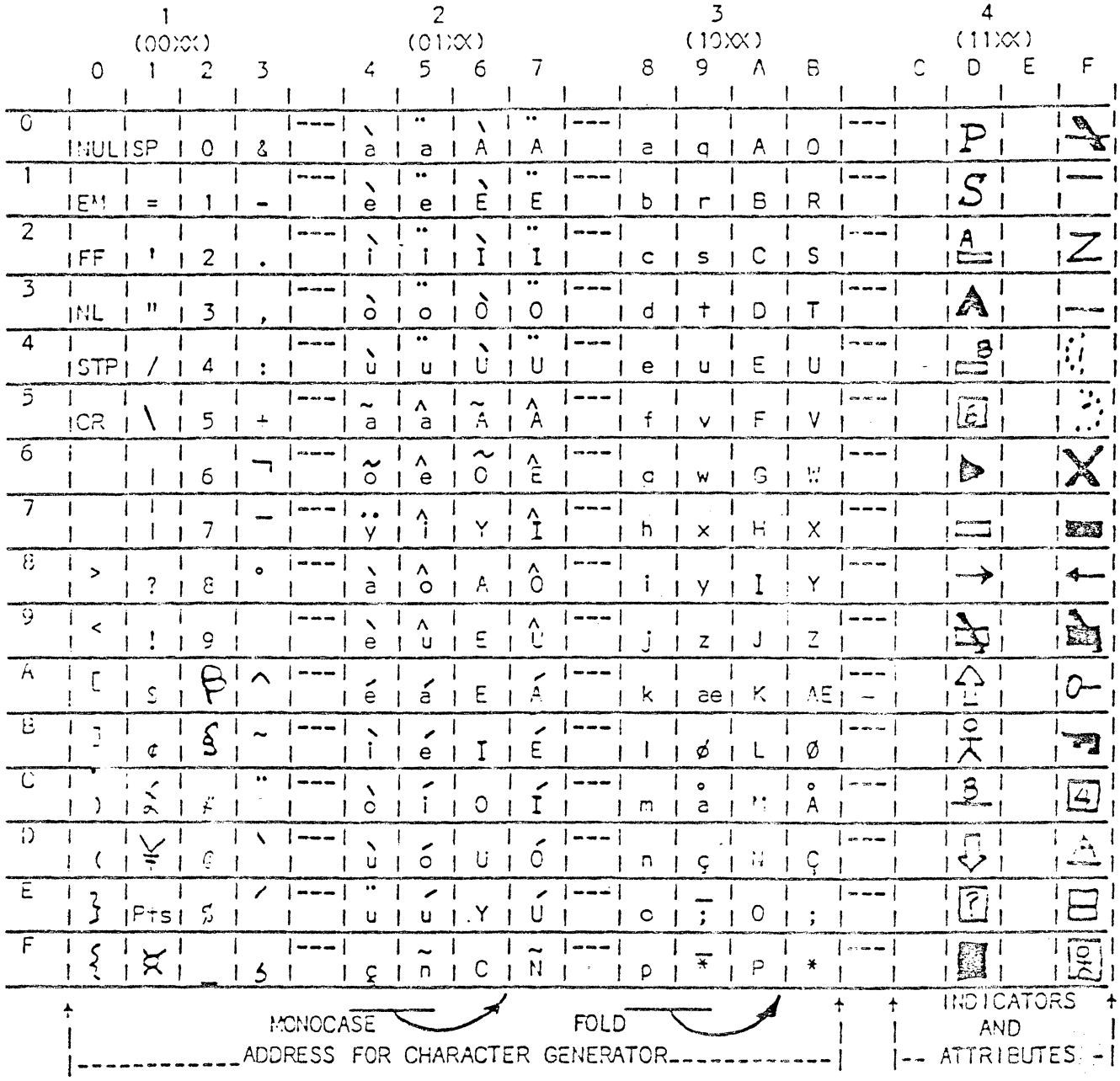
The following code points will be transmitted over the coax:

5.1 DEVICE BUFFER CODES

5.1.1 CHARACTER CODES

The following character codes are sent to display regeneration buffers and to printer "print" buffers. In addition to "internal code" (see following tables), EBCDIC or LU1 will be sent to printers (see 3270 Character Set Reference Manual).

5.1.1.1 DEVICE BUFFER CODING FOR TABLE V



NOTES: (1) Characters in locations 00 thru 07 display as blank.
(2) Codes Hex 9E and 9F are the FM and DUP characters.
(3) Lower case characters in columns 4 & 5 and 8 & 9 fold to upper case characters, columns 6 & 7 and A & B, when the Display is in the Monocase Mode.
(4) Printers are required to support only those graphics that are defined as valid, in GA27-2837, for that particular language.

5.1.1.2 DEVICE BUFFER CODING FOR KATAKANA

(and JAPAN ENGLISH)

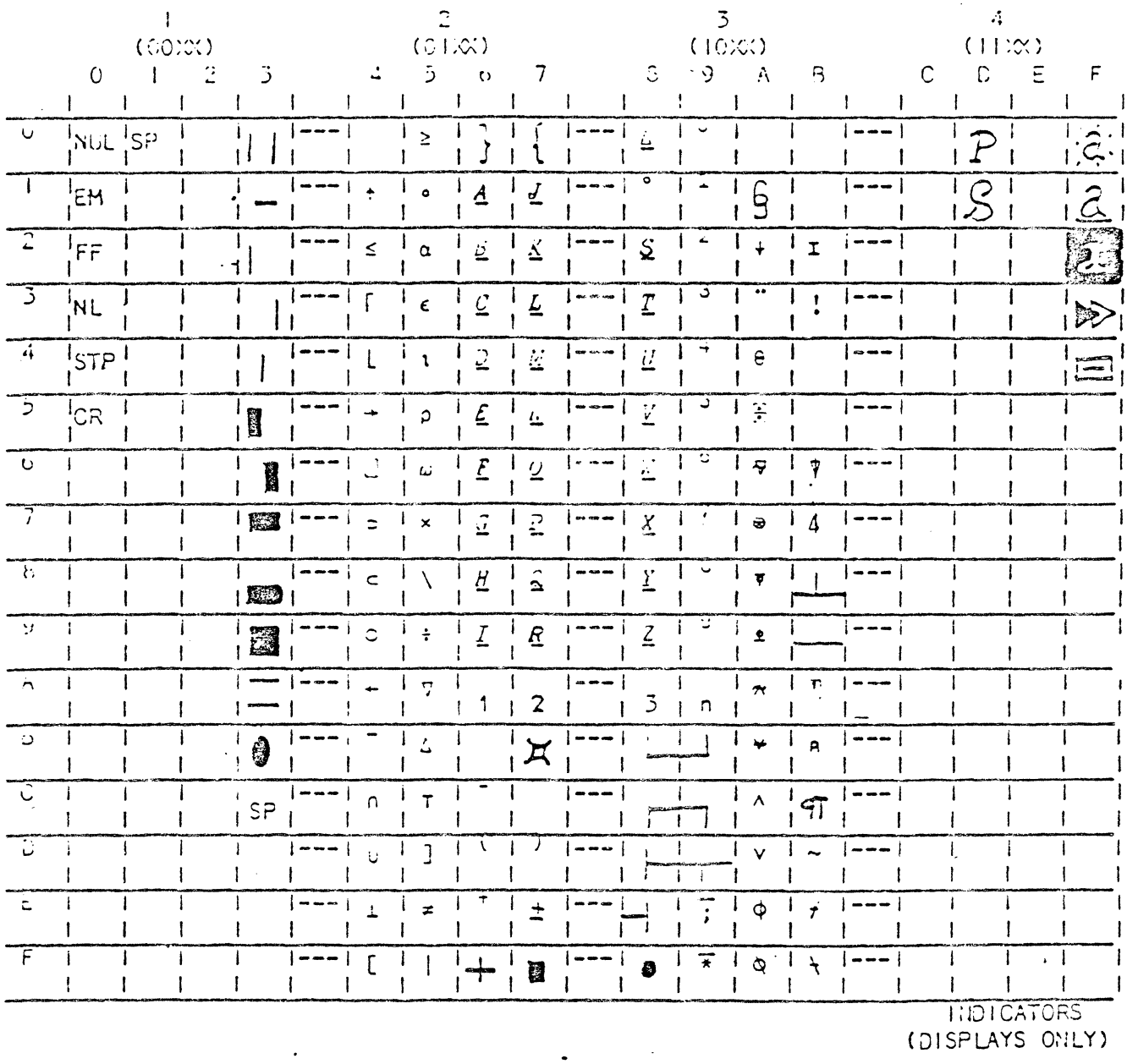
	1 (00XX)				2 (01XX)				3 (10XX)				4 (11XX)			
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SP	0	&	81	92	A6	42	a	q	A	Q				
1	EM	=	1	-	82	93	A7	43	b	r	B	R				
2	FF	'	2	.	83	94	A8	44	c	s	C	S				
3	NL	"	3	,	84	95	A9	45	d	t	D	T				
4	STP	/	4	:	85	96	AA	46	e	u	E	U		SAME		
5	CR		5	+	86	97	AC	47	f	v	F	V		AS		
6			6	¬	87	98	AD	48	g	w	G	W		TABLE IV		
7			7	-	88	99	AE	49	h	x	H	X				
8	>	?	8		89	9A	AF	51	i	y	I	Y				
9	<	!	9		8A	9D	BA	52	j	z	J	Z				
A		$			8C	9E	BB	53	k		K					
B					8D	9F	BC	54	l		L					
C	)	£	#		8E	A2	BD	55	m		M					
D	(	¥	@	`	8F	A3	BE	56	n		N					
E	}		%		90	A4	BF	58	o	;	O	;				
F	{		_		91	A5	41	7F	p	*	P	*				

* EBCIDIC CODES FOR KATAKANA — ADDRESS FOR CHARACTER GENERATOR

* INDICATORS AND ATTRIBUTES

NOTES: (1) Characters in locations 00 thru 07 display as blank.
(2) Codes Hex 9E and 9F are the RA and DUP characters.
(3) 7F is used for " on Katakana devices only.

5.1.1.3 DEVICE BUFFER CODING FOR APL

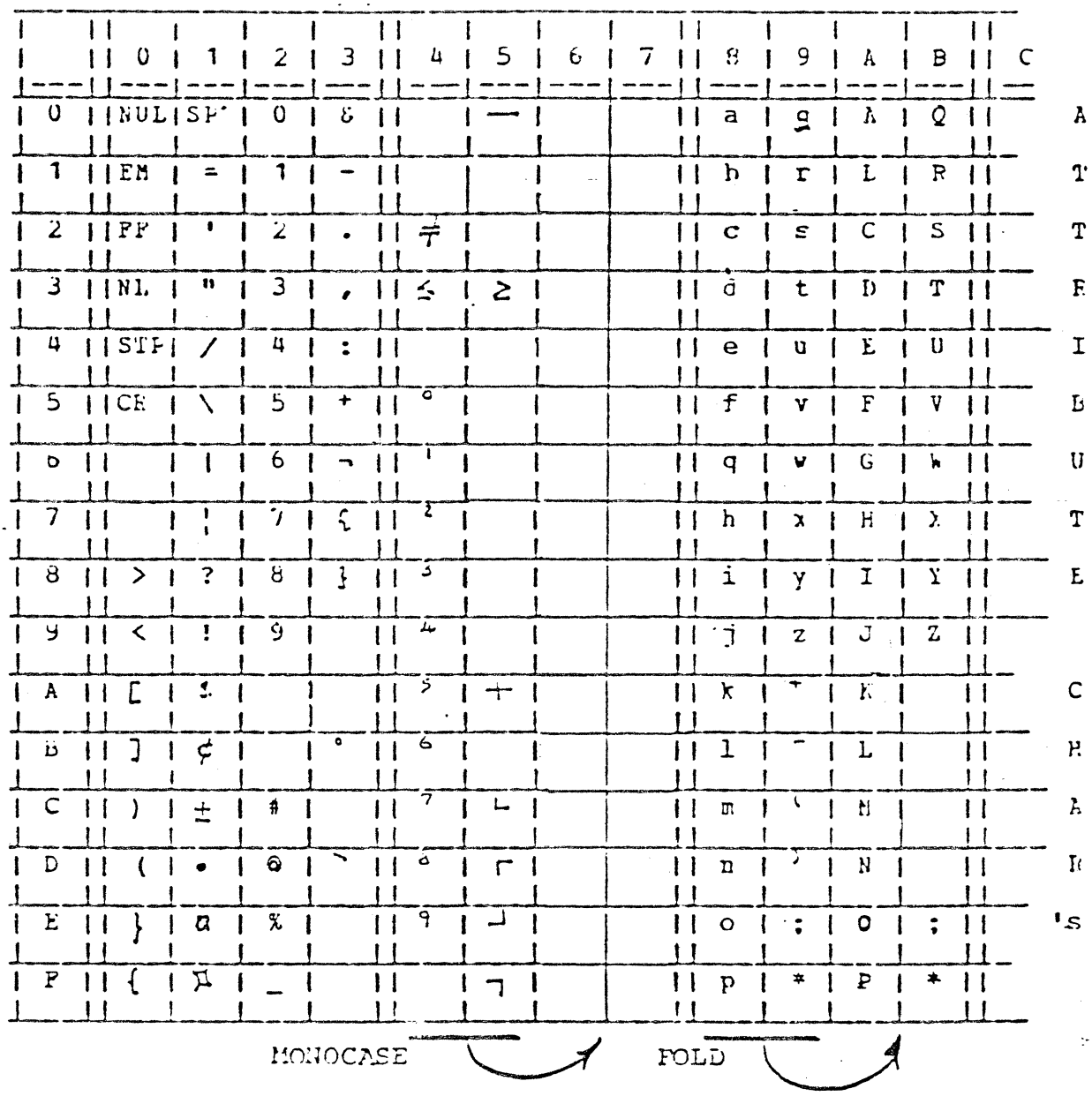


Note 1. Controllers will only transmit valid (filled in) code points. Devices may display/print whatever they please for 'blank' code points between '08' and'BF'.

2. Devices that support a subset of APL will display/print hypens for non-supported valid code points.

5.1.1.4 BUFFER CODING FOR TN/ENGLISH

(3289 Printer with "Text Print Feature" only)



Note: The TN characters in columns 4, 5, and 9 will print in both mono and dualcase modes. Therefore, the corresponding code points in columns 6, 7, and B are 'Reserved.'

5.1.2 ATTRIBUTE CODES

An attribute is used to specify the characteristics of the "field (characters) that follow in the buffer. Each attribute occupies a location in the regen (print) buffer and displays (prints) as a blank.

DATA WORD BITS:

```
2 3 4 5   6 7 8 9   10
1 1 X X   X X X X   P
```

Bit 4=0 Unprotected
=1 Protected
Bit 5=0 Alphameric
=1 Numeric
Bits 4&5=11 Auto skip
Bits 6&7=00 Normal display, nondetectable
=01 " " detectable
=10 Bright " "
=11 Non " nondetectable, nonprint

Bit 8 Reserved. Will not always be zero.
Bit 9 Modified Data Tag (MDT).

5.1.3 EXTENSION ATTRIBUTE CODES

These code points are transmitted to and from the Extension Attribute Buffer (EAB). See para 1.4.5.5. This feature provides an additional byte of storage for each location in the main buffer. The EAB byte corresponding to a field attribute in the main buffer is interpreted as an Extended Field Attribute; bytes corresponding to characters are character attributes.

5.1.4 EXTENDED FIELD ATTRIBUTES

DATA WORD BITS:

```
2 3 4 5   6 7 8 9   10
X X X X   X X X X   P
```

Bits 2,3=00 Normal Mode
=01 Blink Character (Interpreted as 'normal
=10 Reverse Video Character by type 0001 printer)
=11 Underline Character

Bits 4,5,6 Character Colour

=000 Default to Base Colour
=001 Blue
=010 Red
=011 Pink/black
=100 Green
=101 Turquoise/black
=110 Yellow/black
=111 White/Black (unless tri-plane PS)

Bits 7,8,9 Character Generator Selection:

=000 Base ROS (184 character)
=001 APL ROS (128 character)
=010 PS 2 (191 character)
=011 PS 3 " "
=100 PS 4 " "
=101 PS 5 " "
=110 PS 6 " "
=111 PS 7 " "

5.1.5 CHARACTER ATTRIBUTES

DATA WORD BITS:

```
2 3 4 5   6 7 8 9   10
X X X X   X X X X   P
```

Bits 2,3=00 Revert to the EFA
=01 Blink Character (Interpreted as 'normal' by type 0001 printer)
=10 Reverse Video Character
=11 Underline Character

Bits 4,5,6 Character Colour

=000 Revert to the EFA
=001 Blue
=010 Red
=011 Pink/black (Display/Printer)
=100 Green
=101 Turquoise/black
=110 Yellow/black
=111 White/Black (unless tri-plane PS)

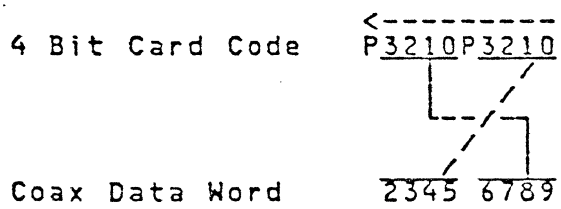
Bits 7,8,9 Character Generator Selection:

=000 Revert to the EFA
=001 APL ROS (128 character)
=010 PS 2 (191 character)
=011 PS 3 " "
=100 PS 4 " "
=101 PS 5 " "
=110 PS 6 " "
=111 PS 7 " "

5.2 MAGNETIC STRIPE CARD CODES

The following Magnetic Stripe Card Codes will be honored by the Mag. Stripe Reader feature and stored by the feature for transmissior to the control unit.

Mag Stripe characters are transmitted as follows:



For the character set used with Magnetic Readers, see the 3274 Description and Programmer's Guide, GA23-0061, or the 3270 Character Set Reference manual, GA27-2837.

5.2.1 MAGNETIC STRIPE CARD CODE-1

10 CHARACTER (NUMERIC ONLY)

CHARACTER_	HEX	BIT P3210	REMARKS
0	0	10000	
1	1	00001	
2	2	00010	
3	3	10011	
4	4	00100	
5	5	10101	
6	6	10110	
7	7	00111	
8	8	01000	
9	9	11001	
SPECIAL	A	11010	TRANSLATED, BY CONTROLLER, TO EBCDIC '7
SPECIAL	B	01011	START SENTINEL (SS/RSS).
-------	C	11100	INVALID CHARACTER.
SPECIAL	D	01101	FIELD SEPERATOR.
-------	E	01110	INVALID CHARACTER.
SPECIAL	F	11111	END SENTINAL (ES).

5.3 KEYBOARD SCAN CODES

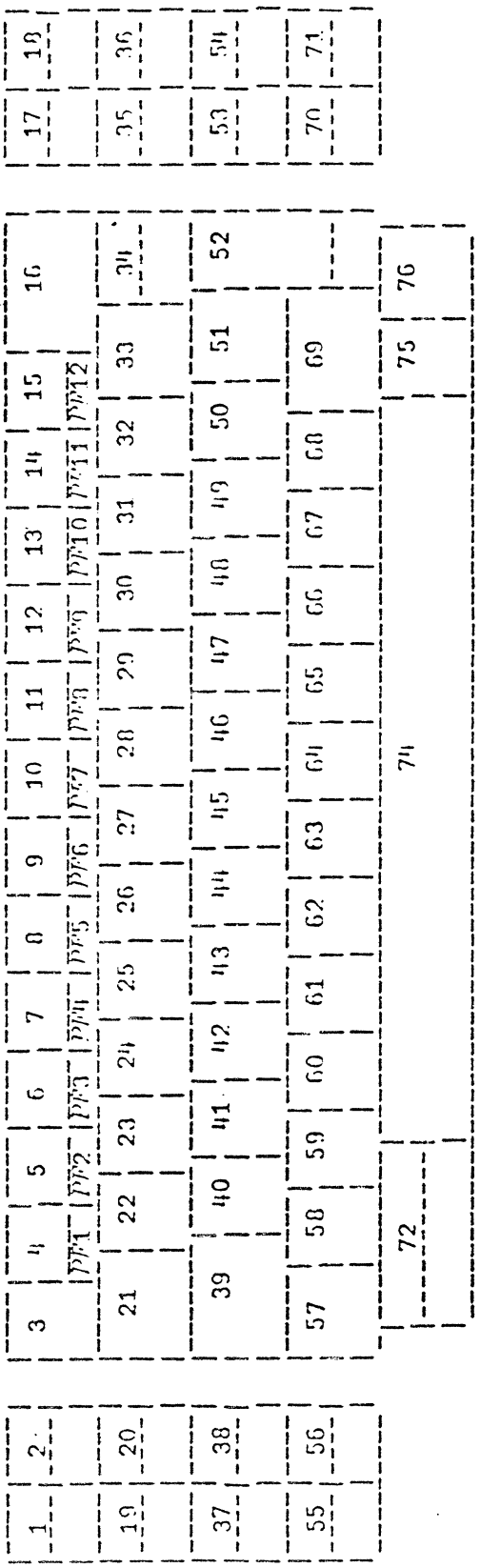
The following tables list the Scan Codes that are sent to the control unit by all displays with alphanumeric keyboards (including Katakana). Refer to the CSRM for details concerning which devices support which keyboards for which countries.

5.3.1 75/87 KEY KEYBOARD LAYOUT

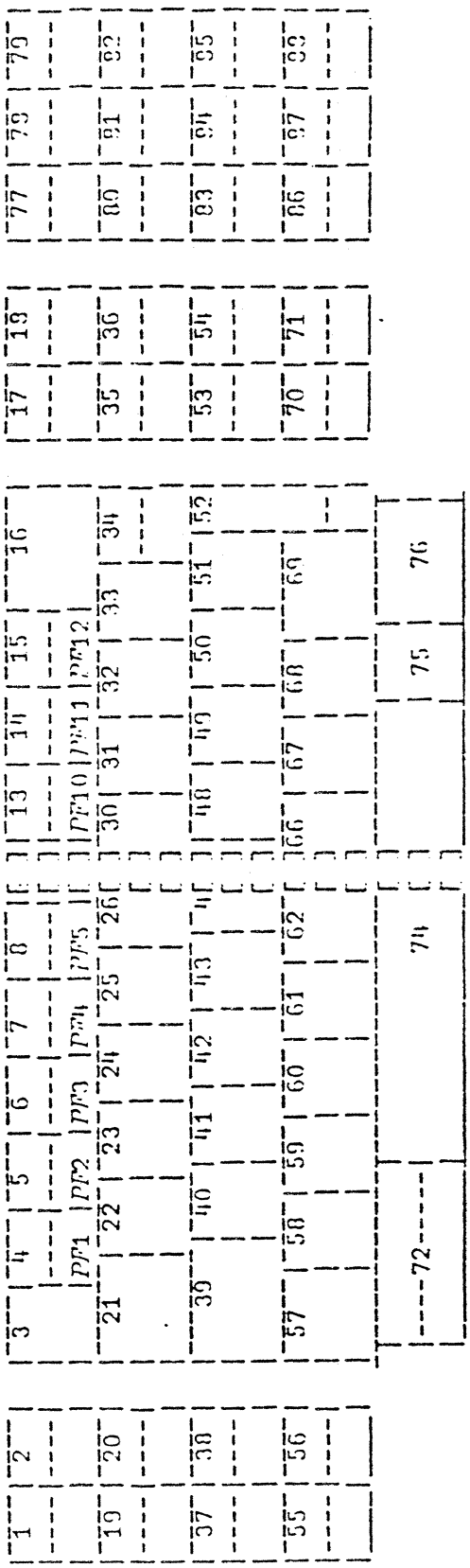
The following charts show the key number assignments for the 75 and 87 key alphanumeric keyboards. The 76 and 88 key typewriter keyboards are identical except for one additional key, number 51A, located on the third row between keys 51 and 52. The keys that generate both make and break codes are shown with an 'X' in scan code bit 2, the make/break bit. This bit is a zero on make, one on break, on the coax.

Key # (Coax bit position): .SK	Hex	Scan Code 2345 6789	Key #	Hex	Scan Code 2345 6789
1	50	0101 0000	45	67	0110 0111
2	51	0101 0001	46	69	0110 1001
3	3D	0011 1101	47	6A	0110 1010
4	21	0010 0001	48	6B	0110 1011
5	22	0010 0010	49	7E	0111 1110
6	23	0010 0011	50	12	0001 0010
7	24	0010 0100	51	0F	0000 1111
8	25	0010 0101	51A	1D	0001 1101
9	26	0010 0110	52	08	0000 1000
10	27	0010 0111	53	0E	0000 1110
11	28	0010 1000	54	13	0001 00
12	29	0010 1001	55	56	0101 01
13	20	0010 0000	56	57	0101 [illegible] 1
14	30	0011 0000	57	4D	X100 [illegible] 1
15	11	0001 0001	58	09	0000 1001
16	31	0011 0001	59	79	0111 1001
17	5F	0101 1111	60	77	0111 0111
18	5E	0101 1110	61	62	0110 0010
19	52	0101 0010	62	75	0111 0101
20	53	0101 0011	63	61	0110 0001
21	36	0011 0110	64	6D	0110 1101
22	70	0111 0000	65	6C	0110 1100
23	76	0111 0110	66	33	0011 0011
24	64	0110 0100	67	32	0011 0010
25	71	0111 0001	68	14	0001 0100
26	73	0111 0011	69	4E	X100 1110
27	78	0111 1000	70	16	0001 0110
28	74	0111 0100	71	1A	0001 1010
29	68	0110 1000	72	34	0011 0100
30	6E	0110 1110	73	NOT USED	
31	6F	0110 1111	74	10	0001 0000
32	1B	0001 1011	75	4F	X100 1111
33	15	0001 0101	76	18	0001 1000
34	35	0011 0101	77	40	0100 0000
35	0C	0000 1100	78	41	0100 0001
36	0D	0000 1101	79	42	0100 0010
37	54	0101 0100	80	43	0100 0011
38	55	0101 0101	81	44	0100 0100
39	4C	X100 1100	82	45	0100 0101
40	60	0110 0000	83	46	0100 0110
41	72	0111 0010	84	47	0100 0111
42	63	0110 0011	85	48	0100 1000
43	65	0110 0101	86	49	0100 1001
44	66	0110 0110	87	4A	0100 10
			88	4B	0100 10

5.3.1.1 .75 KEY KEYBOARD



5.3.1.2 87 KEY KEYBOARD

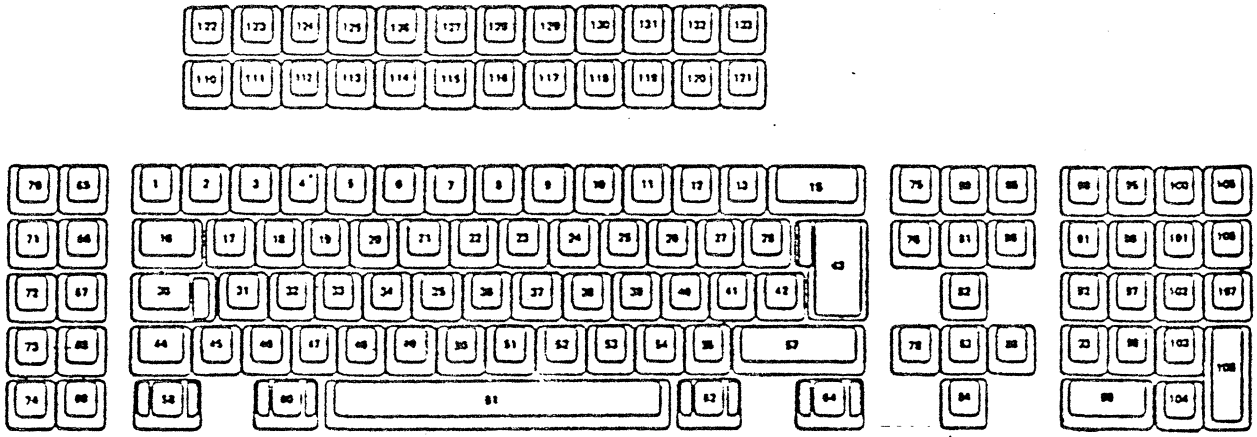


F.3.2 122/124 KEY KEYBOARD LAYOUT

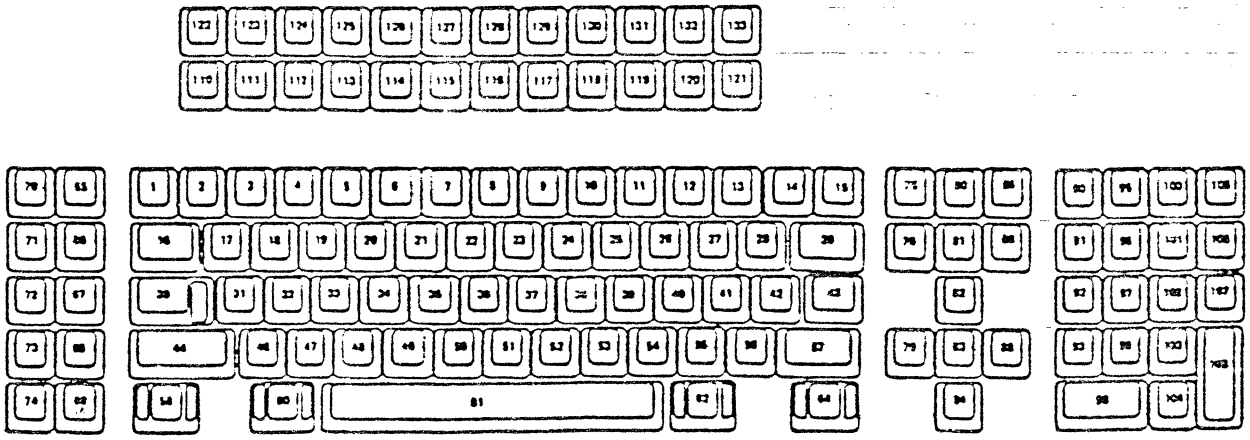
Keys shown with a '(B)' symbol are make/break keys. 'Break' is signified by a scan code x'F0' followed (in response to a subsequent poll) by the key's assigned scan code.

Key	Hex Scan Code	Key	Hex Scan Code	Key	Hex Scan Code	Key	Hex Scan Code
1	0E	33	23	67	0B	103	7A
2	16	34	2B	68	0A	104	71
3	1E	35	34	69	09	105	84
4	26	36	33	70	05	106	7C
5	25	37	3B	71	04	107	7B
6	2E	38	42	72	03	108	79
7	36	39	4B	73	83	109	78
8	3D	40	4C	74	01	110	07
9	3E	41	52	75	67	111	0F
10	46	42	53	76	64	112	17
11	45	43	5A	78	61	113	1F
12	4E	44(B)	12	80	6E	114	27
13	55	45	13	81	65	115	2F
14	5D	46	1A	82	63	116	37
15	66	47	22	83	62	117	3F
16	0D	48	21	84	60	118	47
17	15	49	2A	85	6F	119	4F
18	1D	50	32	86	6D	120	56
19	24	51	31	88	6A	121	5E
20	2D	52	3A	90	76	122	08
21	2C	53	41	91	6C	123	10
22	35	54	49	92	6B	124	18
23	3C	55	4A	93	69	125	20
24	43	56	51	94	68	126	28
25	44	57(B)	59	95	77	127	30
26	4D	58(B)	11	96	75	128	38
27	54	60(B)	19	97	73	129	40
28	5B	61	29	98	72	130	48
29	5C	62(B)	39	99	70	131	50
30(B)	14	64(B)	58	100	7E	132	57
31	1C	65	06	101	7D	133	5F
32	1B	66	0C	102	74		

5.3.2.1 122 KEY TYPENRITER KEYBOARD



5.3.2.2 124 KEY TYPEWRITER KEYBOARD

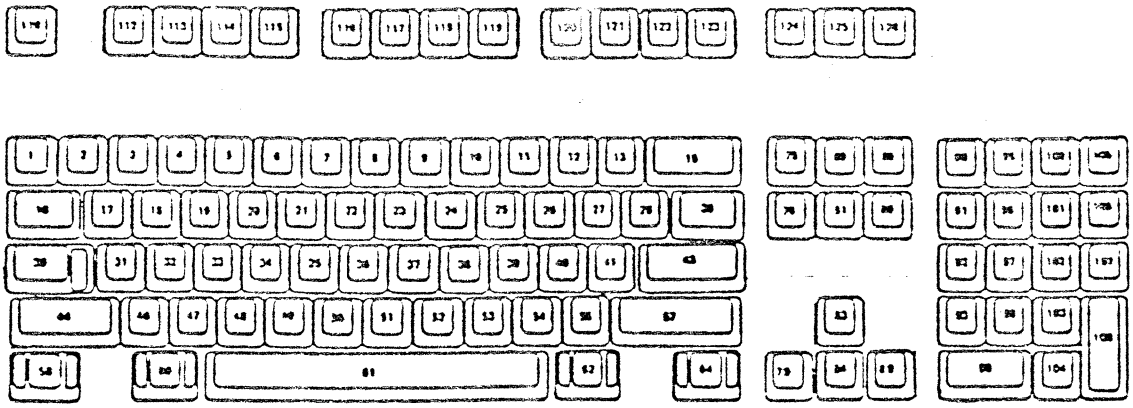


5.3.3 102/103/104 KEY KEYBOARD LAYOUT

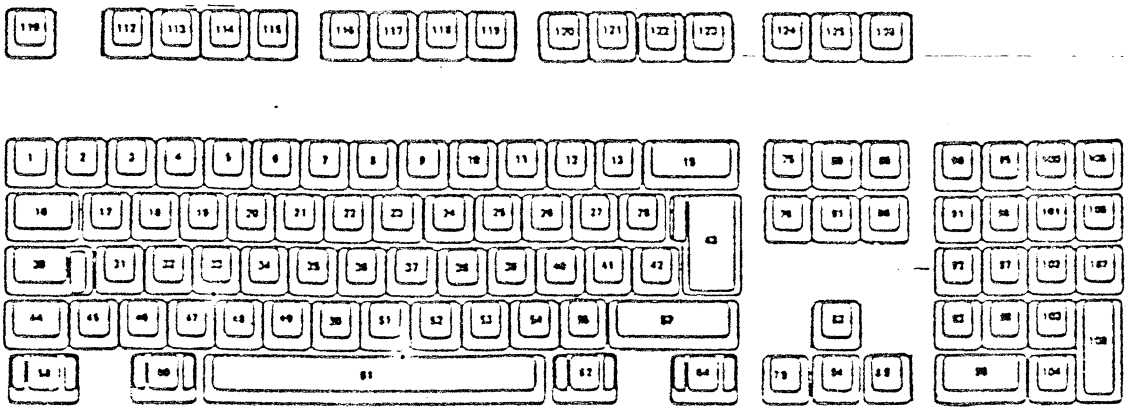
Keys shown with a '(B)' symbol are make/break keys. 'Break' is signified by a scan code x'F0' followed (in response to a subsequent poll) by the key's assigned scan code.

Key	Scan Code	Key	Scan Code	Key	Scan Code	Key	Scan Code
1	0E	28	5B	55	4A	99	70
2	16	29	5C	56	51	100	7E
3	1E	30(B)	14	57(B)	59	101	7D
4	26	31	1C	58(B)	11	102	74
5	25	32	1B	60(B)	19	103	7A
6	2E	33	23	61	29	104	71
7	36	34	2B	62(B)	39	105	84
8	3D	35	34	64(B)	58	106	7C
9	3E	36	33	75	67	107	7B
10	46	37	3B	76	64	108	79
11	45	38	42	79	61	109	78
12	4E	39	4B	80	6E	110	08
13	55	40	4C	81	65	112	07
14	5D	41	52	83	63	113	0F
15	66	42	53	84	60	114	17
16	0D	43	5A	85	6F	115	1F
17	15	44(B)	12	86	6D	116	27
18	1D	45	13	89	6A	117	2F
19	24	46	1A	90	76	118	37
20	2D	47	22	91	6C	119	3F
21	2C	48	21	92	6B	120	47
22	35	49	2A	93	69	121	4F
23	3C	50	32	94	68	122	56
24	43	51	31	95	77	123	5E
25	44	52	3A	96	75	124	57
26	4D	53	41	97	73	125	5F
27	54	54	49	98	72	126	62

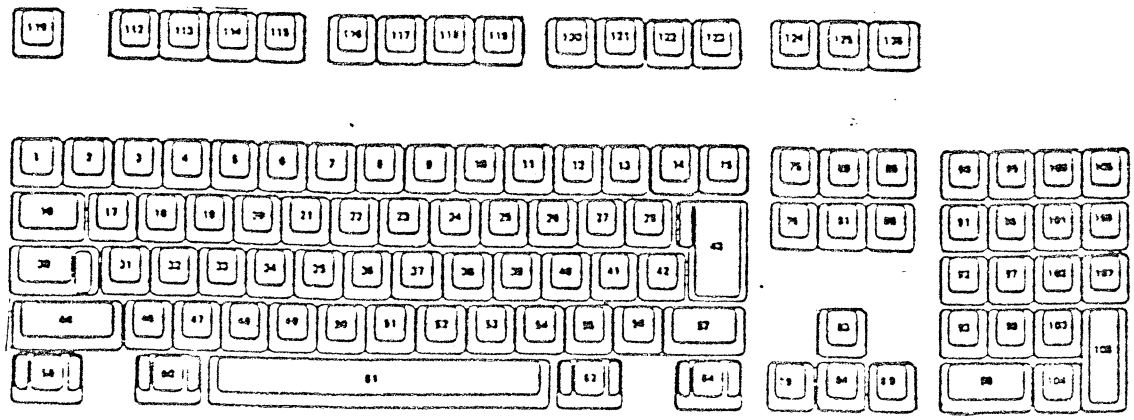
5.3.3.1 102 KEY ENHANCED KEYBOARD (U.S.)



5.3.3.2 103 KEY ENHANCED KEYBOARD (EMEA)



5.3.3.3 104 KEY ENHANCED KEYBOARD (KATAKANA)



6.0 ABBREVIATIONS

Ack	Acknowledge
Adr	Address
AE	Alphanumeric EBCDIC
APA	All Points Available
APL	A Programming Language
ASCII	American National Standard Code for Information Interchange
Bu	Bunch.
Cmd	Command
CPAR	Create Partition
CR	Carriage Return
CSRM	Character Set Reference Manual (GA27-2837)
D/R	Driver / Receiver.
DCA	Device Cluster Adapter (3274). Also known as 'Terminal Adapter'.
DCA-L2	Document Content Architecture - Level 2
DSC	Data Stream Compatible
DSE	Data Stream Emulation
EAB	Extention Attribute Buffer
EACT	Extention Attribute Correlation Table
EBCDIC	Extended Binary-Coded Decimal Interchange Code
ECS	Extended Character Set
EDS	Extended Data Stream
EFA	Extended Field Attribute
EM	End-of-message
EMEA	Europe, Middle East, Africa
EOC	End of Chain
EOM	End Of Message
FAP	Format and Protocol
FF	Form Feed
FIC	First in Chain
FMH	Function Management Header
FSFIC	First Segment, First in Chain
Hdr	Header
IPDS	Intelligent Printer Data Stream
k	kilo
Kbd	Keyboard
LCID	Local Character Set Identifier
LIC	Last in Chain
LPI	Lines per Inch
LU	Logical Unit
m	meter(s)
mcv	mini-code-violation. Part of the 'Transmission Termination Sequence'.
MDT	Modified Data Tag
ML	Message Length
MSA	Message Starting Address
NDS	New Display System
NDCA	New Device Cluster Adapter (3174). Also known as 'Terminal Adapter'.
NL	New Line
OIA	Operator Indicator Area
PA	Program Access
PAI	Product Attachment Information
PCIA	Printer Control Information Area
PDQ	Pretty Damn Quick
PEL	Picture ELement
POR	Power on Reset
PS	Programmable Symbols
PSS	Programmable Symbol Set
PSHICO	PS, HIghlighting, and COlour
RAM	Random Access Memory
RH	Request Header
ROS	Read Only Storage
RU	Response Unit

r.t.	round trip.
SCS	SNA Character String
SNA	Systems Network Architecture
SSA	System Status Available
SW	Switch
SWNDO	Set Window Origin
TMA	Terminal Multiplexer Adapter.
TT/AR	Transmission Turnaround / Auto Response

End of Document