C & W Incotel IMX-7XX Series
Message Switching Systems

■ PROFILE

Function ● turnkey store-and-forward message switching system ● supports self-monitoring of system operation, communication network, and remote terminals; performs routing and network changes on- and off-line ● supports multisystem network configurations.

Associated Systems & Networks ● DEC VAX-11, LA120 Console Terminal ● supports the following asynchronous/synchronous protocols: 81D1, 83B3, 85A, 8A1, Telex, TWX, DDD, Asynchronous Link Control, X.25; also IBM 2780/3780/3270 protocols; other optional protocols available include: 117B, 86B, 115B, 86A, and SDLC.

Communications ● standard configurations support from 8 asynchronous lines operating at different codes and speeds; expanded system supports up to 384 lines at up to 50K bps ● synchronous line protocols require synchronous multiplexers ● communication lines assigned to system in combination of circuit type/speed/protocol.

Operating System ● Incotel communication software runs under control of standard VAX/VMS operating system for VAX-11; VAX/VMS supports multiuser, multiprogramming with concurrent multistream batch processing, real-time processing, and online program development.

Languages/Program Development ● FORTRAN, COBOL, BASIC, PL/1, Pascal, BLISS, and CORAL-66 are supported for new application development ● Symbolic Dump, Symbolic Debugger, Systems Monitoring, and Formatted Disk Dump are standard utilities.

Processor ● DEC VAX-11/730, 750, 780, 782, 785, or VAX cluster system includes 1M to 8M bytes of memory and 8 communication ports; supports dual RA81 456M-byte Winchester disk drives and controller and TU80 magnetic tape drive, LA120 Console Terminal, DZ11 Asynchronous Multiplexers ● VAX cluster can support up to 15 VAX CPUs.
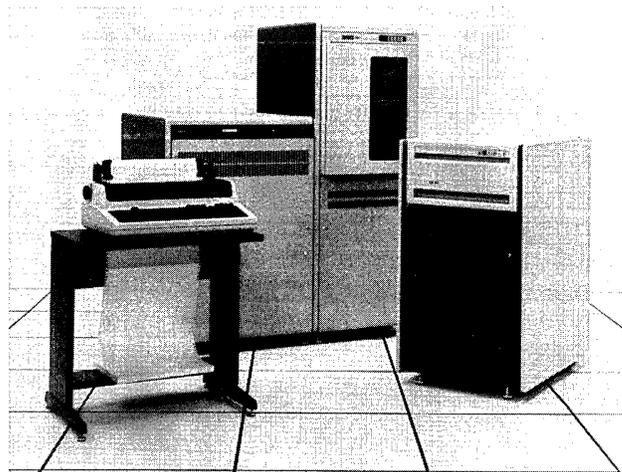
First Delivery ● February 1981.

Systems Delivered ● over 15.

Comparable Systems ● Action/Honeywell Mercury Message Management System; turnkey; based on Nova 3 128K-byte processor; interfaces TWX and Telex; maximum support up to 64 ports and 40M-byte disk; single-, limited-, and full-redundancy configurations.

Vendor ● C & W Incotel, Ltd; One Penn Plaza, New York, NY 10119 ● 212-594-8340.

Distribution ● turnkey; sales and system configurations from

PURCHASE PRICE RANGE

hardware & software ■■■■

IMX-7XX

$250K to $600K

$200K	$400K	$600K	$800K	$1M

C & W INCOTEL IMX-7XX MESSAGE SWITCHING PURCHASE PRICING bar graph illustrates approximate price range from a typical single-processor system to a dual-processor system ● pricing varies depending on the number of lines, single- or dual-processor configuration, and storage capacity required to accommodate retrieval of data at peak throughput times ● **SMALL** system price includes DEC VAX-11/730 CPU, VAX/VMS operating system, and associative equipment as required for the user's specific application requirements and IMX-700 software ● **LARGE** system includes VAX-11/782 and IMX-700 software ● maintenance is provided by DEC under a variety of plans and, therefore, such pricing is **not included** with these overall system prices.

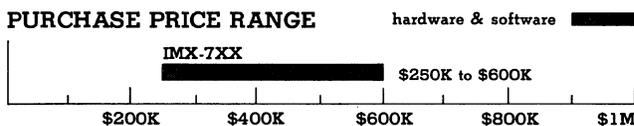center at One Penn Plaza at New York; includes training.

■ ANALYSIS

C & W Incotel has been in business 13 years since it began as a software house in 1970. After developing the IMX-700 software for DEC systems in 1981, the company introduced the Incotel IMX-7XX Message Switching System as a complete packaged system. As a technical OEM vendor for Digital Equipment Corporation, Incotel has been providing users with an attractive system for message switching functions—a system based on DEC's 32-bit VAX-11 minicomputer running under VAX/VMS operating software that can support the Incotel IMX-700 software programs. The IMX-700 software includes store-and-forward message switching, message exchange, error analysis, message routing/queuing/output, system recovery and restart, system status reporting, journaling, and mailbox facility. The IMX-7XX supports almost any number of lines, depending on the VAX-11 system chosen.

Incotel will install the complete IMX-750 system (DEC installation charges) and provide training prior to installation from its center in New York City for users who purchase the packaged IMX-7XX system from Incotel. The company offers a 1-year warranty for systems installed in New York and a 3-month warranty for systems installed elsewhere in the U.S. However, users can purchase only IMX-700 software from C & W Incotel and the DEC VAX-11 system from Digital Systems Corporation. Also, this can be an attractive arrangement for users with installed DEC VAX-11 or VAX/VMS-compatible systems who wish to acquire IMX-7XX message switching capabilities for their existing systems. The one-time basic license fee for the Incotel IMX-700 software is $150,000.

System support for both hardware and software is provided from Digital Equipment Corporation service centers located throughout the U.S. The various maintenance plans offered by DEC apply to the IMX-7XX system.

☐ Strengths

The DEC VAX-11/7XX user has the option to include a Message Switching System in his network environment simply by installing the IMX-700 software provided by the Incotel company. And, by

C & W Incotel IMX-7XX Series
Message Switching Systems

cooperative agreement, both companies share responsibility. Incotel will install and carry through to full implementation the IMX-700 software on the user's existing VAX-11 CPU. Digital Equipment Corporation, on the other hand, assumes support responsibilities via various maintenance plans available to the user.

Another attractive purchasing feature is that the user does have the option to buy the full IMX-7XX package from C & W Incotel—installed and fully implemented (user training provided) through the Incotel center in New York.

☐ Limitations

The user may find it less costly to buy DEC equipment from Digital Equipment Corporation. At least, he does have the option to buy the DEC equipment from DEC, and the Incotel software from Incotel—separately—at similar or better prices.

■ SOFTWARE

☐ Terms & Support

Terms • system purchase agreements through Incotel center in New York • Incotel provides a 1-year warranty for systems installed in New York; 3 months for systems installed within U.S.

Support • through Digital Equipment Corporation under the following terms: software is classified as Category A, B, or C; Category A support provides a 90-day warranty following installation during which defects in the software will be remedied on-site where necessary by temporary corrections or emergency bypass; for the remainder of the first year following installation, Category A remedial work will be handled by normal repair channels and updating will be provided; Category B support provides for normal repair service and maintenance only during the first year following installation; Category C software is provided on an as-is basis with all repair/maintenance work separately charged • service charges are included in license fee for software Categories A and B.

☐ Software Overview

Incotel communications software runs under control of standard VAX/VMS operating system for the VAX-11 system, which provides the 32-bit minicomputer base for the IMX-7XX Message Switching System. The VAX/VMS supports multiuser, multiprogramming with concurrent multistream batch processing, real-time processing, and online program development.

The IMX-7XX application software interfaces the IMX-7XX operating system as partitioned subsystems (application software modules) viewed by the operating system as processes or tasks. Functional subsystems provide store-and-forward, protocol handler, command processor, message retrieval, configuration control, and alarms and reporting. Application software uses standard calls to device drivers, runtime library, system services; all files use standard file structure. The software is table driven, thereby allowing for format changes, code translation, and new protocols. The IMX-700 software package is available for a one-time license fee of $150,000.

A system can be configured around single- or dual-processor configurations or a VAX cluster. In a dual-processor system, the Incotel software resides on a dual disk drive system, each disk drive contains the system software, in-transit storage (which includes Mailbox feature), ledgering information, and message journals. The second disk is a mirror image of the first. The journal is also mirror imaged to magnetic tape for historic retrievals.

Software implements asynchronous and synchronous protocols, routing, polling, network reconfiguration (both online and off-line), and self-monitoring of system operations, communication network, and remote terminal malfunctions such as peripheral device failure, open communication circuits, or no response. Supervisory commands include a HELP facility. In addition, several programming languages are offered as well as program development tools.

☐ IMX-7XX Application Software Functions

Store-and-Forward Message Switching • provides message control by line protocol, code set, and format structure • message validated according to header/structure information and transferred to mass storage • message routing depends on 5 priority level queues: highest level reserved for system only; remaining 4 levels (emergency, urgent, normal, deferred) are available to each station • message codes based on CCITT No. 2 5-level Baudot or standard ASCII 8-level codes; other codes can be accommodated • message format is similar to ATA/IATA format used by domestic/international airlines and other industries • message exchange is over FDX freewheeling (uncontrolled) or HDX polled (controlled) lines and Telex lines using stored or wild addressing modes • message retrieval from journal through online or archival retrieval schemes.

Message Exchange • full-duplex lines require no exchange of central functions/codes between computer and terminals attached to that line; use Input/Output Message Sequence Number for message control • half-duplex lines use poll and selection procedure initiated by system • Telex message exchange via stored or wild addressing modes; stored addresses consist of from 2 to 8 characters per address per message; messages are batched on a station's queue and controlled by wait-for-batch parameters • while address mode Telex allows up to 32 addresses per message, once address and route determined messages are directed to appropriate Telex circuit queue; station-/computer-initiated calls have "answerback" feature to check validity of transmitted messages.

Error Analysis • several error detection methods supported: sequence number check; start-of-message (SOM) verification; detect a second SOM; line length exceeded (more than 69 characters per spaces on any message line); stuck tape detection (more than 80 consecutive duplicate characters on a transmission line); interrupted message detection (counts elapsed time between characters following SOM); open line detection; an overlong message for negative acknowledgement consists of 1-line notification transmitted at system priority.

Message Routing • addressee indicators for outbound port are groups of 2 to 8 alpha characters (by customer option) in address line of message header • broadcasting facility (indicators and group codes) are also available • alternate routing of outbound messages initiated by command on a per-channel basis.

Queueing & Output • 1 system and 4 user station priorities for output on first-in first-out (FIFO) basis • also supports clusters of lines using rotary queueing to primary, secondary, and tertiary routes; each line has its own identification and set of message sequence numbers.

In-Transit Storage • each received message is stored onto 2 separate nonvolatile intermediate storage devices for subsequent transmission • should system fail, mirrored storage device is available • provides storage for up to 10K messages of 750 characters each.

Journaling • output messages are logged on journal file contained on disk and tape for message retrieval, message retransmission, off-line accounting, off-line statistics, and off-line billing • initial configuration provides for up to 60K 750-character messages for online retrieval • archival message retrieval from magnetic tape with wraparound feature; when journal capacity is reached, oldest messages are overwritten by newest.

Retrieval • message retrieval is by input station and message sequence number, output station and message sequence number, range of output sequence numbers; and approximate time range of output transmission(s) by output station • multiple messages or block retrieval is limited to 20 messages per retrieval request • trace, an ancillary retrieval feature; can determine delivery status of all routed messages; will trace active in-transit storage and active journal; trace capability provided only to system traffic control position (TCP) • retransmission of message by special retrieval request.

Format Mask Generation • option provided for station with a display; operator selects desired format mask by entering special control key and format number; desired mask is accessed from a

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table and output to CRT in unprotected mode: mask characters are transmitted along with operator-keyed information; mask characters can be deleted or changed by operator; other masks of protected or unprotected data can be output by display depending on customer specifications.

Mailbox Facility ● electronic mail facility: messages routed to mailbox destinations (any addressable station without physical terminal) are stored by system; requests are identified by Mailbox Station, the station to which message will be delivered, and a special user ID to prevent unauthorized access to mailbox messages.

System Recovery & Restart ● 2 types of recovery procedures: Snapshot (checkpoint) Recovery and Full Disk Recovery ● Snapshot Recovery: in event of hardware/software failure, IMX-750 reloads static system table and executable code image from disk; dynamic table information is reloaded into dynamic tables from a snapshot (checkpoint) file on disk; during normal system operation, the system periodically transfers contents of selected memory areas to the snapshot file on disk; recovery time is generally one minute ● with duplexed disk configurations, system maintains copies of most recent checkpoints (2 on primary in-transit disk; 2 on mirror in-transit disk); should most recent snapshot fail to restore system, next snapshot is selected; should attempts on restoring system fail, operator can initiate Full Disk Recovery procedures: scanning the in-transit file disk queues and rebuilding all corrupted queues, as well as constructing dynamic tables ● a Queue Recovery Program will rebuild the queue if its links have been corrupted.

Dynamic Reports of System Status ● continuous monitoring of status of all peripheral devices; peripheral I/O failures logged to displayable error log file ● existing traffic conditions reported on generated hard copy as well as in response to system commands for system and network control/supervision function ● network alarm system includes generated and displayed alarm messages; major network alarms (a severe peripheral problem) are followed by audible alarm; alarm messages are journaled.

□ Communications/Networks

A typical IMX-7XX configuration can support up to 32 communications lines in any combination of line types, data transmission rate, and protocol. Line support can be expanded to 250 lines at data rates up to 50K bps by adding asynchronous multiplexers, each capable of supporting up to 16 lines.

Asynchronous Line Support ● asynchronous protocols supported as standard software feature include FDX polling 81D1; HDX polling 83B3, 8A1; Telex, both domestic and international; TWX; Dataphone; Asynchronous Link Control ● optionally available at an additional cost are FDX 117B, 86B; and HDX 115B, 85A, 86A protocols.

Synchronous Line Support ● bisynchronous; Dataspeed 40/4; IBM 2780, 3280, 3270; also available are HDLC, SDLC, and X.25 options at additional cost ● synchronous line protocols require optional synchronous multiplexers.

□ Program Development

Program Development ● supports FORTRAN, COBOL, BASIC, PL/1, Pascal, BLISS, and CORAL-66 for new application development.

Program Utilities ● supports such standard utilities as Symbolic Dump, Symbolic Debugger, Systems Monitoring, and Formatted Disk Dump.

■ HARDWARE

□ Terms & Support

Terms ● system purchase agreements through Incotel center in New York ● Incotel provides a 1-year warranty for systems installed in New York; 3 months for systems installed within U.S. ● Incotel provides training at center prior to installation.

Support ● through Digital Equipment service centers through the following conditions: Field Service offers DEC service and Basic Service agreements; both are for 8 hours per day, 5 days per week; both can be extended to 12, 16, or 24 hours per day, 7 days per week ● either service can make use of Remote Diagnosis service at any hour or day at no extra charge; requires direct-dial telephone line and RJ11-C voice-grade jack in U.S. or Bell 103-type full-duplex, low-speed modem in Canada and Europe; typical response is 10 minutes ● DEC service agreement commits DEC to respond to customer call within 4 hours for customers located within 100 miles of a field service office; remedial work continues until repaired; includes scheduled preventive maintenance and installing engineering changes to keep system at current revision level ● Basic Service agreement typically provides next day response, but otherwise the same as DEC service agreement; these are the maintenance figures shown with price data in this report.

□ Hardware Overview

The Incotel Store-and-Forward Message Switching System is configured around a VAX-11 32-bit minicomputer with 2M-byte memory, 32 communications ports, LA120 Console Terminal, and the VAX/VMS Operating System. Mass storage subsystems include the dual RA81 456M-byte Winchester disk drives and UDA 50 Intelligent Disk Controller combined with a TU 80 Streaming Magnetic Tape Drive. The system can be expanded to support up to 250 lines by utilizing DX11 asynchronous multiplexers, each supporting up to 16 lines. Synchronous line support may require optional Synchronous Line Interface units. The IMX-7XX can be configured as a single- or dual-processor system or VAX cluster. Configuration requirements depend largely on user retrieval requirements at peak throughput times.

The IMX-750 pricing varies, depending on the number of lines, processor configuration, and storage requirements. Typically, a single-processor system costs approximately $280,000; a dual system sells for about $600,000.

Systems based on the VAX-11/730 will cost less than the IMX-750 and systems built on the VAX-11/785 will cost more. Of course, the performance of the VAX-11/785 is much higher than that of the VAX-11/730. The VAX-11/785 is a 1.5-MIPS computer as compared to the 0.6-MIPS VAX-11/750.

● **END**

Candle Corporation OMEGAMON/CICS
CICS Diagnostic Tool

■ PROFILE

Function ● real-time monitor for IBM CICS/VS.

Computers/Operating Systems Supported ● any IBM System/370, 3000, 4300, or compatible computer running under DOS/VS(E) and OS/VS2(MVS) with CICS/VS 1.4 and above.

TP & File Access Methods ● uses CICS Terminal Control in transaction mode; uses EXCP (Execute Channel Program) coding when in dedicated 3270 mode ● supports all standard IBM access methods.

Terminals ● 3270 and equivalent; slow-speed devices supported for transferable display/hard-copy output.

Special Facilities ● response time and degradation analyses.

Security ● terminal ID; transaction security key.

Languages Supported ● COBOL, PL/1, RPG II, and assembly.

Logging/Accounting ● log control for hard-copy output from screen displays.

Failure/Recovery ● CICS recovery facilities when operating in transaction mode; built-in recovery routines when in dedicated mode.

Current Version ● 300.

Installations ● over 1,000.

Comparable Systems ● Boole & Babbage RESOLVE-CICS.

Vendor ● Candle Corporation; 10880 Wilshire Boulevard, Suite 2404, Los Angeles, CA 90024 ● 213-470-2277.

■ ANALYSIS

OMEGAMON/CICS is a dynamic software monitor designed for use in medium-to-large-size CICS/VS installations. It can be used to analyze potential bottlenecks before they occur, to observe changes brought about by application program changes and/or access method conversion, and to measure all aspects of hardware operations as they pertain to the CICS/VS environment. As a planning tool, OMEGAMON/CICS can observe the effects of system loading projected by system simulators.

OMEGAMON/CICS utilizes the 3270 terminal (or equivalent) to communicate with the system. For system programmers and per-

formance analysts, the analyzer can be run in transaction mode, which treats OMEGAMON/CICS as a CICS transaction with a high priority over all system and application program codes. In dedicated mode, which is the normal operating mode for operations personnel who must react quickly to system problems, the 3270 does not rely on system I/O coding. Direct EXCP coding is used to allow OMEGAMON/CICS to continue operations even when the system is locked up.

All measurement and analysis information is displayed as tabular data, graphs, hexadecimal interpretations, and exception messages. Exception reporting is based on installation-specified thresholds. Some of the problem areas measured include task degradation, problems carried by the operating system environment, CICS and system paging problems, storage violations, VSAM bottlenecks, enqueue bottlenecks, storage fragmentation, and short-on-storage conditions.

RTA/CICS is an extra-cost option that enables the user to monitor CICS response time in a real-time environment. ESRA/CICS is another extra-cost option designed to analyze response time problems and the causes of performance degradation.
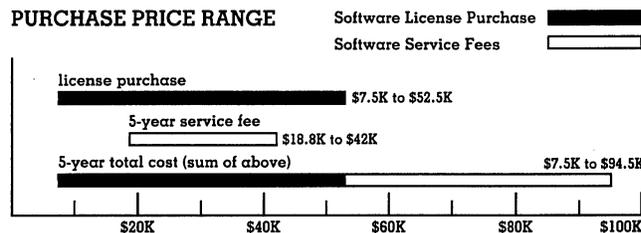
□ Strengths

OMEGAMON/CICS is a very effective performance monitor for use in the CICS/VS environment. Practically every system fine-tuning measurement can be displayed or transferred to hard-copy for analysis and review. The throughput improvements gained by modifying the CICS environment based on OMEGAMON/CICS results are usually significant and can result in substantially more efficient use of system hardware. Capacity planning and scheduling can be drastically improved, as can conversion efforts, applications maintenance, and revisions.

The ability of OMEGAMON/CICS to alert operations personnel to impending failure is a major benefit, particularly since OMEGA-MON/CICS permits operations personnel to reset threshold criteria dynamically. Users can thus detect and sidestep problems before they develop into catastrophic failures. The Candle-developed methodology called Degradation Analysis directly relates service levels for selected work loads to the resources which make it up. This methodology, along with the system's explicit exception messages, allows rapid identification of problems with less expertise. OMEGAMON/CICS also contains an excellent tutorial facility that gives users helpful insights into CICS/VS system concepts.

□ Limitations

The only true limitation that one notices immediately is the complexity of the OMEGAMON/CICS system. According to the vendor, OMEGAMON/CICS provides over 500 commands, each of which addresses 1 of the 3 operational environments covered by the package. Even though we estimate that it would take a significant amount of time to learn all the ins and outs of OMEGA-MON/CICS, meaningful problem solving can start as soon as the product is installed. The documentation, although plentiful, is strong on command description but weak on overall system implementation and "how-to-use" instructions. No one can fault the methods and coverage provided . . . practically every CICS control block and function is measurable, and the results show detailed performance figures . . . but a very experienced, well-trained person is needed to determine how to fine-tune the system. OM-EGAMON/CICS seems to be better suited for a large MVS-type environment than the smaller DOS/VS(E) shop. Smaller installations could find it difficult to justify the type of trained expert the system requires.

PURCHASE PRICE RANGE

Software License Purchase ▬▬▬
Software Service Fees ▭▭▭

license purchase
▬▬▬▬▬ $7.5K to $52.5K
5-year service fee
▭▭▭ $18.8K to $42K
5-year total cost (sum of above) $7.5K to $94.5K

| $20K | $40K | $60K | $80K | $100K |

CANDLE OMEGAMON/CICS PRICING ● solid bar shows typical min/max configuration price range; open bar shows corresponding service fee range for 5-year period, but fees are computed for 4 years (48 mos) because first-year service is included in license purchase price ● **MINIMUM CONFIGURATION** is OMEGAMON/CICS for DOS/VS(E) installations ● **MAXIMUM CONFIGURATION** is OMEGAMON/CICS for OS/VS systems with Response Time Analyzer for CICS (RTS/CICS) and ESRA/CICS options.

Candle Corporation OMEGAMON/CICS
CICS Diagnostic Tool

■ OVERVIEW

☐ Terms & Support

Terms ● license available for purchase only; multiple sites are discounted 40% after the first installation; contact vendor for educational discount terms; 30- and 90-day trial fees are $100 and $1,000, respectively; trial fee is credited to license purchase.

Support ● no charge for first-year maintenance; ongoing annual fee is 20% of then-current license fee; includes code correction, product updates, and manual updates; provides technical support.

☐ Computer & Operating Systems

OMEGAMON/CICS can be installed on any IBM System/370, 3000, 4300, or compatible computer capable of running under DOS/VS(E), or OS/VS2(MVS)/SE2/SP1/SP2(XA) with CICS/VS, including Release 1.5 or above.

☐ Minimum Operational Configuration

The OMEGAMON/CICS load module requires 300K bytes of main storage. In addition, 20K bytes of "OSCOR" and 4K bytes of "USER" storage in the CICS/VS partition are required to prevent the monitor from interfering with other users of these areas. Approximately 7 cylinders of 3350 DASD (Direct Access Storage Device) space are required for the OMEGAMON/CICS data sets.

OMEGAMON/CICS requires a 3270 family display terminal. It also supports the 132-column 3278 Mod 5, the 3278 Mod 4, and the 3279 color graphics terminal.

■ CICS MONITORING/DIAGNOSTIC FACILITIES

OMEGAMON/CICS operates in 2 modes: transaction mode for systems programmers to analyze specific areas of the system, and dedicated mode for operational personnel to react to changing system profiles. In dedicated mode, OMEGAMON/CICS can use any 3270-type console to communicate directly with the system (except for the master console) unless it has been taken off-line.

OMEGAMON/CICS is command driven. In transaction mode, commands are typed on the console and are entered only when the ENTER key on the keyboard is depressed. In dedicated mode, the sampling process can be automated. The sampling period can be specified by the operator or can be defaulted to every 5 seconds. BTAM, TCAM, or VTAM is used to communicate with the system in transaction mode; EXCP is used in dedicated mode. Four different types of displays are generated: task/system displays and task/system exception displays. Exception thresholds are set when OMEGAMON/CICS is generated but can be overridden dynamically from the console. The system responds to 3 different types of commands: a major command, which is used to select the entity within the CICS/VS environment that information is to be displayed on; minor commands, which allow the user to specify what information to display on the selected entity; and immediate commands, which are independent commands normally used for control functions.

OMEGAMON/CICS contains a degradation exception analysis facility that allows the user to analyze system bottlenecks in real-time. All results are presented as graphical reductions of statistical observations and calculations. The PFK (Program Function Key) facility allows the user to store up to 99 repetitive function sets via the 3270 PF keys. All 24 keys are usable for system functions.

OMEGAMON/CICS ● for IBM OS/VS installations:

$23,500 lcns	NA mo	$4,700 serv

OMEGAMON/CICS ● for IBM DOS/VS(E) installations:

7,500	NA	1,500

CICS Response Time Analysis in Real-Time

RTA/CICS (Response Time Analyzer for CICS) ● extends automatic analysis capabilities of OMEGAMON/CICS to include real-time displays of CICS response time; measures time intervals, time slots, and type of work; provides analyses of the effects of fine tuning, system modifications, and changing workloads ● re-quires IBM FDP PA II (Performance Analyzer II) Version 1.4 or later, or the CICS Monitoring Facility (CMF); uses PA II or CMF response time data in dynamic displays; measures response time within the CICS address space; does not reflect line delays, communications controller delays, etc; user can specify 3 time intervals for analysis; second interval must be a multiple of the first, and the third a multiple of the second; time slots can be established for 24-hour period or less; the intervals cannot overlap, but gaps are permitted; up to 48 slots can be defined; transactions within a specific application or group of applications can be analyzed through the use of Transaction Groups; up to 12 transactions can be monitored simultaneously on the 3278-4 graphic terminal:

$9,500 lcns	NA mo	$1,900 serv

Potential Problem Area Analysis

ESRA/CICS ● performance monitor that seeks response time problems for analysis; automatically invoked when user-specified thresholds are overrun; performs degradation analysis on CPU utilization, paging, I/O, CICS services, queuing for resources, etc; logs collected information to hard-copy printout that shows each type of degradation and effect on response time:

$19,500 lcns	NA mo	$3,900 serv

■ USER INTERFACES

☐ Display Commands

OMEGAMON/CICS provides 4 types of displays: task displays, system displays, task exceptions, and system exceptions. Each display group contains its own major, minor, and immediate commands for an aggregate list of over 500 unique command elements.

Task Display Group

Task Information commands monitor currently running CICS transactions to provide instantaneous displays of task activity. Snapshots of all CICS task activities are available. The user can display any task in any status on a selective basis by name, transaction class, terminal ID, or task number. Some of the task information minor commands provide displays on: DCA and TCA addresses; transaction class and dispatching priority; program address, language, length, residency indicator use count (total and current), and identification of current program; ID of CICS service module in use and transaction security key; all associated storage elements in use; all associated terminal status readouts; and transaction activity statistics. Specified subsets of transactions can be analyzed through the use of the Group Selection commands.

System Display Group

To fully analyze the CICS environment, users must be able to analyze external system functions that impact the CICS partition. These functions include paging rates, CPU availability, transaction rates, system initialization parameters, VSAM string usage, etc. OMEGAMON/CICS system information commands display storage management information and break down all the elements that make up the CICS storage environment, including page-in/-out counts, elapsed time, working set size, paging rate, total SRB and TCB time, and target working set size. Disk units can be selected for analysis, and detailed information about the number of current allocations, depth of I/O queue, number of open DCBs, current user, etc can be displayed. A current status report shows up-to-the-minute activity.

CICS internal environment information is also provided. This information includes transaction rates, paging factors, VSAM activity, and display of all CICS tables, control blocks, and storage areas. Displays can be presented in either hexadecimal or character format.

LCNS: license purchase fee; includes first-year maintenance. NA MO: no rental or lease plans available. SERV: ongoing annual maintenance fee after the first year based on 20% of the then-current license fee. Prices effective as of December 1984.

Candle Corporation OMEGAMON/CICS
CICS Diagnostic Tool

Task Exception Group

The degradation exception analysis facility consists of 3 basic command functions that control the graphic display of factors contributing to system bottlenecks and overall system degradation. One function controls displays of current system conditions; another supports split screen displays of current system status and a status graph of the results of an average sampling cycle; and the third function is a graph of percentage of total degradation attributed to specified segments of the system. The last function can also be shown on a split screen to compare current percentages against an average percentage. The Degradation Data Collector routine analyzes the CICS environment at a fixed sampling rate and can be applied to both global and transaction analyses.

System Exception Group

System exception analysis operates with the threshold criteria established by the user to evaluate CICS performance in specific production/testing environments and to warn operations personnel when a problem is imminent. The system issues messages whenever an installation-defined threshold is being approached. A warning bell option is available. Eight groups of data can be evaluated by the subanalysis function: environmental, storage control, task control, file control, transient data, transaction dumps, temporary storage, and VSAM split analysis.

☐ Failure Recovery

When OMEGAMON/CICS is operating in transaction mode, it functions as a standard CICS transaction running in virtual memory and communicates with the user via VTAM, TCAM, or BTAM operations. Therefore, it is subject to the overall recovery methods that apply to any CICS transaction in the system. In dedicated mode, OMEGAMON/CICS utilizes its own EXCP-generated recovery modules, which make it secure from ordinary system problems. It is always operational unless the entire system goes down or the OMEGAMON/CICS terminal is defective. Two commands allow the operator to turn the error recovery on and off. Normal operating status requires that it be on at all times.

☐ Shared Screen Support

All Candle real-time products (except for the DOS/VSE version of OMEGAMON/CICS) can share a 3270-family terminal with up to 7 other Candle products running on the same or loosely coupled systems; feature allows centralized performance monitoring for MVS, IMS, CICS, and VM—in other words, total system monitoring.

☐ Common Architecture

Candle uses a common architecture for all of its real-time monitors; even though information provided differs depending on the environment, operating commands are virtually identical; simplifies cross-training among monitor products.

■ USER REFERENCE LIST

The following users can be contacted directly by Data Decisions subscribers for firsthand advice and opinions about the products covered in this report:

- Mr. Bob Cronin
  Project Manager
  Wang Data Center
  20 South Avenue
  Burlington, MA 01803
  Tel: 617-272-8550

- Mr. Steve Goldbloom
  Lead Systems Programmer
  McCormick & Co, Inc
  414 Light Street
  8th Floor
  Baltimore, MD 21202
  Tel: 301-547-6137

- Mr. Bob Miloux
  Assistant Vice President Systems Programming
  Santa Monica Bank
  1324 5th Street
  Santa Monica CA 90401
  Tel: 213-394-9611

• END

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

■ PROFILE

Function ● statistical multiplexer and network concentrators (DCX 812, DCX815/Commux/DCX817/DCX825/DCX836/DCX840/DCX850) ● bit-interleaved time-division multiplexer (DCX725).

Communications/Networks ● X.25 PAD/Commux/DCX815/DCX812 supports up to 8 asynchronous channels; DCX817 up to 4 asynchronous and 2 IBM BSC channels; DCX825 up to 32 asynchronous channels; DCX836 up to 60 asynchronous channels; DCX840/DCX850 up to 240 asynchronous channels ● channel rates up to 9600 bps ● maximum aggregate channel rate of 38.4K bps (DCX812); 38.4K bps (DCX815); 38.4K bps (DCX817); 153.6K bps (DCX825); 576K bps (DCX836); 2304K bps (DCX840/DCX850) ● DCX725/DCX812 Commux/DCX815/DCX825/DCX836 support single composite link in point-to-point configuration ● DCX840 supports up to 15 composite links in multinode configuration; addresses a virtually unlimited number of DCX840 and smaller DCX nodes, restricted only by throughput degradation ● DCX850 supports up to 14 composite links in multinode configuration; addresses up to 63 DCX850 nodes plus a virtually unlimited number of DCX840 and smaller DCX nodes, restricted only by throughput degradation ● modified HDLC/CCITT X.25 link protocol (statistical DCX models).
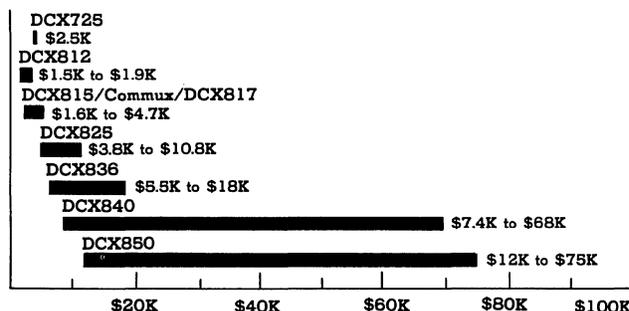
First Delivery ● 1980 for DCX815 ● 1981 for DCX825/

The CASE DCX840 addresses medium-to-large scale network requirements and can be configured with multiple composite network links for communicating with other DCX models in a multinode network.

PURCHASE PRICE RANGE   hardware ■▬▬▬

DCX725
I $2.5K
DCX812
■ $1.5K to $1.9K
DCX815/Commux/DCX817
■▬ $1.6K to $4.7K
DCX825
▬▬ $3.8K to $10.8K
DCX836
▬▬▬ $5.5K to $18K
DCX840
▬▬▬▬▬▬▬▬▬▬▬▬ $7.4K to $68K
DCX850
▬▬▬▬▬▬▬▬▬▬▬▬▬ $12K to $75K

| $20K | $40K | $60K | $80K | $100K |

CASE DCX SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations; annual contract maintenance adds 7.3 to 12 percent to the purchase price, depending on model and distance from a CASE Service Center ● **DCX725** basic configuration consists of 4-channel synchronous mux ● **DCX812** small configuration consists of 4-channel asynchronous mux; large of 8-channel asynchronous mux ● **DCX815/Commux/DCX817** small configuration consists of 4-channel async mux; large of 8-channel async mux with integral 9600-bps modem ● **DCX825** small configuration consists of 4-channel async mux; large of 32-channel async mux ● **DCX836** small configuration consists of 4-channel async mux with 16K-byte buffer; large of 48-channel async mux with 64K-byte buffer ● **DCX840** small configuration consists of card frame with 4 async channels, 16K-byte buffer, network configuration module, and 1 composite link; large of 5 card frames with 192 async channels, 256K-byte buffer, network configuration module, and 12 composite links ● **DCX850** small configuration consists of card frame with 4 async channels, 16K-byte buffer, network configuration module, switching module, and single composite link; large of 5 card frames with 192 async channels, 256K-byte buffer, network configuration module, multinode switching module, and 12 composite links.

DCX836/DCX840/DCX850 ● 1982 for Commux ● 1984 for DCX812.

Systems Delivered ● 1000+ (DCX815); 100 (DCX825 and DCX836); 500 (DCX840 and DCX850).

Comparable Systems ● principal competition for CASE DCX812/DCX815/Commux from Codex 6001/6005; DCA 105; Gandalf PIN 9106; GDC 1240/1241; Infotron Supermux 480; Micom Micro800/2; Prentice SNP1000; Racal-Milgo Omnimux 40/80/160; Timeplex M4A/M8C ● for CASE DCX825/DCX836 from Codex 6010; DCA System 120; DCC CM9100; Gandalf PIN9103; GDC 1257/1258 Megamux; Infotron Supermux 680/780; Micom Micro800/2; Racal-Milgo Omnimux 320; Timeplex Series II Microplexer M24C/M48C ● for CASE DCX840/DCX850 from Codex 6030/6040/6050; Infotron 790 Network Concentrator; Timeplex Switching/Networking Microplexers.

Vendor ● CASE Communications, Inc; 2120 Industrial Parkway, Silver Spring, MD 20904 ● 301-381-2300.

Canadian Distribution ● CASE Communications Limited; 284 Consumers Road, Willowdale, ON M2J 1P8; 416-465-0333.

Distribution ● nationwide via Rixon sales offices and authorized distributors.

GSA Schedule ● listed.

■ ANALYSIS

CASE Rixon, now officially renamed CASE Communications, has aggressively retained its competitive positioning by introducing a slew of data communication products over the past year. An expanded development effort has resulted in the launching of Series 5000 network management products comprising the 5100 and 5200 network management systems and the 5010 and 5020

CASE DCX Series Statistical Multiplexers
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wraparound units. Designed to function as an integral part of a new CASE networking strategy, the 4000 Series of high-performance modems with diagnostic options has joined the extended line-up. The new 500A Data Service Unit and the Beeline Electronic Mail Exchange have also been recently unveiled.

Although the DCX multiplexers represent a mature product line, CASE has strategically enhanced its flexibility by developing a range of synchronous transport products. Specifically, CASE introduced S-LINK, BLUE-LINK, BATCH-LINK, and DDCMP-LINK products for handling IBM synchronous and DEC-DDCMP traffic. S-LINK is intended to handle SNA/SDLC protocols; BLUE-LINK and BATCH-LINK are designed for 3270 BSC and 2780/3780 BSC remote job entry, respectively; and DDCMP-LINK provides compatibility with DEC protocols.

These new extra-cost options dramatically increase product flexibility by allowing users to integrate several protocols in a common network. The products employ a proprietary poll elimination technique which prevents polls from being transported across the network. The local DCX responds to polls from the host, while the remote IBM control units are polled by the DCX adjacent to it. This poll elimination technique is designed to reduce line traffic for SNA/SDLC 3270 interactive applications. We weren't able to obtain specific details on these new options for this report revision. Pricing, however was made available. S-LINK, BLUE-LINK, and BATCH-LINK will carry a purchase price tag of $7,00 each. The DDCMP-LINK option for handling DEC protocols will sell for $9,950.

In addition to the IBM synchronous transport capability, CASE has added a low-end model, the DCX812, designed for Hewlett-Packard, Tandem, and Wang computer users. The new DCX812 is a 4- or 8-channel multiplexer with a maximum rate of 9600-bps per channel and an aggregate rate of 19.2K bps. Intended to eventually replace the aging DCX850, the DCX812 offers standard features including an inactivity timer; local echo; flow control translation; HP, Wang, and Tandem flow control options; 9-level codes; and compatibility with current DCX asynchronous multiplexers.

Pricing on selected models and options has changed since the last review of the DCX product line. For instance, the purchase price of the 4- and 8-channel Commux rackmount models has increased by 2 percent and pricing for DCX825 main and expander modules has been increased from 23 to 35 percent. The card frame assembly for the rackmount units received an 11-percent price increase. In addition, other items including the DCX825 Onward-Link module and integral 9600-bps modem received price reductions of 19 and 3 percent, respectively.

The DCX725 is being marketed to provide synchronous support for specific protocols not handled by DCX statistical multiplexers. It is a standalone version of the DCX825 Synchronous Module, and in tandem with other DCX statistical models can support colocated or remote synchronous terminals in a bandsplitting role, although the DCX725 can be used in a standalone point-to-point configuration as well.

The CASE family of statistical multiplexers encompasses 7 models that focus on small-, medium-, and large-scale asynchronous network requirements. They are transmission compatible with one another and can all be used in the same network. Point-to-point, onward linking, and multinode applications are supported. Onward linking combines the composite link from 1 or more remote multiplexers with the composite link of an intermediate (hub) site multiplexer to eliminate the cost of extra lines.

The statistical DCX family ranges from the entry-level DCX812 with 4 or 8 channels, through the 32-channel DCX825 and the 60-channel DCX836, to the top-end 240-channel multinode DCX840/850. The top-end DCX models address 63 nodes at 255 ports per node. The DCX family is upward and downward compatible to benefit operating flexibility as well as future growth requirements.

The DCX812 is a 4- or 8-channel multiplexer which will eventually replace the older DCX815. Boasting full compatibility with all existing DCX networking and switching systems, the

DCX812 provides a viable product alternative to users with small but growing network requirements. In addition, the DCX812 supports Hewlett-Packard HP 3000, Tandem T-pause, and Wang 2200 computer systems.

The DCX815 is a packaged multiplexer designed to combine 8 or fewer asynchronous lines or devices on a high-speed link. Available as a standalone or rackmount unit, the DCX815 is easily upgraded from 4 to 8 channels. It is a basic multiplexer without frills. Flow control and automatic speed detection are standard. Echoplex is not provided. The Commux is a DCX815 with an integral CCITT V.29/V.27 modem for 9600-/4800-bps data transmission; it deletes the extra-cost, additional cables, and service problems of an external modem.

The DCX825 is essentially a package of up to 4 DCX815s in a single unit. The unit accommodates DCX815 asynchronous quad-channel adapters that have been altered for vertical mounting, and/or 2-channel IBM BSC adapters. A synchronous quad-channel bandsplitter and BSC support are optional. The synchronous channels share the bandwidth of the composite link with asynchronous channels to eliminate the extra cost of separate dedicated lines for synchronous traffic. The bandsplitter must be used at both ends of the link. The user can assign 1 of 2 priority levels to each synchronous channel to service critical traffic over traffic that is less- or noncritical. Users with 1 to 3 remote DCX815 sites located beyond a remote DCX825 can eliminate the cost of extra lines between each of those sites and the central site through a special bandsplitter option for the DCX825 that CASE calls an Onward Link. Each Onward Link combines the composite data stream from a remote multiplexer with its own composite stream. The remote multiplexer is limited to 8 channels; a multiplexer that contains 3 Onward Link options is limited to 8 asynchronous channels. An optional integrated link, modem eliminates the extra cost, additional cables, and service problems of an external modem. The modem is a board equivalent of CASE's TA208A/B at 4800 bps, or a CCITT V.29-compatible PC card for 4800-/9600-bps data transmission.

The DCX836, 840, and 850 address medium-to-large-scale network requirements for asynchronous and/or BSC communication support. They are extremely flexible, large-capacity units that can be configured to meet immediate needs as well as those for future expansion. The DCX836 is limited to point-to-point communication over a single composite link, whereas the DCX840 and 850 perform as nodal processors and can be configured with multiple composite network links that link with other DCX models in a network.

Channel/link routing assignments for the DCX840 are easily established through a numeric keypad on the unit's front panel. A password is required to alter routing assignments to maintain security. Dual configuration memories for channel/link routing and speed assignments enhance operating flexibility and ease of use. While one is in use (active), the other can be altered and selected as active to respond to changing operating requirements. A user can record routing and speed assignments from configuration memory on user-supplied disk or tape and reload the assignments into nonactive memory as required. This feature is useful for installations with periodically changing assignments that are consistent for equivalent periods within each time cycle. A printed copy of configuration memory can also be produced on a user-supplied printer if necessary for logging.

The DCX850 substantially extends operating flexibility over the DCX840. The user can establish channel assignments as switched, contention, or fixed in any combination to satisfy specific operating requirements, and assignments can be altered as needed to meet changing requirements. Channel assignments are password protected for security and can be established from a user-supplied ASCII terminal at any point in a network. Users connected to switched channels can establish a connection to any network switched-channel destination. Contention channels are typically used to access processors with few ports to eliminate the cost of added ports. Fixed channels serve applications that require a permanent connection between 2 points.

In a multinode network consisting of several DCX850 nodes, fixed channels are automatically rerouted according to established alternative routes to recover from a link outage. Rerouting must

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be performed manually by establishing alternative channel/link routing assignments in a multinode network consisting of only 1 DCX850 and multiple DCX840s. And like the DCX840, the DCX850 can establish a connection between pairs of channels on the same multiplexer to pass local data. For network security, the user can restrict channel access on a port-by-port basis to specific channels within a network. The Closed User Group, a standard feature, prevents users from accessing unauthorized network channels.

Other standard DCX850 features benefit dialup users and users connected to switched or contention channels. Dialup users can establish multiple sequential connections without placing a call for each additional connection, eliminating connection time for each additional connection. Switched or contention channel users need not disconnect when a destination channel is busy. A standard camp-on feature queues calls waiting for a busy channel to become available.

The DCX836, 840, and 850 are based on the same 17-slot card cage with power supply, and use the same basic plug-in modules. This architecture facilitates ease of expansion to satisfy future growth requirements. A user can install a DCX836 and expand into an 840, or eventually an 850, according to growth requirements. Central control is distributed among quad-channel adapters and composite link modules, which minimizes the cost for central control.

☐ Strengths

The principal advantage of the CASE DCX family is that **all models** can be used in a single- or multinode network. The user can configure a network according to need; the configuration flexibility satisfies a variety of different applications. Individual models are configuration flexible and can easily be expanded to meet user's growth requirements within channel capacity limits. All modules are readily accessible from the front without disturbing cable connections at the rear. Channel adapters, composite link modules, and buffers are inserted in vacant slots to accommodate expansion or reconfiguration. The DCX815 is easily upgraded from 4 to 8 channels by the insertion of a second logic board.

Multinode support, a strong user benefit of the DCX840 and DCX850, allows data to be exchanged between data terminal equipment located at various nodes of a multinode network, and it provides redundant paths to reroute data in case of a link outage. Specific channel/link assignments route data according to user requirements. Also, the multilink capability of these multiplexers allows the user to expand a network to meet growth requirements. And, link compatibility among models allows the user to configure a network according to needs. Dedicated channel/link routing assignments are established through a numeric keypad on the front panel of a DCX840. The assignments can be easily and quickly changed to satisfy changing needs by switching between 2 configuration memories. The provision for recording or printing (logging) channel/link assignments is beneficial to users with periodically changing routing assignments that are consistently the same over extended periods, e.g., 24 hours.

Users who need to access more than 1 host system or users with many more terminals than computer ports should consider the DCX850. This top-of-the-line model offers extensive operating flexibility over the DCX840. Users can address any network destination through any DCX850 node. Multiple users can contend for available computer ports. Dedicated routing can be specified for fixed applications. Switched, contention, and dedicated channels can easily be assigned, and assignments can be altered when needed to satisfy changing requirements. Channel assignments are established through any dumb asynchronous ASCII terminal assigned as a supervisor console and located anywhere in the network at the user's convenience. Each DCX850 node can accommodate a supervisor console, although 1 console can control an entire network consisting of multiple DCX850. However, the supervisor terminal can control only 1 DCX850 at a time.

Users needn't be concerned about terminal operators gaining unauthorized access to network resources. Security measures

prevent access to supervisor-specified channels. Each user or group of users can be allowed to access supervisor-specified channels only.

The level of DCX operating flexibility has been further enhanced by the introduction of extra-cost protocol options for high-end DCX850 multiplexers. The availability of S-LINK, BLUE-LINK, and BATCH-LINK options provides a significant benefit to users with a number of synchronous terminals scattered about remote sites. Now, not only can asynchronous and IBM synchronous traffic be transported across a DCX network, but leased lines previously used exclusively for IBM traffic can now be used for effectively transmitting non-IBM traffic. According to the vendor, the poll elimination technique utilized by these new options is intended to reduce line traffic by up to 80 percent in 3270 BSC interactive applications and by 60 percent for 3270 SNA/SDLC interactive applications. This reduced traffic will free up lines for transmitting asynchronous traffic to a non-IBM host; asynchronous traffic to an IBM host via a protocol converter; and support additional control units per line.

In addition to IBM synchronous protocol support provided by DCX Bluegate, S-LINK, BLUE-LINK, and BATCH-LINK, CASE also offers the DCX XGate option for accessing packet networks such as Tymnet and Telenet. Also, users with multiple-host installations will appreciate the inclusion of special protocol options for handling the flow control idiosyncrasies of Wang, Hewlett-Packard, and Tandem computers.

☐ Limitations

The DCX725 and the synchronous channel option for the DCX825 is a bandsplitter with dedicated bandwidth that varies according to channel priority assignments. The DCX825 Onward Linking option is also a bandsplitter that shares a composite link with a local and remote multiplexer. Bandsplitters reduce the concentrated throughput rate of a statistical multiplexer and can cause intolerable delays for asynchronous channels, or completely choke off asynchronous channel transmission depending on traffic load. Traffic load balancing must be achieved to effectively utilize these options.

The Onward Linking option benefits users with multiplexers remotely located with respect to the remote multiplexer that incorporates this option, by reducing line costs. But it also reduces the maximum allowable number of channels per multiplexer. The total network linked together by Onward Linking options cannot exceed 32 channels.

Although the aggregate data rate for 4-channel async adapters is up to 38.4K bps (9600-bps maximum per channel), some limitations still exist for low-end 4- to 32-channel models that share logic among channel-card pairs. The 39.4K-bps aggregate only applies to the 4-channel master card in an autonomous 8-channel grouping. In other words, all 8 channels in a fully configured DCX815 or DCX825 master/expander card combination are restricted to the 38.4K-bps aggregate rate (4800-bps maximum per channel). No such limitation exists for DCX836/840/850 models, where each 4-channel card contains its own independent logic. BSC dual-channel cards, however, are also limited to a maximum aggregate rate of 9600 bps; the new enhanced asynchronous option (LSC3a module) is limited to a 19.2K-bps aggregate per 4 channels, as well.

Data compression techniques that reduce data loads by encoding repeated characters or common bit sequences are not provided by the DCX Series. Data compression can yield increased throughput rates for certain types of data traffic and more effectively utilizes the communication facility.

The method by which operating parameter changes are made is another limitation of low-end DCX multiplexers. Except for the DCX840/DCX850, parameter changes must be made by DIP switch settings on the front panel or on individual channel adapters. While this method is satisfactory for a few channels with constant configuration parameters, it is inconvenient and unwieldy for large numbers of channels or frequently changing channel parameters. In large networks with a combination of different model DCX multiplexers, users are unable to reconfigure or monitor DCX812, DCX815, or DCX825 units from their

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DCX840/DCX850 master nodes. Paradyne, also a licensee of CASE DCX multiplexers, has significantly improved the method of changing operating parameters by incorporating a Network Supervisory Controller into its existing DCX line-up. Paradyne's latest DCX addition promotes centralized network control and provides comprehensive diagnostic support. Designed for operation in a network with one or more DCX850 multiplexers, the new DCX/NSC consolidates all network monitoring and configuration functions for review at one location. For users with complex networks requiring frequent alterations of operating parameters, this simplified method of supervisory control is a definite advantage over the method currently employed by CASE Communications.

CASE offers an integral link modem for its DCX815 and DCX825 only. This CCITT V.29/V.27 modem cannot fit DCX836/840/850 card cages.

■ HARDWARE

□ Terms & Support

Terms • the DCX models are available for purchase on a 1-, 2-, 3-, or 4-year lease • separate maintenance contract available for both leased and purchased units • lease/purchase credit is 50 percent of lease paid out up to 50 percent of purchase • 1-year warranty on purchased units • quantity discounts available for DCX815 and DCX825 only.

Support • DCX815, DCX817, and DCX825 installed by CASE or by user; DCX836, DCX840, and DCX850 installed by CASE • installation charge ranges from $145 to $520 for the Commux/DCX815/DCX817/DCX825, depending on distance from a CASE Service Center; and from 2.5 to 3.5 percent of purchase price for the DCX836, DCX840, and DCX850, depending on distance • maintenance available under annual contracts for leased or purchased equipment, or via factory repair • contract maintenance performed from 8:00 AM to 5:00 PM, Monday through Friday except holidays; provides on-site repair within 1 to 6 hours of service call, depending on distance from nearest CASE Service Center; annual contracts range from $125 to $395 for the DCX815, and at 8/10/12 percent of purchase price at a distance of within 100/400/800 miles of a CASE Service Center for the remaining DCX series • factory repair available for purchased or leased equipment; repair or replacement at no cost for equipment under warranty; turnaround typically within 14 days • service provided through CASE Service Centers located in Garden Grove and Foster City, CA; Denver, CO; Tampa, FL; Downers Grove, IL; Silver Spring, MD; Ann Arbor, MI; Newark, NJ; Houston, TX; Minneapolis, MN; Boston, MA; and Ottawa, ON • dial-in diagnostics to CASE Statistical Multiplexer Test Center (SMTC) in Silver Spring, MD, available free of charge; SMTC provides network mapping and diagnostic functions for DCX840/DCX850 multiplexers; requires 300-bps AT&T 212, AT&T 103J, or compatible modem • customized service plans available to meet customer specific requirements.

□ Overview

The 7 models of the DCX family statistical multiplexers are designed for point-to-point and multinode network configurations. The models are available with 4 to 240 asynchronous channels in 4-channel increments; upper-end models can support networks containing dozens of nodes and up to 16,000 asynchronous terminals. Two IBM BSC channels can be substituted for the 4-channel async adapter in most DCX models. The entire DCX line is upward and downward compatible, and the 3 upper-end units share components; the DCX836 is upgradable through to the DCX850. Composite link protocol is CCITT X.25 Level II for all models; error detection and correction are performed using CRC 16 and ARQ techniques. Models 836, 840, and 850 support an optional X.25 Level III/PAD composite link, as well.

The DCX725 is a bit-interleaved synchronous time-division multiplexer (TDM) or dynamic bandsplitter, with 4 fixed synchronous channels. It is intended for use in conjunction with other DCX members, in tandem, to supplement asynchronous traffic over the same composite link. The composite link of a remote DCX statistical multiplexer, for example, could connect to one of the DCX725 channels while the remaining 3 channels could be reserved for synchronous devices, such as printers or high-speed synchronous terminals. The DCX725 is also available as a card-mounted option for the DCX725, occupying a single slot within that unit's card enclosure.

The DCX840 and DCX850 are both multilink models with a 15 and 14 composite link capacity, respectively. The DCX850 can contain dedicated channels as well as switched or contention channels; network configuration and control are normally performed via any one of the network terminals attached to a regular data channel. The DCX840 supports static channel/link network configurations; network "mapping" is programmed by the network supervisor through the front-panel keypad. Both models require an AT&T-compatible 212 or 103J modem to facilitate network control and dial-in diagnostics.

Quad-channel adapters are standard for the entire DCX statistical family with data rates from 50 to 9600 bps; aggregate data rates can reach 38.4K bps per each quad adapter. Channel parameters are switch selectable and downline loadable from the master site to the unattended slave multiplexer(s). Individual channel ports accommodate dial-up or dedicated communications facilities as well as data terminal equipment; passes 4 full-duplex control signals.

DCX725 Configuration • 4-channel fixed configuration, standalone unit • bandsplits synchronous channels at selectable rates to 9600 bps; 19.2K-bps maximum aggregate channel rate • 1 composite link; synchronous rates to 19.2K bps • dynamically allocates channel bandwidth on a priority basis; passes 3 full-duplex control signals.

DCX812 Configuration • 4- or 8-channel fixed configuration, standalone or rackmount unit; field expandable from 4 to 8 channels • supports asynchronous channels at rates to 9600 bps; 38.4K bps maximum aggregate channel rate • 1 synchronous composite link; synchronous rates to 19.2K bps • standard support for Hewlett-Packard, Wang, Tandem special flow control systems.

DCX815/Commux Configuration • 4- or 8-channel fixed configuration, standalone or rackmounted unit; field expandable from 4 to 8 channels • supports asynchronous channels at rates to 9600 bps; 38.4K-bps maximum aggregate channel rate • 1 composite link; synchronous rates to 19.2K bps • Commux is a 4- or 8-channel DCX815 with integral 9600-bps modem.

DCX817 Configuration • 6-channel fixed configuration, standalone unit • supports single IBM BSC channel at 9600 bps or 2 BSC channels at 4800 bps each; supports 4 asynchronous channels at selectable rates to 9600 bps; 19.2K-bps maximum asynchronous aggregate channel rate • single composite link; synchronous rates to 19.2K bps.

DCX825 Configuration • rackmounted unit expandable to 32 channels in 4-channel increments • supports asynchronous channels at rates to 9600 bps; 153.6K-bps maximum aggregate channel rate • supports optional BSC synchronous channels • 1 composite link; synchronous rates to 19.2K bps.

DCX836 Configuration • rackmounted or optional standalone unit • expandable to 60 channels maximum in 4-channel increments • supports asynchronous channels at rates to 9600 bps; 576K-bps maximum aggregate channel rate • supports optional BSC synchronous channels • 1 composite link; synchronous rates to 80K bps • field upgradable to DCX840.

DCX840 Configuration • rackmounted base and expansion units • expandable to 240 channels maximum in 4-channel increments • supports asynchronous channels at rates to 9600 bps; 2304K-bps maximum aggregate channel rate; dedicated channels only • supports optional BSC synchronous channels • 15 composite links maximum; synchronous rates to 80K bps • field upgradable to DCX850.

DCX850 Configuration • rackmounted base and expansion units • expandable to 240 channels maximum in 4-channel increments • supports asynchronous channels at rates to 9600 bps; 2304K-bps maximum aggregate channel rate • supports dedicated, contention, and switched channels • supports optional

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BSC synchronous channels • 14 composite links maximum; synchronous rates to 80K bps.

□ DCX725 Synchronous Multiplexer

DCX725 Central Control

Central control module contains central logic, power supply, integral channel adapters, and composite link module • rackmount version serves as DCX825 Synchronous Module • standard 4-channel unit:

NA mo	$2,495 prch	NA maint

DCX725 Diagnostic Tests

Isolates failures in local/remote channels or in the composite link through local/remote channel loopbacks and composite link loopback testing • requires data entered from terminal or test pattern from test set • standard feature included in package price:

NA mo	NA prch	NA maint

DCX725 Status Reporting

LED status display panel indicates channel activity; channel or composite link loopback conditions; loss of clock signal; loss of synchronization; invalid option configuration; invalid channel configuration; and 7 EIA control signals • standard feature included in package price:

NA mo	NA prch	NA maint

DCX725 Channels

Central control module packaged with 4 channels • synchronous channel rates switch-selectable at 1200/2400/4800/7200/9600 bps • maximum aggregate data rate 19.2K bps • passes 3 full-duplex EIA control signals • switch selectable RTS/CTS delay at 0 to 95 milliseconds • overhead bits for synchronization claimed from channel 1; overhead is no more than 2 percent of composite rate • internal or external clocking (internal for channel 1 only) • RS-232C/CCITT V.24/V.28 electrical interface • channels included in package price:

NC mo	NC prch	NC maint

Dynamic Channel Allocation • improves composite link utilization by automatically assigning only active data channels for transmission, at 3 switch-selectable channel priorities • priority 1 (bandsplit) channels have dedicated bandwidth; priority 2 (contention) channels contend with other priority 2 channels and with priority 3 channels; priority 3 (varispeed) channels have permanent minimum bandwidth and contend with priority 2 channels for additional bandwidth • channel 1 is always priority 3 • standard feature included in package price:

NC	NC	NC

DCX725 Composite Link

Central-control package link • synchronous full-duplex data rates switch selectable at 4800/7200/9600/14.4K/16K/19.2K bps • internal or external clocking • RS-232C/CCITT V.24/V.28 electrical interface • standard feature included in package price:

NC mo	NC prch	NC maint

□ DCX812 Statistical Multiplexer

DCX812 Central Control

Central control module available in 4- or 8-channel packaged configurations, expandable to a maximum of 8 channels, and contains power supply, central logic, 5.5K-byte RAM buffer, and composite link module.

4-Channel DCX812 • multiplexer configuration packaged with 4 channels and composite link; expandable to 8 channels maximum • standalone:

NA mo	$1,495 prch	NA maint

8-Channel DCX812 • multiplexer configuration packaged with 8 channels and composite link; nonexpandable • standalone:

NA	1,895	NA

DCX812 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals, resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC2 or DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; buffer flow suspension disables all ports simultaneously • detects and responds to raising/lowering of Data Terminal Ready (DTR) or XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 75-percent total buffer utilization; flow resumption threshold at 50-percent buffer utilization • data lost message sent to affected terminals on buffer overflow • standard feature included in package price.

Link Outage Recovery • link down message sent to terminal equipment when composite link is out • standard feature included in package price:

NC mo	NC prch	NC maint

Hewlett-Packard Protocol Support • supports HP 3000 systems using ENQ/ACK block-mode protocol in concert with XON/XOFF flow control • standard feature included in package price:

NC	NC	NC

Tandem Protocol Support • supports Tandem computers using T-Pause flow control technique • standard feature included in package price:

NC	NC	NC

Wang Protocol Support • supports Wang 2000 systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • standard feature included in package price:

NC	NC	NC

Flow Control Translation • supports any combination of in-band (control character) or out-of-band (control signal) flow control mechanisms at opposite ends of a data channel • standard feature included in package price:

NC	NC	NC

DCX812 Diagnostics Tests

Isolates failures in local/remote data channels and local composite link through selectable tests • remote and local channel loopback • local composite link loopback • validation test feature ensures the existence of a comparable channel at the remote DCX812 to be tested; checks integrity of data path • channels in loopback mode do not interfere with active channels • standard feature included in package price.

DCX812 Status Reporting

Single-character digital display indicates composite link utilization percentage and component testing/failure • status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; line degradation when error rate is approximately greater than 1 in 100,000 bits; buffer overflow; loopback modes; validation test mode; and channel activity for any or all channels • standard feature included in package price.

DCX812 Channels

Central control module packaged with 4/8 half-/full-duplex asynchronous channels • switch-selectable channel rates of 50/75/100/110/134.5/150/200/300/600/1200/2400/3600/4800/7200/9600 bps; maximum aggregate input rate of 38.4K bps • 6 channel parameter combinations selected via front-panel DIP switches; includes data rates, character codes, stop bits, and channel options • 5 through 8 data bits; 1/1.5/2

MO: single-unit monthly charge for leased units. PRCH: single-unit purchase price. MAINT: monthly maintenance charge. NA: not available (undisclosed). NC: no charge. Prices are current as of June 1985.

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

stop bits • automatically codes flyback buffering time delays (CR/LF/FF/HT/VT or CR/LF/NL/EOT character delays) • RS-232C/CCITT V.24/V.28 electrical interface • included in package price:

	NC mo	NC prch	NC maint

Autospeed Option • Automatic Baud Rate (ABR) regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 50- to 2400-bps data rates • CR convention or any ASCII character with 101- or 010-bit pattern • included in package price:

	NC	NC	NC

Unbalanced Baud Rate (Split Channel Speed) Option • supports terminals operating at different receive/transmit data rates • receive data rate switch-selected on local DCX812; transmit data rate determined at remote DCX812 • typical receive/transmit data rates of 1200/75, 1200/150 bps applicable to Viewdata and other public information networks • included in package price:

	NC	NC	NC

Local Echoplex • echoes operator input from remote multiplexer instead of from CPU for visual verification, improving screen response time • does not distinguish between data and passwords • standard feature:

	NC	NC	NC

DCX812 Composite Link

Central control module packaged link • up to 19.2K bps full-duplex synchronous with external clock source • switch-selectable data rates at 1200/2400/3600/4800/7200/9600 bps full-duplex synchronous with internal clock source • CCITT X.25 Level II protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface.

☐ DCX815/Commux Statistical Multiplexer

DCX815/Commux Central Control

Central control module available in 4- or 8-channel packaged configurations, expandable to a maximum of 8 channels, and contains power supply, central logic, 5.5K-byte RAM buffer, and composite link module.

4-Channel DCX815 • multiplexer configuration packaged with 4 channels and composite link; expandable to 8 channels maximum • standalone:

NA mo	$1,595 prch	NA maint

4-Channel DCX815 Rackmount • same as above; fits vertical slot in RM80 Card Frame:

NA	1,495	NA

8-Channel DCX815 • multiplexer configuration packaged with 8 channels and composite link; nonexpandable • standalone:

NA	2,195	NA

8-Channel DCX815 Rackmount • same as above; fits 2 vertical slots in RM80 Card Frame:

NA	2,095	NA

4-Channel Commux • 4-channel DCX815 with integral CCITT V.29, 9600-bps modem; expandable to 8 channels maximum • standalone:

NA	3,995	NA

4-Channel Commux Rackmount • same as above; fits 2 vertical slots in RM80 Card Frame:

NA	3,895	NA

8-Channel Commux • 8-channel DCX815 with integral CCITT V.29, 9600-bps modem; nonexpandable • standalone:

NA	4,695	NA

8-Channel Commux Rackmount • same as above; fits 3 vertical slots in RM80 Card Frame:

NA	4,595	NA

4-Channel Expansion Card • plug-in board expands 4-channel

DCX815/Commux to 8-channel DCX815/Commux:

NA	799	NA

Mounting Kit • rackmount option for 4-/8-channel DCX815/Commux standalone models; mounts single unit in 19-inch standard cabinet:

NA	25	NA

RM80 Card Frame • rackmount unit with power supply and 16 vertical card slots; fits 19- and 23-inch equipment cabinets:

NA	1,495	NA

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • standard feature included in package price:

NC	NC	NC

DCX815/Commux Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals, resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC2 or DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; buffer flow suspension disables all ports simultaneously • detects and responds to raising/lowering of Data Terminal Ready (DTR) or XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 75 percent total buffer utilization; flow resumption threshold at 50-percent buffer utilization • data lost message sent to affected terminals on buffer overflow • standard feature included in package price.

Link Outage Recovery • link down message sent to terminal equipment when composite link is out • standard feature included in package price.

DCX815/Commux Diagnostic Tests

Isolates failures in local/remote data channels and local composite link through selectable tests • remote and local channel loopback • local composite link loopback • validation test feature ensures the existence of a comparable channel at the remote DCX815 to be tested; checks integrity of data path • channels in loopback mode do not interfere with active channels • standard feature included in package price.

DCX815/Commux Status Reporting

Single-character digital display indicates composite link utilization percentage and component testing/failure • status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; line degradation when error rate is approximately greater than 1 in 100,000 bits; buffer overflow; loopback modes; validation test mode; and channel activity for any or all channels • standard feature included in package price.

DCX815/Commux Channels

Central control module packaged with 4/8 half-/full-duplex asynchronous channels • switch-selectable channel rates of 50/75/100/110/134.5/150/200/300/600/1200/2400/3600/4800/7200/9600 bps; maximum aggregate input rate of 38.4K bps • 6 channel parameter combinations selected via front-panel DIP switches; includes data rates, character codes, stop bits, and channel options • 5 through 8 data bits; 1/1.5/2 stop bits • automatically codes flyback buffering time delays (CR/LF/FF/HT/VT or CR/LF/NL/EOT character delays) • RS-232C/CCITT V.24/V.28 electrical interface • included in package price:

	NC mo	NC prch	NC maint

Autospeed Option • Automatic Baud Rate (ABR) regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 50- to 2400-bps data rates • CR convention or any ASCII character with 101- or 010-bit pattern • included in package price:

	NC	NC	NC

Unbalanced Baud Rate (Split Channel Speed) Option •

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

supports terminals operating at different receive/transmit data rates • receive data rate switch-selected on local DCX815; transmit data rate determined at remote DCX815 • typical receive/transmit data rates of 1200/75, 1200/150 bps applicable to Viewdata and other public information networks • included in package price:

	NC	NC	NC

DCX815/Commux Composite Link

Central control module packaged link • up to 19.2K-bps full-duplex synchronous with external clock source • switch-selectable data rates at 1200/2400/3600/4800/7200/9600 bps full-duplex synchronous with internal clock source • CCITT X.25 Level II protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface.

Commux Integral Modem • 4- and 8-channel Commux models contain an integral synchronous full-duplex 9600-/4800-bps modem • operates over 4-wire dedicated Type 3002 lines • CCITT V.29/V.27 compatible • automatic adaptive equalization • standard feature included in Commux package system price:

NC mo	NC prch	NC maint

☐ DCX817 Statistical Multiplexer

Central control module contains 2 IBM BSC channels and 4 asynchronous channels, nonexpandable, and contains power supply, central logic, 10.5K-byte RAM buffer, and composite link module • standalone only:

NA mo	$2,295 prch	NA maint

Mounting Kit • rackmount option mounts single DCX817 in 19-inch equipment cabinet:

NA	20	NA

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • standard feature included in package price:

NC	NC	NC

DCX817 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals, resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC2 or DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; buffer flow suspension disables all ports simultaneously • detects and responds to raising/lowering of Data Terminal Ready (DTR) or XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 75-percent total buffer utilization; flow resumption threshold at 50-percent buffer utilization • data lost message sent to affected terminals on buffer overflow • standard feature included in package price.

Link Outage Recovery • link down message sent to terminal equipment when composite link is out • standard feature included in package price:

NC mo	NC prch	NC maint

Hewlett-Packard Protocol Support • supports HP 3000 systems using ENQ/ACK block-mode protocol in concert with XON/XOFF flow control • standard feature included in package price:

NC	NC	NC

Flow Control Translation • supports any combination of in-band (control character) or out-of-band (control signal) flow control mechanisms at opposite ends of a data channel • standard feature included in package price:

NC	NC	NC

DCX817 Diagnostic Tests

Isolates failures in local/remote data channels and local composite link through selectable tests • remote and local channel loopback • local composite link loopback • end-to-end test and error injection • validation test feature ensures the existence of a comparable channel at the remote DCX815 to be tested; checks integrity of data path • channels in loopback mode do not interfere with active channels • standard feature included in package price.

DCX817 Status Reporting

Single-character digital display indicates composite link utilization percentage and component testing/failure • status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; line degradation when error rate is approximately greater than 1 in 100,000 bits; buffer overflow; loopback modes; validation test mode; and channel activity for any or all channels • standard feature included in package price.

DCX817 Channels

Central control module packaged with 4 half-/full-duplex asynchronous channels and 2 half-duplex synchronous channels • asynchronous channels feature switch-selectable channel rates of 50/75/100/110/134.5/150/200/300/600/1200/2400/3600/4800/7200/9600 bps; maximum aggregate asynchronous input rate of 19.2K bps • 7 through 9 data bits; 1/1.5/2 stop bits • 110 bps at 8 bits plus 2 stop bits only; 7 bits plus 1 stop bit for 75/300/600/1200 bps only • automatically codes flyback buffering time delays (CR/LF/FF/HT/VT or CR/LF/NL/EOT character delays) • synchronous channels support IBM 3270/2870/3780 BSC or ICL C01/C03 protocols at 1200/2400/3600/4800/7200/9600 bps, DLL, and speed mismatching; maximum aggregate synchronous input rate of 9600 bps • internal or external clock source; channel configured as DCE • DTR/DSR, RTS/CTS, BO, CD, RI control signals • ASCII or EBCDIC codes, IBM BSC; ASCII only, ICL • RS-232C/CCITT V.24/V.28 electrical interface • channels included in package price:

NC mo	NC prch	NC maint

Autospeed Option • Automatic Baud Rate (ABR) regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 50- to 2400-bps data rates • CR convention or any ASCII character with 101- or 010-bit pattern • included in package price:

NC	NC	NC

Unbalanced Baud Rate (Split Channel Speed) Option • supports terminals operating at different receive/transmit data rates • receive data rate switch-selected on local DCX815; transmit data rate determined at remote DCX815 • typical receive/transmit data rates of 1200/75, 1200/150 bps applicable to Viewdata and other public information networks • included in package price:

NC	NC	NC

Local Echoplex • echoes operator input from remote multiplexer instead of from CPU for visual verification, improving screen response time • does not distinguish between data and passwords • standard feature:

NC	NC	NC

DCX817 Composite Link

Central control module packaged link • up to 9600-bps full-duplex synchronous with internal clock source • CCITT X.25 Level II protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface.

☐ DCX825 Statistical Multiplexer

DCX825 Central Control

Basic card frame with power supply and 16 vertical card slots; accommodates up to eight 4-channel asynchronous adapters, and/or up to 4 STP adapters, an optional 4-channel synchronous adapter, up to 3 single-channel synchronous bandsplitters (Onward Linking modules), an optional integral link modem, and composite link • central control distributed among channel adapters and composite link module; channel adapters include Main and Expander Modules; each contains 4 asynchronous channels and are combined in pairs for each 8-channel increment to a maximum 32-channel capacity • Main Module

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

contains central control (TI 9900 microprocessor), 4K-byte RAM buffer, and 4 channels/ports; expanded to 8 channels x 4-channel Expander Module, which shares Main Module central control and buffer ● unused card slots for future options.

RM80 Card Frame ● rackmount unit with power supply and 16 vertical card slots; fits 19- and 23-inch equipment cabinets:

	NA mo	$1,495 prch	NA maint

Downline Load ● automatically downline loads channel configuration parameters from master to slave unit ● standard no-cost feature:

	NC	NC	NC

DCX825 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data ● controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC2 or DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; buffer flow suspension disables all ports simultaneously ● detects and responds to raising/lowering of Data Terminal Ready (DTR) or XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs ● buffer flow suspension threshold set at 75-percent total buffer utilization; flow resumption threshold at 50-percent buffer utilization ● data lost message sent to affected terminals on buffer overflow ● standard feature included in package price:

	NC mo	NC prch	NC maint

Link Outage Recovery ● link down message sent to terminal equipment when composite link is out ● standard feature included in package price:

	NC	NC	NC

DCX825 Diagnostic Tests

Isolates failures in local/remote data channels and local composite link through selectable tests ● remote and local channel loopback ● local composite link loopback ● validation test feature ensures the existence of a comparable channel at the remote DCX825 to be tested; checks integrity of data path ● channels in loopback mode do not interfere with active channels ● standard feature included in package price:

	NC mo	NC prch	NC maint

DCX825 Status Reporting

Main Module ● single-character digital display indicates buffer utilization and component testing/failure ● status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; XOFF sent to terminals; buffer overflow; loopback modes; validation test mode; and channel activity for any or all channels ● standard feature included in module price:

	NC mo	NC prch	NC maint

Composite Link Processor ● single-character digital display indicates composite link utilization and component testing/failure ● status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; line degradation when error rate is approximately greater than 1 in 100,000 bits; loopback mode; absence of received/transmitted clock; absence of received/transmitted data ● standard feature included in module price:

	NC	NC	NC

DCX825 Channels

Main and Expander Modules packaged with 4 asynchronous channels each, half-/full-duplex; accommodates up to 32 channels ● switch-selectable channel rates of 50/75/100/110/134.5/150/200/300/600/1200/2400/3600/4800/7200/9600 bps; aggregate data rate of 19.2K bps per each 4 channels, maximum aggregate input rate of 153.6K bps ● 6 channel parameter combinations selected via front-panel DIP switches; includes data rates, character codes, stop bits, and channel options ● 5 through 8 data bits; 1/1.5/2 stop bits ● automatically codes flyback buffering time delays (CR/LF/FF/HT/VT or

CR/LF/NL/EOT) ● RS-232C/CCITT V.24/V.28 electrical interface ● channel features included in module pricing.

Main Module ● contains central logic, 4K-byte buffer, and 4 asynchronous channels; supports Expander Module ● requires card slot in RM80:

	NA mo	$1,495 prch	NA maint

Expander Module ● 4-channel asynchronous channel adapter; requires Main Module and card slot in RM80:

	NA	799	NA

Main/Expander Module ● Main Module packaged with associated Expander Module; contains 8 asynchronous channels ● requires 2 card slots in RM80:

	NA	2,600	NA

Autospeed ● Automatic Baud Rate (ABR) option ● regulates asynchronous channel rate to rate of dial-up line ● switch selectable on individual channel basis ● 50- to 2400-bps data rates ● CR convention on any ASCII character with 101- or 010-bit pattern ● option price included in cost of central control unit:

	NC	NC	NC

Unbalanced Baud Rate (Split Channel Speed) Option ● supports terminals operating at different receive/transmit data rates ● receive data rate switch selectable on local DCX825; transmit data rate determined at remote DCX825 ● typical receive/transmit data rates of 1200/75, 1200/150 applicable to Viewdata and other public information networks ● option price included in cost of central control unit:

	NC	NC	NC

DCX825 Composite Link

Composite link contained in Composite Link Processor Module ● up to 19.2K bps full-duplex synchronous with external clock source ● switch-selectable data rates at 1200/2400/4800/7200/9600/19.2K bps full-duplex synchronous using internal DCX825 clock source ● CCITT X.25 Level II protocol ● CRC 16 and ARQ error detection and correction ● RS-232C/CCITT V.24/V.28 electrical interface ● features included in Composite Link Processor Module pricing.

Composite Link Processor Module ● contains microprocessor logic for combining up to 32 asynchronous channels into 1 composite link ● requires card slot in RM80:

	NA mo	$1,195 prch	NA maint

Onward-Link Module ● combines composite link data stream from local or remote multiplexer with composite data stream of local DCX825 ● functions as bandsplitter ● 3 maximum Onward-Link modules per DCX825 ● 32 channels maximum among all sites linked by Onward-Link modules; 8 channels per site; 4800-bps maximum link rate ● requires slot in card frame:

	NA	1,495	NA

TA208A/B Integral Modem ● 4800-bps full-duplex integral modem for operation over 4-wire dedicated Type 3002 lines ● automatic adaptive equalizer ● compatible with AT&T modem 208A/B ● requires slot in card frame:

	NA	1,695	NA

Integral 9600-bps Modem ● 9600-/4800-bps full-duplex integral modem for operation over 4-wire dedicated Type 3002 lines ● CCITT V.29/V.27 compatible ● automatic adaptive equalization ● requires slot in card frame:

	NA	1,995	NA

☐ DCX836 Statistical Multiplexer

DCX836 Central Control

Basic card frame with power supply and 17 vertical card slots; accommodates up to four 16K-byte RAM buffer modules for a total of 64K-byte RAM buffer storage, up to fifteen 4-channel adapters for 60 channels maximum (48 channels maximum with full buffer complement), and single composite link module.

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

Card Frame Assembly • rackmount unit with power supply and 17 vertical card slots; fits 19- and 23-inch equipment cabinets or standalone enclosure:

NA mo	$2,695 prch	NA maint

Buffer Module • buffer memory assigned dynamically to active channels only; buffers data between individual channels and composite link module; contains 3 bit-slice microprocessors (AMB 2901's, 4-bit architecture) • automatically deletes longest data queue upon buffer overflow • DCX836 requires 1 to 4 Buffer II modules, depending on channel capacity and data speeds.

Buffer II Module • 16K-byte RAM buffer • requires slot in Card Frame Assembly:

NA	1,090	NA

Standalone Enclosure • standalone, desktop enclosure for DCX836 only • extra-cost option:

NA	899	NA

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • standard no-cost feature:

NC	NC	NC

DCX836 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC2 or DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; buffer flow suspension disables all ports simultaneously • detects and responds to raising/lowering of Data Terminal Ready (DTR) or XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 75-percent total buffer utilization; flow resumption threshold at 50-percent buffer utilization • data lost message sent to affected terminals on buffer overflow • standard feature included in package price:

NC mo	NC prch	NC maint

Link Outage Recovery • link down message sent to terminal equipment when composite link is out • standard feature included in package price:

NC	NC	NC

DCX836 Diagnostic Tests

Isolates failures in local/remote data channels and local composite link through selectable tests • remote and local channel loopback • local composite link loopback • validation test feature ensures the existence of a comparable channel at the remote DCX836 to be tested; checks integrity of data path • channels in loopback mode do not interfere with active channels • standard feature:

NC mo	NC prch	NC maint

DCX836 Status Reporting

LSC Module • channel adapter status display panel indicates results of performance monitoring; LEDs indicate data channel loopback modes; validation test mode; and EIA interface signal status.

Buffer Module • LED status display panel indicates memory error, parity error, and buffer overflow.

ARQ Module • composite link module provides single-character digital display; indicates composite link utilization percentage and component testing/failure • status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; line degradation when error rate is approximately greater than 1 in 100,000 bits; composite link loopback mode; and EIA interface signal status.

DCX836 Channels

LSC3 Module • channel adapter with microprocessor logic (Texas Instruments TI 9900); contains 4 half-/full-duplex asynchronous channels • up to 15 LSC Modules per DCX836, 60

channels maximum • switch-selectable channel rates of 50/75/100/110/134.5/150/200/300/600/1200/2400/3600/4800/7200/9600 bps; aggregate data rate of 19.2K bps per each 4-channel module, maximum aggregate input rate of 288K bps • channel parameter combinations selected via internal DIP switches; includes data rates, character codes, stop bits, and channel options • 5 through 8 data bits; 1/1.5/2 stop bits • automatically codes flyback buffering time delays (CR/LF/FF/HT/VT or CR/LF/NL/EOT) • local/remote loopbacks and channel validation tests selected via front-panel thumbwheel switch • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Card Frame Assembly • channel features included in LSC Module pricing:

NA mo	$790 prch	NA maint

LSC3a Module • same as LSC3 but supports Hewlett-Packard ENQ/ACK protocol, local echoplex, 9-level character codes, and flow control translation • supports HP 3000 systems using ENQ/ACK block-mode protocol in concert with XON/XOFF flow control • local echoplex echoes operator input from remote multiplexer instead of from CPU for visual verification, improving response time; does not distinguish between data and passwords • supports 7 through 9 bit codes (see DCX817 Channels for details) • 19.2K-bps maximum aggregate channel rate • supports any combination of in-band (control character) or out-of-band (control signal) flow control mechanisms at opposite ends of a data channel • requires slot in Card Frame Assembly:

NA	790	NA

LSC4 Module • same as LSC3 but supports aggregate data rate of 38.4K bps per each 4-channel module, maximum aggregate input rate of 576K bps • requires slot in Card Frame Assembly:

NA	890	NA

LSC5 Module • channel adapter with 2 synchronous channels • supports IBM 3270/2870/3780 BSC or ICL C01/C03 protocols at 1200/2400/3600/4800/7200/9600 bps each, DLL, and speed mismatching; maximum aggregate data input rate of 9600 bps • internal or external clock source; channel configured as DCE • DTR/DSR, RTS/CTS, BO, CD, RI control signals • ASCII or EBCDIC codes, IBM BSC; ASCII only, ICL • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Card Frame Assembly:

NA	1,225	NA

Autospeed • Automatic Baud Rate (ABR) Option regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 50- to 2400-bps data rates • CR convention or any ASCII character with 101- or 010-bit pattern • option price included in cost of async LSC modules:

NC	NC	NC

Unbalanced Baud Rate (Split Channel Speed) Option • supports terminals operating at different receive/transmit data rates • receive data rate switch selected on local DCX825; transmit data rate determined at remote DCX825 • typical receive/transmit data rates of 1200/75, 1200/150 applicable to Viewdata and other public information networks • option price included in cost of async LSC modules:

NC	NC	NC

DCX836 Composite Link

Composite link contained in ARQ Card with microprocessor logic (Texas Instruments TI 9900) • up to 19.2K bps full-duplex synchronous with external clock source • switch-selectable data rates at 1200/2400/4800/7200/9600/19.2K bps full-duplex synchronous using internal DCX836 clock source • CCITT X.25 Level II protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • features all included in ARQ Card.

Automatic Retransmission Request (ARQ) Module • contains logic to combine up to 60 asynchronous channels into a single composite link • requires slot in Card Frame Assembly:

NA mo	$790 prch	NA maint

ARQ2 Module • combines up to 60 channels into single

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

composite link • up to 72K-bps full-duplex synchronous data rates, external clock source; up to 80K-bps with internal clock source, without modems • modified ISO HDLC Level II link protocol • CRC and ARQ error detection and correction • satellite optimization for 2-hop satellite links • RS-232C/RS-422/CCITT V.24/V.28/V.35 electrical interface • requires slot in Card Frame Assembly:

	NA	1,290	NA

Bluegate ARQ Module • protocol converter/link module combines up to 32 asynchronous ASCII channels into a single composite link; channels mapped across single IBM BSC circuit to the host • emulates an IBM 3271 or 3274 model 2 cluster controller handling IBM 3277 or 3278 terminals • accepts ASCII input with even parity, upper- and lowercase; terminals must generate Escape and Control characters, have Clear Screen function and addressable cursor • link speeds up to 9600-bps, half-duplex synchronous, point-to-point or multidrop; EBCDIC character code • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Card Frame Assembly:

	NA	7,000	NA

XGATE ARQ Module • combines up to 60 virtual circuits (low-speed channels) into single composite link • up to 72K-bps full-duplex synchronous rates, external clock source • X.25 Level II link access protocol balanced (LAPB) • certified for use over Telenet, Tymnet public data networks and CASE private packet networks • supports CCITT Recommendation X.121 international address coding; includes short-form (mnemonic) addressing • window (k) size user selectable from 1 to 7 frames • number of retries in case of error (N2) user selectable from 0 to 20 • network packet size established at 128 characters • interval (T1) user selectable in 100-millisecond units from 1 to 100 (1 to 10 seconds) • supports CCITT Recommendations X3, X.28, and X.29 supports switched and permanent virtual circuits; supports all 18 X.3 PAD parameters currently sanctioned by the CCITT • requires slot in Card Frame Assembly:

	NA	7,000	NA

☐ DCX840 & DCX850 Statistical Multiplexers

DCX840/DCX850 Central Control

The DCX840 and DCX850 are configured identically, except that the 850 sacrifices 1 composite link (up to 14 compared to the 840's 15 composite links) to contain channel switching logic; the 850 can additionally assign network supervisory status to any network display terminal • DCX840/850 system includes a basic card frame with power supply and 17 card slots for microprocessor-controlled adapter/modules; 5 card frames per system maximum • initial (master) card frame accommodates composite link modules, system control (STC/MTP) module/panel, bus expansion modules, user switching module (850 only), and channel adapters in smaller systems • supports up to 240 channels using 4-channel adapters, or up to 256K-byte RAM buffer; required buffer module occupies slot in card frame; up to 3 additional buffer modules per card frame, 1 per slot, each displace one 4-channel adapter in a full configuration; 192 channels maximum with full buffer complement • additional card frames, cascaded in desk-high or standard equipment cabinet, each require connector card with corresponding bus extension card in master card frame.

Card Frame Assembly • rackmount unit includes power supply and 17 vertical card slots; accommodates adapters for master card frame, and serves as card nest for channel adapters and buffer modules; maximum 5 card frame assemblies per system; multiframe systems require cooling fan • units fit standard or desk-high equipment cabinet:

	NA mo	$2,695 prch	NA maint

Bus Extension Module/Bus Termination Module (BEM/BTM) • provides control path from master card frame to expansion card frame; package price includes 2 cards linked by ribbon cable, 1 for master frame and 1 for expansion card frame:

	NA	950	NA

Buffer Modules • buffer memory assigned dynamically to active channels only; channels use buffers from their respective card

frame only • buffers data between individual channels and composite link module; contains 3 bit-slice AMB 2901 microprocessors (4-bit architecture, each microprocessor) • automatically deletes longest data queue upon buffer overflow • DCX840/850 requires 1 to 4 Buffer II modules per card frame, depending on channel capacity and data speeds; both types can be mixed in the same frame.

Buffer II Module • 16K-byte RAM buffer • requires slot in Card Frame Assembly:

	NA	850	NA

System Test & Configuration/Mapping Test Panel (STC/MTP) Module • in the DCX840, provides 2 network routing maps, an active map and backup map, that define network channel-to-channel and channel-to-link configurations entered via a front-panel numeric keypad; configuration maps are static and configured only by the network supervisor at a designated central (master) site • network parameters are manually downline loaded from master to slave units via either a regular data channel or, in start-up situations and during composite link failures, via an AT&T 212- or 103J-compatible modem attached to an interface on the STC module; the modem also allows communication with the CASE test center in Silver Spring, Maryland, for dial-in diagnostics • port accommodates user-supplied storage device for dumping/loading routing maps from/to inactive configuration memory; port also accommodates user-supplied printer for logging routing maps • master node in a multinode network assumes control over network parameters; slave 840s can assume partial control over their particular network segment • the STC/MTP module in the DCX850 provides configuration programming for dedicated, nonswitched channels only; switching functions are contained in the optional USO module • STC/MTP card module requires slot in master card frame; operator panel with keypad hinges over master card frame power supply, includes status displays and remote diagnostics switches • 1 STC/MTP module required per each DCX840/DCX850:

	NA	2,390	NA

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • standard no-cost feature:

	NC	NC	NC

DCX840/DCX850 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC2 or DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; buffer flow suspension disables all ports simultaneously • detects and responds to raising/lowering of Data Terminal Ready (DTR) or XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 75-percent total buffer utilization; flow resumption threshold at 50-percent buffer utilization • data lost message sent to affected terminals on buffer overflow • standard feature:

	NC mo	NC prch	NC maint

Link Outage Recovery • link down message sent to terminal equipment when composite link is out • standard feature included in package price:

	NC	NC	NC

DCX840/DCX850 Diagnostic Tests

Isolates failures in local/remote data channels and local composite link through selectable tests • remote and local channel loopback • local composite link loopback • validation test feature ensures the existence of a comparable channel at the remote DCX840/DCX850 to be tested; checks integrity of data path • DCX840/DCX850 users can perform diagnostics from the front of individual channel adapters or, alternatively, from the MTP panel; DCX850 can additionally perform diagnostics from any network terminal designated supervisory terminal by the master DCX850 • channels in loopback mode do not interfere

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CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

with active channels • standard feature:

	NC mo	NC prch	NC maint

Dial-In Diagnostics • DCX840/DCX850 users have free access to CASE's Statistical Multiplexer Test Center (SMTC) in Silver Spring, Maryland, via the dial-in modem attached to the STC module • provides multiplexer diagnostic troubleshooting and network mapping analysis/assistance • user pays only for the cost of the call; standard no-cost feature:

	NC	NC	NC

DCX840/DCX850 Status Reporting

Low-Speed Channel (LSC) Module • status display panel on individual channel adapters indicate results of performance monitoring; LEDs indicate data channel loopback modes; validation test mode; and EIA interface signal status.

Buffer Card • LED status display panel on Buffer II Cards indicate memory error; parity error; and buffer overflow.

ARQ Card (Composite Link Module) • single-character digital display indicates composite link utilization percentage and component testing/failure • status display panel indicates results of performance monitoring; LEDs indicate normal/fault modes; line degradation when error rate is approximately greater than 1 in 100,000 bits; composite link loopback mode; and EIA interface signal status.

STC/MTP Module • status display reflects map entries/network parameter changes; indicates system errors and composite link(s) utilization • status display on the DCX850 can additionally indicate switching statistics; switching statistics can alternatively be displayed on a supervisory terminal.

DCX840/DCX850 Channels

Low-Speed Channel (LSC3) Module • channel adapter with microprocessor logic (Texas Instruments TI 9900); contains 4 asynchronous channels, half-/full-duplex • up to 15 LSC modules per DCX840/DCX850 expander frame with 1 buffer card, 240 channels maximum • switch-selectable channel rates of 50/75/100/110/134.5/150/200/300/600/1200/2400/3600/4800/7200/9600 bps; aggregate data rate of 19.2K bps per each 4-channel adapter, maximum aggregate input rate of 1152K bps • channel parameter combinations selected via internal DIP switches; includes data rates, character codes, stop bits, and channel options • 5 through 8 data bits; 1/1.5/2 stop bits • automatically codes flyback buffering time delays (CR/LF/FF/HT/VT or CR/LF/NL/EOT) • local/remote loopbacks and channel validation tests selected via front-panel thumbwheel switch • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Card Frame Assembly • channel features included in·LSC module pricing:

	NA mo	$790 prch	NA maint

LSC3a Module • same as LSC3 but supports Hewlett-Packard ENQ/ACK protocol, local echoplex, 9-level character codes, and flow control translation • supports HP 3000 systems using ENQ/ACK block-mode protocol in concert with XON/XOFF flow control • local echoplex echoes operator input from remote multiplexer instead of from CPU for visual verification, improving response time; does not distinguish between data and passwords • supports 7- through 9-bit codes (see DCX817 Channels for details) • 19.2K-bps maximum aggregate channel rate • supports any combination of in-band (control character) or out-of-band (control signal) flow control mechanisms at opposite ends of a data channel • requires slot in Card Frame Assembly:

	NA	790	NA

LSC4 Module • same as LSC3 but supports aggregate data rate of 38.4K bps per each 4-channel module, maximum aggregate input rate of 2304K bps • requires slot in Card Frame Assembly:

	NA	890	NA

LSC5 Module • channel adapter with 2 synchronous channels • supports IBM 3270/2870/3780 BSC or ICL C01/C03 protocols at 1200/2400/3600/4800/7200/9600 bps each, DLL, and speed mismatching; maximum aggregate data input rate of 9600 bps • internal or external clock source; channel configured as

DCE • DTR/DSR, RTS/CTS, BO, CD, RI control signals • ASCII or EBCDIC codes, IBM BSC; ASCII only, ICL • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Card Frame Assembly:

	NA	1,225	NA

Autospeed • Automatic Baud Rate (ABR) option regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 50- to 2400-bps data rates • CR convention or any ASCII character with 101- or 010-bit pattern • option price included in cost of LSC module:

	NC	NC	NC

Unbalanced Baud Rate (Split Channel Speed) Option • supports terminals operating at different receive/transmit data rates • receive data rate switch selected on local DCX840/DCX850; transmit data rate determined at remote DCX840/DCX850 • typical receive/transmit data rates of 1200/75, 1200/150 applicable to Viewdata and other public information networks • option price included in cost of LSC module:

	NC	NC	NC

DCX Monitor • passive line monitor for any network channel; can display both data and control characters on user-terminal screen or attached printer • menu driven • monitors receive or transmit data, or both • multiple triggers function on single character only; traps on specified character sequences only • can display data, control characters, or both; data displayed in readable ASCII; control characters displayed in a hexadecimal format and highlighted • includes 15K-byte buffer • occupies single slot in master card frame; displaces composite link module • extra-cost option:

	NA	4,490	NA

DCX850 Channel Routing

Channel switching and contention is implemented by a User Switching Option (USO) module when combined with an STC/MTP module • USO or Multinode USO converts a DCX840 to a DCX850; USO module supports a single DCX850 node; Multinode USO supports each DCX850 node in a multi-DCX850 network, 1 per DCX850 • also implements supervisor control; any asynchronous ASCII terminal in network can be used as supervisor console; performs network routing configurations, diagnostic testing, and status reporting; supports all functions of MTP panel on DCX840.

The supervisor can configure channels as 1 of 3 types: User Mapped Port (UMP); Internal Mapped Port (IMP); or Auto Mapped Port • User Mapped Ports allow terminal operator to establish destination connection • Internal Mapped Ports are dedicated channels with fixed routing assignments established by the supervisor only • Auto Mapped Ports contend for destination connection with other AMPs • supervisor can assign UMPs and AMPs on a port-by-port basis to Closed User Groups for network security; a Closed User Group restricts access to assigned channels within a user group; prevents unauthorized access to network resources • channels assigned as UMP's or AMP's supported by camp-on feature that queues calls until a busy network channel becomes available for connection • Dual Connect Event feature allows dialup channels to establish multiple switched connections without breaking dialup connection.

DCX850 channel switching allows connections to be made dynamically, rather than following map routes as defined in the DCX840. Terminal operators enter commands that automatically connect them to other switched network terminals, provided they are allowed access and the desired connection is not "busy." All channel relationships are programmed by the network supervisor, either at an MTP panel or, more efficiently, at a designated network terminal. The DCX850 also supports terminal-to-terminal communications either remotely or locally within a single node, performing as a data PBX and bypassing composite link communications.

User Switching Option (USO) Module • provides terminal-initiated channel switching, in combination with STC/MTP module • allows any network display terminal to serve as the

CASE DCX Series Statistical Multiplexers
Models DCX725, DCX812, DCX815/Commux, DCX817, DCX825, DCX836, DCX840 & DCX850

network supervisory terminal, assuming the functions of the Mapping Test Panel and providing statistics reporting (event log) of each switching event ● card module requires slot in master card frame; displaces 1 composite link module; for single DCX850 node only:

NA mo	**$5,990 prch**	**NA maint**

Multinode USO Module ● provides all USO functions in multinode DCX850 networks, also provides automatic rerouting of any composite link upon link failure; reroutes data through alternate DCX850 network nodes; for each DCX850 in multi-DCX850 network:

NA	**5,950**	**NA**

DCX840/DCX850 Composite Link

Composite link contained in ARQ module with microprocessor logic (Texas Instruments TI 9900) ● DCX840 supports up to 15 composite links; DCX850 supports up to 14 composite links ● up to 19.2K bps full-duplex synchronous with external clock source ● switch-selectable data rates at 1200/2400/4800/7200/9600/ 19.2K bps full-duplex synchronous using internal DCX840/ DCX850 clock source ● CCITT X.25 Level II protocol ● CRC 16 and ARQ error detection and correction ● RS-232C/CCITT V.24/V.28 electrical interface ● features all included in ARQ module.

Automatic Retransmission Request (ARQ) Module ● contains logic to combine up to 60 asynchronous channels into 1 composite link ● requires slot in Card Frame Assembly:

NA mo	**$825 prch**	**NA maint**

ARQ2 Module ● combines up to 128 channels into single composite link ● up to 72K-bps full-duplex synchronous data rates, external clock source; up to 80K-bps with internal clock source, without modems ● modified ISO HDLC Level II link protocol ● CRC and ARQ error detection and correction ● satellite optimization for 2-hop satellite links ● RS-232C/RS-422/CCITT V.24/V.28/V.34 electrical interface ● requires slot in Card Frame Assembly; up to 3 ARQ2 modules per system maximum, with up

to 9 additional ARQ as required:

NA	**1,290**	**NA**

Bluegate ARQ Module ● protocol converter/link module combines up to 32 asynchronous ASCII channels into a single composite link; channels mapped across single IBM BSC circuit to the host ● emulates an IBM 3271 or 3274 model 2 cluster controller handling IBM 3277 or 3278 terminals ● accepts ASCII input with even parity, upper- and lowercase; terminals must generate Escape and Control characters, have Clear Screen function and addressable cursor ● link speeds up to 9600-bps, half-duplex synchronous, point-to-point, or multidrop; EBCDIC character code ● RS-232C/CCITT V.24/V.28 electrical interface ● requires slot in Card Frame Assembly:

NA	**NA**	**NA**

XGATE ARQ Module ● combines up to 128 virtual circuits (low-speed channels) into single composite link ● up to 72K-bps full-duplex synchronous rates, external clock source ● X.25 Level III link access protocol balanced (LAPB) ● certified for use over Telenet, Tymnet public data networks and CASE private packet networks ● supports CCITT Recommendation X.121 international address coding; includes short-form (mnemonic) addressing ● window (k) size user selectable from 1 to 7 frames ● number of retries in case of error (N2) user selectable from 0 to 20 ● network packet size established at 128 characters ● interval (T1) user selectable in 100-millisecond units from 1 to 100 (1 to 10 seconds) ● supports CCITT Recommendations X3, X.28, and X.29 supports switched and permanent virtual circuits; supports all 18 X.3 PAD parameters currently sanctioned by the CCITT ● requires slot in Card Frame Assembly; up to 11 XGATES per DCX840, 10 per DCX850:

NA	**NA**	**NA**

Automatic Composite Link Rerouting ● DCX850s with optional Multinode USO Module provide automatic rerouting of composite link(s) in the event of composite link failure ● feature included in price of Multinode USO Module.

● END

CASE Rixon Modems
AT&T 100 Series-, 202-, 212A-, 201- & 208-Compatible, Non-AT&T-Compatible & CCITT-Compatible Models
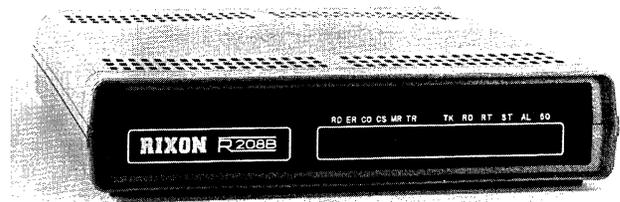
■ PROFILE

Function ● low- to high-speed, AT&T-compatible, non-AT&T-compatible, and CCITT-compatible modems.

Communications/Networks ● 300-bps AT&T 103/113 compatible for the DDD network; point-to-point or multipoint over unconditioned 2- or 4-wire Type 3002 facility ● 1200-bps AT&T 202 compatible for the DDD network; 1200-/1400-bps AT&T 202-compatible point-to-point and multipoint over unconditioned 2- or 4-wire dedicated Type 3002 facility; 1800-bps AT&T 202-compatible point-to-point or multipoint over C2 conditioned 2- or 4-wire dedicated Type 3002 facility ● 300-/1200-bps AT&T 212A compatible for the DDD network ● 2400-bps AT&T 201 compatible for the DDD network; 2400-bps AT&T 201-compatible point-to-point and multipoint over unconditioned 2- or 4-wire dedicated Type 3002 facility ● 2400-bps non-AT&T compatible and CCITT compatible, full-duplex for the DDD network ● 4800-bps AT&T 208B compatible for the DDD network; 4800-bps AT&T 208A compatible over unconditioned 4-wire dedicated Type 3002 facility ● 9600-bps CCITT V.29 compatible over unconditioned 4-wire dedicated Type 3002 facility, 14.4K-bps point-to-point over D-1 conditioned 4-wire dedicated Type 3002 facility.

First Delivery ● 1975 (T202S, T202T); 1978 (T113C, T212A); 1979 (T108); 1980 (TA201C); 1981 (T801 A/C); 1982 (R103J, R212A, TA208A/B); 1983 (R212A Intelligent Modem, PC212A, R96/R96FP, RV.29/2, R2424).

Units Delivered ● undisclosed.

PURCHASE PRICE RANGE

Hardware ■■■■■

AT&T 100 Series compatible
■ $250 to $600
AT&T 202 compatible
■ $450 to $700
AT&T 212A compatible
■ $500 to $900
AT&T 201 compatible
■ $800 to $1K
AT&T 208 compatible
■ $1.5K to $1.9K
Non-AT&T compatible $1.3K to $10K
■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■
CCITT compatible
■■■■■ $1.6K to $3K

| $2K | $4K | $6K | $8K | $10K |

CASE RIXON MODEMS PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations; annual contract maintenance adds $150 to $520 plus 2.5 percent of purchase price up to 3.5 percent, depending on the modem model and distance from a CASE Rixon Service Center ● **AT&T 100 Series-compatible small** configuration consists of 300-bps Model R103J modem; **large** of 300-bps Model T103J modem ● **AT&T 202-compatible small** configuration consists of 1200-bps Model T202T modem; **large** of 1200-bps Model T202S/Reverse Channel modem ● **AT&T 212A-compatible small** configuration consists of 300-/1200-bps Model R212A Intelligent Modem; **large** of Model T212A modem ● **AT&T 201-compatible small** configuration consists of 2400-bps Model TA201C modem; **large** of Model TA201C/DDD modem ● **AT&T 208-compatible small** configuration consists of 4800-bps Model R208B modem; **large** of Model TA208A/B ● **Non-AT&T-compatible small** configuration consists of 2400-bps Model R2424 modem; **large** of 14.4K-bps Model R14.4 Six-Port modem with integral 6-channel TDM multiplexer ● **CCITT-compatible small** configuration consists of 2400-bps Model RV.22 bis modem; **large** of 9600-bps Model R96FP multipoint modem.

Comparable Systems ● principal competition from Anderson Jacobson AJ 245, AJ 1211, AJ 1259, and AJ 4048; AT&T System 103, 108, 113, 201, 202, 212A, 208A/B; Concord Data CDS 212 and CDS 224; General DataComm 103J, 202S, 212A, 201C, 208B/A, 9600, 9600MD, and 9600 QP; Prentice P103/P113, P212A/C, P202A, and P-V.29; Racal-Vadic VA300, VA212, VA1200, VA3400, and VA4400 Series; Universal Data 103, 202, 201, 208, and 9600 Series; Ventel MD103, MD202, and MD212.

Vendor ● CASE Rixon Communications; 2120 Industrial Parkway, Silver Spring, MD 20904 ● 301-622-2121.

Distribution ● nationwide via Rixon sales offices and authorized distributors ● Canada via CASE Rixon Canada Ltd, Edmonton, Ottawa, Toronto; and ElectroRent Corp, Mississauga.

■ ANALYSIS

Rixon was acquired in May by Computer And Systems Engineering (CASE) of Watford, England, a marriage combining Rixon's modem expertise and CASE's multiplexer/concentrator technology. Besides providing a firmer base for CASE multiplexer sales in the U.S., the merger supplies an avenue for Rixon modems to enter European and other world markets via CASE distribution channels.
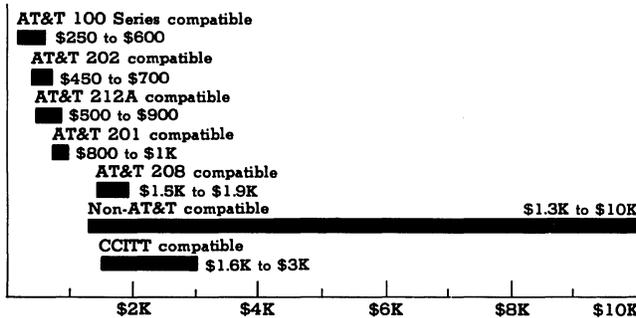
Since Rixon produced its first modem in 1957, it has traditionally served the AT&T-compatible marketplace, including common carriers and other large users. Because of government deregulation and the AT&T System divestiture, however, and ensuing market upheavals, CASE Rixon has retargeted its customer base to include business end users. End-user modem models are prefixed with the letter "R."

The latest crop of CASE Rixon modems are indicative of this end-user trend. These include the R208B, a half-duplex, 4800-bps modem for dial-up networks; the Executive 212, essentially an older R212A Intelligent modem with front-panel controls and an audible call monitor; and the R14.4, a second-generation 14.4K-bps dedicated modem wtih self-error correction. Although CASE Rixon claimed in official announcements that the R14.4 contained a forward error correction (FEC) algorithm, such is not the case; rather, the R14.4 employs a modified QAM signal pattern optimized for better performance over "dirty" or noisy voice-grade communication circuits.

Besides CASE Rixon's bedrock AT&T-compatible business, the firm also produces a 2400-bps, full-duplex, 2-wire modem (in Rixon or CCITT versions); 9600-bps CCITT V.29-compatible modems; and the aforementioned R14.4. Models PC212A, R212A Intelligent modem, Executive 212, and R103J are designed for business and home personal computer users, and

CASE Rixon Modems
AT&T 100 Series-, 202-, 212A-, 201- & 208-Compatible, Non-AT&T-Compatible & CCITT-Compatible Models

are available through Computerland personal computer stores. CASE Rixon is also marketing Microstuf CROSSTALK XVI communication software as an option for the PC212A card modem, designed for the IBM PC.

CASE Rixon will continue to produce fully featured, AT&T-compatible modems for its established customer base of Telcos and large users, as well as for the still-regulated Canadian market. The vendor also produces two limited distance modems (not covered in this report) for nonloaded metallic wire pairs, supporting synchronous and asynchronous communication at data rates up to 19.2K bps and distances up to 24 miles.

☐ Strengths

Rixon is a strong engineering-oriented firm with a long history of modem development. A traditional Telco supplier, the company is now serving a wide variety of users and shows a marked trend towards innovation. Rixon offers one of the most extensive selections of AT&T 212A-compatible modems in the industry, and provides the auxiliary equipment (enclosures, dial backup, short-haul modems, and multiplexers) to support its entire product line.

Evidence of Rixon's expertise is embodied in Model R2424, a 2400-bps full-duplex, 2-wire modem with features generally not available on other entrants in the genre. These include a fallback data rate at 1200-bps in AT&T 212A-compatible mode, and front-panel switch-selection between DDD and dedicated circuits.

The R14.4 is another technologically advanced product. It incorporates a self-error correction technique which purportedly negates the effects of phase jitter and S/N distortion over leased voice-grade circuits.

The PC212A is a 1200-bps plug-in modem for IBM PC and XT users. It comprises a 212 modem and communication circuitry all on 1 card, and can be purchased with an RS-232C port for serial printer attachment (or second communication interface) also on the same card; this arrangement saves the expense and wasted space involved in buying an IBM communication card(s) and an external modem. It also provides modem configuration from the PC in either Rixon or Hayes Smartmodem formats.

☐ Limitations

Rixon's traditional dedication to the AT&T-compatible market can also be seen as a liability. Its large and confusing array of card cages, similar to AT&T's offerings, prohibits the mixing of low- and high-speed modems in the same enclosure. Competitor General DataComm provides this capability with its DataComm series modems. The T801A/B automatic calling unit, also a AT&T-compatible model, only allows 1 modem to be dialed from a single computer port. Non-AT&T ACUs from Universal Data Systems, on the other hand, allow 2 CPU ports to address as many as 60 mdoems, saving money and rackmount space.

Although the R14.4 may provide better error rate performance over leased voice-grade channels, it carries a premium price tag. At $9,000 to $10,000, the unit costs up to 40 percent more than basic 14.4K modems currently on the market. Users may achieve acceptable error rates using cheaper conventional 14.4K modems with additional communication equipment (such as a statistical multiplexer) containing an error detection and block retransmission technique.

Models R96 and R96FP are no-frills, high-speed modems for the economy minded, and do not support secondary channels or advanced diagnostics. These units compete with the likes of Universal Data Systems 9600 Series, and while the multipoint version can train in less than half the time of its UDS competitor (12 milliseconds compared to 30 milliseconds), it cannot be used over the DDD network, a distinct disadvantage for some applications.

■ HARDWARE

☐ Terms & Support

Terms ● available for purchase, or under 1-, 2-, 3-, or 4-year lease

● separate maintenance contract available for both leased and purchased units ● lease/purchase credit is 50 percent of lease paid out up to 50 percent of purchase ● 1-year warranty on purchased units; 2-year warranty for the PC212A and R212A Intelligent Modem ● quantity discounts available.

Support ● installed by Rixon or by user; contact vendor for quotation ● maintenance available under annual contracts for leased or purchased equipment, or through factory repair ● contract maintenance performed from 8:00 AM to 5:00 PM, Monday through Friday except holidays; provides on-site repair within 1 to 6 hours of service call, depending on distance from nearest Rixon Service Center; annual maintenance contracts range from $150 to $520 per year per modem, plus 2.5 percent of purchase price up to 3.5 percent, depending on model and distance from a Rixon Service Center ● factory repair available for purchased or leased equipment; repair or replacement at no cost for equipment under warranty; turnaround typically within 14 days ● service provided through Rixon Service Centers located in Garden Grove and Foster City, CA; Denver, CO; Tampa, FL; Silver Spring, MD; Ann Arbor, MI; Newark, NJ; Downers Grove, IL; Houston, TX; Burnsville, MN; Framingham, MA; and Ottawa, Canada ● customized service plans available to meet customer-specific requirements.

☐ Overview

Rixon's modem family is comprised of 23 basic models that satisfy a wide range of low- to high-speed data communication requirements. The family contains AT&T- and CCITT-compatible models; a 2400-bps full-duplex, switched network modem; and models for personal computer and terminal users, including a plug-in modem for the IBM PC/XT. Some models are carry-overs from the days when Rixon marketed its AT&T-compatible modems and products almost exclusively to telephone companies and other large users; these include the T103J, T108, T113C, T202S/T202T, T212A, and TA201C. Although unnecessarily overequipped, these older units still cater to an established customer base as well as to the regulated Canadian marketplace.

Other models are geared primarily for business-oriented end users and for the growing horde of micro users migrating to the AT&T 212A standard. The R212A Intelligent Modem, Executive 212, and PC212A, in particular, are designed to be easy interfaces between users and online database/timesharing services, and are configured entirely from an operator terminal with menu assistance. The PC212A is a cost-effective alternative for IBM PC users who wish to communicate, combining a communication card, modem, and optional RS-232C printer port (also used as an auxiliary communication interface) on a single plug-in card. It requires an IBM PC or XT computer with at least 64K bytes of RAM memory, at least 1 diskette drive, and an 80-column CRT display.

On the high-speed side, Rixon's new R14.4 modem uses a technique called "grid shaping" to achieve superior performance at 14.4K bps over D-1 conditioned voice-grade communication circuits. A self-error-correcting modem, the R14.4 combines partial response encoding with the Viterbi algorithm to optimize its own signal pattern for near immunity to phase jitter and signal-to-noise distortion, according to the vendor. It is available in single-channel and 6-channel TDM multiplexer versions. Models R96 and R96FP, CCITT point-to-point and multipoint 9600-bps modems, are designed for the economy-minded, combining high data rates with modern technology for a very low price.

Most Rixon modems are available for leased-line as well as DDD network applications, and are supplied in card versions for central-site rackmounting. Rixon card cages are available for private-line models, DDD models, or combinations of the two. Dial backup units require their own card cages; the Rixon C801A/C automatic calling unit is restricted to Models RM40A/B and RM40A/3 card cages.

AT&T 103-/113-Compatible Models ● AT&T 103-/113-compatible direct-connect modems and AT&T 108-compatible point-to-point/multipoint modems with data rates to 300 bps.

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AT&T 212A-Compatible Models ● AT&T 103-/212A-compatible direct-connect modems with data rates at 300/1200 bps.

AT&T 201-Compatible Models ● AT&T 201-compatible direct-connect and point-to-point/multipoint modems with data rate of 2400 bps.

AT&T 208-Compatible Models ● AT&T 208-compatible direct-connect and point-to-point/multipoint modems with data rate of 4800 bps.

Non-AT&T-Compatible Modems ● point-to-point 2-wire modem for the DDD or dedicated networks with data rate of 2400 bps, 1200-bps fallback in AT&T 212A mode ● point-to-point and multichannel 14.4K-bps 4-wire modem for dedicated networks.

CCITT-Compatible Modems ● point-to-point and multipoint 4-wire dedicated modems (CCITT V.29/V.27 compatible) with data rates at 4800/7200/9600 bps ● point-to-point 2-wire modem for the DDD or dedicated networks at 2400/1200 bps (CCITT V.22 bis compatible).

☐ **Packaged Modems**

Standalone packaging standard for all models except the PC212A; most models available in a modem card, rackmount version for central-site card nesting ● rackmount versions fit 1 of 7 card cages, depending on modem model and configuration ● central-site card cages fit standard 19-inch or 23-inch equipment cabinets ● PC212A occupies single card slot in the IBM Personal Computer.

AT&T 100 Series-Compatible Modems

Model R103J ● standard DDD direct-connect 300-bps modem with manual originate and automatic answer mode ● standalone:

| NA mo | $249 prch | NA maint |

Model C103J ● same as Model R103J except contained on single PC card for rackmounting ● fits RM70 card cage:

| NA | 249 | NA |

Model T103J ● standard DDD direct-connect 300-bps modem with manual originate and manual/automatic answer mode ● standalone:

| NA | 595 | NA |

Model C103J ● same as Model T103J except contained on dual PC cards for rackmounting ● fits RM40A/B card cage:

| NA | 495 | NA |

Model T108 ● standard 2- or 4-wire dedicated 300-bps modem with originate-only or answer-only mode ● standalone:

| NA | 395 | NA |

Model C108 ● same as Model T108 except contained on single PC card for rackmounting ● fits RM40A/B, RM40A3, or RM40B1A card cages:

| NA | 295 | NA |

Model T113C ● standard DDD direct-connect 300-bps modem with manual originate only mode ● standalone:

| NA | 445 | NA |

Model C113C ● same as Model T113C except contained on dual PC cards for rackmounting ● fits RM40A/B card cage:

| NA | 345 | NA |

AT&T 202-Compatible Modems

Model T202S ● standard DDD direct-connect 1200-bps modem with manual originate and manual/automatic answer modes ● standalone:

| NA mo | $595 prch | NA maint |

Model C202S ● same as Model T202S except contained on single PC card for rackmounting ● fits RM40A/B or RM40A3 card cages:

| NA | 495 | NA |

Model T202S/Reverse Channel ● same as Model T202S except with 5-bps reverse channel ● standalone:

| NA | 695 | NA |

Model C202S/Reverse Channel ● same as Model T202S/Reverse Channel except contained on dual PC cards for rackmounting ● fits RM40A/B or RM40A3 card cages:

| NA | 595 | NA |

Model T202T ● standard 2- or 4-wire dedicated 1200/1400/1800-bps modem ● standalone:

| NA | 495 | NA |

Model C202T ● same as Model T202T except contained on single PC card for rackmounting ● fits RM40A/B, RM40A3, or RM40B1A card cages:

| NA | 395 | NA |

Model T202T/Reverse Channel ● same as Model T202T except with 5-bps reverse channel ● standalone:

| NA | 595 | NA |

Model C202T/Reverse Channel ● same as Model T202T/Reverse Channel except contained on dual PC cards for rackmounting ● fits RM40A/B, RM40A3, or RM40B1A card cages:

| NA | 495 | NA |

AT&T 212A-Compatible Modems

Model R212A ● standard DDD direct-connect 300-/1200-bps modem with manual originate and manual/automatic answer modes ● standalone:

| NA mo | $685 prch | NA maint |

Model R212A Rackmount ● same as Model R212A except contained on single PC card for rackmounting ● fits RM50 card cage:

| NA | 645 | NA |

Model Executive 212 ● same as Model R212A except with integral manual/automatic originate mode:

| NA | 599 | NA |

Model Executive 212 Rackmount ● same as Model Executive 212 except contained on dual PC cards for rackmounting ● fits RM70 card cage:

| NA | 539 | NA |

Model R212A Intelligent Modem ● similar to Model R212A Auto-dial but excludes front-panel switches, DIP switches, and LEDs; configuration from DTE only ● automatic originate and manual/automatic answer modes ● standalone:

| NA | 499 | NA |

Model R212A Intelligent Modem Rackmount ● same as Model R212A Intelligent modem except contained on single PC card for rackmounting ● fits RM70 card cage:

| NA | 499 | NA |

Model T212A ● standard DDD direct-connect 300-/1200-bps modem with manual originate and manual/automatic answer modes ● standalone:

| NA | 895 | NC |

Model C212A ● same as Model T212A except contained on dual PC cards for rackmounting ● fits RM40A/B or RM40A3 card cages:

| NA | 795 | NC |

Model PC212A ● standard DDD direct-connect 300-/1200-bps modem with communication software (on diskette) for the IBM

MO: monthly charge for leased units. PRCH: single-unit purchase price. MAINT: monthly maintenance charge. NA: not available (undisclosed). NC: no charge. Prices effective as of June 1984.

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Personal Computer ● automatic originate or manual/automatic answer modes ● inserts into the Personal Computer or IBM XT backplane:

	NA	499	NC

Model PC212A/Async Port ● same as Model PC212A except includes RS-232C interface for an additional communication channel (with external modem) or serial printer connection:

	NA	539	NC

AT&T 201-Compatible Modems

Model TA201C ● standard 2- or 4-wire dedicated 2400-bps standalone modem ● AT&T 201C/B compatible:

	NA mo	$795 prch	NC maint

Model CA201C ● same as Model TA201C except contained on dual PC cards for rackmounting ● fits RM40A/B, RM40A3, or RM40B1A card cages:

	NA	695	NA

Model TA201C/DDD ● standard 2- or 4-wire dedicated or DDD direct-connect 2400-bps standalone modem with manual originate and manual/automatic answer modes ● AT&T 201C/B compatible:

	NA	995	NA

Model CA201C/DDD ● same as Model TA201C/DDD except contained on dual PC cards for rackmounting ● fits RM40A/B or RM40A3 card cages:

	NA	895	NA

AT&T 208-Compatible Modems

Model TA208A/B ● standard 4-wire dedicated or DDD direct-connect 4800-bps standalone modem with manual originate and manual/automatic answer modes ● AT&T 208A/B compatible:

	NA mo	$1,895 prch	NA maint

Model CA208A/B ● same as Model TA208A/B except contained on dual PC cards for rackmounting ● fits RM80 card cage:

	NA	1,695	NA

Model R208B ● standard DDD direct-connect 4800-bps standalone modem with manual originate and manual/automatic answer modes ● AT&T 208B compatible:

	NA	1,495	NA

Model R208B Rackmount ● same as Model R208B except contained on dual PC cards for rackmounting ● fits RM60 card cage:

	NA	1,445	NA

Non-AT&T-Compatible Modems

Model R2424 ● standard 2-wire dedicated or DDD direct-connect 2400-bps standalone modem with manual originate and manual/automatic answer modes ● AT&T 212A-compatible fallback rate at 1200 bps:

	NA mo	$1,295 prch	NA maint

Model R2424 Rackmount ● same as Model R2424 except contained on dual PC cards for rackmounting ● fits RM90 card cage:

	NA	1,245	NA

Model R2424 Autodialer ● same as Model R2424 but includes single-number auto-dialer (automatic originate mode):

	NA	1,395	NA

Model R2424 Autodialer Rackmount ● same as Model R2424 Autodialer except contained on dual PC cards for rackmounting ● fits RM90 card cage:

	NA	1,345	NA

Model R14.4 Single-Port ● standard 4-wire dedicated 14.4K-bps standalone modem ● AT&T 209A-compatible fallback rate at 9600 bps:

	NA	8,950	NA

Model R14.4 Six-Port ● standard 4-wire dedicated 14.4K-bps standalone modem with integral 6-port TDM multiplexer ● AT&T 209A-compatible fallback rate at 9600 bps:

	NA	9,950	NA

CCITT-Compatible Modems

Model RV.22 bis ● standard 2-wire dedicated or DDD direct-connect 2400-bps modem with manual originate and manual/automatic answer modes ● CCITT V.22 bis compatible; standalone only:

	NA mo	$1,595 prch	NA maint

Model R96 ● standard 4-wire dedicated 9600-bps standalone modem ● CCITT V.29 compatible:

	NA	2,595	NA

Model R96 Rackmount ● same as Model R96 except contained on dual PC cards for rackmounting ● fits RM90 card cage:

	NA	2,545	NA

Model R96FP ● standard 4-wire dedicated 9600-bps multipoint standalone modem ● CCITT V.29 compatible:

	NA	2,995	NA

Model R96FP Rackmount ● same as Model R96FP except contained on dual PC cards for rackmounting ● fits RM90 card cage:

	NA	2,945	NA

Modem Enclosures

RM40A/B Card Cage ● 16-slot card nest with power supply ● accommodates up to 16 T108 or T202T dedicated card modems; up to 8 T202T/Reverse Channel or 8 TA201C dedicated card modems; up to 8 T103J, T113C, T202S, T212A, or TA201C/DDD direct-connect card modems; or up to 8 T801A/C ACUs ● dedicated and direct-connect modems can be intermixed in the same card cage; modems of varying speeds can be intermixed in the same card cage ● accommodates up to 4 T801A/C ACUs paired with direct-connect card modems in the same card cage ● 7-inch high enclosure fits standard 19-inch, 23-inch, or 26-inch equipment racks:

	NA mo	$995 prch	NA maint

RM40A/3 Card Cage ● 8-slot card nest with power supply ● accommodates up to 8 TA201C/DDD, T103J, T113C, T212A, or T202S direct-connect card modems, or up to 8 T801A/C ACUs ● also supports TA201C, T108, T202T, or T202S dedicated card modems in the following combinations with direct-connect modems: 5 direct-connect modems and 3 dedicated modems, or 3 direct-connect modems and 5 dedicated modems ● modems of varying speeds can be intermixed in the same card cage ● accommodates up to 4 T801A/C ACUs paired with direct-connect card modems in the same card cage ● 7-inch high enclosure fits standard 19-inch, or 23-inch equipment racks:

	NA	795	NA

RM40B1A Card Cage ● 16-slot card nest for dedicated-line modems with power supply ● accommodates up to 16 T202T or T108 dedicated card modems, or up to 8 T202T/Reverse Channel or TA201C dedicated modems ● different modem types can be intermixed in the same card cage ● 7-inch high enclosure fits standard 19-inch or 23-inch equipment racks:

	NA	850	NA

RM50 Card Cage ● 15-slot card nest with power supply ● accommodates up to 15 R212A modems without auto-dial ● modems can be intermixed in any combination ● 10.5-inch high enclosure fits standard 19-inch or 23-inch equipment racks:

	NA	395	NA

RM70 Card Cage ● 16-slot card nest with power supply ● accommodates up to 8 R103J, R212A Intelligent Modem, or 201C direct-connect card modems ● different modem types can be

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intermixed in the same card cage, including Rixon LDM710 and LDM720, limited-distance modems ● 7-inch high enclosure fits standard 19-inch or 23-inch equipment racks:

NA	395	NA

RM80 Card Cage ● 16-slot card nest with power supply ● accommodates up to 8 TA208A/B modem cards, or in combination with DCX725, DCX815, DCX825, and COMMUX statistical multiplexers ● 14-inch high enclosure fits standard 19-inch or 23-inch equipment racks:

NA	1,200	NA

RM90 Card Cage ● 18-slot card nest with power supply ● accommodates up to 9 R2424, R208B, R96, or R96FP card modems ● different modem types can be intermixed in the same card cage ● 10.5-inch high enclosure fits standard 19-inch or 23-inch equipment racks:

NA	395	NA

R14.4 Mounting Kit ● mounts R14.4 modem in standard 19-inch or 23-inch equipment cabinet:

NA	NA	NA

☐ Application

AT&T 100 Series-Compatible Modems

Models R103J, T103J & T113G ● designed for operation over the DDD network.

Model T108 ● point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel ● switch-selectable 0/8.5/265-millisecond training time (CTS) delay.

AT&T 202-Compatible Modems

Models T202S & T202S/Reverse Channel ● designed for operation over the DDD network.

Models T202T & T202T/Reverse Channel ● point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel, up to 1400 bps; up to 1200 bps with reverse channel; C2 conditioning required at data rates to 1800 bps ● switch-selectable 8/30/60/180-millisecond training time (CTS) delay ● operates over the DDD network in backup mode.

AT&T 212A-Compatible Modems

All Models ● designed for operation over the DDD network.

AT&T 201-Compatible Modems

Model TA201C ● point-to-point and multipoint communication over unconditioned 2- or 4-wire Type 3002 voice channel ● 0 to 7-/150-millisecond training time (CTS) delay.

Model TA201C/DDD ● point-to-point and multipoint communication over unconditioned 2- or 4-wire Type 3002 voice channel, or over the DDD network ● 0 to 7-/150-millisecond training time (CTS) delay.

AT&T 208-Compatible Modems

Model TA208A/B ● point-to-point and multipoint communication over unconditioned 4-wire Type 3002 voice channel, or over the DDD network ● 50/150/600-millisecond training time (CTS) delay.

Model R208B ● designed for operation over the DDD network ● 50/150/600-millisecond training time (CTS) delay.

Model R14.4 ● point-to-point communication with single-channel or multichannel operation over a 4-wire dedicated Type 3002 voice channel with D-1 conditioning.

Non-AT&T-Compatible Modems

Model R2424 ● point-to-point communication over unconditioned 2-wire dedicated Type 3002 voice channel, or over the DDD network.

CCITT-Compatible Modems

Model RV.22 bis ● point-to-point communication over unconditioned 2-wire dedicated Type 3002 voice channel or over the DDD network.

Model R96 ● point-to-point communication over unconditioned 4-wire dedicated Type 3002 voice channel.

Model R96FP ● point-to-point and multipoint communication over unconditioned 4-wire Type 3002 voice channel ● 12-millisecond training time (CTS) delay.

☐ Operating Parameters

AT&T 100 Series-Compatible Modems

All Models ● asynchronous full-duplex at rates up to 300 bps ● FSK modulation.

AT&T 202-Compatible Modems

Model T202S ● asynchronous half-duplex at rates up to 1200 bps ● FSK modulation ● compromise (statistical) equalization.

Model T202T ● asynchronous half-/full-duplex at rates up to 1200/1400/1800-bps FSK modulation ● compromise (statistical) equalization.

AT&T 212A-Compatible Modems

All Models ● asynchronous full-duplex at rates up to 300 bps, AT&T 103 mode; FSK modulation ● character asynchronous or synchronous full-duplex at 1200 bps, AT&T 212A mode; PSK modulation ● selectable 9- or 10-bit character code at 1200 bps.

AT&T 201-Compatible Modems

All Models ● synchronous half-duplex at 2400/1200 bps, 2-wire mode; synchronous full-duplex at 2400/1200 bps, 4-wire mode ● PSK modulation ● compromise (statistical) equalization.

AT&T 208-Compatible Modems

All Models ● synchronous half-/full-duplex at 4800 bps ● PSK modulation ● continuous automatic adaptive delay and amplitude equalization.

Non-AT&T-Compatible Modems

Model R2424 ● asynchronous or synchronous full-duplex at 2400 bps; QAM modulation ● asynchronous or synchronous full-duplex at 1200 bps, AT&T 212A mode; PSK modulation.

Model R14.4 ● synchronous half-/full-duplex at 14.4K bps, 9600-bps fallback ● 32-point QAM modulation with self-error correction ● RTS/CTS delay switch-selectable at 0 or 8 milliseconds ● continuously adaptive amplitude and delay equalization.

CCITT-Compatible Modems

Model RV.22 bis ● asynchronous or synchronous full-duplex at 2400 bps; QAM modulation ● asynchronous or synchronous full-duplex at 1200 bps; PSK modulation ● CCITT V.22 bis compatible.

Models R96 & R96FP ● synchronous full-duplex at 9600/7200, 9600/4800, or 7200/4800 bps; QAM modulation ● CCITT V.29 compatible ● continuous automatic adaptive equalization.

☐ Channel Functions

Multiport ● Model R14.4 Six-Port contains an integral 6-channel TDM multiplexer; supports 6 data rate combinations from 2400 bps to 14.4K bps ● supports 5 data rate combinations from 2400 bps to 9600 bps at 9600-bps fallback data rate ● channels accommodate any mix of colocated terminal and tail circuits ● standard feature, Model R14.4 Six-Port only:

NC mo	NC prch	NC maint

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5-bps Reverse Channel ● 0- to 5-bps half-duplex, amplitude-modulated channel ● provides control path for message acknowledgement; eliminates line turnaround time ● standard feature on Models T202S/Reverse Channel and T202T/Reverse Channel only:

NC	NC	NC

Local Copy ● selectable option permits transmitted data to be echoed back to DTE for local display or print-out ● standard feature included in Models T108 (half-duplex only), T202S, and T202T only:

NC	NC	NC

Digital Interface ● EIA RS-232C/CCITT V.24/V.28, all models except PC212A; 25-pin electrical connector ● PC212A interfaces to IBM PC or XT directly through PC bus via TTL logic ● optional 20-mA or 60-mA current-loop interface, Model T108.

☐ **Control Functions**

LSD-6C Line Saving Device ● standalone unit allows up to 6 terminals to share 1 modem, one at a time, in polled or non-polled environments ● permits asynchronous or synchronous operation, up to 9600 bps, over 2- or 4-wire dedicated lines ● automatically scans terminals for RTS and queues terminals for modem access in a predetermined order ● multiple LSD-6C units employed in tandem can allow up to 21 terminals to share 1 modem ● can also be used to interface up to 6 modems to 1 terminal at central-site locations; the LSD-6C connects the terminal to whichever modem receives a carrier, excluding other modems ● extra-cost option:

NA mo	$795 prch	NA maint

FCC-Registered Modems ● all Rixon direct-connect modems are FCC registered under FCC Rules Part 68; does not require a separate Data Access Arrangement (DAA) ● standard feature included in modem pricing:

NC	NC	NC

Alternate Voice/Data ● direct-connect modem Models R103J, T113C, R212A, R212A Intelligent Modem, and PC212A include an integral voice/data switching function; can operate with standard TelCo telephones ● direct-connect modem Models T103J, T202S, T212A, TA201C/DDD, and TA208A/B require an exclusion-key telephone or 2-/3-position cable switch for alternate voice/data applications ● dedicated modem Models T108, T202T, TA201C, TA208A/B, R96, and R96FP can be equipped for alternate voice/data with the addition of Model C48A1 Alternate Voice Unit.

Model C48A1 Alternate Voice Unit (AVU) ● rackmounted PC card unit provides alternate voice capability over dedicated 4-wire circuits when used with a Model 565 or 2565 2-wire key telephone with 10 vac buzzer ● mounts in Rixon DM48 or DM59 standalone enclosures, or in a DM56 rackmounted card cage (pricing not available) ● extra-cost option:

NA	200	NA

Failure Recovery ● provides immediate recovery from dedicated line failures ● switches modem at attended site or unattended sites between 4-wire dedicated line and 2 dial-up lines to restore communication interrupted by line failure/degradation.

Model C48E/F1 Dial Backup Unit (DBU) ● rackmounted PC card unit manually originates or answers both calls; manually originates and automatically answers both calls; manually originates and automatically answers first call, and automatically originates and manually answers second call; or automatically orginates and automatically answers both calls (requires additional automatic calling unit (ACU) or single number dialer) ● provides dial backup to 4-wire dedicated circuit when used with a modified Model 565 or 2565 2-wire key telephone with a 10 vac buzzer ● compatible with AT&T 48ER1 and 48FR1 dial-backup units ● mounts in Rixon DM48 or DM59 standalone enclosure, or in a DM56 rackmounted card cage (pricing not available) ● extra-cost option:

NA	495	NA

Auto-Answer (Automatic Answer) ● Models R103J, T103J,
T202S, R212A, R212A Intelligent Modem, PC212A, T212A, TA201C/DDD, and TA208A/B include switch-selectable automatic answer function ● standard feature:

NC	NC	NC

Auto-Dial (Automatic Originate) ● Models T103J, T202S, T212A, TA201C, and TA208A/B can accommodate an external Model T801A/C automatic calling unit (ACU) for CPU-generated automatic dialing ● Models Executive 212, R2424 Autodialer, R212A Intelligent Modem, and PC212A are equipped with an integral auto-dialer.

Models Executive 212/R212A Intelligent Modem/PC212A Auto-Dial ● integral auto-dialer (optional for Model R212A) stores up to 10 telephone numbers of 60 characters each, plus last number dialed ● terminal screen menu provides operator prompts and messages; selectable Rixon or Hayes (Smartmodem) abbreviated format ● pulse or tone dialing, or combination pulse/tone dialing; keyboard dialing or single keystroke (stored number) dialing; instant redial of last number dialed via single keystroke; multiple redials up to 10 times ● supports linked numbers for alternate dialing; blind dialing (for nonstandard dial tones); tandem dialing (through a PBX); computer-originated dialing ● standard feature:

NC	NC	NC

Model R2424 Autodialer ● integral autodialer allows single-number dialing via keyboard selection ● command menu ● pulse or tone dialing ● standard feature:

NC	NC	NC

Model T801A/C Automatic Calling Unit ● standalone tone or pulse dial unit ● supports tandem dialing, U.S. and CCITT answer tone frequencies ● FCC registered ● compatible with 565/2565 telephone for voice/data operation ● RS-366 parallel interface ● AT&T 801A/C compatible:

NA	595	NA

Model C801A/C Automatic Calling Unit ● same as Model T801A/C except contained on single PC card for rackmounting ● fits RM40A3 or RM40A/B card cages:

NA	NA	NA

Satellite Delay ● integral strap-selectable option inserts 275-millisecond delay after answer tone to inhibit RTS; enables activation of TelCo echo suppressors for use in DDD satellite links ● standard feature for Model TA201C only:

NC	NC	NC

Anti-Streaming ● integral strap-selectable option detects streaming condition; modem automatically disconnects itself from the line when RTS from the DTE is on continuously for 3 or 27 seconds ● standard feature for Model TA201C only:

NC	NC	NC

New Sync ● integral selectable option squelches receiver clock at end of a message, providing rapid resynchronization of incoming calls at master polling stations ● standard feature for Models TA201C and TA208A/B only:

NC	NC	NC

Clock-Slaved Timing ● integral selectable option locks received clock signal in phase with outgoing signal; slaves modem tail circuit to high-speed modem, multiplexer, or digital transmission service ● standard feature for Models T212A, TA201C, and TA208A/B only:

NC	NC	NC

Automatic Disconnects ● direct-connect Rixon modems for the DDD network contain integral strap-selectable timers that automatically disconnect call upon loss of carrier or when remote end fails to answer call:

NC	NC	NC

☐ **Diagnostics & Status Indicators**

Loopback diagnostics isolate failures in local or remote modems,

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AT&T 100 Series-, 202-, 212A-, 201- & 208-Compatible, Non-AT&T-Compatible & CCITT-Compatible Models

dedicated line, or data terminating equipment (DTE) depending on model • manual control of diagnostics from modem front panel, or from operator terminal for Models R212A Intelligent Modem and PC212A (limited diagnostic ability available from operator terminal for some other models) • front-panel visual indication of operating conditions and test conditions; visual warning of abnormal conditions; operator terminal display of visual conditions only, Models R212A Intelligent Modem and PC212A.

Loopback Tests • modem self-test, all models • local analog and remote digital loopback, all models except R103J (PC212A with analog loopback only) • end-to-end self-test, Models T103J, T108, T113C, T212A, R212A, TA201C, TA208A/B, R96, and R96FP:

NC mo	NC prch	NC maint

Test Pattern Generator • integral bit pattern generator and error detector provides bit error rate analysis for loopback testing:

NC	NC	NC

Dial-Up Data Test Center • allows Rixon customers to perform online checkout of dial-up or dial backup equipment • customer pays only for toll-call to Rixon factory in Silver Spring, MD, at 301-622-1333.

Status Indicators • EIA interface signal activity; power-on/-off and circuit quality, some models ● Models R212A Intelligent Modem and PC212A do not contain status indicators; all status information displayed on operator terminal.

● END

CASE 4000 Series Modems
Models 4048, 4096 & 4144

■ PROFILE

Function • high-performance modems with network control capabilities for dedicated facilities.

Communications/Networks • synchronous at 2400/4800/7200/9600/12.0K/14.4K bps; point-to-point or multipoint communication over unconditioned (4048 & 4096) and D1 conditioned (4144) 4-wire dedicated Type 3002 facility; tail circuits supported via multiport option • non-AT&T compatible • designed for use with CASE 5200 Network Management System.

First Delivery • targeted for July 1985.

Comparable Systems • principal competition from AT&T Dataphone II modems; Codex 2600 Series; IBM 3860 Series; Infinet DMX Series; Paradyne VHS/MPX Series; Racal-Milgo Omnimode Series.

Vendor • CASE Communications, Inc; 2120 Industrial Parkway, Silver Spring, MD 02904• 301-622-2121.

Canadian Headquarters • CASE Communications Limited; 284 Consumers Road, Willowdale, ON M2J 1P8; 416-465-0333.

Distribution • nationwide via CASE sales offices.

GSA Schedule • listed.

■ ANALYSIS

Introduced in March at Interface'85, the CASE 4000 Series represents an initial thrust by CASE Communications into the realm of network management and control. Designed to function as an integral part of a new CASE networking strategy, the 4000 Series of high-performance modems with diagnostic options joins other recently unveiled Series 5000 products to provide a cohesive network management approach. Series 5000 products which shared the Interface spotlight included the 5200 Network Management System and the 5010 and 5020 "wraparound" units.

Consisting of Models 4048, 4096, and 4144, the new CASE modems offer high-speed transmission on point-to-point or multipoint networks. All 3 models can accommodate an optional DXM Diagnostic Card that passes diagnostic and remote control information back to the 5200 Network Management System using a low-speed 75-bps secondary channel. Network control for the monitoring and testing of lines and devices can be initiated directly from the 4000 Series front panel display or from a central-site 5200 Network Management System. Network control eliminates excessive downtime which plagues most networks, spares revenue and business lost to downtime, and is crucial to productivity.

In a network control environment, the modems automatically alert users of deteriorating line conditions so that remedial action can be taken short of line failure. The user can quickly pinpoint failures

PURCHASE PRICE RANGE

hardware ■

CASE 4000 SERIES

$1.9K to $10.2K

$3K	$6K	$9K	$12K	$15K

CASE 4000 SERIES PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware; maintenance pricing is presently not available. 4000 Series pricing ranges from Standard Model 4048 at the low end to Model 4144 with multiport support and DXM Diagnostics Card support at the high end.
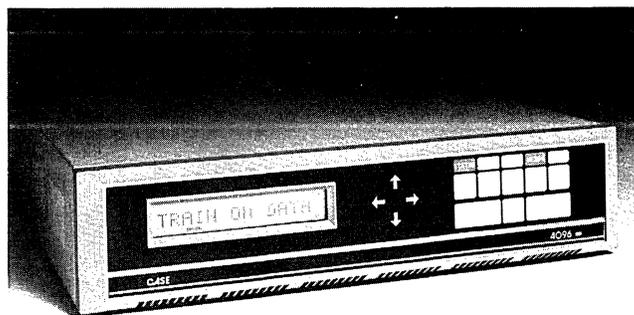
Model 4096 represents the mid-range Series 4000 modem with features including 9600-bps data transmission, optional network control support for point-to-point or multipoint applications, an intelligent front panel display with menu-driven keys and 14-character LCD display.

through modem-executed diagnostics that isolate failures within central- or remote-site modems, or the line. The diagnostics are automatically executed in response to operator commands at the central-site 5200 console. Without 5200 network control, user awareness to degradation or failure, and diagnostic testing are severely limited.

The introduction of the Series 5000 and 4000 products represents the first results of a joint effort between the U.K.-based parent company, CASE, and recently acquired Rixon of Silver Spring, Maryland. In conjunction with the recent product developments, the U.S. headquarters, based in Silver Spring, has undergone a corporate name change to CASE Communications Inc from CASE Rixon Communications, Inc.

At the present time, only preliminary 4000 specifications are available and are presented in this report. Lease and maintenance pricing hasn't been firmly established and distribution channels have not yet been solidified. according to a CASE spokesperson, the 4000 Series units are scheduled for beta testing during late May and initial deliveries are targeted for July 1985.

Initial deliveries of CASE 5200 Network Management System along with the 5010 and 5020 wraparound devices are presently unknown. Future development plans are already underway and include both low- and high-end network management systems to accompany the mid-range 5200 as well as enhanced graphics capabilities for producing network topology maps.

□ Strengths

CASE's wise move into the area of network control positions them competitively against leading-edge vendors such as Codex, Infinet, Paradyne, and Racal-Milgo. Similar in approach to both Paradyne and Racal-Milgo, CASE employs an optional plug-in diagnostic card for passing diagnostic and configuration information between a central-site 5200 system and central-/remote-site 4000 Series modems.

Network control and management functions aid in the elimination of excessive downtime and put the network manager in touch with the performance of the network. It also provides the necessary tools for isolating failures, therefore removing the guesswork from failure isolation. Additionally, network control allows the manager to restore communication through temporary alternate paths until
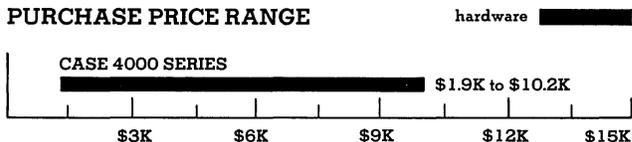
CASE 4000 Series Modems
Models 4048, 4096 & 4144

a failure is resolved.

Configuration flexibility and ease of use also surface as significant CASE 4000 Series strengths. There are no internal straps or switch settings; all modem parameters are soft-configured from the modem's intelligent front panel. An innovative design feature, the 4000 Series front panel facilitates operator ease of use with its menu-driven keys and 14-character, English-prompted, LCD display. The Message Exchange Feature supported by the DXM Diagnostic Card effectively utilizes the front panel by allowing dispersed personnel to exchange 14-character messages through the front panel without incurring dial-up telephone charges. In addition, CASE 4000 Series modems of different rates and applications are packaged in the same manner, permitting them to be combined in the same rackmount enclosure or standalone case. Users do not have to maintain different enclosures or learn different operating procedures which simplifies network operations and reduces costs. This configuration flexibility also presents an advantage over older CASE AT&T-, non-AT&T-, and CCITT-compatible modems with their large and confusing array of card cages which may prohibit the mixing of different modems in the same enclosure. The addition of single-circuit card versions will also appeal to user with space constraints, enabling them to intermix 16 cards in a single-card nest.

For users with critical applications, the Trellis Coded Modulation (TCM) scheme employed by the high-end Model 4144 enhances data transmission reliability at rates above 9600 bps. TCM uses a forward-error correction technique which trellises or encodes additional data bits to each original data stream transmitted. This trellising technique produces an accurate representation of data transmitted and provides significant performance improvements at rates of 14.4K bps.

□ Limitations

The CASE 4000 Series modems are designed primarily for use with the CASE 5200 Network Management System. Without network control, diagnostic testing is limited to loopback tests and simple line-level/quality reporting.

CASE 4000 series modems are also restricted to 4800, 9600, and 14.4K bps data rates. Competitive offerings from Codex and Paradyne provide data rates at 2400 and 16K bps for enhanced operating flexibility. At the present time, the vendor has indicated no plans for adding low- and high-end models to the current line-up. Furthermore, no provision exists for supporting asynchronous data traffic; both Codex and Paradyne offer asynchronous-to-synchronous converter options for converting asynchronous data at the EIA RS-232C interface to a synchronous stream at the modem's clocked data rate.

The 4000 Series secondary channel exists exclusively for the purpose of passing diagnostic and network control information. There are no provisions for supporting an auxiliary channel to carry digitized voice or building supervision commands which presents a drawback for users requiring such capabilities. While increased immunity to line noise and other circuit impairments are decided advantages of Trellis Coded Modulation it creates a compatibility problem that prospective users should be aware of. The high-end Model 4144 is **only** transmission compatible with Models 4048 and 4096 at 9600 bps.

At the present time, the list of 4000 Series options is brief. Only multiport options and DXM Diagnostic Card support have been indicated as extra-cost options. In addition, there is no mention in the preliminary specifications concerning the level of channel priorities or the availability of modem redundancy.

■ HARDWARE

□ Terms & Support

Terms • available for purchase, or under 1-, 2-, 3-, or 4-year lease • separate maintenance contract available for both leased and purchased units • lease/purchase credit is 50 percent of lease paid out up to 50 percent of purchase • 1-year warranty on purchased units • quantity discounts available.

Support • installed by CASE or by user; contact vendor for quotation • maintenance available under annual contracts for

leased or purchased equipment, or through factory repair • contract maintenance performed from 8:00 AM to 5:00 PM, Monday through Friday except holidays; provides on-site repair within 1 to 6 hours of service call, depending on distance from nearest CASE Service Center; annual maintenance contracts range from $150 to $520 per year per modem, plus 2.5 percent of purchase price up to 3.5 percent, depending on model and distance from a CASE Service Center • factory repair available for leased or purchase equipment; repair or replacement at no cost for equipment under warranty; turnaround typically within 14 days • service provided through CASE Service Centers located in Garden Grove and Foster City, CA; Denver, CO; Tampa, FL; Silver Spring, MD; Ann Arbor, MI; Newark, NJ; Downers Grove, IL; Houston, TX; Burnsville, MN; Framingham, MA; and Ottawa, Canada • customized service plans available to meet customer-specific requirements.

□ Overview

The 3 models in the CASE 4000 Series operate at 4800, 9600, and 14.4K bps with fallback rates for transmission over degraded communication facilities. Models 4048 and 4096 are designed for either point-to-point or multipoint applications; Model 4144 is intended for point-to-point applications only. All modem configuration settings, diagnostics, and status information are soft-configured and viewed from the modem's front panel; no internal strap adjustments or switch settings are required. The 4000 Series front panel display features a touch-sensitive LCD display which shows the modem status in plain English. When equipped with an optional DXM Diagnostic Card, the 4000 Series modems support all diagnostic and remote control facilities provided by the company's 5200 Network Management System. The diagnostic card monitors modem status, the performance of the line, and the interface between the terminal and the modem, and passes the results back to the 5200 processor. Functions supported and executed by both central- and remote-site modems include the monitoring of analog and digital interfaces for abnormal conditions that exceed preassigned thresholds, diagnostic testing procedures, and remedial recovery from failures. In addition, all options can be downline loaded at a central site using either the 4000 Series front panel or through the 5200 Network Management System.

Each 4000 Series modem can accommodate a multiplexer option that splits available bandwidth for additional flexibility. Every port on the multiplexer contains RS-232C interface control signals which enables remote modems to dial in to an individual port. Individual port speed and EIA interface status can be displayed on the modem front panel or forwarded to the 5200 processor. Additional capabilities supported by the CASE 4000 multiplexer options include individual port diagnostics, port signal simulation for point-to-point or multipoint configurations, and dynamic port speed allocation.

All 3 modem models are available in either a standalone version or rackmount modem card for high-density, central-site card nesting. Different modem models and data rates can be intermixed in the same rackmount enclosure which supports up to 16 modem cards. DXM Diagnostic Card and multiport options each occupy a single-card slot.

□ Packaged Modems

Standalone packaging standard for all models; rackmount optional at extra cost.

Standalone Packaging

Model 4048 • standard 4800-bps modem • without options:

NA mo	$1,995 prch	NA	maint

Model 4096 • standard 9600-bps, CCITT V.29-compatible modem • without options:

NA	2,995	NA

PRCH: single-unit purchase price. NA: not available. NC: no-charge item. Maintenance pricing and lease pricing has not been established at this time. Purchase prices are current as of April 1985.

CASE 4000 Series Modems
Models 4048, 4096 & 4144

Model 4144 • standard 14.4K-bps, CCITT V.29-compatible at 9600 bps • without options:

NA	7,995	NA

Rackmount Packaging

Model 4048 • single-card modem equivalent to standalone Model 4048 • occupies single slot in 4000 Series rackmount kit:

NA mo	$1,795 prch	NA	maint

Model 4096 • single-card modem equivalent to standalone Model 4096 • occupies single slot in 4000 Series rackmount kit:

NA	2,795	NA

Model 4144 • single-card modem equivalent to standalone Model 4144 • occupies single slot in 4000 Series rackmount kit:

NA	9,795	NA

RM110 Card Cage • 16-slot card nest with power supply • different modem types can be intermixed in the same rackmount enclosure:

NA	1,195	NA

☐ Application

Point-to-point or multipoint communication over unconditioned (4048 and 4096) and D1 conditioned (4144) 4-wire dedicated Type 3002 voice channel • Model 4048 RTS/CRS delay selectable at 12 or 18 milliseconds fast poll, selectable at 15 or 253 milliseconds point-to-point • Model 4096 RTS/CTS delay selectable at 12 or 18 milliseconds fast poll, selectable at 15 or 253 milliseconds point-to-point • Model 4144 RTS/CTS delay at 1.4 seconds.

☐ Operating Parameters

Synchronous half-/full-duplex transmission with selectable fallback data rates • Model 4048 rates at 4800 bps with half-speed fallback • Model 4096 rated at 9600 bps with fallback rates of 7200/4800 bps • Model 4144 rated at 14.4 bps with fallback rates of 12K/9600 bps • V.29-compatible • QAM modulation (Models 4048 & 4096), QAM modulation with Trellis Coded error-correction scheme (Model 4144).

Train On Data (TOD) • standard feature for all models • compensates for changes in line conditions that cause abnormal error rates:

NC mo	NC prch	NC maint

☐ Channel Functions

Multiport • Model 4048 accommodates optional 2-channel TDM multiplexer; Model 4096 accommodates optional 4-channel TDM multiplexer; Model 4144 accommodates optional 6-channel TDM multiplexer • port data rates manually selected via front-panel switches and LED display or automatically for all DXM Diagnostic Card-equipped modems from the 5200 Network Management System • individual ports can be configured for point-to-point or multidrop applications via port signal and dynamic port speed allocation.

MX-2 2-Channel Multiplexer • single-board Model 4048 option provides selectable port data rates at 4800 bps and at 2400-bps fallback rate • occupies designated slot in RM110 Card Cage:

NA mo	$795 prch	NA maint

MX-4 4-Channel Multiplexer • single-board Model 4096 option provides selectable port data rates at 9600 bps and at 7200/4800 bps fallback rates • occupies designated slot in RM110 Card Cage:

NA	995	NA

MX-6 6-Channel Multiplexer • single-board Model 4144 option provides selectable port data rates at 14.4K bps and at 12K/9600 bps fallback rates • occupies designated slot in RM110 Card Cage:

NA	1,295	NA

DXM Diagnostic Card • 4000 Series option for separate Diagnostics Card provides a narrow-band 75-bps full-duplex FSK-modulated channel • provides control path for passing control, monitoring, and configuration parameters between central-site CASE 5200 Network Management System and central-/remote-site, point-to-point or multipoint modems • message exchange feature provides message communication between central and remote personnel by passing user-designated message codes • functional alarms include DTE power failure, modem power failure, external alarms, and 1004 Hz tone measurement • threshold alarms for noninterruptive analog parameters can be set for signal quality, line level, carrier offset, phase jitter, and signal-to-noise ratio • operating parameters and extra-cost options can be downline loaded through modem front-panel display • available for all 4000 Series models:

NA	995	NA

Digital Interface • EIA RS-232C/CCITT V.24 all ports • 25-pin electrical connector:

NC	NC	NC

☐ Control Functions

Failure Recovery • provides immediate recovery from line or modem failures • switches modems at attended or unattended sites between 4-wire dedicated line and 2 dial-up lines to restore communication interrupted by line failure/degradation • switches data terminal equipment and 4-wire dedicated line between faulty modem and hot-spare modem to restore communication interrupted by modem failure/degradation.

Dial Backup Unit • switches unattended-site modem between dedicated and switched lines • automatically answers calls on switched lines • FCC-certified standalone unit • central-site modem or 5200 network control:

NA mo	NA prch	NA maint

Diagnostics & Status Indicators

Comprehensive diagnostics isolate failures in local or remote modems or dedicated line • diagnostics test conducted manually via front panel or automatically via the CASE 5200 Network Management System; DXM Diagnostic Card required for 5200 network control • CASE 5200 system extends diagnostic testing to include analog parameter measurements that it compares with preassigned thresholds for normal or alarm conditions • visual warning and alarm monitoring of deteriorating or abnormal conditions.

Loopback Tests • modem self-test • local analog and remote digital loopback • end-to-end self-test.

Test Pattern Generator • integral bit pattern generator and error detector provides bit error rate and analysis for loopback testing.

Analog Parameter Tests • threshold alarms can be set for transmit/receive levels and signal quality • additional measurements provided when used with DXM Diagnostic Card including signal-to-noise ratio, phase jitter, line level, and carrier off-set:

NA mo	NA prch	NA maint

Eye Pattern Generator • creates eye pattern on externally connected oscilloscope; eye pattern presents analog transmission conditions:

NA	NA	NA

Dial-Up Data Test Center • allows CASE customers to perform online checkout of dial-up or dial backup equipment • customer pays only for toll-call to CASE factory in Silver Spring, Maryland, at 301-622-1333.

Status Indicators • indicates power on; alarm; fallback; test mode; circuit quality; receive signal quality; and EIA interface signal activity including TXD, RXD, RTS, CTS, DSR, DTR, and DCD (all EIA status indicators related to selected modem port) • 14-character English language display for operating mode and status, data rates, diagnostics, etc.

• END

Cincom Systems ENVIRON/1
TP Monitor System

■ PROFILE

Function • multitasking, multithreaded, general-purpose telecommunications monitor for medium-to-large network environments; a single-threaded version is available for smaller environments.

Computer/Operating Systems Supported • any IBM System/370, 3000, 4300, or compatible computer; DOS/VS, DOS/VSE, OS/VS1, OS/VS2(SVS), or OS/VS2(MVS).

Networks & Protocols • SNA, point-to-point, multidrop, and switched; SDLC, asynchronous, and bisynchronous.

Languages Supported • COBOL-XT (proprietary) and IBM BAL (Basic Assembly Language) are supported directly; ANS COBOL, FORTRAN, and PL/1 are supported indirectly.

Database Interfaces • Cincom TOTAL directly; others through special access support modules.

TP & File Access Methods • BTAM, VTAM, VTAM/ACF, ISAM, BDAM, DAM, VSAM, and Data Management Language (proprietary).

Terminals • 3270-type; most other SDLC and start-stop terminals.

Special Options • entry ENVIRON/1, Task Level Checkpoint (TLC), Advanced Mapping Support, Standard Access Method Option, ENV-DATA, LMS-II, T-ASK.

Security • sign-on ID verification, terminal-to-program association, command-directed parameters, addressability authorization.

Logging/Accounting • standard system log file, task log-file, statistics gathering utility program.

Failure/Recovery • optional Task Level Checkpoint recovery; automatic backout; before and after imaging with Roll File status.

Current Version • 8.3.

Installations • approximately 450.

Comparable Systems • ADR DATACOM/DC, Software AG COMPLETE, Altergo SHADOW II.

PURCHASE PRICE RANGE

Software License Purchase ████████
Software Service Fees ▭

license purchase
████████ $49.5K to $141.9K

5-year service fee
▭ $19.4K to $62.8K

5-year total cost (sum of above) $49.5K to $204.7K

| $50K | $100K | $150K | $200K | $250K |

CINCOM SYSTEMS ENVIRON/1 PRICING • solid bar shows typical min/max configuration price range, including associated installation charges per program product; open bar shows corresponding service fee range for a 5-year period, but fees are computed for 4 years (48 mos) because first-year service is included in the license purchase price • **MINIMUM CONFIGURATION** represents a basic DOS/VS ENVIRON/1 system • **MAXIMUM CONFIGURATION** reflects the OS/VS version of ENVIRON/1 with the following options: ENV-DATA, Standard Access Method, Advanced Mapping System, ENTIRE, and Task Level Checkpoint/Restart Recovery.

Vendor • Cincom Systems, Inc; 2300 Montana Avenue, Cincinnati, OH 45211; 513-662-2300 • Cincom Systems of Canada, Ltd; 130 Dunda Street East, Suite 201, Mississauga, ON L5A 3B8; 416-279-4220.

■ ANALYSIS

ENVIRON/1 is a feature-selectable, general-purpose telecommunications monitor that can be configured to operate in a medium-to-large network environment. ENVIRON/1 supplies multitasking and multithreading operations and is very suitable for large-volume transaction operations. It is built around a proprietary language processor called COBOL-XT (at one time called TEBOL). This high-level language is similar to standard ANS COBOL, but produces code that operates only in the ENVIRON/1 system. BAL programs are also supported for the special environment required by ENVIRON/1, but special handling of program decks is required. Provisions are made to support ANS COBOL, FORTRAN, and PL/1 application programs, but not in standard ENVIRON/1 operating mode.
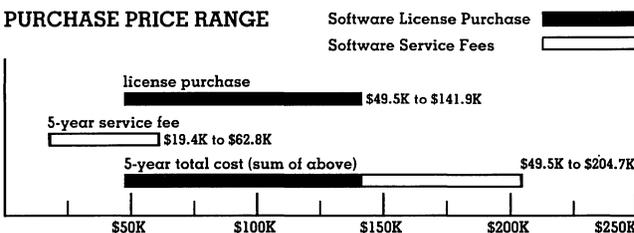
ENVIRON/1 operates as a task in the OS or DOS operating system configuration. It is responsible for all communications to and from the terminals attached to the system. Unlike monitors that operate on a time-slice basis, ENVIRON/1 is activated by processing interrupts. Provisions are included in ENVIRON/1 to prevent a long-operating transaction from monopolizing the system.

A key element in the design of the ENVIRON/1 monitor is its paging technique, which reduces everything in the system to the base structure of a 512-byte segment. ENVIRON/1 gains considerable flexibility from the variety of options that can be appended to it. Some of these options are integral elements of the Cincom Series 80 total DB/DC concept, and include ENV-DATA, T-ASK, MANTIS, LMS-II, and SOCRATES. All interfaces with Cincom TOTAL are fully supported and integrated into ENVIRON/1 and TOTAL. Although MANTIS is not an integral element of the ENVIRON/1 system, ENVIRON/1 could be an integral part of the MANTIS application development tool (see referenced report in this section). The design of MANTIS has been constructed so that it must operate with either ENVIRON/1 or the IBM CICS/VS communications monitor (please see the MANTIS product report in this section).

Since our last report, Cincom has introduced TIS and TIS/CM, its new technology DBMS and communications monitor. These new generation products are intended to be upward compatible replacements for TOTAL and ENVIRON/1. Therefore, even if Cincom continues to make TOTAL and ENVIRON/1 available, it is probably safe to assume that they will be placed in a fairly dormant maintenance status.

☐ Strengths

ENVIRON/1 supports a large range of terminal devices—SDLC, bisynchronous, and start/stop. It can be structured and tailored to meet almost any communications environment requiring monitor support. Data integrity is one of ENVIRON/1's strongest points. ENVIRON/1 offers a task-level checkpoint/restart facility that allows the system to continue performing when a task has failed. The ENVIRON/1 512-byte block paging technique used to manage both program code and data elements is another major advantage. By breaking down the area of concentration into 512-byte pages, users only need to activate a small section of data or code at any time instead of the 2K- or 4K-byte blocks of information required by the operating system. Using this 512-byte paging technique, COBOL-XT is the only language compiler that makes sense for users of ENVIRON/1, because it was developed to support the paging concept of the monitor and fully supports all the processing and recovery techniques available with ENVIRON/1.

Cincom Systems ENVIRON/1
TP Monitor System

Programmers do not need to learn the special handling techniques frequently demanded by general-purpose language compilers. This same ease of use is also available to BAL programmers. The Program Data Set (PDS) file that houses all the compiled programs is similar to the organization of the IBM Partitioned Data Set in that it contains all the object-level programs as entries in a single data set. The PDS appears to users as a single data set in which all programs are shareable and reentrant. To terminal operators, the operating environment appears as a dedicated system in which all allocated resources are permanently (for the life of the task) assigned.

ENVIRON/1 commands are English-like and are parameter-driven. Operator assistance is supplied through screen menus and prompting messages. With this type of support, even the most novice user can carry on an interactive communications session. The ability to add features that are both unique to ENVIRON/1 and are shared by ENVIRON/1 and TOTAL permits users to build a sophisticated DB/DC system. TOTAL capabilities are integrated into ENVIRON/1 communications facilities. Handling TOTAL databases through ENVIRON/1 is as simple as handling standard access method files in other general-purpose systems. Complex add-ons are available for the more advanced users of ENVIRON/1. The newly released ENTIRE program development tool provides an extensive array of security and development aids. The Advanced Mapping System further eases the use of the 3270-type mapping facility and extends screen formatting capabilities beyond what is offered with the basic system. ENVIRON/1 is designed primarily to support programs written in COBOL-XT or BAL, but it also supports application programs written in most other high-level languages in degraded mode.

☐ Limitations

Application programs written in COBOL-XT cannot be used in any other environment, which could pose a problem to some large COBOL-oriented shops. The reverse is also true. Standard COBOL application programs must be rewritten to take full advantage of the performance attributes of ENVIRON/1. The XT compiler is similar to ANS COBOL, but similarity is not sameness, and the average programmer must adjust to subtle differences in the language. True, standard language application programs can function in the ENVIRON/1 system, but the degradation in monitor performance will be very noticeable.

As mentioned under Strengths, much emphasis has been placed on the security characteristics of ENVIRON/1. If users have an older version of the monitor that includes the original system-level checkpoint/restart facilities (not offered with recent versions of the system), the applications programs had to make provisions for the actual restart checkpoints upon program failure, and the entire TP partition had to quiesce before the restart procedure could be executed. The Task Level Checkpoint (TLC) option avoids this inconvenience (and is the only option available with recent versions of ENVIRON/1). However, not only does TLC cost extra, but it requires a great deal of special attention from the application programmers to implement. It should also be noted that the standard system checkpoint was directed toward tape, whereas the TLC log is a disk file.

Finally, ENVIRON/1 users should understand that COBOL-XT does not support a sort or report writer subroutine capability. It also does not support segmentation or decision table handling. COBOL-XT does not require or support the standard COBOL Identification and Environment Division statements because ENVIRON/1 handles all I/O. Information encountered in these sections is treated as comments and does not affect compilation.

■ OVERVIEW

☐ Terms & Support

Terms ● available on a single-use license basis; second and subsequent usage licenses are discounted approximately 20% of the initial usage license fee; also available on a 1-, 2-, 3-, 4-, and 5-year lease basis; each priced element carries an installation charge ● when 2 or more Cincom products are installed at 1 location at the same time, the lesser (or least) installation charge is discounted 50%; additional installations of the same system at the initial site are discounted 30%; a 10% discount from the initial use price is extended to single-use nonprofit educational institutions ● system and product upgrade discounts are available and are prorated as per license agreement.

Support ● installation charge covers delivery of product tape, documentation, and a set number of days for on-site support; additional on-site support is available on a man-day basis for rates ranging from $500 to $750 per day; for single-use/multiuse license holders, the first year of maintenance support is free; for subsequent years, an annual rate adjusted to 10% of the then-current initial single-use license is available; the number of on-site support days varies depending on the system and option selected.

☐ Component Summary

ENVIRON/1 offers many selectable features and extra-cost add-on options. Users can create a small, efficient terminal control system or a complex, sophisticated DB/DC environment. The kernel of the monitor is the Control Program, which consists of the Supervisor and Root phases. These are the only 2 elements of the system that must be generated; all other facilities can be built onto one or the other of these segments. The basic support provided by the Control Program handles terminal control, data integrity, message and transaction processing, and the ability to edit and control the overall operations of the system through a 3270-type CRT terminal. Users can expand ENVIRON/1 in several ways. By adding the Advanced Mapping System, users can relieve the application programmer from any worries relating to screen matrices and data maps generated for 3270-type terminals. The ENTIRE function provides users with more complex terminal and program control functions. Task Level Checkpoint provides a much higher level of restart capability. The Standard Access Method Option makes provisions for handling the standard ISAM, BDAM, and VSAM data files without leaving the ENVIRON/1 operating environment. Support for the TOTAL DBMS environment is integrated throughout all the facilities that make up ENVIRON/1. ENV-DATA (the standalone data entry and verification system), T-ASK (the online query language), and MANTIS (the comprehensive programming aid) can all be integrated into both the ENVIRON/1 and TOTAL configurations. LMS-II is another programming tool that can be appended to ENVIRON/1 to support source statement libraries.

☐ Host Computers & Operating Systems

ENVIRON/1 and all options can be installed on any IBM System/370, 3000, 4300, or compatible computer that can support DOS/VS, DOS/VSE, OS/VS1, SVS, or MVS operating systems. Because ENVIRON/1 functions simply as a task in the operating environment, it is not affected by operating system changes.

☐ Minimum Operational Configuration

The memory requirements for any TP monitor depend on the size of the supported network, on the sizes of the application programs and transactions that must be loaded into the system at one time, and on the options selected to configure the nucleus. For a minimum ENVIRON/1 configuration (up to 10 terminals) with most standard facilities, a partition or region of about 200K bytes is required to support either VTAM or BTAM. All system-supported 3270-type terminals are supported by ENVIRON/1, along with about 20 other CRT- and TTY-type devices.

ENVIRON/1 requires approximately 35 tracks on a 3330-type device in the Source Statement library, about 60 tracks in the Relocatable library, and about 25 tracks in the Core Image library.

■ TP MONITOR FACILITIES

☐ Control Program

The Control Program consists of 2 basic components: the monitor supervisor and the monitor root segment. All other system elements are appended to these modules to meet specific network

Cincom Systems ENVIRON/1
TP Monitor System

requirements. The segments are added through a macro capability that defines a series of discrete modules. The modules are link-edited to make up the effective Control Program. An important responsibility of the Control Program is to handle all terminal I/O through the use of the IBM VTAM, VTAM/ACF, or BTAM access methods.

ENVIRON/1 functions in the total system environment as another task, and when it attaches an application program to a terminal, the program functions as an entity in the same region or partition. All I/O is handled by ENVIRON/1, so the application program continuously communicates with the Control Program. The concept used to establish program and data relationships is unique. When application programs are compiled and link-edited by the COBOL-XT compiler and system utility, the object code is reentrant and pageable in 512-byte segments. ENVIRON/1 link-edits the programs into the Program Data Set (PDS), which appears as a single data set made up of individual members with unique entry points. The PDS stores both program code and data elements. It is a virtual file, and all programs and data stored on the file are shareable. Security provisions are relegated to terminal- and command-level authorizations.

Another key element of ENVIRON/1 is the Roll File. All data and program segments are maintained on the Roll File in the same 512-byte segments as in the PDS. All ABEND and restart control block information is also housed in this file. In a multitasking environment, control is passed from task to task whenever a "wait" condition arises. If the wait is deemed a "long" wait, meaning that a request for service goes beyond what the system considers tolerable, the requesting task is rolled out to the Roll File so that another task can use its resources. In this way, the amount of space needed in the partition is minimized. Rollouts can be forced or established for a purpose, such as allowing a transaction-bound job to quiesce itself at times to balance overall performance. The monitor uses a "Contiguous Use Algorithm" facility to determine which program/data segments should be retained in the partition and which, because of limited use, could be overlayed. In this way, a heavily used module can be made effectively resident.

The area in the partition allocated to executable task information and control blocks is called the Application Paging Area. It too is broken down into 512-byte pages. The space is divided into 2 logical areas. One area houses the first page of the sign-on routine and the pages of program code as they are required; the second area houses the terminal input message area and the Program Memory Blocks (PMBs) where task control information and data reside. Each terminal is assigned 2 PMBs. PMB1 is used as a scratchpad for task control; PMB2 is used as an application scratchpad for maintaining dynamic pointers. The input message areas and control block information areas are called "context pages."

The terminal environment is defined in a unique Terminal Environment Module. All line groups and terminals assigned to each group are identified in this module. Operating characteristics such as polling sequence and message broadcasting characteristics are also defined here. These modules are created through macros that are assembled and then become part of the Control Program. For users with TOTAL, a Data Base Description module (DBD) is generated to maintain all the database relationships and characteristics. For users with the standard IBM access methods, a File Definition module maintains all file characteristics. A Device Dependent Module (DDM) handles all communications to system input/output devices (e.g., disk, tape, or terminal). Each local or remote terminal is supported by a unique DDM, and new DDMs are provided by Cincom as new devices are introduced.

For ENVIRON/1 users with TOTAL, the Data Management Language (DML) translates service requests into retrieval requests and returns the requested information to the application program. A series of drivers is provided for the standard IBM file access methods.

Logging and checkpoint/restart are other key features in the ENVIRON/1 system. The logging and restart facilities in the Control Program support system level processes. During logon, the relationship between terminal and task is defined and established

based on authorization. At the same time, the logon can initiate a branching action to an application program to start the processing cycle automatically.

As with all checkpoint/restart capabilities, the users must set up checkpoint logging intervals. In ENVIRON/1, users must also establish the rules for indicating restart points. When a failure occurs, ENVIRON/1 rolls out to the Roll File the control blocks of information required to restart the system. However, no restart can begin until the entire system is quiesced. The recovery facility uses a backout approach to system restart. All transactions are backed out as the monitor moves back to the checkpoint position. In addition to the standard system checkpoint/restart facilities, a Task Level Checkpoint option, which does not cause the system to stop processing, can be acquired.

Finally, the Control Program provides users with a fairly comprehensive editing capability. ENVIRON/1 can translate from free-form external input to fixed-form construct for internal processing by utilizing an EDIT command facility with associated parameters. A masking technique is used for editing.

The installation charge is $5,500 for the DOS version and $6,000 for the OS version. Seven days of support are provided for DOS systems and 8 days are provided for OS systems.

ENVIRON/1 ● DOS version:

	$44,000 lcns	$1,860 mo	$4,840 serv

ENVIRON/1 ● OS version:

	56,700	2,360	6,240

☐ TP Monitor Compiler

COBOL-XT ● proprietary high-level programming language designed to produce online, pageable (512-byte), reentrant code; verb structure is similar to standard ANS COBOL; does not require Identification or Environment Division coding, but supports comments in those areas for compatibility reasons; no Select Statements, device assignments, or file descriptions are required; file descriptions and screen formats are built external to application program ● COBOL-XT object code is loaded into IBM object code library and then linked into PDS with special ENVIRON/1 linkage editor; all COBOL-XT CALLs invoke ENVIRON/1 services; the PERFORM verb is the most powerful verb in the language; it acts on paragraphs, sections (or portions of sections), programs, or any entry point; it provides data addressability across a series of PERFORMs; up to 20 nested PERFORMs can be supported ● COBOL-XT does not support a sort routine or a report writer facility; COBOL-XT is exclusive to the ENVIRON/1 operating environment.

☐ File Access Method Facilities

Standard Access Method Option ● provides interface module for files created with standard IBM ISAM, BDAM, or VSAM access methods; interfaces (or drivers) compromise total interface between monitor and operating system; users are responsible for setting up working areas and assigning unique file names ● the Data Management Language (DML) supports commands for retrieval and update of ISAM, BDAM, and VSAM records; commands are designed to be embedded in application programs; the Standard Access Method Option drivers run asynchronously with the rest of the ENVIRON/1 system; the option consists of 2 phases: file definition and data management; in the file definition phase the physical characteristics of the file are described; the data management phase defines how application programs can access and manipulate data on the defined files ● installation charge for this option is $1,000 for either DOS or OS; 1 day of on-site support is provided:

	$9,500 lcns	$395 mo	$1,045 serv

LCNS: single-use license fee with first year of maintenance included. MO: monthly fee based on a 1-year lease plan. SERV: annual service charge after first year for license holders; based on approximately 11% of the then-current single-use license fee. Prices are effective as of October 1984.

Cincom Systems ENVIRON/1
TP Monitor System

Screen Mapping/Development Aids

Advanced Mapping System ● designed to support 3270-type terminals; frees application program from problem of defining screen formats; performs 3 logical functions: creates screens, provides map-edit generator, and supports mapping service routines ● map definition statement file stores data for map creation; generator defines editing requirements for each data field on the screen; service routines retrieve specific screen map upon request; all matrices are stored on the Program Data Set by name; all map definition statements are coded, assembled, and then link-edited into PDS; user exits are supported; all I/O operations for 3270 applications are executed through CALL statements in COBOL-XT or BAL macros; edit functions provide full range of error-detecting capabilities; screen totaling and balancing and conditional compares are supported ● top line of each map on the screen is reserved for use by the ENV-DATA option; Advanced Mapping System is a prerequisite for ENV-DATA ● installation charge is $2,000; 2 days of on-site support are provided:

	$12,700 lcns	$530 mo	$1,400 serv

ENTIRE ● programming productivity tool designed to reduce coding in the online application development environment; integrates with the reentrant architecture of ENVIRON/1 ● the module includes security management facilities to protect applications from unauthorized access; a printer-support feature that provides additional protection and control facilities for printed output; network services for monitoring and controlling the terminal network; and a programmer support system that provides a set of programming standards, integrates with Cincom's COBOL-XT, and supports multiple service routines including TOTAL, BDAM, ISAM, and VSAM input/output, error message display, and intertask message routing:

	15,000	625	1,650

Logging/Recovery Facilities

Task-Level Checkpoint (TLC)/Restart Recovery ● performs recovery at task level without requiring system to stop operating; all context blocks pertaining to failed task are copied from the Roll File; application program must have provisions for capturing checkpoints, and Task Log File must be mounted; log images with automatic backout are used to restore task from point of failure to last taken checkpoint; log consists of chained records; all task resources (line, record, file, etc) are assigned to that task from point of acquisition but are released at checkpoint ● installation charge is $2,000; 2 days of on-site support are provided:

	$17,600 lcns	$730 mo	$1,935 serv

☐ Data Entry & Verification

ENV-DATA ● an online data entry and verification system that can be implemented either standalone or with ENVIRON/1 resources in a DC or DB/DC environment with TOTAL; requires the ENVIRON/1 Advanced Mapping System option; can be installed under either the Entry or Comprehensive version of ENVIRON/1 ● addresses 4 types of data organizations: a field, which is the basic unit against which editing and verification is performed; a data page, which is made up of fields and represents 1 unit of input in any format (1 page is equal to 1 display screen); a batch, which is a group of pages that has related information for reference; and categories, which is a group of batches that contains an organization of data such as a total application; batched data cannot be transferred from one batch to another in ENVIRON/1 ● ENV-DATA references 3 basic types of batches: user batch, statistics batch, and system batch; user batch data is input that the user is responsible for; statistics batch data contains statistical information pertinent to each of the user batches; system batch is built internally and is accessed and maintained by the system; when an operator signs on to a batch, a list of legal screens is displayed for selection; batches can be restricted or can be labeled read-only, although in most instances the operator has update capabilities; batch extractions to sequential files can be handled concurrently with ENV-DATA operations if the user has enabled the Concurrent Extraction Facility; data pages are not deleted by the extract function; only a PURGE command can delete pages ● data entry portion runs as a normal application under ENVIRON/1, but the data entry routine takes full responsibility for opening and closing its own files ● HELP command displays a prompting menu for assistance ● installation charge for ENV-DATA with ENVIRON/1 is $2,600; 3 days of on-site support are provided:

	$16,800 lcns	$700 mo	$3,425 serv

☐ Program Development

LMS-II ● online programming development tool designed to consolidate all JCL, test data, documentation, etc, in a 3270-type workstation; developed programs can be entered directly to the host operating system for compilation and testing; also supports batch mode for program entry/maintenance; online and batch modes can operate concurrently ● provides online access to source program libraries; supports code verification and modification through display terminal; submit jobs to queue for compilation ● ADR The LIBRARIAN and Pansophic PANVALET source maintenance programs can be interfaced and supported ● installation charge for LMS-II with ENVIRON/1 is $2,000; 2 days of on-site support are provided.

LMS-II ● DOS version:

	$22,500 lcns	$940 mo	$2,475 serv

LMS-II ● OS version:

	25,000	1,040	2,750

T-ASK ● normally used with TOTAL to provide online interactive query capabilities; combined with ENVIRON/1 it provides online query facilities through a 3270-type terminal; command language is made up of simple syntax and English-language-based vocabulary; designed for use by nonprogramming personnel; supports arithmetic and Boolean operators and provides work space/scratchpad capabilities ● installation charge for ENVIRON/1 users is $2,000; 2 days of on-site support are provided.

T-ASK ● DOS version:

	36,700	1,530	4,040

T-ASK ● OS version:

	39,600	1,650	4,355

Monitor Utilities ● 5 unique utilities are provided: special linkage editor, maintenance utility, terminal simulator, log-tape dump, dump utility, and TOTAL batch utility program ● linkage editor loads the PDS from the user's object deck; maintenance utility allows users to add, delete, and/or update modules on the PDS; terminal simulator supports testing online program testing by using magnetic tape input to simulate a terminal; log-tape dump analyzes and prints portions of the special ENVIRON/1 Log Tape File; the standard dump utility prints core dumps for failed tasks; TOTAL batch utility restores after images or recovers before images to TOTAL data sets ● simulation utility can also be used to simulate system changes to evaluate the effect of proposed changes for fine tuning purposes and to gather statistics on message rates, file accesses, channel usage, and program paging rates ● the log-tape dump provides a Roll File analysis, which gathers abend-associated data, identifies failing instructions, and shows status of terminal data at the time of task failure.

■ USER REFERENCE LIST

The following users can be contacted directly by Data Decisions subscribers for firsthand advice and opinions about the products covered in this report:

● Mr. D.J. Pala
Manager, Computer Services
Westinghouse Electric Corp
2040 Ardmore Boulevard
Pittsburgh, PA 15221
Tel: 412-636-3108

● Mr. Eric Hardison
Supervisor, Technical Support
Lithonia Lighting, Inc
1400 Lecter Road
Conyers, GA 30207
Tel: 404-922-9000 Ext 488

Cincom Systems ENVIRON/1
TP Monitor System

● Mr. Vincent D'Angelo
Manager of Computer Services
Goodyear Canada, Inc
21 Four Seasons Place
Islington, Ontario M9B 6G2
Tel: 416-626-4611 Ext 2311

● Mr. Joe McMullan
Operations Manager
Denver Equipment Division
621 South Sierra Madre
Colorado Springs, CO 80901
Tel: 303-371-3443 Ext 392

● **END**

Coastcom D/I MUX
Drop & Insert T1 Multiplexer

■ PROFILE

Function ● 64K-bps channelized/byte-interleaved TDM designed for T1 carrier facilities (1.544M bps) and CCITT (CEPT) facilities at 2.048M bps; compatible with D1D, D2, and D3 frame formats ● point-to-point or drop/insert applications ● handles asynchronous data, synchronous data, voice channels, and video ● complete network compatibility ● certified compatible with ATTIS System 85 and System 75, and the Rolm CBX.

Communications ● supports asynchronous data channels to 19.2K bps; telegraph channels to 2400 bps; and synchronous data channels from 2.4K to 1.536M bps ● composite link speeds of 1.544M or 2.048M bps ● RS-232C or RS-422 interface for asynchronous and MIL 188, RS-449, or V.35 interface for synchronous data ● point-to-point single composite link (trunk) or dual links for drop/insert applications, fiber optic cable interface (optional).

First Delivery ● 1980.

Systems Delivered ● over 1,000 units.

Comparable Systems ● Amdahl Model 2211, Avanti Ultra Mux, Bayly Omniplexer, Datatel DCP9100, DCA Netlink, Tautron, General DataComm Megamux, Infotron Systems TMux and InfoStream, Paradyne DCX-T1, Scitek BSPT1, Tellabs, Telebit, and Timeplex Link/1.

Vendor ● Coastcom Inc; 2312 Stanwell Drive, Concord, CA 94520; 415-825-7500 ● mailing address: P.O. Box 27068, Concord, CA 94527.

Canadian Distribution ● contact vendor headquarters.

Distribution ● worldwide through direct sales and manufacturer representatives.

GSA Schedule ● unlisted.

PURCHASE PRICE RANGE   hardware ■■■■■■■

Model 301
■■ $5K to $9.6K
Model 302
■■■■■ $13K to $21.2K
Model 303
■■ $8.4K to $12.2K
Model 307
■■ $20.4K to $24.4K

$10K	$20K	$30K	$40K	$50K

COASTCOM D/I MUX PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware products (solid bars) ● each of the 4 product models require 2 line interface units, an alarm module, a channel-select strobe generator, and a power supply—all extra-cost options; prices shown include those options ● small **Model 301** consists of 8-channel slot chassis and 3 synchronous data channel cards; large of 3 asynchronous channel cards and 5 synchronous channel cards ● small **Model 302** consists of a 24-channel slot chassis with 6 synchronous and 6 asynchronous channel cards; large of 12 asynchronous and 12 synchronous channel cards ● small **Model 303** consists of a 16-channel slot chassis with 4 synchronous channel cards and four 4-wire E&M signaling voice cards; large of 8 synchronous channel cards and eight 4-wire E&M signaling voice cards ● small **Model 307** consists of a 48-channel slot chassis with 8 asynchronous and 12 synchronous channel cards and eight 4-wire E&M voice cards; large of 12 synchronous and 12 asynchronous channel cards and sixteen 4-wire E&M voice cards ● **Note** prices do not include monthly maintenance costs which typically add about 10 percent per year to overall cost ● all prices are for single-quantity purchase.

The D/I MUX can be used in point-to-point and drop/insert applications, and provides one of the highest synchronous data-handling facilities on the market.

■ ANALYSIS

The Coastcom D/I MUX is a specialized 64K-bps channelized/byte-interleaved time-division multiplexer (TDM) designed specifically to combine a wide range of asynchronous/synchronous data and voice channels on a single broadband digital link referred to as a T1 carrier. T1 offers the end user a high-volume communication facility at low cost. For example, a single 1.544M-bps link can support up to 24 64K-bps channels, and the transmission quality is superior: 95 to 99 percent error-free seconds over a 24-hour period, depending on the facility.
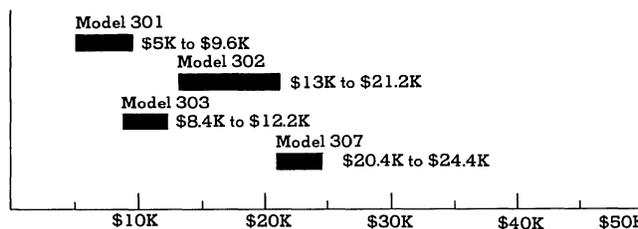
The T1 carrier service has been used by the telephone company since the early 1960s to carry digitized voice/data between central offices. Until early in 1983, T1 was unavailable as a tariffed service to private users; those requiring it had to subscribe to independent carriers or had to install their own microwave links. Users can now order T1 facilities through AT&T Communications via its Accunet T1.5 Service, or from independents such as SBS, MCI, etc.

The D/I MUX consists of common equipment and channel units that handle asynchronous data up to 19.2K bps; synchronous data up to 1.536M bps; and voice. The latter employs pulse code modulation (PCM) and quantizer voice at 64K bps. The multiplexer also accepts high-fidelity audio signals (program audio).

The common equipment multiplexes the outputs of the channel units, generates a D3/D4 Mode 4 format, and interfaces with the T1 line. In the receive direction, it performs the inverse operations. The D/I MUX architecture offers applications flexibility because all that is required to tailor a system to a given requirement is to select the proper channel units.

D/I MUX can be configured to handle conventional TDM multiplexing applications whereby n-channels communicate with a like number of channels on a point-to-point basis; or the multiplexer can handle **drop-and-insert** applications (the D/I in this multiplexer's name stands for drop/insert). With drop/insert, user-assigned channels originating at one multiplexer can be dropped at an intermediate multiplexer, while the remaining channels continue on to their ultimate destination. With data insert, channel data can be inserted into the message train at the same

Coastcom D/I MUX
Drop & Insert T1 Multiplexer

intermediate multiplexer where data is dropped. A more detailed description of drop/insert is contained under the Overview portion of this report.

Drop/insert is ideally suited for companies with distributed processing applications. Organizations such as large banks and companies with sizeable regional centers are typical candidates for this type of service. The D/I MUX could also be used at a digital microwave site to provide drop/insert access for voice/data subscribers or with analog microwave radio by employing appropriate T1 modems.

In summary, products like the D/I MUX that align transmission on 64K-bps channel boundaries are fully compatible with D3/D4 channel banks, and thus can be used with telephone company switching equipment to selectively switch and route channels to different locations. AT&T Information Systems, in fact, offers the D/I MUX as its T1 Channel Division Multiplexer. The Coastcom product has also been certified for use with the Rolm CBX II, as well as the AT&T System 75 and 85.

While the D/I MUX is a solid product, it lacks some of the more sophisticated facilities now offered by several competitors; for example, beneficial features such as software configuration and control, redundant control logic and power supplies, and sophisticated bypass schemes to handle node failures in drop/insert applications. These limitations are discussed in detail under Limitations.

☐ Strengths

Aside from the aforementioned compatibility with existing AT&T D3/D4 channel banks, the principal strengths of the D/I MUX are its ability to handle drop/insert applications, its range of synchronous speeds, its variety of voice channels, and its ability to be used in PBX applications. With the latter, the D/I MUX is bridged onto the T1 port of the PBX and "examines" the data stream for unused time slots. When found, the multiplexer inserts data into the unused slots, thus effecting a totally occupied T1 message stream. At the receiving end, another D/I MUX strips the inserted data.

With drop/insert, users can designate certain data/voice channels originating from one multiplexer to be dropped/inserted at intermediate destinations (via D/I multiplexers) within a network. As discussed under Overview, such a facility should be invaluable to large organizations with sizeable dispersed regional offices.

Another D/I MUX strength worth mentioning is the full range of toll-quality voice channel units. D/I MUX offers 2-wire FXO/FXS cards, which allow off-premises terminals to interface via the DDD or private lines with the multiplexer. This is very handy and easy to use.

The D/I MUX is 1 of 2 products (the DCA Netlink being the other) that supports a synchronous data channel at 1.536M bps. At this transmission rate, most applications (including digital video) can be accommodated. File transfer is one such application that requires a high-speed channel. As part of its broadband data support, D/I MUX offers a channel card (part 30036-001) that provides 24 user-selectable data rates from 56K to 1.536M bps.

☐ Limitations

D/I MUX is one of the older T1 multiplexers on the marketplace, and therefore, has some dated facilities. Because the product is configured principally through hardware, channel speeds and other parameters are established via DIP switches and jumper cables; even the drop/insert channel designation is strapped. Such techniques are inconvenient to use and are usually unpopular. Many users want to configure and control the system from a terminal for ease and flexibility of network configuration. We understand the Coastcom is working on such a facility.

D/I MUX is one of the few products in the T1 category not to offer redundant control logic and power supplies. Thus, a failure of either one of these key components renders the entire multiplexer inoperative, which of course, interrupts communications over that portion of the network. However, should a power or logic failure occur, the D/I MUX alarm circuits within the

affected multiplexer will automatically bridge the unit on the T1 span, bypassing the failed unit. While this scheme will prevent a **total** network shut down, it does not help those users who are cut off from processing services. This problem can be eliminated with redundant power/control logic that automatically switches in should a failure occur.

The user should strongly consider the bypassing scheme employed by Coastcom which makes no provision for blocking channels targeted for the failed node. Coastcom's bypass procedure passes these data channels on to the other nodes in the network. This recovery procedure sustains communication but it causes a security problem. Since D/I MUX employs back-to-back demultiplexing/multiplexing, the passed-through channel data can be accessed by unauthorized users and, therefore, compromised. A solution to this problem is to encrypt data, which is what Coastcom recommends.

Two other limitations are the lack of D4Fe framing and incompatibility with AT&T Digital Access and Crossconnect Service (DACS). As mentioned under Analysis, D4Fe framing will soon be mandatory for connection to AT&T Communication's Accunet T1.5 service; products without it will be excluded. Coastcom claims that D4Fe framing will be available this year.

The DACS service allows distribution (switching) of individual DSO 64K-bps channels among T1 systems at a digital level. From a simple ASCII terminal, a user can direct a DACS controller to switch individual channels within a T1 stream to another T1 stream associated with the same DACS controller.

The DACS controller (AT&T calls it a "terminal") terminates up to 128 DS1 signals, one of which is used for control. The remaining 127 DS1 terminations (3,048 64K-bps channels) can be used for crossconnections. Since 2 DSO controllers are required for a crossconnect, the DACS controller provides a maximum of 1,524 DSO crossconnections. DS1 signals to and from DACS are provided via DSX-1.

DACS is compatible with DS1 formats found in D1D, D2, D3, and D4 channel banks, and is end-to-end compatible with general trade channel banks meeting the requirements of PUB 43801. For a T1 multiplexer to be DACS-compatible, **its channels must be DSO (64K bps)** and its frame format must consist of 24 8-bit words and 1 superframe bit for a total of 193 bits. (A superframe is made up to 12 frames, and each superframe bit is timeshared to identify both channel framing and signal framing.) When the DACS services become available on a widespread basis, users will have one of the more powerful individual channel-switching facilities available on the commercial network. Coastcom is working to make D/I MUX compatible.

■ HARDWARE

Terms • D/I MUX components are offered on a purchase or lease basis, discounts are based on an actual dollar volume agreement, leases through manufacturer representatives.

Support • product warranted 18 months after shipment from factory or 12 months from date of installation, whichever period ends first; on-site service available or customer may return product to factory for repair/replacement; third-party maintenance through Honeywell.

☐ Overview

The Coastcom D/I MUX is a 64K-bps channelized/byte-interleaved TDM compatible with the AT&T Communications D1D, D2, and D3 frame formats, and can be terminated into digital switches or conventional D3 and D4 channel banks. The multiplexer accepts both voice and data channels, and can be used in conventional point-to-point and drop/insert applications. The D/I MUX also conforms to the DS1 message format established by AT&T Communications for connection to Accunet T1.5 (1.55M-bps) service.

D3 and D4 channel banks (along with the older D1 and D2) are AT&T standards for framing. D2 and D3 call for 24 VF channels employing an 8-bit encoding scheme and a signal bit; a sequential sample sequence is employed and multiplexing produces a 1.544M-bps composite link rate. D4 calls for 48 VF channels,

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Drop & Insert T1 Multiplexer

8-bit voice encoding scheme, and a signal bit; alternate bit interleaving is employed, producing a 1.544M- or a 3.152M-bps multiplexed output. D4 also uses T1C repeated lines.

The D/I MUX conforms to DS1 framing standards (24 64K-bps channels) and has the correct bit density for each message frame. Accunet T1.5 requires that any 24-bit interval must have at least 3 "ones" and no more than 15 consecutive "zeros" to maintain carrier timing.

Sometime this year, AT&T proposes to implement a new framing format called D4Fe which will be required for connecting to Accunet T1.5. The D4Fe format will also be based on DS1 and retain its bit density requirements; however, it will differ in that an 8K-byte (to be used by AT&T for signaling and diagnostics) will be inserted in every 193rd bit position of a message frame (24 channels x 8 bits per channel per sample = 192 bits plus 1 frame bit). Currently, the D/I MUX does not support this **extended frame formatting** but it is projected for release by the end of this year.

The D/I MUX handles asynchronous data, synchronous data, and digitized voice directly. Any asynchronous data rate is acceptable up to 19.2K bps. In addition, Coastcom offers a 7-port low-speed data channel card which interfaces up to 7 telegraph channels at speeds up to 19.2K bps. Synchronous data channels are accommodated by a channel card that handles rates up to 56K bps or one that handles rates to 1.536M bps. Coastcom offers a standard 56K-bps Data Channel Unit (DCU), as well as a card that provides 24 user-selectable data rates from 56K to 1.536M bps. All channel cards operate in full-duplex mode, and are available with RS-232C, RS-449, or CCITT V.35 interfaces. The synchronous channels provide clocking to the data terminal equipment (DTE), and can also send/receive data at 9600 bps with less than 20 percent distortion.

The voice channels (VF) employ Pulse Code Modulation to quantize analog voice inputs and produce a 64K-bps digitized output. Voice channel cards are available with 2- or 4-wire E&M/PLR, FXS, or FXO signaling or without signaling.

The D/I MUX can be used for point-to-point applications involving the AT&T Communications Accunet T1.5 service, twisted-pair wiring, point-to-point microwave, satellite links, and fiber optic cable transmission media. Inputs to the channel cards can be co-located terminals or the terminals can be multidropped (multipoint) polled. The low-speed asynchronous channel employs submultiplexing, and allows up to **168** 2400-bps channels to share one 1.544M-bps trunk.

Drop/Insert

D/I MUX is offered in 4-shelf configurations which differ in the number of channels accepted, and whether the unit is operated as a unidirectional or bidirectional multiplexer in drop/insert applications. Models 301, 302, and 307 are unidirectional and handle up to 8 or 24 channels, respectively. Model 303 is bidirectional and handles up to 8 drops/channels in **each direction**. Each unit contains a power supply, control logic, system alarm, channel slots, and a strobe generator which generates a strobe for each channel time slot. The strobes are connected to a channel-select matrix that assigns time slots to the physical card slot in the shelf. Shorting plugs are provided for drop/insert to select channels and bandwidth.

A simplified block diagram of the drop and insert procedure is shown in **Figure 1**. In the Mux 1 data stream, certain channels are assigned to terminate (drop) at Mux 2 while the remainder of data continues to the Mux 3. At the same time, data originating at Mux 2 location or from Mux 3 can be inserted into the data stream targeted from Mux 1 or 3. With the D/I MUX, drop/insert requires full-duplex transmission facilities in one direction for unidirectional Models 301, 302, and 307 and full-duplex transmission facilities in both directions for the bidirectional Model 303.

Figure 2 depicts the components employed with Models 301 and 303. The Model 301 channel-select matrix consists of a drop section and an insert section. Normally the drop and insert sections are programmed identically, i.e., if a channel receives drop information from time slot 5 in the East/West direction, it will insert information in the slot 5 time slot in the West/East direction. With the 303, 2 channel-select matrices control the drop and insertion of information in the East/West direction. The first matrix controls channel drop and insertion in the East/West direction. The second controls drop and insertion in the West/East direction. Associated with the channel-select matrix is a strobe generator that generates a separate strobe for each channel. The channel-select strobes are synchronous to the inputs and permit data to be dropped in the proper time slots.

The 24-channel Model 302 does not contain a channel-select matrix. Instead, a channel unit inserted in a terminal shelf slot employs the corresponding time slot accessed.

With the D/I MUX bidirectional models, a dropped channel can be reused, thus allowing more than 24 channels to operate on a T1 span. For example, if information is dropped from a channel targeted for Mux 2 in **Figure 1**, the channel-select matrix in that multiplexer can write over the vacated slot to insert data for transmission.

The **alarm** unit in the D/I MUX monitors input data, clock, and output data. Facilities are provided for recovery of lost clock or synchronization, and the entire multiplexer can be bypassed in the event of a power failure.

The loopback facilities are relay-actuated and provide checks of the system logic and channel cards. Local and remote loopback are supported.

Should an intermediate node in a drop/insert configuration fail, a relay is automatically triggered to reroute the data stream **bypassing** the failed unit. All channels targeted for a failed node are passed on to the ultimate network termination point.

☐ D/I Multiplexer

Central Control

Central Control • chassis and channel-select matrix • requires optional line interface units, alarm circuit, and strobe generator • Model 301 accommodates 8 channel cards; Models 302 and 307 accommodate 24; Model 303 accommodates 8 drops/channels in **each direction** • common logic occupies 2 card slots; alarm and strobe generator each occupy 1 slot • all chassis are standard 19 inches wide; Model 301 consists of single shelf and is 5.25 inches high; Models 302, 303 and 307 contain 2 shelves and are 10.5 inches high.
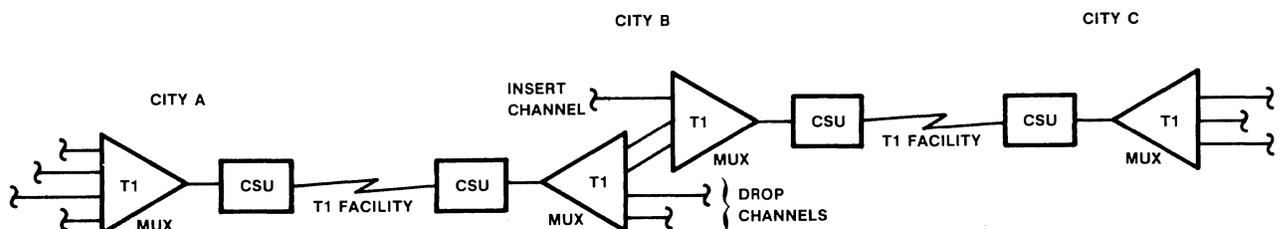
Figure 1 • channel drop and insert example.

Coastcom D/I MUX
Drop & Insert T1 Multiplexer

MODEL 301 UNIDIRECTIONAL MODE

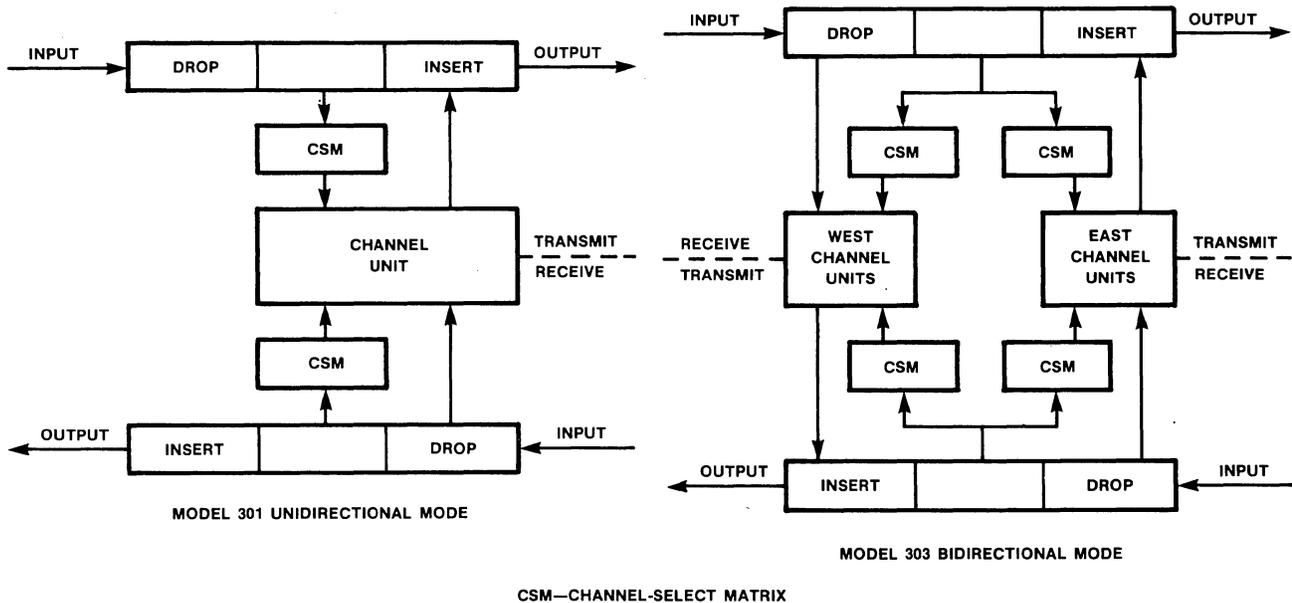MODEL 303 BIDIRECTIONAL MODE

CSM—CHANNEL-SELECT MATRIX

Figure 2 • D/I Mux Models 301 and 303 configuration.

Model 301 Unidirectional Chassis • provides channel card slots for 8 data/voice channel cards • includes channel-select matrix and 48VDC power supply:

$2,785 prch

Model 302 Unidirectional Chassis • provides channel card slots for 24 data/voice channel cards • contains 48VDC power supply:

3,480

Model 303 Unidirectional Chassis • provides channel card slots for 8 data/voice channel cards for each direction • contains 48VDC power supply:

3,350

Model 307 Unidirectional Chassis • provides channel card slots for 24 data/voice channel cards • includes channel-select matrix and 48VDC power supply:

3,590

30009-001 Line Interface Unit • detects framing; drops/inserts voice or data; interfaces with T1 line • 2 required for each chassis configuration:

400

30005-01 Alarm Unit • detects loss of frame synchronization, receive signal or power:

515

30007-01 Channel-Select Strobe Generator Unit • generates a strobe for each channel time slot • works with channel-select matrix to assign time slots to physical card slot on chassis shelf:

100

30008-002 48VDC Power Connector:

495

30015-001 115/230 VAC Power Supply • offered with Models 301 and 303:

715

Channels

The D/I MUX offers channel cards to handle asynchronous data, synchronous data, and voice. Asynchronous data rates range up to 19.2K bps and are available with an RS-232C or RS-422

interface. The synchronous data channel cards are offered in versions handling data rates up to 1.536M bps, and are available with RS-449 or CCITT V.35 interfaces. One card, part number 30036-01, provides 24 user-selectable data speeds from 56K to 1.536M bps.

Four other classes of data cards are offered. One is a Teletype-compatible card that has 7 channel ports and accommodates speeds up to 2400 bps. Another card is essentially an AT&T Dataport unit like the type employed for interfacing data to the DDS. The Coastcom card handles the standard DDS speed of 56K bps as well as subrates of 2400, 4800, 9600 bps.

The remaining 2 cards are synchronous low-speed units that allow protocol-insensitive transmission between DCE and DTE equipment. Both cards support data rates of 75 to 4800 bps and feature auto-rate detection. The receiving card automatically "sets up" to accommodate the transmission rate of the sending card.

In addition to the data cards, Coastcom offers 2 modules that provide interface conversion plus line-driver services. One module converts asynchronous RS-232C to RS-422, while the other converts synchronous RS-232C to RS-422. Both transmit data up to 4,000 feet.

An extensive line of voice channel cards is offered which provides signaling interfaces to allow the D/I MUX to operate with telephone trunks, PBXs, off-premise extensions, and station-to-station systems. Each channel card occupies a channel location, and employs PCM quantization.

30011-001/-002 Asynchronous Channel Card • provides channel logic for single asynchronous data channel • full-duplex • RS-232C or RS-422 interface • occupies single card slot:

$615 prch

30012-003 Synchronous Channel Card • provides channel logic for single synchronous data channel at rates up to 56K bps • full-duplex • RS-449 or V.35 interface • occupies single card slot:

750

PRCH: single-unit purchase price. Prices current as of August 1985.

Coastcom D/I MUX
Drop & Insert T1 Multiplexer

30036-001 Synchronous Channel Card • provides channel logic for a single synchronous data channel at user-selectable rates from 56K to 1.536M bps; 24 different speed increments • full-duplex • RS-449 or V.35 interface • occupies single card slot:

1,170

30039-001 Synchronous Low-Speed Adaptive Rate Channel Card (DCE) • provides channel logic for a single synchronous data channel at speeds of 75 bps to 4800 bps; auto-speed detect • RS-232C interface • logical DCE function:

750

30040-001 Synchronous Low-Speed Adaptive Rate Channel Card (DTE) • same as 30039-001, except has DTE logical function:

750

30010-001 DDS Dataport AT&T D4 Channel Card • data channel unit adapter card accepts 2400/4800/9600/56000-bps OCU units • occupies single card slot:

340

30021-01 Teletype Data Channel Card • provides channel logic for up to 7 Teletype channels at channel rates to 2400 bps • full-duplex • RS-232C interface • occupies single card slot:

400

38100-001 Async Converter/Line Driver • channel card with RS-232C to RS-422 interface conversion plus line-driver services • transmits asynchronous data up to 4,000 feet:

475

38103-002 Sync Converter/Line Driver • channel card with same support as 38100-001, except handles synchronous data:

845

30045-001 Voice Channel Card • provides channel logic for a single voice channel • 4-wire transmission only:

180

30045-002 Voice Channel Card • same as 30045-001, except has 4-wire E&M/pulse link repeater signaling:

195

30044-307 Voice Channel Card • same as 30045-001, except has 4-wire SF signaling:

600

30042-001 Voice Channel Card • same as 30045-002 except employs 2-wire transmission:

180

30042-002 Voice Channel Card • same as 30042-001 except employs E&M signaling:

270

30042-004 Voice Channel Card • same as 30042-001 except employs FXS signaling:

290

30042-005 Voice Channel Card • same as 30042-001 except employs FXO signaling:

350

Composite Link

The D/I MUX supports up to 2 composite links at speeds at 1.544 or 2.048M bps, full-duplex, bipolar, NRZ. Standard link interfaces are RS-232C, MIL 188, RS-422/CCITT V.11 DS1.

• **END**

Codex 2600 Series Modems
Models 2620, 2640 & 2660

■ PROFILE

Function ● high-performance modems with network control capabilities for dedicated facilities.

Communications/Networks ● synchronous at 2400/4800 bps (2620) and synchronous with optional asynchronous-to-synchronous conversion at 4800/9600/14,400/16,800 bps; point-to-point or multipoint communication over unconditioned (2620 & 2640), and D1 conditioned (2660) 4-wire dedicated Type 3002 facility ● non-AT&T compatible ● designed for use with Codex Distributed Network Control System (DNCS).

First Delivery ● December 1984 (2620); April 1984 (2640 & 2660).

Units Delivered ● over 10,000.

Comparable Systems ● principal competition from Paradyne VHS/MPX Series; Racal-Milgo Omnimode Series; General DataComm (GDC) Modems; Infinet NCM Series; NCR Comten 7160 Series; Kinex Modems.

Vendor ● Codex Corporation, Subsidiary of Motorola Inc; 20 Cabot Boulevard, Mansfield, MA 02048 ● 617-364-2000.

Distribution ● nationwide via local Codex direct sales/service offices and worldwide via distributors ● Canada via ESE Limited ● Great Britain via Codex Limited ● Europe via Codex Europe S.A., Brussels, Belgium ● Asia via Codex Far East, Tokyo, Japan.

■ ANALYSIS

Introduced last March at Interface'84, the Codex 2600 Series embraces new technology and advanced features in an effort to achieve improved levels of performance and reliability. Superseding the CS Series as the Codex high-end modem offering, the 2600 Series represents a new generation of high-speed modems based on the Motorola 68000 microprocessor. The implementation of Trellis Coded Modulation, an Adaptive Rate System, a custom VLSI signal processing chip set, and an optimized V.29 QAM modulation scheme are among the innovations employed by the 2600 Series. Designed for dedicated point-to-point or multipoint networks, the new modem family comprises the Codex 2620 for 4800-bps transmission; the Codex 2640 for 9600-bps transmission; and the Codex 2660 for 9600- to 16,800-bps transmission.

The 2620 utilizes a proprietary VLSI design to offer reliable performance at data rates of 4800 and 2400 bps and supports a unique Train On Data (TOD) feature for eliminating data interruptive retrains in multipoint applications. TOD is intended to facilitate throughput and faster response times by enabling remote modems to equalize on the data being transmitted. The

PURCHASE PRICE RANGE   hardware   ▇▇▇▇

5-year maint fee ☐☐☐☐

☐ $4.2K to $15.7K

| $4K | $8K | $12K | $16K |

CODEX 2600 SERIES PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware (solid bar) and for associated 5-year period maintenance (open bar) ● 2600 Series pricing ranges from standard 2620 at low end to 2660 with multiport support and DNCS at high end.
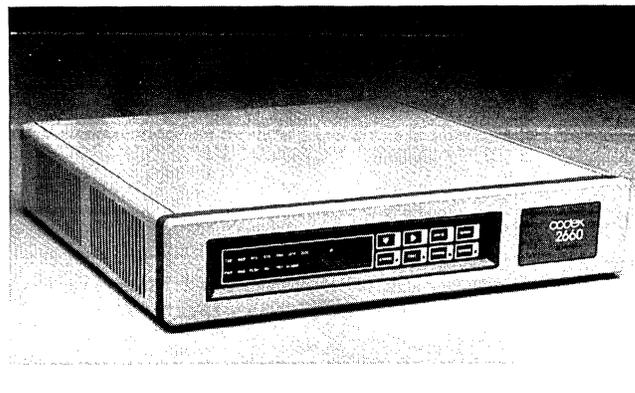
2620's control panel allows the central site or local operator to configure, monitor, and test both local and remote modems. Major EIA and Circuit Quality Monitoring System (CQMS) line parameters can be monitored from the control panel. Other standard features include network control through the Codex Distributed Network Control System (DNCS), automatic line equalization, error probability readout, and optional integral dual dial restoral. A 4-channel multiplexing option with integral Modem Sharing Unit (MSU), asynchronous/synchronous converter, and control signaling capability are available.

Like the 2620, the mid-range 2640 is designed for operation over unconditioned Type 3002 voice grade lines. The 2640 uses an enhanced modulation technique known as the Codex Improved (CI96) modulation scheme for providing improved performance and fewer bit errors at 9600 bps. Aside from the Train On Data feature which comes standard on 2620 and 2640 modems, the addition of Mixed Inbound Rate and Multipoint Signal Quality Binning features further refine the 2640's multipoint capabilities. In multipoint mode, the Multipoint Signal Quality Binning (MSQB) feature assists the network operator in troubleshooting problems by identifying signal quality data for up to 15 individual drops on a multipoint line. Using the Mixed Inbound Rate (MIR) feature while in multipoint mode allows the master modem to accept different inbound rates. A 4-channel multiplexing option with integral Modem Sharing Unit (MSU); asynchronous/synchronous converter, and control signaling capability are available at extra cost.

The top-of-the-line 2660 utilizes an 8-state Trellis Coded Modulation technique to insure data reliability at transmission rates up to 16.8K bps. A novel forward error-correction (FEC) approach, Trellis Coded Modulation (TCM) transmits and interweaves 5 data bits to every 4 of the original data stream. The additional bits expedite the selection of the most accurate representation of the data transmitted. Another unique 2660 feature is the Codex-developed Adaptive Rate System (ARS). ARS senses line quality and automatically adjusts the main channel data rate from 9600 to 16.8K bps in 2.4K-bps increments according to line conditions. By using data derived from the integral Circuit Quality Monitoring System (CQMS), the Adaptive Rate System evaluates line conditions and then selects the optimal data rate. The Adaptive Rate System is suitable for a range of host-to-host, statistically multiplexed, and buffered multiplexed applications. In addition, the 2660 can be equipped with an internal 6-channel buffered multiplexer, an integral Modem Sharing Unit (MSU), asynchronous/synchronous converter, and control signal capability.
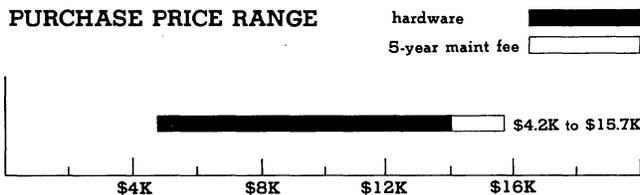
Codex 2600 Series Modems
Models 2620, 2640 & 2660

Codex continues to emphasize the value of network diagnostics by incorporating network control functions into all 3 models of the 2600 Series. Network control for the monitoring and testing of lines and devices can be initiated directly from the 2600 Series Control Panel or from a central site Codex Distributed Network Control System (DNCS). Network control eliminates excessive downtime which plagues most networks, spares revenue and business lost to downtime, and is crucial to productivity.

In a network control environment, the modems automatically alert users of deteriorating line conditions so that remedial action can be taken short of line failure. The user can quickly pinpoint failures through modem-executed diagnostics that isolate failures within central or remote site modems, or the line. The diagnostics are automatically executed in response to operator commands at the central-site DNCS console. Options are available for remedial recovery from modem or line failures through modem substitution or dial backup. Fallback data rates support the possible resumption of communications with tolerable error rates over degraded facilities.

Without DNCS control, user awareness to degradation or failure, and diagnostic testing is severely limited. The user is alerted to degradation or failure through visual observance of front-panel indicator lamps, which indicate good, marginal, or poor communications based on bit error rate measurement. Diagnostic tests are performed through front-panel controls which establish loopback paths and generate a pseudo-random bit pattern for failure isolation.

As an independent communication supplier, Codex is a single-source vendor and has retained a leading edge in this highly-competitive industry segment. A pioneer in the data communications industry, Codex was one of the first vendors to introduce a 9600-bps modem for communication over a voice-grade facility, made possible by its patented QAM modulation technique. Since its inception in 1962, Codex has expanded its product line to include approximately 200 types of modems, statistical multiplexers, electronic data switches, network control and management systems, intelligent terminals, local area network products and a complement of technical control and network support equipment. Codex has established a sound reputation for itself as a vendor of highly reliable products and provides strong product support through its nationwide sales force and sales organization.

☐ Strengths

The Codex 2600 Series represents a new generation of high-speed modems that combine new architecture, new technology, and new features to provide a range of user benefits. The 2600 Series are Codex's first commercial offering to use the powerful Motorola 68000 microprocessor as a controller. In addition, a Codex-developed VLSI signal processing set works with the 68000 to implement advanced modem algorithms. The new architecture benefits users with increased modem functionality and reliable data transmission at rates up to 16.8K bps.

High reliability and low power consumption are other important considerations. The calculated MTBF is in excess of 30,000 hours, which means that the modem should operate constantly for almost 3.5 years without a failure. Power consumption is just 35 watts without options.

Transmission reliability is further enhanced by the inclusion of integral network control functions. DNCS support offers the user an effective method of diagnosing and troubleshooting problems. It puts the network manager in touch with network performance and supplies the necessary tools to quickly isolate failures. It also enables the network manager to restore communication through temporary alternate paths until a failure is resolved. Diagnostic functions are extended by the standard Circuit Quality Monitoring System (CQMS), which provides transparent monitoring of line conditions. In addition, the network operator can troubleshoot individual multipoint segment line problems by using the 2640 Multipoint Signal Quality Binning (MSQB) feature.

For users with highly critical applications, the Trellis Coded Modulation technique employed by the 2660 significantly

improves performance above 9600 bps. TCM uses a forward error correction scheme which trellises an additional 5 data bits to every 4 bits transmitted. This trellising technique produces an extremely accurate representation of the data transmitted. As a forerunner in the realm of trellis coding, Codex supports a data rate of 16.8K bps over most D1 lines and offers performance at 14.4K bps that approaches performance levels of current 9600 V.29 modems.

Automatic speed adjustment to changing line conditions is another 2660 advantage. This new feature eliminates the inefficiency and inconvenience of manually changing main channel rates. Optimal throughput is then provided under a variety of line conditions. So, for example, if line conditions degrade, the Adaptive Rate System automatically falls back from 16.8K bps to 14.4K bps. Once line conditions improve, the data rate is automatically stepped up to 16.8K bps. Increased throughput in multipoint operations is provided by the 2640 modem using the Mixed Inbound Rate feature which allows the master modem to handle a mixture of different inbound rates in addition to the Train On Data feature which reduces the amount of time-consuming retrains.

Other Codex 2600 Series advantages are application-dependent and include multiport support, asynchronous-to-synchronous conversion, downline program loading, and resource sharing via the Modem Sharing Unit (MSU). The XL-1 system extension and downline program load feature reduce life-cycle costs and eliminate the need to dispatch service engineers when the user wishes to add additional capabilities. These options are important considerations to users with these application requirements.

☐ Limitations

The Codex 2600 Series modems are designed primarily for use with the Codex Distributed Network Control System (DNCS) and contain microprocessor control for DNCS support. The added circuitry increases the unit price which is high in comparison to comparable units. Since the Codex modems come packaged with standard DNCS support, users not requiring extensive diagnostics must consider the older LSI Series or the 2300 Series as product alternatives. However, the LSI Series has remained relatively inactive over the past few years, and only the high-end model of the 2300 Series is currently available. The top-of-the-line 2360 modem also employs trellis-coded modulation to achieve transmission rates up to 14.4K bps without DNCS support.

While increased immunity to line noise and other circuit impairments are decided advantages of trellis coded modulation, its high overhead limits its use to the most critical applications. Although trellis-coded modulation guarantees error-free transmission, it is a costly alternative. In addition, it creates a compatibility problem for products that cannot recognize trellis-encoded data. At the present time, the 2660 is only transmission compatible with the 2640, but in V.29 mode. It is not transmission compatible with other Codex product offerings including the 2620. Furthermore, the 2640 is only compatible with Codex CS 48FP modems. Prospective users should strongly consider this incompatibility when making a purchase decision.

The 2600's secondary channel provision exists exclusively for passing DNCS diagnostic and network control information. There are no provisions for an auxiliary channel to support user-specified applications, such as a low-speed TTY channel or building management control.

■ HARDWARE

☐ Terms & Support

Terms ● available for purchase or for lease under 1-, 2-, 3-, 4-, or 5-year agreement; leases include maintenance for term of lease ● first-year maintenance free of charge for purchased units ● lease/purchase credit on 2-year or more lease agreements is 75 percent of unit purchase price ● 1-year warranty for purchased units ● quantity discounts available for purchased or leased units.

Support ● installed by user or by Codex; installation charge is $74; installation charge on per-unit per-site basis; minimum installation charge is $165 within 100 miles of Codex service Center (Zone A); $340 over 100 miles (Zone B) ● 3 service plans:

Codex 2600 Series Modems
Models 2620, 2640 & 2660

Time and Materials Factory Maintenance/Fixed Price ● Time and Materials Plan billed for time and materials plus transportation; material replaced or repaired at Codex option ● Factory Maintenance Plan includes cost of material and labor ● Fixed Price consists of 2 plans: On-Site Maintenance Agreement and Unit Exchange Maintenance Agreement ● On-Site maintenance performance under annual contract during prime shift hours 8:00 AM to 5:00 PM, Monday through Friday; $26 per month Zone A; $42 per month Zone B ● Unit Exchange maintenance provides a replacement for defective equipment when notified on a same day or next day priority basis.

☐ Overview

The 2600 Series are an advanced, high-speed modem family designed for point-to-point and multipoint network configurations in a network control environment. The 3 models of the 2600 Series are components of the Codex Distributed Network Control System (DNCS) and contain microprocessor controlled logic to execute commands entered at a central site DNCS network operator console. Network control commands and modem status are transmitted between the DNCS system and individual modems via a full-duplex narrowband secondary channel supported by each modem. Functions supported and executed by the modems include the monitoring of both analog and digital interfaces for abnormal conditions that exceed user-defined alarm thresholds, diagnostic testing procedures, and remedial recovery from failures.

☐ Packaged Modems

Standalone packaging standard for all models; rackmount optional at extra cost. Rackmount kit permits a single 2600 Series modem to be horizontally mounted in a standard 19-inch equipment rack. Each model measures 3.5x17x16.25 (HxWxD) inches and weighs 20 pounds.

Model 2620 ● standard 4800-bps, CCIITT V.27 bis-compatible modem with DNCS control:

$150/$130 mo	$4,175 prch	$26/$42 maint

Model 2640 ● standard 9600-bps, CCITT V.29-compatible modem with DNCS control:

220/205	7,200	26/42

Model 2660 ● standard 16.8K-bps modem with DNCS control:

430/360	13,000	26/42

Drawer Rackmount Kit ● equipped with sliding drawer for easy modem access ● accommodates single modem:

10/7	50	NC/NC

☐ Application

Point-to-point and multipoint communication over unconditioned (2620 & 2640) and D1 conditioned (2660) 4-wire dedicated Type 3002 voice channel. Model 2620 training time delay selectable at 9/50/67/708/943 milliseconds. Model 2640 training time delay selectable at 9/17/253 milliseconds. Model 2660 training time delay selectable at 200/300/400/500 milliseconds.

☐ Operating Parameters

Synchronous half-/full-duplex; selectable data rates. Model 2620 selectable at 4800/2400 bps. Model 2640 selectable at 9600/7200/4800 bps. Model 2660 selectable at 16.8K/14.4K/12.0K/9600/7200/4800 bps. QAM modulation (all models); Codex Improved 96 (CI96) modulation (2640); Trellis Coded Modulation (2660). Automatic line equalization (2620). Train On Data (2620 & 2640). Mixed Inbound Rate (2640). Adaptive Rate System (2660).

Codex Improved (CI96) Modulation ● standard modulation scheme exclusively for Model 2640 ● an optimized QAM modulation technique, CI96 is particularly suited for constant carrier applications and recovers more readily from short dropouts of 10 seconds or less by retaining critical information on circuit equalization.

Trellis Coded Modulation ● improves BER of Model 2660 modems ● data is transmitted at 7 bits per baud at a baud rate of 2400 bps, producing a 128-point constellation instead of the common 64-point signal pattern ● Trellis Coded Modulation (TCM) facilitates the detection of errors in sequences rather than in individual bits.

Train On Data (TOD) ● standard feature for models 2620 and 2640 ● compensates for changes in line conditions that cause abnormal error rates ● receiver clamped to mark state (receiver off-line) while modem re-equalizes (retrains) on data sequence transmitted by master modem ● modem regains online status and reactivates Receive Data (RD) lead once equalization is recovered.

Mixed Inbound Rate (MIR) ● standard feature only for Model 2640 in a multipoint environment ● allows the 2640 modem to set the transmitter of each slave modem at a different inbound data rate to compensate for degrading line conditions at individual drops without affecting entire network ● modems on deteriorating line segments can be downshifted to reduced rates via DNCS or the master modem Control Panel until line quality is restored ● eliminates need to reduce rate for entire network to compensate for poor conditions at a few drops.

Adaptive Rate System (ARS) ● standard feature only for 2660 modems in a point-to-point environment ● selects optimum data rate for a modem pair based on existing line quality ● especially suitable for host-to-host and statistically multiplexed links ● line quality sensed by CQMS within each modem ● either modem can initiate a fallback rate for degrading line conditions; both modems must be synchronized in order for data rate to fall forward ● fallback and fall-forward rates implemented in 2.4K-bps increments ● adaptive rate selections range from a 2- to 3-minute fallback waiting time to an 8- to 15-minute fall-forwarding wait time ● ARS requires that DTE's connected to the appropriate ports be synchronous and accept clock from the modems.

XL-1 System Extension ● accommodates custom or standard hardware and software ● provides memory for storing additional features ● card fits into fourth slot of chassis:

NC/NC mo	NC prch	NC/NC maint

Downline Program Load (DPL) ● downline loads custom or standard software from Codex Distributed Network Control System (DNCS):

NC/NC	NC	NC/NC

☐ Channel Functions

Multiport ● 2620 & 2640 each accommodate integral 4-channel buffered multiplexer ● individual multiplexer channels can be set to any mix of rates, the aggregate of which does not exceed the selected main channel rate; channel rate selection via modem control panel or DNCS ● 2660 accommodates optional integral 6-channel buffered multiplexer ● for point-to-point operation only; cannot used with CS 48FP or V.27 bis operating modes on 2620 & 2640.

4-Channel Buffered Multiplexer for 2620 & 2640:

$45/$35 mo	$700 prch	NC/NC maint

6-Channel Buffered Multiplexer for 2660:

70/55	1,200	NC/NC

Modem Sharing Unit (MSU) ● a feature of the multiplexer option for resource sharing ● user can share full modem bandwidth or that assigned to a single multiplexer port ● each port configure for MSU operation utilizes entire channel bandwidth and contends, via the RTS signal, to transmit on channel bandwidth allocated for MSU operation ● MSU function restricted to single multiplexer channel, but physical mux ports divided between MSU-assigned and actual multiplexer channels ● can be used in point-to-point or multipoint modes:

NC/NC	NC	NC/NC

Codex 2600 Series Modems
Models 2620, 2640 & 2660

Secondary Channel ● a narrow-band, low-speed, full-duplex channel FDM multiplexed with the main high-speed channel ● provides control path for passing control, monitoring, and configuration information between the central-site Codex DNCS system and central-/remote-site modems ● asynchronous FSK modulation with selectable rates of 75/110/150 bps (2620 & 2640) or 75/110 bps (2660):

NC/NC	NC	NC/NC

Async/Sync Converter ● included with multiplexer option ● converts asynchronous data at the digital electrical interface to a synchronous data stream (and the converse):

NC/NC	NC	NC/NC

Digital Interface ● EIA RS-232C/CCITT V.24/V.28 all ports ● 25-pin electrical connector:

NC/NC	NC	NC/NC

☐ Control Functions

Failure Recovery ● provides immediate recovery from line or modem failures ● switches modems at attended and unattended sites between 4-wire dedicated line and 2 dial-up lines to restore comunications interrupted by line failure/degradation ● switched data terminal equipment and 4-wire dedicated line between faulty modem and hot-spare modem to restore communications interrupted by modem failure/degradation.

Dual Dial Restoral (DDR) Unit ● switches attended-site modem between dedicated and switched lines ● FCC-certified ● manually or Codex DNCS controlled standalone unit ● originate only:

$45/$40 mo	$650 prch	NC/NC maint

Dial Backup Auto-Answer Unit ● switches unattended-site modem between dedicated and switched lines ● automatically answers calls on switched lines ● FCC-certified standalone unit ● central site modem or DNCS control:

NA/NA	NA	NA/NA

☐ Diagnostics & Status Indicators

Comprehensive diagnostics isolate failures in local and remote modems or dedicated line ● manual (modem) or DNCS control of diagnostic functions ● visual indication of operating conditions; visual warning and alarm monitoring of deteriorating or abnormal conditions.

Loopback Tests ● terminal loopback in accordance with CCITT V.54 Loop 1; local digital loopback in accordance with CCITT V.54 Loop 2; local analog loopback in accordance with CCITT

V.54 Loop 3; audio loopback in accordance with CCITT V.54 Loop 4; and double analog loopback loops analog side of modem and send and receive side of communication line:

NC/NC mo	NC prch	NC/NC maint

Poll Test ● end-to-end test for monitoring multipoint networks or for block error rate testing of point-to-point networks ● when initiated from DNCS, test message length is operator-configurable:

NC/NC	NC	NC/NC

Eye Pattern Generator (EPG) ● diagnostic tool used with an oscilloscope to evaluate telephone line performance ● converts equalizer digital inputs to analog voltages that are displayed as an "eye" pattern:

NC/NC	NC	NC/NC

Power-Up Self Test ● modem device test which internally loops test patterns through modem itself:

NC/NC	NC	NC/NC

Circuit Quality Monitoring System (CQMS) ● provides noninterruptive qualitative monitoring of line conditions ● estimates line degradations by averaging the differences in magnitude and phase of the equalized received signal from the values that would result from an undistorted channel; averages are then compared to DNCS-established thresholds ● measured parameters include: signal-to-noise ratio phase jitter, phase hits, gain hits, impulse hits, dropouts, receive level, marginal polls, transmit level, retrains, harmonic distortion, frequency offset, and error probability:

NC/NC	NC	NC/NC

Multipoint Signal Quality Binning (MSQB) ● standard 2640 feature for multipoint environments ● used with DNCS to track the individual performance of the inbound line from each slave modem (up to 15) by providing the poll percentage from each slave with high error probability:

NC/NC	NC	NC/NC

Status Indicators ● indicates power on; alarm; fallback; test mode; circuit quality; receive signal quality; and EIA interface signal activity including: TXD, RXD, RTS, CTS, DSR, DTR & DCD (all EIA status indicators related to selected modem port) ● 8-character digital display for operating mode and status, data rates, diagnostics, etc.

● END

Codex CS Series Modems
Models CS 48FP, CS 96FP, CS 4800 & CS 9600

■ PROFILE

Function ● high-performance modems with network control capabilities for dedicated facilities.

Communications/Networks ● synchronous 4800-/9600-bps point-to-point, multipoint, and multichannel communications over unconditioned 4-wire dedicated Type 3002 facility ● non-AT&T compatible ● designed for use with Codex Distributed Network Control System (DNCS).

First Delivery ● 1981.

Units Delivered ● undisclosed.

Comparable Systems ● principal competition from AT&T Dataphone II modems 2048A/C and 2096A; IBM 3864/3865; Intertel MCS4800/MCS9600; Paradyne MP/MPX Series; Racal-Milgo CMS 4801/CMS 9601.

Vendor ● Codex Corporation, Subsidiary of Motorola Inc; 20 Cabot Boulevard, Mansfield, MA 02048 ● 617-364-2000.

Distribution ● nationwide via local Codex direct sales/service offices and worldwide via distributors ● Canada via ESE Limited ● Great Britain via Codex Limited ● Europe via Codex Europe S.A., Brussels, Belgium ● Asia via Codex Far East, Tokyo, Japan.

■ ANALYSIS

The Codex CS Series are established network control modems which have only experienced price changes over the past year. In an attempt to retain this mature line's competitive positioning, Codex has reduced purchase prices by approximately 20 percent. Lease pricing for the Model CS 96FP has also been lowered by approximately 10 percent.

The Codex strategy of incorporating network control and management functions into its modem offerings was reinforced by last year's unveiling of the 2600 Series. Intended to supersede the CS Series as the Codex high-end modem offering, the 2600 Series comprises 3 models: the 4800-bps Model 2620, the

PURCHASE PRICE RANGE

hardware ▬▬▬

5-yr maint fee ▭

CS 48FP — $3.7K to $7.1K

CS 4800 — $4.2K to $7.5K

CS 96FP — $5.4K to $8.7K

CS 9600 — $5.9K to $9.2K

$3K $6K $9K $12K

CODEX CS SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for hardware (solid bars), and for associated 5-year period maintenance (open bars) ● **CS 48FP small** configuration consists of CS 48FP 4800-bps modem; **large** of CS 48FP 4800-bps modem with 150-bps auxiliary user channel, alternate voice/data handset, dual dial backup/auto-answer, and modem substitution switch ● **CS 4800 small** configuration consists of CS 4800 4800-bps modem with 4-channel multiplexer; **large** of CS 4800 4800-bps modem with 4-channel multiplexer, auxiliary 150-bps user channel, dual dial backup/auto-answer, and modem substitution switch ● **CS 96FP small** configuration consists of CS 96FP 9600-bps modem; **large** of CS 96FP 9600-bps modem with alternate voice/data handset, dual dial backup/auto-answer, and modem substitution switch ● **CS 9600 small** configuration consists of CS 9600 9600-bps modem with 4-channel multiplexer; **large** of CS 9600 9600-bps modem with 4-channel multiplexer, dual dial backup/auto-answer, and modem substitution switch.

9600-bps Model 2640, and the top of the line Model 2660 for 9600- to 16.6K-bps transmission. The 2600 Series embraces new technology and advanced features in an effort to achieve improved levels of performance and reliability.

The 2600 Series combines a Motorola 68000 microprocessor and custom VLSI signal processing to implement advanced modem algorithms. Built-in network control for monitoring and testing lines and devices can be initiated directly from the 2600 Series Control Panel or from a central site Codex DNCS network control system. The 2660 employs Trellis Coded Modulation which utilizes an advanced error correction scheme to insure transmission reliability at high speeds. While the 2600 Series directly responds to the growing demand for reliable high performance data transmission, it is not totally compatible with the rest of Codex's products. The CS Series, although essentially replaced by the 2600 entry, does remain transmission compatible with other Codex product offerings.
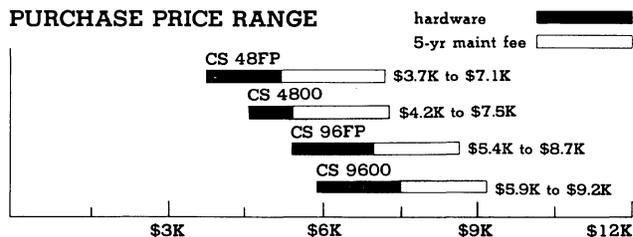
CS Series modems are microprocessor-based (Motorola 6800) high-performance units designed to operate in a point-to-point or multipoint network under control of the Codex Distributed Network Control System (DNCS). The DNCS is not required for modem operation within a network; operations can be performed manually without the use of network control functions. However, the higher cost of the modems reflects DNCS support.

In a network control environment, the modems automatically alert users of deteriorating line conditions so that remedial action can be taken short of line failure. The user can quickly pinpoint failures through modem-executed diagnostics that isolate failures within central or remote site modems, or the line. The diagnostics are automatically executed in response to operator commands at the central-site DNCS console. Options are available for remedial recovery from modem or line failures through modem substitution or dial backup. Fallback data rates support the possible resumption of communications with tolerable error rates over degraded facilities.

Without DNCS control, user awareness to degradation or failure, and diagnostic testing is severely limited. The user is alerted to degradation or failure through visual observance of front-panel indicator lamps, which indicate good, marginal, or poor communications based on bit error rate measurement. Diagnostic tests are performed through front-panel controls which establish loopback paths and generate a pseudo-random bit pattern for failure isolation.

The CS Series modems are split into 2 sets of 2 models. Each set is designed for a specific application. Models CS 48FP and CS 96FP are designed for multipoint communications where a fast response to polling is necessary to cut down on extensive delays

Codex CS Series Modems
Models CS 48FP, CS 96FP, CS 4800 & CS 9600

when servicing several drops. These models respond to polling in just 9 milliseconds, the fastest response time in the industry. Models CS 4800 and CS 9600 are designed to eliminate the cost of separate dedicated lines or for separate multiplexers and modems to handle as many as four synchronous devices. These modems can also be used in a multipoint environment, but their excessive training time, about 100 milliseconds, makes them unsuitable for multipoint operation.

The Codex CS Series modems reflect the continued trend for network control among high-performance modems for dedicated networks. Network control eliminates excessive downtime which plagues most networks, spares revenue and business lost to downtime, and is crucial to productivity.

☐ Strengths

The Codex CS Series modems offer several important user benefits. Principal among these are the advantages of network control to eliminate excessive downtime. It puts the network manager in touch with the performance of his network, and gives him the tools to quickly isolate failures, removing the guesswork from failure isolation. It also allows him to restore communication through temporary alternate paths until a failure is resolved.

High reliability, an extremely low error rate with a high signal-to-noise ratio over unconditioned lines, and low power consumption are other important considerations. The expected MTBF is in excess of 30,000 hours, which means the modem should operate constantly for almost 3.5 years without a failure. The modems are expected to achieve a bit error rate of less than one error in one million bits. However, C2 conditioning may be required for optimum performance over degraded circuits. Power consumption is just 35 watts.

The fast poll capability of the CS 48FP and CS 96FP modems is an important consideration for multipoint networks. It significantly reduces the time lost to training time delays, which can be substantial where there are many drops per line. This is a valuable asset where volume traffic conditions exist.

The Alternate Voice/Data option is beneficial to applications that require voice coordination between central and remote sites. It eliminates the cost of a separate telephone circuit for voice communications, which can be quite expensive over long distances.

The extended cable distance between data terminal equipment and modem supported by the modem's RS-423/CCITT V.10 electrical interface is an important consideration to applications requiring cable distances greater than the 50-foot limitation imposed by the RS-232 standard.

Codex is a leader in the data communications industry, and is one of the early pioneers and innovators of high-performance modem technology. It was one of the first vendors to introduce a 9600-bps modem for communication over a voice-grade facility, made possible by its patented QAM modulation technique. Since its inception in 1968, Codex has dedicated itself to the data communications marketplace and has expanded its product line to include a full line of low- to high-speed modems including AT&T-compatible models, statistical multiplexers, network processors, network control systems and support products, tech control equipment, intelligent terminals, electronic data switches, and local area network products. In short, Codex is a single-source vendor, and it has maintained its innovative role in the industry. Codex provides strong product support through its own nationwide sales force and service organization. The company has gained a sound reputation for itself as a vendor of highly reliable, solid products.

☐ Limitations

There are no obvious serious limitations in the Codex CS Series product line. However, the user should be advised that these modems are designed primarily for use with the Codex Distributed Network Control System (DNCS) and contain microprocessor control for DNCS support. Users who do not plan to incorporate network control into their network should consider the Codex LSI Series or equivalent modems. These modems are

transmission compatible with the CS Series and identical in capability and performance, but are priced considerably below the CS Series since they do not include network control as a standard feature.

■ HARDWARE

☐ Terms & Support

Terms ● available for purchase or for lease under 1-, 2-, 3-, 4-, or 5-year agreement; leases include maintenance for term of lease ● first-year maintenance free of charge for purchased units ● lease/purchase credit is 75 percent of lease paid out ● 1-year warranty for purchased units ● quantity discounts available for purchased or leased units.

Support ● installed by user or by Codex; installation charge is $64; installation charge on per-unit per-site basis; minimum installation charge $165 within 100 miles of Codex service center (Zone A); $340 over 100 miles (Zone B) ● 3 service plans: Fixed Price/On-Call/Factory Maintenance ● Fixed Price maintenance performed under annual contract during prime-shift hours 8:00 AM to 6:00 PM, Monday through Friday; $18 per month Zone A; $30 per month Zone B ● On-Call maintenance billed for time and materials plus transportation; material replaced or repaired at Codex option ● Factory Maintenance includes cost of material and labor ● Fixed Price/On-Call Maintenance performed by Codex nationwide service organization.

☐ Overview

The 4 models of the Codex Network Control Series family are designed for point-to-point and multipoint network configurations in a network control environment. The modems are components of the Codex Distributed Network Control System (DNCS) and contain microprocessor controlled logic to execute commands entered at a central site DNCS operator console. Network control commands and functions are transmitted between the DNCS system and individual modems via a full-duplex narrowband secondary channel supported by each modem. Functions supported and executed by the modems include monitoring of both analog and digital interfaces for abnormal conditions that exceed user-defined alarm thresholds, diagnostic testing procedures, and remedial recovery from failures.

Models CS 48FP & CS 96FP ● identical in performance to CS 4800 and CS 9600 except that they are designed with millisecond "fast-poll" training capability to provide quick response to central site poll message inquiries ● these modems also provide split data rate selection; transmit and receive data rates are independently selectable.

Models CS 4800 & CS 9600 ● multichannel modems that contain integral 4-channel buffered TDM multiplexer ● channels accommodate any mix of colocated terminals and tail circuits ● up to 4 independent synchronous data streams can be multiplexed at channel rates from 1200 bps to 3600 bps (CS 4800) or 7200 bps (CS 9600) ● internal or external clocking permitted ● data rate selection and channel configuration can be performed manually at the modem, or automatically from central-site DNCS console.

CS 48FP & CS 96FP Configuration ● standalone or rackmount; 1 or 2 units side-by-side in sliding drawer rackmount ● secondary channel for DNCS control ● optional secondary channel on CS 48FP for user-specified applications.

CS 4800 & CS 9600 Configuration ● standalone or rackmount; 1 or 2 units side-by-side in sliding drawer rackmount ● 4-channel buffered TDM multiplexer ● secondary channel for DNCS control ● optional secondary channel on CS 4800 for user-specified applications.

☐ Packaged Modems

Standalone packaging standard; rackmount optional at extra cost ● sliding drawer rackmount kit fits standard 19-inch equipment rack ● kit accommodates single modem or dual modems in side-by-side arrangement.

Codex CS Series Modems
Models CS 48FP, CS 96FP, CS 4800 & CS 9600

Model CS 48FP • standard 4800-bps fast-poll modem with DNCS control:

$135/$115 mo	$3,750 prch	$18/$30 maint

Model CS 4800 • standard 4800-bps modem with DNCS control and integral 4-channel multiplexer:

160/130	4,250	18/30

Model CS 96FP • standard 9600-bps fast-poll modem with DNCS control:

200/175	5,400	18/30

Model CS 9600 • standard 9600-bps modem with DNCS control and integral 4-channel multiplexer:

245/210	5,900	18/30

Drawer Rackmount Kit • equipped with sliding drawer for easy modem access • single/dual modems • requires 7-inch vertical mounting space:

10/5	85	NC/NC

☐ Application

Point-to-point or multipoint communications over unconditioned 4-wire dedicated Type 3002 voice channel • C2 conditioning recommended for optimum performance over degraded facilities • CS 48FP and CS 96FP specifically designed for multipoint communications; both provide 9-millisecond RTS/CTS delay with switched carrier • CS 4800 and CS 9600 specifically designed for multiport communications over point-to-point line.

☐ Operating Parameters

Synchronous half-/full-duplex; selectable data rates • CS 9600 selectable at 9600/7200/4800 bps • CS 96FP transmit selectable at 9600/7200/4800 bps; receive selectable at 4800/2400 bps or 2400 bps with auto-shift to 4800 bps • CS 4800 selectable at 4800/2400 bps • CS 48FP transmit selectable at 4800/2400 bps; receive selectable at 4800/2400 or 2400 with auto-shift to 4800 bps • automatic adaptive equalization • QAM modulation.

☐ Channel Functions

Multiport • CS 9600/CS 4800 contain integral 4-channel buffered multiplexer • any mix of synchronous rates from 1200 bps to 7200 bps on CS 9600; 1200 bps to 3600 bps on CS 4800 • selectable rates; 7 combinations on CS 9600; 4 combinations on CS 4800 • Codex DNCS control:

NC/NC mo	NC prch	NC/NC maint

Secondary Channel • a narrow-band, low-speed, full-duplex channel FDM multiplexed with the main high-speed channel • provides control path for passing control, monitoring, and configuration information between the central-site Codex DNCS system and central-/remote-site modems.

CS 9600/CS 96FP • asynchronous FSK modulated to 75 bps:

NC/NC	NC	NC/NC

CS 4800/CS 48FP • asynchronous FSK modulated to 150 bps:

NC/NC	NC	NC/NC

MO: single-unit 1-year/2-year monthly lease charges with maintenance included. PRCH: single-unit purchase price. MAINT: monthly Zone A/Zone B maintenance charge for purchased units. NC: no-charge item. Prices are current as of December 1984.

Auxiliary Secondary Channel • FSK, 150-bps, asynchronous secondary channel for user-specified applications • available for CS 4800 and CS 48FP modems only:

30/25	525	NC/NC

Digital Interface • EIA RS-423/CCITT V.10 all ports; downward compatible with RS-232C/CCITT V.24/V.28 • 25-pin electrical connector • DTE/DCE cable distance extended to 100 feet:

NC/NC	NC	NC/NC

☐ Control Functions

Alternate Voice/Data • equips CS 48FP and CS 96FP modems with telephone handset for alternate voice/data communications:

$25/$20 mo	$385 prch	NC/NC maint

Failure Recovery • provides immediate recovery from line or modem failures • switches modems at attended and unattended sites between 4-wire dedicated line and 2 dial-up lines to restore communications interrupted by line failure/degradation • switches data terminal equipment and 4-wire dedicated line between faulty modem and hot-spare modem to restore communications interrupted by modem failure/degradation.

Registered Dual Dial Restoral Unit • switches attended-site modem between dedicated and switched lines • FCC-certified manually or Codex DNCS controlled standalone unit • originate only:

12/7	250	NC/NC

Dial Backup Auto-Answer Unit • switches unattended-site modem between dedicated and switched lines • automatically answers calls on switched lines • FCC-certified standalone unit • central site/DNCS control:

25/20	435	NC/NC

Standalone Modem Substitution Switch • switches analog and digital connections between primary modem and hot-spare backup modem • central-site/DNCS control:

30/25	635	NC/NC

☐ Diagnostic & Status Indicators

Comprehensive diagnostics isolate failures in local or remote modems or dedicated line • manual or DNCS control of diagnostic functions • visual indication of operating conditions; visual warning of deteriorating or abnormal conditions.

Loopback Tests • local analog loopback in accordance with CCITT V.54 Loop 3; local digital loopback in accordance with CCITT V.54 Loop 2; double analog loopback loops analog side of modem and send and receive side of communications line:

NC/NC mo	NC prch	NC/NC maint

Test Pattern Generation • integral pseudo random generator/comparator for error testing; can be used with loopback • integral eye pattern generator for external oscilloscope display and measurement of phase jitter, harmonic distortion, white noise, phase/amplitude hits, etc:

NC/NC	NC	NC/NC

Status Indicators • indicates operating mode; data rate; test mode; circuit quality; and EIA interface signal activity • circuit quality indicators for bit error rate of less than 1 bit error in 100,000 bits; 1 bit error in 100,000 to 10,000 bits; 1 bit error in less than 10,000 bits to indicate good/marginal/bad line or modem.

• END

Codex Distributed Network Control System (DNCS)
DNCS 200, 300 & 400 Network Control/ Management Systems

■ PROFILE

Function • network control system (DNCS 200/300) and network control and management reporting system (DNCS 400)

Communications/Networks • DNCS 200 supports up to 8 or 16 4-wire dedicated Type 3002 lines; DNCS 300 supports 2 to 124 Type 3002 lines in 2-line increments; DNCS 400 supports 2 to 496 Type 3002 lines in 2-line increments • accommodates 16 line segments per line port • DNCS 200 addresses 3,168 drops (modem addresses) maximum, 198 drops per line maximum; DNCS 300 addresses 24,552 drops maximum, 198 drops per line maximum; DNCS 400 addresses 98,208 drops maximum, 198 drops per line maximum • accommodates Codex CS and SP series modems equipped with integral network control; accommodates other Codex modems or non-Codex modems equipped with plug-in or wraparound network control • 150-bps or 75-bps secondary channel supports network control functions

First Delivery • April 1980 (DNCS 300); August 1981 (DNCS 200); October 1981 (DNCS 400)

Systems Delivered • unknown

Comparable Systems • principal competition from AT&T Information Systems Dataphone II Service, General DataComm Netcon 5, IBM 3860 Series modems with NPDA software product, Intertel Series 90, Paradyne ANALYSIS System, Racal-Milgo System 185 and CMS 1000/2000 Systems

Vendor • Codex Corporation, Subsidiary of Motorola Inc; 20 Cabot Boulevard, Mansfield, MA 02048 • 617-364-2000

Distribution • nationwide via local Codex direct sales/service offices and worldwide via Motorola and distributors • Canada via ESE Limited • Great Britain via Codex Limited • Europe via Codex Europe S.A., Brussels, Belgium • Asia via Codex Far East, Tokyo, Japan

■ ANALYSIS

Codex has not changed DNCS significantly over the past year, although major enhancements await in the wings. The company

PURCHASE PRICE RANGE

hardware ▮▮▮▮
5-yr maint fee ▭▭▭▭

DNCS 200
▮▭ $11.9K to $31.2K
DNCS 300
▮▮▭ $29.5K to $81K
DNCS 400 — $79.5K to $254.2K

| $60K | $120K | $180K | $240K | $300K |

CODEX DNCS SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for hardware (solid bars), and for associated 5-year period maintenance (open bars); maintenance contracts for purchased DNCS 400 systems require special quotation from Codex • **DNCS 200** small configuration consists of an 8-line system with system printer; large consists of a 16-line system with printer, desk, and accessories • **DNCS 300** small system configuration consists of a diskette-based system with 2 secondary channels and system printer; large of a rigid disk-based system with 124 lines, system printer, desk, and accessories • **DNCS 400** small configuration consists of a 2-line kernel system; large of a kernel system with 496 lines, 4 distributed network processors, 2M bytes of main memory, 6 system printers, and 6 network consoles; does not include management report software licenses or monthly fees.
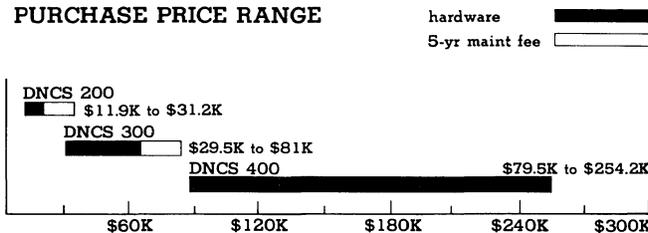
added the SP series of diagnostic modems which operate under DNCS control. The new SP series are basically similar to the established CS series with integral diagnostics, but operate at higher data rates: the first model in the SP series is a 14.4K-bps variant. In a major development, however, Codex announced the Extended Management Reports option for the DNCS 400. This option will provide user-definable management reporting and will replace the 3 existing software packages that presently handle administrative functions for Codex' high-end network control system. Perhaps in preparation for the new option or as a general enhancement, the company increased the DNCS 400 maximum main memory capacity from 1 to 2 megabytes, and also increased the maximum allowable number of operator consoles from 4 to 6. Pricing has neither decreased nor increased significantly across the board during the past year.

The Distributed Network Control Systems are a maturing line of sophisticated network control and management products. They are part of a company that has been dedicated to data communication since the early 1960s: Codex is an engineering-oriented firm committed to product excellence and to serving the broad requirements of the data communications user. With this in mind, the company has developed a network control philosophy based on 2 major tenets; namely, network integrity and management of service levels. Although not a unique philosophy, it nevertheless is backed by a comprehensive array of diagnostic capabilities in the form of DNCS, and in the reliability of various Codex components spread throughout a network.

DNCS systems can continuously monitor a network for component failures and degradation; perform specific tests to isolate component and line failures; and undertake remedial recovery to insure network integrity. These functions are standard for most network control systems. What separates DNCS from the pack is the extraordinary amount of control afforded to the user over various monitor and alarm parameters for network components, and especially over analog parameters on a traditionally weak link: the TelCo line. DNCS operators can establish individual alarm thresholds for literally each and every

Codex Distributed Network Control System (DNCS)
DNCS 200, 300 & 400 Network Control/Management Systems

modem and line in the network; or if this proves to be unnecessary or too tedious for an entire network, similar groups of thresholds can be set all at once for an entire multipoint line, or for any other user-defined subset.

Measuring analog line quality is a hotly debated issue among network vendors and users. Some claim the practice is irrelevent and misleading because measurements are not made in the same manner as the phone company. When AT&T tests a line, it "removes" it from the network and sends down a tone from which measurements are taken. DNCS, on the other hand, tests actual data signals as they pass down the line in the real-time environment. Therefore, line measurements by both DNCS and TelCo equipment are open to time-sensitive variations. Another factor in the Codex/TelCo variation is that neither takes a measurement at the same point in the line, and different equipment is used for the job. Codex, though, claims that while measurements from the Telco and DNCS might be off by a constant, both readings should reflect the same trends. Moreover, any additional information on leased line activity, including analog measurements, is an asset and a boon to network managers. Signal monitoring is an effective tool for providing tighter control over network facilities, and can expedite corrective actions on the part of the phone company to correct line deficiencies.

Codex entered the data communication market as a high-speed modem vendor, introducing the first 9600-bps modem in the late 1960s. The company continues to be a prime supplier of modems, and routes DNCS control signals through these devices over a narrowband secondary channel. Network modems are the eyes and ears of DNCS, but modems are also where network control ends: surveillance and control cannot extend to the terminal level or through standalone network multiplexers, although multipoint modems with integral TDM multiplexers can be used. Original DNCS customers had to purchase plug-in modules containing the network control circuitry for their Codex LSI or MX series modems, or install a standalone "wraparound" device for non-Codex modems. In 1981 the company introduced the CS series of high-performance modems which contain integral DNCS circuitry. Network control cards and the wraparound unit are still being marketed, but it is more cost effective and efficient to replace other modems with the CS series.

In describing DNCS architecture, it is difficult to convey concepts in lucid terms. Network control terminology, like other data communication patois, has not been standardized within the industry. DNCS supports a multitier network structure, which can be explained as follows. DNCS systems provide from 8 secondary channels at the low end of the DNCS family to 496 secondary channels on a full-blown DNCS 400. Although Codex and others call these "lines," it may be confusing to some because a "line" can be segmented into multiple Telco leased circuits. A DNCS secondary channel supports up to 16 Type 3002 4-wire circuits (segments) in various arrangements, including point-to-point, multipoint, and point-to-point circuits with TDM multiplexing—and all possibly on the same "line" in back-to-back configurations. Therefore, the number of "lines" attached to central site modems supported by a DNCS system is equivalent to the system's maximum number of secondary channels. For example, a full-blown DNCS 400 supports up to 496 lines and 7,936 line segments. Furthermore, each secondary channel can accommodate up to 198 drops, or modem addresses, which is more than adequate for the majority of private networks.

The DNCS product line is presently comprised of 3 upward-compatible systems. DNCS 200 and DNCS 300 are microprocessor-based units limited to 1 network control console apiece, and designed for small- to medium-sized networks. The DNCS 400 is a minicomputer-based unit with a Data General S/140 Eclipse at the heart of the system; it can be composed of multiple sub-units either centrally located or remoted throughout the network for greater flexibility. The DNCS 400 also supports network management software to facilitate the administrative and management tasks of an extensive network and its various components.

Codex has announced an Extended Management Reports option for the DNCS 400. A replacement for 3 currently existing management report options, the new extended option adds a

screen generator and report generator to the INFOS II file management system, allowing users to tailor administrative tracking and reporting functions to their own needs. Extended Management Reports will provide standard formats for tracking network equipment problems and for keeping tabs on inventory in a manner similar to the present system; however, the formats have been enlarged and improved, and the structure is no longer rigid: users will be able to add/delete/modify the formats, or create entirely new data structures to meet specific requirements. Major formats in Extended Management Reports, defined by Codex, include Site/Equipment/Vendor/Problem/Alarm/Financial Management, and Report Generation. Financial Management, an entirely new category, will track financial information such as equipment leasing terms and purchase versus lease terms. The new option is not an enhancement to the 3 previous management software packages, but an entirely new package with system-oriented utilities including backup and restoral, archiving, purging, and a "comprehensive" online help facility for DNCS operators. Extended Management Reports will cost users between $9K and $10K for a one-time license, but Codex will provide the new option free-of-charge to existing customers with the older Management Reports options. The extended option is scheduled for December 1983 release; Codex will discontinue the 3 older software packages.

Codex also plans to soon unveil a host link option providing a link between DNCS and IBM host computers. Basically a protocol converter for transforming a DNCS-originated asynchronous data stream into an IBM 3270 BSC format, the host link option will enable real-time, interactive control of DNCS from an IBM host computer. This arrange would provide 3 separate advantages for DNCS users: DP'ers could work with a CPU they are already familiar with; users could format DNCS data into reports using a host-resident database management system (DBMS); and users could increase the number of remote/distributed DNCS locations beyond the limits imposed by Codex, by employing inexpensive nodal processors tied by communication lines to the host computer. Codex also plans to offer a 3270 SNA link sometime later in 1984.

Codex is a dynamic company with the resources to effectively upgrade existing products and bring new developments to market. It is investigating other enhancements for the DNCS line, which may include extension of network control beyond the modem level. There is a trend now among network control vendors to incorporate response-time measuring; this has already been done by Intertel with its Series 90, which now offers the optional 90/15 Performance Measurement Feature. It is extremely valuable to be able to combine these 2 functions, as separate control and performance measurement systems cannot operate simultaneously on the same network; it will be interesting to see if Codex provides its own response time measuring for DNCS in the near future.

☐ Strengths

DNCS is a flexible family of systems designed for small to very large networks. Users can expand a system from a small configuration of 8 lines to a network with as many as 496 lines to accommodate growth. Each secondary channel supports up to 198 modem drops per line, and hot spare modems occupy the same address as primary modems; this capacity is more than adequate for the majority of networks. Furthermore, at the high end the DNCS 400 allows multiple controller stations to be physically spread throughout a network, providing additional configuration flexibility. Management reporting is also available through the DNCS 400, providing valuable cumulative data for network managers in an understandable (and soon to be user-definable) format; options such as these are not always available on competitive systems.

The out-of-band secondary channel approach used by DNCS to monitor network performance is non-interfering with normal data communication activity. Other major systems, from IBM for example, employ an in-band approach that adds overhead to normal communication and can affect throughput.

DNCS alarm thresholds are established by the user for entire network subsets or for individual components. Individual sites or parameters can be masked-out from the monitoring process as

Codex Distributed Network Control System (DNCS)
DNCS 200, 300 & 400 Network Control/Management Systems

well. A key feature of DNCS is its measurement of analog line parameters in addition to digital interface parameters. This important feature alerts the user to degrading line conditions that reduce performance. The level of control that DNCS affords over digital and analog parameters is almost unique in the industry.

The CS series modems designed by Codex for use with DNCS exhibit high performance and reliability; they incorporate the fastest training time in the industry, and error rates are reportedly less than 1 error in 1 million bits. Codex also provides options to accommodate older Codex modems as well as non-Codex modems, and supports IBM 3600 Loop Systems through its MX2400 modem with a standalone option. Codex provides its own field service, which is often of a higher quality than third-party service; Codex is a subsidiary of giant Motorola Inc.

☐ Limitations

The DNCS out-of-band technique for transmitting diagnostic and control signals prohibits its use over AT&T's DDS network as well as over value-added networks, which will not pass secondary channels. IBM's in-band approach to network control, on the other hand, is amenable to DDS and the VANs.

The DNCS does not presently provide diagnostics to the terminal level; standalone TDM or statistical multiplexers are also not supported, and must be bypassed by DNCS in the user's network. Network modems must be continuously polled, or monitored, on the secondary channel for notification of abnormal or degrading conditions, a time-consuming process. Some diagnostic modems from competing vendors (Racal-Milgo for example) are self-monitoring and give unsolicited alarms upon detection of any failures.

The DNCS does not provide automatic diagnostic testing of all or user-selected sites during inactive periods (after normal business hours) such as performed by the Intertel Series 90.

The wraparound option for non-Codex modems and older Codex modems with add-in DNCS circuitry do not include the comprehensive capabilities offered by the newer Codex CS and SP series modems. The wraparound option, for instance, does not support modem fallback to a lower data rate.

Codex's recently announced Extended Management Features option for the DNCS 400 will use the INFOS II file management system now resident on DNCS 400 systems. INFOS II does not have the power of a true DBMS, is more difficult to use, and requires more work to update files and perform file maintenance; nor does it have a true query capability. However, Extended Management Features is cheaper than a true DBMS by tens of thousands of dollars, and sophisticated DP shops could conceivably program active DBMS-like structures (file linkages) into the Data General software. Paradyne's new ANALYSIS 5530 network control system reportedly supports a relational DBMS for user-definable reporting structures, and may be a more effective alternative for some users.

Codex presently does not provide a response-time measurement system, like Intertel, which could be used in conjunction with DNCS. Such a system would provide valuable data on a network's performance, and could be used to improve network performance, to provide assistance in testing or troubleshooting, or to assist network planning.

■ SOFTWARE

☐ Terms & Support

Terms ● DNCS Control Program bundled with hardware system pricing; management reports software available for a one-time license fee or lease under 1-, 2-, 3-, 4-, or 5-year agreement; leases include maintenance for term of lease ● other software terms are identical to hardware; listed under HARDWARE section.

Support ● software support service is automatically included in monthly lease and is identical to hardware; listed under HARDWARE section.

☐ Operating System

DNCS 200 and DNCS 300 systems run under proprietary operating systems; DNCS 400 runs under Data General AOS operating system with SORT/MERGE and INFOS II file manager. Operating systems and Control Program are bundled with hardware.

☐ DNCS Control Program

System Control

System control is performed by the operating system under the direction of the console operator through keyed commands, operating parameters, and system information; system executes commands entered into operator console keyboard and interacts with operator through displayed menus, formats, prompts, and error messages; menus and task-related formats are key-selectable for all activities; formats contain discrete fields for entering operating parameters and other information ● master console initializes system; all consoles operate independently; password protection against unauthorized use ● system automatically performs self-test on power-up.

System Commands ● power-up/-down and initialize system; create and modify entries in system activity files.

Diagnostic Commands ● conduct individual qualitative and quantitative tests at selected sites and abort tests.

Monitor Commands ● enable/disable automatic monitor mode; display alarm status (abnormal conditions that exceed threshold values); and add/delete devices to/from a poll list ● alarm reports automatically logged on system printer as they occur.

Status Commands ● display condensed status of entire network or detailed status of EIA interface leads for specific device or statistical status of analog conditions for specific line.

Remedial Commands ● control dial backup; hot spare modem switching; terminal streaming through modem disconnection/restoration; data rate fallback and channel data rate reconfiguration (for multiple channel modems).

Loopback Commands ● establish/break analog or digital loopback path at specified remote device; analog loopback path on local modem; or initiate/terminate constant spacing condition (data clamp) on main channel of specified modem.

Utility Commands ● set time and date; change password; copy contents of disk on another; delete contents of configuration files; perform DNP port loopback test (DNCS 300 only); format diskette; list configuration files on printer.

Network Surveillance

Network Surveillance is performed continuously in the Monitor mode during active communication periods without interfering with network activity. Digital and analog modem and line parameters for devices specified in a polling list are monitored for alarm or status change conditions. Alarm conditions are abnormal conditions that exceed user-established operating thresholds. The operator is immediately alerted to an alarm condition both audibly and visually, the alarm condition is entered in the Alarm Status Display File, and logged on the printer. A corrected alarm condition is reported on the printed alarm log and is automatically deleted from the Alarm Status Display File.

System Activity Files

Five disk-resident system files store network activity information ● files created, accessed, modified, and deleted through operator console ● file contents displayable for review or printed for hard copy at operator command.

Network Configuration File ● contains NMU (DNCS 200) or DNP (DNCS 300/400) port address (1 to 16 for DNCS 200 or 1 to 124 for DNCS 300/400) and optional name, total number of devices (modems) online (198 devices maximum), secondary channel transmission rate (75/150 bps), and optional miscellaneous information such as circuit numbers, line data rate, number of tiers, etc; total devices/line supplied by system.

Line Configuration File ● contains device address and optional name, device type (model number of modem wraparound unit), master/slave designation (1 per segment), device's line segment

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(1 to 16), device's level number in multitier network (1 to 9), device's threshold group number (1 to 32), and optional miscellaneous information such as device or drop characteristics.

General Line Information File • contains additional user-specified information for each network device such as terminal type, dial backup numbers, modem serial numbers, scheduled maintenance date, and name/address/phone number of maintenance personnel.

Device Alarm Threshold File • contains user-established alarm threshold (limit) values and masks for 13 EIA interface signal parameters and 12 analog (line) signal parameters for individual Codex modems and wraparound devices; EIA alarm thresholds established for Codex LSI, MX, SP, and CS series modems only, and for Codex NA1296 wraparound option; alarm thresholds individually enabled/disabled (masked) and threshold established as signal duration in seconds (255-second default value) for RTS on/off, DTR off, DCD on/off, Good Data off (NA1296 excluded), Marginal Circuit on (MX2400 and NA1296 excluded), SQ off (NA1296 only), Auto Stream Disconnect (CS4800/9600 excluded), DSR off and Dial Backup on (time values and MX2400 excluded for last 2 parameters), plus 2 user-specified parameters • Good Data off indicates a hot error rate in excess of 1 error in 10,000 bits; Marginal Circuit on indicates a bit error rate in excess of 1 error in 100,000 bits; Auto Stream Disconnect threshold identifies extended RTS as streaming terminal and shuts down modem transmitter • analog alarm parameters established only for Codex CS and SP series modems and for MX2400 modems with CMQS (Circuit Quality Monitoring System) option; each alarm parameter assigned enable/disable (masks) status and quantitative value within available range; parameters include signal/noise ratio (10 to 30 dB), phase jitter (5 to 40 degrees P-P), frequency offset (2 to 8 Hz), non-linear distortion (25 to 35 dB second harmonic), receive level low/high (-40 to 0 dB), phase hits, gain hits, impulse hits; drop outs, retrains, and marginal polls (1 to 99 events per 15 minutes for last 6 parameters); MX2400 excluded for frequency offset, non-linear distortion, and retrain threshold parameters; enabled marginal polls parameter requires all other CMQS alarm thresholds to be disabled; CS4800/9600 modems excluded for marginal polls; marginal polls defined as apparent signal quality of received transmission from slave modem; value calculated over 5-minute period as 100 times the number of marginal polls divided by the total number of polls.

Alarm Status Display File • accumulates detected network abnormalities defined as conditions that exceed user-established parameter threshold values as they occur; each entry includes line and device address, date and time of alarm, alarm status, and total outstanding alarms; normalized alarms automatically deleted from file.

Diagnostic Tests

Diagnostic test procedures isolate and identify failures or degradation in network lines or components • specific diagnostic tests of designated components and lines executed at console operator command • network monitoring suspended for duration of test • active tests disrupt normal main channel communication; passive tests are not disruptive; modems automatically restored from test mode to normal mode via integral timer • maximum of 6 tests can be active concurrently; tests can be aborted at any time; each test conducted on specific line, line segment, and/or device; pre-defined test default parameters; 2 display formats per test, test definition format and test result format; test parameters are keyed into test definition format.

Poll Test • determines modem polling performance • master modem sends FOX message to 2 or more slave modems on line segment; each slave compares received message with that expected and records error count; slave sends test message to master modem which records error count; test results show error counts for each device tested • test parameters include line/segment/device address, total polls per slave (4 to 1020 in multiples of 4), total messages per poll outbound/inbound (0 to 99), all devices on line segment or identified devices only • test interrupts normal communication on main channel.

Line Bit Error Rate Test • pseudo-random bit pattern tests steady-state performance of line and modem via outbound,

inbound, or end-to-end test • outbound test sends test pattern from master modem to all slave modems; slaves check for proper receipt of test pattern • inbound test sends test pattern from slave modem to master modem; master checks for proper receipt of test pattern • end-to-end test sends test pattern from slave modem to master; master sends to slave; pattern is looped back to master and both outbound and inbound errors are reported • test results show devices and corresponding error rates • test parameters include line/segment/device address, test mode, and length of test in bits per test pattern • tests interrupt normal communication on main channel.

Device Bit Error Rate Test • device self test determines data integrity • device generates test pattern while it introduces to transmitter and is looped back to receiver; receive pattern compared with transmitted pattern and errors appear in test results • test parameters include line/segment/device address and length of test in bits per test pattern • test interrupts normal communication on main channel.

Transmit Level Test • specified modem measures own transmit signal level in dB; applies only to Codex MX and CS series modems • non-disruptive of normal communication for CS series modems; communication interrupted for MX series modems.

Receive Level Test • specified modem measures own main-channel receive signal level in dB; applies only to Codex MX and CS series modems • non-disruptive of normal communication.

DNP Port Loopback Test • DNCS 300/400 only • verifies integrity of DNP terminal port hardware on any configured line • FOX message sent and looped back on DNP terminal port; test results show number of messages in error and number of messages with timeouts • test parameters include line number/name, data rate (75/150/300/600/1200 bps), and number times test message repeated (1 to 255).

Remedial Recovery

Remedial recovery procedures restore communication interrupted by line outages or degradation, modem failure, or terminal or modem streaming conditions until faulty condition is corrected • recovery procedures conducted by console operator through keyed commands • dial backup, data rate fallback switching, and hot spare modem switching restore communication interrupted by line outage or degradation or by modem failure • terminal or modem streaming, a prolonged or continuous Request-To-Send (RTS) or modem carrier signal prevents use of multipoint line by other multidropped terminals; communication restored by disabling modem until condition is corrected.

Dial Backup • switches modem at remote (unattended) site between 4-wire dedicated line and 2 dial-up lines to restore communication interrupted by line failure or degradation; remote dial backup unit automatically answers call on DDD lines and switches modem from dedicated to dial-up lines; under console operator command, dial backup unit switches from dial-up to dedicated lines without terminating (hanging up) DDD call until dedicated line restoration is established.

Hot Spare Modem Switching • switches data terminal equipment and 4-wire dedicated line between faulty modem and hot spare (backup) modem under console operator command; restores communication interrupted by modem failure or degradation.

Modem Fallback/Reconfiguration • switches modem data rate to fallback rate to compensate for line degradation; reconfigures subchannel and main channel rates of multichannel modem; procedures executed under console operator command; Codex CS, LSI, or MX2400 modems only.

Streaming Recovery • disables streaming modem by disconnecting main or secondary data channels on DTE interface or main or secondary analog channels; restores disabled modem after streaming condition is corrected; procedures executed under console operator command.

☐ **Management Reports**

Three separately licensed software products that produce

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management reports are available only for the DNCS 400. These products eliminate manual administrative tasks including creating historical files for analysis of performance data, writing and tracking trouble tickets, and producing and maintaining an inventory file for installed equipment. The options make it much easier and more effective for the user to handle administrative information, especially when vital information such as a contact name or site information is needed in a hurry or when chronic network problems need to be identified to increase network performance. Management reports follow a rigid format that is unalterable by users, however, an undesirable characteristic soon to be remedied by an Extended Management Reports option (see ANALYSIS).

234 14 Network Analysis Summary Reports ● historical alarm file; contains all alarms reported through DNCS Monitor function; report information for each alarm includes date/time, Distributed Network Processor (DNP) number, line number/name, line segment, device number/name/type, alarm type, event code, and threshold level ● analysis of network alarms or any subset of it can be performed for specified time frame through 3 types of historical alarm reports: listing, histogram, or profile ● listing a printout of all records in file or partial file within specified time frame and selection of fields ● histogram is single-page graphic plot of alarms versus time increments within selected time frame and fields ● profile is matrix of number of occurrences per alarm type versus time increment within time frame; selection of system, DNP, line, or segment; first report in numeric alarm code order, second report ranked by occurrence of alarm codes within time frame ● earliest and latest dates of file records displayed for identification of file's time range:

$50/$45 mo	$1,000 lcns

234 15 Trouble Ticket System ● trouble report file for tracking malfunctioning equipment in network; Trouble Ticket reports equipment malfunction; ticket identifies device, location in network, type of failure, and related information ● Open Trouble Ticket reports an existing failure; Closed Trouble Ticket reports a resolved malfunction ● Open Trouble Ticket created by console operator when alerted to failure; ticket can be viewed, printed (listed), updated, and closed; tickets maintained in chronological order ● Closed Trouble Ticket can be viewed or printed (listed) for analysis ● Open and Closed Trouble Ticket formats are displayed for operator entry of data within specified fields:

25/22	500

234 16 Inventory System ● stores inventory information for all network devices; each record includes inventory number (supplied by system), name, address, and phone number of location where equipment is installed, equipment vendor and related vendor information, device type and serial number, network address of device, purchase/lease/installation/removal/refurbish date, purchase/lease/maintenance price, customer's account number, etc ● console operator can create inventory record, update, view, or print (list) records ● listing specified as inventory directory or as inventory listing ● inventory directory lists inventory records sorted by physical address, device address, or device type as specified by operator; default/listing is in order by inventory number ● inventory listing produced within a specified installation time frame; inventory records sorted by 1 to 4 operator-specified sort fields, where sort order is in priority of 1 to 4 (primary to lowest); default listing is in order by inventory number ● inventory listing sort fields are install/purchase/lease/state/zip code/service/region/vendor/device type/account ● inventory record formats are displayed for operator entry of data within specified fields:

25/22	500

☐ **Program Development/Languages**

Codex does not presently provide high-level compilers for the DNCS series. Applications for DNCS 200/300 are written in proprietary code; DNCS 400 applications written in PL/1, Codex applications code, and network control code. The DNCS 400 with optional Extended Management Reports provides a screen generator and report generator for user-definable report formatting.

■ **HARDWARE**

☐ **Terms & Support**

Terms ● available for purchase or for lease under 1-, 2-, 3-, 4-, or 5-year agreement; leases include maintenance for term of lease ● first-year maintenance free of charge for purchased units ● lease purchase credit is 75 percent of lease paid out ● 1-year warranty for purchased units ● quantity discounts for purchased or leased units.

Support ● installed by Codex; installation charges are $292 for DNCS 200; $463/$600 for diskette/rigid disk-based DNCS 300; and $1,471 for DNCS 400; large DNCS 400 systems incur additional charges at $246 per DNP and $25 per NCT; Zone B locations incur 20 percent higher charges ● 3 service plans: Fixed Price/On-Call/Factory maintenance ● Fixed Price maintenance performed under annual contract during prime-shift hours 8:00 AM to 5:00 PM, Monday through Friday ● On-Call maintenance billed for time and materials plus transportation; material replaced or repaired at Codex option ● Factory maintenance includes cost of material and labor ● Fixed Price/On-Call maintenance performed by Codex nationwide service organization.

☐ **Overview**

The DNCS series of Network Management and Control Systems all supervise network performance through network surveillance, diagnostic testing, and remedial failure recovery; the DNCS 400 at the top end can optionally provide network managers with status reports and graphs detailing network performance. Supervision is performed through a narrowband secondary channel attached to the primary communication channel; digital modem parameters and analog line parameters are continuously monitored for abnormal conditions according to user-defined alarm thresholds. Visual and audible alarms alert the network operator, and a record of the condition is logged on the system printer. In addition, status displays can be immediately called up with a summary of EIA/analog parameters for all or any network modems, lines, or subsets thereof. The network status is continuously updated as a function of normal network monitoring.

Diagnostic testing is manually performed by the console operator for specific lines or modems. Individually enacted tests such as loopbacks, bit error rate tests, and line level measurements can pinpoint line or modem degradations or failures. Most diagnostic tests interfere with normal network communication, but do not affect normal network monitoring on the secondary channel; up to 6 tests can be conducted simultaneously.

Remedial recovery initiated at the operator console (DNT or NCT) immediately restore communication interrupted by a line outage, modem failure, or streaming terminal. The console operator can restore communication by disabling a streaming terminal monopolizing a multipoint line, switching to a hot spare modem at a remote site to recover from modem failure, selecting a lower (fallback) data rate to compensate for line degradation, or by switching from a remote site modem dedicated line to dial backup to recover from a line outage, or switching from dial backup to dedicated facilities once the outage is corrected.

Optional licensed software products provide DNCS 400 users with: an Historical Alarm File including a sort and compare capability for entire lists of alarms or individual digital/analog parameters, which allows the user to spot relationships and trends among the various alarms; a Trouble Ticket System which documents equipment or line problems and the action taken to resolve the problem; and an Inventory System listing pertinent equipment information such as physical address, vendor, service policy and lease information. All files can be indexed or sorted according to the needs of network management.

Another feature of the DNCS 400 is the ability to configure it with multiple DNP's and associated peripherals that can be remoted

MO: 1-year/2-year monthly lease charge including maintenance. LCNS: one-time license fee. Prices effective as of September 1984.

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from the CPU as well as from each other. In this arrangement, the 400 itself can function as a distributed system with sub-sites located in optimal network locations; any site can be assigned master status of the network, and a multilevel password protection scheme provides security from unauthorized entry into the system. This distributed configuration, however, requires a pair of modems for each remoted DNP plus a Codex error controller for faulty message retransmission (ARQ).

DNCS 200 Configuration • central site system includes an operator console with integral network control logic, a dual diskette drive, and a system printer • provides 8 or 16 secondary channels • supports Codex CS series modems, Codex LSI or MX modems with plug-in channel card, or other modems via NA1296 wraparound option • each secondary channel supports up to 16 individual 4-wire dedicated Type 3002 lines in multiplexed, multipoint, and tail circuit arrangements with a maximum of 198 modem drops per secondary channel.

DNCS 300 Configuration • central site system consists of an operator console, triple diskette drives or removable 10M-byte rigid disk drive, a system printer, and a rackmounted distributed network processor (DNP) • DNP supports from 1 to 4 port nests; port nests #1 and #3 each support up to 30 secondary channels, while port nests #2 and #4 each support up to 32 secondary channels for a maximum of 124 secondary channels • secondary channel characteristics same as for DNCS 200.

DNCS 400 Configuration • central site system consists of a CPU with 512K to 2M bytes of main memory and associated operator console; 1 to 5 **additional** operator consoles; a diskette drive; a nonremovable 25M-byte rigid disk drive; and 1 to 6 system printers • DNPs support from 2 to 4 port nests in increments of 2; supports 62 secondary channels in each pair of port nests for a maximum of 496 secondary channels • secondary channel characteristics same as for DNCS 200.

☐ DNCS 200 Network Control System

DNCS 200 Central Site Control

System consists of an operator console (DNT) with integral Network Monitoring Unit (NMU), dual diskette unit, and a system printer • provides up to 8 or 16 secondary channels; each secondary channel supports 1 communication path composed of up to 16 individual 4-wire Type 3002 circuits in multiplexed/tail circuit environments • DNT links Codex CS and SP series modems via standard modem circuitry; links Codex LSI and MX modems via add-in secondary channel card; links other Codex and non-Codex modems via NA1296 wraparound option • Codex CS series modems, Codex secondary channel card, and NA1296 option monitor modem and line parameters, execute diagnostic testing, and support control functions via 75-bps secondary channel on communications link.

23150 8-Line DNCS 200 • includes operator console (Distributed Network Terminal-DNT) with integral network control logic and 64K-byte RAM memory for support of up to 8 secondary channels, plus 1 1M-byte dual-drive diskette unit • each secondary channel supports a maximum of 198 drops (modem addresses) • requires separate printer for system operation • diskette unit fits standard 19-inch equipment rack or equipment desk:

$460/$400 mo	$9,200 prch	$156/$218 maint

23152 16-Line DNCS 200 • includes operator console (Distributed Network Terminal-DNT) with integral network control logic and 64K-byte RAM memory for support of up to 16 secondary channels, plus 1 1M-byte dual-drive diskette unit • each secondary channel supports a maximum of 198 drops (modem addresses) • requires separate printer for system operation • diskette unit fits standard 19-inch equipment rack or equipment desk:

560/487	11,200	156/218

Operator Console (DNT) • contains CRT screen, network control logic, and functional keyboard • console screen divided into 3 functional areas (segments) • Status Segment displays date, time, software status, and illegal or invalid system conditions • Application Segment displays menu parameters for operator interaction • Operator Attention Segment displays 9 attention

fields which relate to specific operational functions; indicates active function or required operator interaction • console keyboard includes top row of 10 function keys and 3 special keys used to display system functions and subfunctions • system security via password protection • 1 DNT operator console per DNCS 200 system; price included in basic 8-line/16-line configuration:

NC/NC	NC	NC/NC

23370 Equipment Desk • equipment desk accommodates DNT operator console, dual diskette drive, and 150-cps printer:

45/30	975	NC/NC

23369 Chair • chair for DNCS desk console:

12/8	150	NC/NC

23250 Printer • 150-cps, 132-column, dot-matrix printer with tractor feed • 1 required per system:

135/117	2,700	34/48

23251 Printer Stand • printer stand with paper stacker for 150-cps printer:

12/8	150	NC/NC

23252 Paper Stacker • tabletop paper stacker for 150-cps printer:

3/2	45	NC/NC

23160 Conversion Kit • 8-line to 16-line upgrade kit:

100/87	2,000	NC/NC

DNCS 200 Remote Site Control

Network control functions at intermediate and remote sites implemented for Codex CS and SP series modems, for Codex LSI and MX series modems via plug-in PC board, and for other Codex and non-Codex modems via the NA1296 Network Adapter (wraparound option) • secondary channel supports network control functions • PC board/modem control card resides in standalone modem cabinet • NA1296 Network Adapter contained in standalone unit and interfaced with modem.

23320 Modem Control Card Set • 2-card set contains DNCS Secondary Channel and control circuitry for 4800-bps Codex LSI modems • 1 set required per modem:

$25/$20 mo	$675 prch	NC/NC maint

23321 Modem Control Card Set • 2-card set contains DNCS Secondary Channel and control circuitry for 7200-/9600-bps Codex LSI modems • 1 set required per modem:

25/20	675	NC/NC

24330 Modem Control Card • contains DNCS Secondary Channel and control circuitry for Codex MX series modems • 1 required per modem: .

25/20	675	NC/NC

23600 NA1296 Network Adapter • standalone wraparound unit provides digital and analog interfaces for non-DNCS modems; contains 75-bps secondary channel for use with 9600-bps modem • 1 required per modem:

40/35	820	24/36

23610 NA1296 Network Adapter • standalone wraparound unit provides digital and analog interfaces for non-DNCS modems; contains 150-bps secondary channel • 1 required per modem:

40/35	820	24/36

47080 LC3600 Loop Controller • standalone unit provides DNCS interface to an IBM 3600 Financial Controller Loop for Codex MX2400 modems • 1 required per loop:

37/24	500	NC/NC

MO: 1-year/2-year monthly lease charge including maintenance. PRCH: purchase price. MAINT: Zone A/Zone B monthly maintenance charge for purchased units. NA: not available. NC: no charge. Prices effective as of September 1984.

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22330 Modem Substitution Switch • standalone unit switches analog and digital connections between primary modem and hot spare backup modem • DNCS control:

25/20	575	NC/NC

22325 Dial Backup Auto-Answer Unit • switches unattended site modem between 4-wire dedicated line and 2 switched lines • automatically answers calls on switched lines • FCC certified standalone unit • DNCS control:

20/15	395	NC/NC

☐ DNCS 300 Network Control System

System consists of operator console (DNT), a triple diskette unit or a rigid disk unit, a system printer, and a Distributed Network Processor (DNP) • DNP supports 1, 2, 3, or 4 port nests with up to 30 secondary channels in port nests #1 and #3, and up to 32 secondary channels in port nests #2 and #4, in 2-channel increments, for a maximum system of 124 secondary channels • each secondary channel supports one communication path composed of up to 16 individual 4-wire Type 3002 circuits in multiplexed or tail circuit environments • DNP links Codex CS and SP series modems via standard modem circuitry; links Codex LSI and MX modems via add-in secondary channel card; links other Codex and non-Codex modems via NA1296 wraparound option • Codex CS series modems, Codex secondary channel card, and NA1296 option monitor and line parameters, execute diagnostic testing, and support control functions via 75-/150-bps secondary channel on communication link.

DNCS 300 Central Control—Diskette-Based Systems

Each diskette-based system consists of a DNP with network control logic; 1, 2, 3, or 4 empty port nests; a DNT desktop operator console with 64K-byte RAM memory; and a 1.5M-byte triple-drive diskette unit • requires separate printer for system operation • DNP unit and associated port nest(s) come with standard 19-inch equipment rack; diskette unit fits standard 19-inch equipment rack or equipment desk.

23301 32- Line DNCS 300 • kernel system with port nest housed in 42-inch high equipment rack; accommodates up to 15 Dual Universal Terminal Port Cards for a maximum of 32 secondary channels:

$1,325/$858 mo	$26,500 prch	$198/$274 maint

23302 64-Line DNCS 300 • kernel system with 2 port nests housed in 42-inch high equipment rack; accommodates up to 32 Dual Universal Terminal Port Cards for a maximum of 64 secondary channels:

1,390/898	27,800	198/274

23303 96-Line DNCS 300 • kernel system with 3 port nests housed in 70-inch high equipment rack; accommodates up to 48 Dual Universal Terminal Port Cards for a maximum of 96 secondary channels:

1,540/1,003	30,800	198/274

23304 128-Line DNCS 300 • kernel system with 4 port nests housed in 70-inch high equipment rack; accommodates up to 64 Dual Universal Terminal Port Cards for a maximum of 128 secondary channels:

1,965/1,303	38,400	198/274

DNCS 300 Central Control—Rigid Disk-Based Systems

Each rigid disk-based system consists of a DNP with network control logic; 1, 2, 3, or 4 empty port nests; a DNT desktop operator console with 64K-byte RAM memory; and a 5M-byte removable rigid disk unit • requires separate printer for system operation • DNP unit and associated port nest(s) come with standard 19-inch equipment rack; rigid disk unit fits equipment desk or tabletop enclosure.

23101 32-Line DNCS 300 • kernel system with single port nest housed in 42-inch high equipment rack accomodates up to 15 Dual Universal Terminal Port Cards for a maximum of 32 secondary channels:

$1,685/$1,118 mo	$32,800 prch	$246/$342 maint

23102 64-Line DNCS 300 • kernel system with 2 port nests

housed in 42-inch high equipment rack; accommodates up to 32 Dual Universal Terminal Port Cards for a maximum of 64 secondary channels:

1,750/1,158	34,100	246/342

23103 96-Line DNCS 300 • kernel system with 3 port nests housed in 70-inch high equipment rack; accommodates up to 47 Dual Universal Terminal Port Cards for a maximum of 96 secondary channels:

1,900/1,263	37,100	246/342

23104 128-Line DNCS 300 • kernel system with 4 port nests housed in 70-inch high equipment rack; accommodates up to 64 Dual Universal Terminal Port Cards for a maximum of 128 secondary channels:

1,965/1,303	38,400	246/342

DNCS 300 Central Control—System Components

Operator Console (DNT) • contains CRT screen, 64K-byte RAM memory, and functional keyboard • console screen divided into 3 functional areas (segments) • Status Segment displays time, software status, and illegal or invalid system conditions • Application Segment displays menu parameters for operator interaction • Operator Attention Segment displays 9 attention fields which relate to specific operational functions; indicates active function or required operator interaction • console keyboard includes top row of 10 function keys and 3 special keys which are used to display system functions and subfunctions • system security via password protection • 1 DNT operator console maximum per DNCS 300 system; price included in all configurations:

NC/NC mo	NC prch	NC/NC maint

23370 Equipment Desk • equipment desk accommodates DNT operator console, diskette or rigid disk unit, and 150-cps printer:

45/30	975	NC/NC

23369 Chair • chair for DNCS desk console:

12/8	150	NC/NC

23329 Standalone Tabletop Enclosure Option • for triple diskette drive:

10/7	120	NC/NC

23250 Printer • 150-cps, 132-column, dot-matrix printer with tractor feed • 1 required per system:

135/117	2,700	34/48

23251 Printer Stand • printer stand with paper stacker for 150-cps printer:

12/8	150	NC/NC

23252 Paper Stacker • tabletop paper stacker for 150-cps printer:

3/2	45	NC/NC

Retrofit Option Kits • provides necessary port nests, power supplies, RAM, and cables for expanding either diskette- or rigid disk-based DNCS 300 systems; systems which expand to more than 2 port nests require a larger equipment rack provided by option #23362.

23380 • provides expansion from single port nest to 2 port nests:

100/70	1,500	NC/NC

23381 • provides expansion from single port nest to 3 port nests:

235/160	4,700	NC/NC

23382 • provides expansion from single port nest to 4 port nests:

300/200	6,000	NC/NC

23383 • provides expansion from 2 port nests to 3 port nests:

185/125	3,200	NC/NC

23384 • provides expansion from 2 port nests to 4 port nests:

235/160	4,700	NC/NC

23385 • provides expansion from 3 port nests to 4 port nests:

100/70	2,000	NC/NC

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23362 ● 42-inch to 70-inch rack substitution option:

10/7	120	NC/NC

23333 Dual Universal Terminal Port Card ● PC card provides secondary channels for DNCS control functions ● each channel supports a maximum of 198 drops (modem addresses) ● occupies single slot in DNCS 300 port nest:

15/10	300	NC/NC

DNCS 300 Remote Site Control

Network control functions at intermediate and remote sites implemented for Codex CS and SP series modems, for Codex LSI and MX series modems via plug-in PC board, and for other Codex and non-Codex modems via the NA1296 wraparound option ● secondary channel supports network control functions ● PC board/modem control card resides in standalone modem cabinet ● NA1296 Network Adapter (wraparound option) contained in standalone unit and interfaced with modem.

23320 Modem Control Card Set ● 2-card set contains DNCS Secondary Channel and control circuitry for 4800-bps Codex LSI modems ● 1 set required per modem:

$25/$20 mo	$675 prch	NC/NC maint

23321 Modem Control Card Set ● 2-card set contains DNCS Secondary Channel and control circuitry for 7200-/9600-bps Codex LSI modems ● 1 set required per modem:

25/20	675	NC/NC

24330 Modem Control Card ● contains DNCS Secondary Channel and control circuitry for Codex MX series modems ● 1 required per modem:

25/20	675	NC/NC

23600 NA1296 Network Adapter ● standalone wraparound unit provides digital and analog interfaces for non-DNCS modems; contains 75-bps secondary channel for use with 9600-bps modem ● 1 required per modem:

40/35	820	24/36

23610 NA1296 Network Adapter ● standalone wraparound unit provides digital and analog interfaces for non-DNCS modems; contains 150-bps secondary channel ● 1 required per modem:

40/35	820	24/36

47080 LC3600 Loop Controller ● standalone unit provides DNCS interface to an IBM 3600 Financial Controller Loop for Codex MX2400 modems ● 1 required per loop:

37/24	500	NC/NC

22330 Modem Substitution Switch ● standalone unit switches analog and digital connections between primary modem and hot spare backup modem ● DNCS control:

25/20	575	NC/NC

22325 Dial Backup Auto-Answer Unit ● switches unattended site modem between 4-wire dedicated line and 2 switched lines ● automatically answers calls on switched lines ● FCC certified standalone unit ● DNCS control:

20/15	395	NC/NC

☐ DNCS 400 Network Control System

DNCS 400 Central Site Control

System consists of CPU with 512K to 2M bytes of main memory in 256K-byte increments; from 1 to 6 operator consoles (Network Control Terminals); from 1 to 4 Distributed Network Processors (DNPs); from 1 to 6 system printers, diskette unit, and a rigid disk unit ● DNPs support up to 4 port nests in increments of 2; accommodates up to 62 secondary channels per each port nest pair; secondary channels added in 2-channel increments for a maximum system of 496 individual 4-wire Type 3002 circuits in multiplexed or tail-circuit environments ● printers, operator consoles (NCTs), and DNPs can be remotely located from central site; separate DNP/operator consoles can operate independently and assume master status; multilevel password protection ensures network integrity ● DNP links Codex CS and SP series modems via standard modem circuitry; links Codex LSI and MX modems

via add-in secondary channel card; links other Codex and non-Codex modems via NA1296 wraparound option ● Codex CS and SP series modems, Codex secondary channel card, and NA1296 option monitor modem and line parameters, execute diagnostic testing, and support control functions via 75-/150-bps secondary channel on communication link ● provides optional network management reporting via 3 licensed software products, including an historical file of all network alarms; trouble ticket formulation; and an inventory file for pertinent information on network devices.

23400 DNCS 400 Kernel System ● includes 16-bit minicomputer (Data General S/140 Eclipse) with 512K-byte memory, 25M-byte non-removable rigid disk unit, 1.25M-byte double-sided double-density diskette unit, 8-line asynchronous interface, Network Control Terminal, system printer, Distributed Network Processor (DNP) with 2 empty port nests, 2 equipment cabinets, and LP103 modem for remote diagnostics ● includes operating system and DNCS software ● port nests support up to 31 dual-channel secondary channel cards (Dual Universal Terminal Port Card) for 62 secondary channels; expandable by adding additional port nests and DNPs:

$4,462/$3,983 mo	$79,255 prch	NA/NA maint

23402 Distributed Network Processor (DNP) ● contains 2 empty port nests and can accommodate up to 4 port nests; requires dual secondary channel cards ● up to 3 additional DNPs per DNCS 400 system:

445/387	8,890	76/106

23404 Port Nest Upgrade Kit ● 2 to 4 port nest upgrade for DNP; empty secondary channel slots; accommodates 31 dual-channel cards ● includes power supply and fan assembly ● requires 23402 DNP:

260/226	5,200	NA/NA

23333 Dual Universal Terminal Port Card ● dual-channel PC card provides secondary channels for DNCS control functions ● each channel supports a maximum of 198 drops (modem addresses) ● occupies single slot in DNP port nest; up to 248 maximum per DNCS 400:

15/10	300	NC/NC

23403 Network Control Terminal (NCT) ● equivalent to DNT operator console in DNCS 200 and DNCS 300 systems without intelligence or RAM memory; contains CRT screen and functional keyboard ● console screen divided into 3 functional areas (segments) ● Status Segment displays date, time, software status, and illegal or invalid system conditions ● Application Segment displays menu parameters for operator interaction ● Operator Attention Segment displays 9 attention fields which relate to specific operational functions; indicates active function or required operator interaction ● console keyboard includes top row of 13 function keys and 3 special keys which are used to display system functions and subfunctions ● system security via password protection ● up to 6 NCTs per each DNCS 400 system:

143/124	2,850	16/22

23250 Printer ● 150-cps, 132-column, dot-matrix printer with tractor feed ● 1 supplied with kernel system; DNCS 400 supports up to 6 printers maximum:

135/117	2,700	34/38

23407 8-Line Asynchronous Interface ● communication multiplexer provides additional attachments for printers, NCTs, or DNPs; remote DNPs require modems and Codex 6001 error protection unit for remote communication and data integrity ● requires single slot in S/140 CPU chassis ● supports 19.2K-bps data rates: RS-232C/CCITT V.24 compatible:

138/120	2,760	NA/NA

23418 Main Memory Expansion ● 256K-byte memory expansion board ● 1 to 6 boards can be added for 2M-byte maximum:

NA/NA	5,000	NA/NA

DNCS 400 Remote Site Control

Network control functions at intermediate and remote sites implemented for Codex CS and SP series modems, for Codex LSI

Codex Distributed Network Control System (DNCS)
DNCS 200, 300 & 400 Network Control/Management Systems

and MX series modems via plug-in PC board, and for other Codex and non-Codex modems via the NA1296 wraparound option • secondary channel supports network control functions • PC board/modem control card resides in standalone modem cabinet • NA1296 Network Adapter (wraparound option) is standalone unit interfaced with modem.

23320 Modem Control Card Set • 2-card set contains DNCS Secondary Channel and control circuitry for 4800-bps Codex LSI modems • 1 set required per modem:

$25/$20 mo	$675 prch	NC/NC maint

23321 Modem Control Card Set ○ 2-card set contains DNCS Secondary Channel and control circuitry for 7200-/9600-bps Codex LSI modems • 1 set required per modem:

25/20	675	NC/NC

24330 Modem Control Card • contains DNCS Secondary Channel and control circuitry for Codex MX series modems • 1 required per modem:

25/20	675	NC/NC

23600 NA1296 Network Adapter • standalone wraparound unit provides digital and analog interfaces for non-DNCS modems; contains 75-bps secondary channel for use with 9600-bps modem • 1 required per modem:

40/35	820	24/36

23610 NA1296 Network Adapter • standalone wraparound unit provides digital and analog interfaces for non-DNCS modems; contains 150-bps secondary channel • 1 required per modem:

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47080 LC3600 Loop Controller • standalone unit provides DNCS interface to an IBM 3600 Financial Controller Loop for Codex MX2400 modems • 1 required per loop:

37/24	500	NC/NC

22330 Modem Substitution Switch • standalone unit switches analog and digital connections between primary modem and hot spare backup modem • DNCS control:

25/20	575	NC/NC

22325 Dial Backup Auto-Answer Unit • switches unattended site modem between 4-wire dedicated line and 2 switched (DDD) lines • automatically answers calls on switched lines • FCC certified standalone unit • DNCS control:

20/15	395	NC/NC

• END

Codex 600 & 670 Series
604, 605 & 670 Multiplexers

■ PROFILE

Function ● bit-interleaved multiplexers (604/605) ● multipoint statistical multiplexers (670).

Communications/Networks ● Codex 604/605 supports up to 4 synchronous channels; 670 up to 2/4/8/16 multipoint asynchronous channels ● maximum aggregate channel rate of 19.2K bps (604/605); 19.2K/38.4K bps (670 Slave/Master) ● supports 1 composite link in point-to-point or multipoint (670) configurations ● polling link protocol (670).

First Delivery ● 1979 (600 Series); 1980 (670 Series).

Systems Delivered ● 100+ (600 Series); 100+ (670 Series).

Comparable Systems ● principal competition for 600 Series from Compre Comm Sprint; GDC 1253; Infotron Timeline 290; Micom Micro 700 ● for 670 Series from Comdesign TC5/TC8; GDC Pollkat; Micom Micro 900.

Vendor ● Codex Corporation, subsidiary of Motorola Inc; 20 Cabot Boulevard, Mansfield, MA 02048 ● 617-364-2000.

Distribution ● nationwide via local Codex direct sales/service offices and worldwide via Codex distributors ● Canada via ESE Limited ● Great Britain via Codex Limited ● Europe via Codex Europe S.A., Brussels ● Asia via Codex Far East, Tokyo, Japan.

■ ANALYSIS

Both the Codex 600 and 670 Series are mature product lines which have experienced no changes over the past year. Product pricing has also remained unaltered since this report was last updated.

The Codex 600 and 670 Series multiplexers are fixed-configuration, limited-capacity units targeted at users with specialized low-volume multiplexing requirements. They are manufactured by Micom and are intended to fill a gap in the low-end multiplexer market for Codex. The Codex 6005 statistical multiplexer garners most of the business for Codex in the low-end mux market (see the Codex 6000 Series product report). The 600 and 670 Series, on the other hand, continue to satisfy a more narrowed market segment than does the 6005, and Codex will continue providing them under an OEM agreement with Micom rather than produce similar units of its own.

The Codex Model 604 and its enhanced version, the Model 605, are Micom Micro 700 synchronous TDMs that eliminate the high cost of 2 or more dedicated lines and high-performance modems by combining synchronous traffic on one line. All channels but the first on the Model 604, and the first and second channels on the Model 605, support tail circuit modems for network extensions. These channels operate at reduced rates to support

PURCHASE PRICE RANGE

hardware & software ■■■■■
5-yr maint/serv fee ▭▭▭▭

604/605 ■■▭ $1.7K to $3.2K
670 ■■■■■▭▭ $2.2K to $7.2K

| | $2K | $4K | $6K | $8K | $10K |

CODEX 600/670 SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations (solid bars), and for associated 5-year period maintenance fees (open bars) ● **604/605 small** configuration consists of 604 4-channel/1-link mux; **large** of 605 4-channel/1-link mux with enhancements ● **670 small** configuration consists of 4-channel/1-link master/slave multipoint mux; **large** of 16-channel/1-link master multipoint mux.

overhead functions. The model can also be used to support colocated Codex 6000 Intelligent Network Processors or dial lines via a telephone rotary. Channel capacity can be expanded through cascading; rackmounting is not available. The AT&T DDS or a voice-grade line can be used for composite line communications, but at a reduced performance rate of 9600 bps. Full performance at 19.2K bps can be achieved over a long distance using 2 dedicated lines and a Codex 296 Biplexer, or an equivalent, at each end. The Biplexer splits the 19.2K-bps transmission into 2 9600-bps streams and provides clocking at each end. High-speed communication over limited distances can be achieved through private lines and short-haul modems.
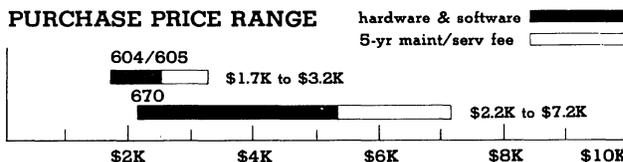
The 670 Series multipoint statistical multiplexers, Micom Micro 900 units, eliminate the need and cost of separate dedicated lines and modems for geographically dispersed asynchronous terminals. Channel flexibility meets requirements for as few as 2 channels at a remote location to as many as 8. Rackmounting is available as a no-cost option. Asynchronous terminals in a maximum of 8 different locations can share a common line to the master unit at the central site. The master unit is available in 4-, 8-, or 16-channel configurations and communicates with the remote slave or node unit via a polling protocol. Flexible transmission parameters allow either medium-to-high-speed synchronous transmission between master and remote site units, or medium-speed asynchronous transmission to satisfy specific requirements and eliminate unnecessary operating costs. The Codex CS 48FP or CS 96FP fast-poll multipoint modems are recommended for use on the composite link to reduce RTS/CTS delay time to a 9-millisecond minimum. The CS Series modems are also compatible with the Codex Distributed Network Control System (DNCS), a central-site operator-controlled system which monitors the network for abnormalities, reports failures, conducts diagnostic tests, and performs automatic failure recovery.

□ Strengths

The big advantage of the 604/605 is the elimination of dedicated lines and extra modems for separate synchronous terminals. Front-panel thumbwheel selection of individual channel data rates and display of EIA control signals facilitate ease of use. The capability to pass EIA control signals plus the enhanced diagnostic capability of the 605 are added user benefits. Its high aggregate composite link rate, operating flexibility, ease of use, and compact size make it an attractive package.

Model 670 eliminates multiple dedicated lines and modems between central-site and remotely scattered terminals through multipoint multiplexing. It provides a polling protocol for use with otherwise nonpollable asynchronous terminals, and, accordingly, relieves the host from performing polling. Benefits include the high line utilization efficiency of statistical multiplexing, CRC and ARQ error detection and correction to ensure an error rate of less than one in one trillion bits, and flow control to protect against

Codex 600 & 670 Series
604, 605 & 670 Multiplexers

buffer overflow and loss of data at the multiplexer as well as overflow and loss of data at the terminal end. Benefits also include comprehensive diagnostics for self-testing and local/remote loopback testing, and performance monitoring with visual display of vital operating statistics. User-selectable composite link parameters lead to further cost savings, eliminating the cost of sophisticated modems in low-volume traffic applications. Composite link parameter selection also allows the user to accommodate increased traffic volume without replacing equipment. Configuration flexibility allows the user to configure a 670 network to satisfy the requirements of his particular application and to easily expand the configuration to accommodate growth.

□ Limitations

Models 604 and 605 synchronous TDMs are limited to small-scale applications; channel expansion through cascading reduces the maximum per-channel data rate. The models are fixed configuration standalone units that cannot be upgraded to accommodate future growth nor can they be rackmounted along with other equipment in a conventional-site installation.

Model 670 multipoint statistical multiplexer is limited to small-scale applications that do not exceed the channel capacity of the central-site (master) multiplexer or the maximum number of drops, a function of master unit channel capacity and channels per drop. Flow control inhibits all channels simultaneously, instead of on a per-channel or most-active channel basis as is now offered with newer model multiplexers. Asynchronous transmission over the composite link, a selectable feature, reduces the maximum aggregate channel rate by approximately 20 percent to accommodate transmission of start/stop bits.

■ HARDWARE

□ Terms & Support

Terms ● the Codex 600 and 670 Series multiplexers are available for purchase or on a 1-, 2-, 3-, 4-, or 5-year lease which includes maintenance for term of lease ● first-year maintenance free of charge for purchased units ● lease/purchase credit is 75 percent of lease paid out ● 1-year warranty for purchased units ● quantity discount for purchased units is 5 percent for 4 to 9 units; 10 percent for 10 to 19 units.

Support ● installed by user or by Codex; installation charge is $132 for 600 Series; $142 for 670 Series; installation charge on per-unit per-site basis; minimum installation charge is $140 within 100 miles of Codex service center; $298 over 100 miles ● 3 service plans: Fixed-Price/On-Call/Factory Maintenance ● Fixed-Price maintenance performed under annual contract during prime-shift hours (8:00 AM to 5:00 PM, Monday through Friday) ● On-Call maintenance billed for time and materials plus transportation; material replaced or repaired at Codex option ● Factory maintenance includes cost of material and labor ● Fixed-Price/On-Call maintenance performed by Codex nationwide service organization.

□ Overview

The Codex 600 and 670 Series multiplexers each serve different applications. Models 604/605 are bit interleaved, synchronous time-division multiplexers designed for point-to-point network configurations. The 605 is an enhanced version with the capability to pass a maximum of 4 full-duplex EIA control signals and provides extended diagnostics.

Model 670 is a statistical multiplexer designed for multipoint communications between a host CPU and dumb asynchronous terminals. Its transparent polling protocol can accommodate up to 16 channels on a 4-wire full-duplex lease line. The 670 is available as a 4-, 8-, or 16-channel master unit for central-site communication with as many as 8 remotely located node (slave) units. Node units are equipped with 2, 4, or 8 channels. Error detection and correction is supported by CRC 16 and ARQ techniques. The maximum aggregate channel rate is 19.2K bps for node units and 38.4K bps for master units. Operating parameters established at the master unit are automatically downline loaded to the node units.

Codex 604/605 Configuration ● 4-channel fixed-configuration standalone unit; channel expansion via cascading ● supports synchronous channels at selectable rates to 9600 bps; 19.2K-bps maximum aggregate channel rate ● 1 composite link; synchronous rates to 19.2K bps ● 605 passes 4 full-duplex control signals.

Codex 670 Configuration ● fixed-configuration 4/8/16-channel master unit; 2/4/8-channel node (slave) unit ● standalone; rackmount optional ● supports asynchronous channels at selectable rates to 4800 bps; maximum aggregate channel rate 19.2K bps for node units; 38.4K bps for master units ● 1 composite link; synchronous rates to 9600 bps; asynchronous rates to 2400 bps.

□ Codex 604/605 Synchronous Multiplexer

604/605 Central Control

Central control module contains central logic, power supply, integral channel adapters, and composite link module.

Codex Model 604 ● standard 4-channel unit:

$105/$85 mo	$1,650 prch	$20 maint

Codex Model 605 ● enhanced 4-channel unit:

140/110	2,200	20

604/605 Diagnostic Tests

Standard test features of Model 604 include local composite link loopback only with status indicators for EIA RS-232C control signals ● test features of the Model 605 include local and remote composite link loopback with status indicators for EIA RS-232C control signals, channel activity, and control signal activity ● standard features:

NC/NC mo	NC prch	NC maint

604/605 Channels

Central control module comes packaged with 4 channels ● synchronous channel rates selectable at 0.25/0.50/0.75/1.0 times composite rate; 8 rate combinations via front-panel thumbwheel switch ● 605 passes 4 full-duplex control signals; signals passed in order of priority as change is detected; signals in order of priority include RLSD/RTS, CTS, DTR/DSR, Busy/RI; control signal delays range 30 to 240 milliseconds ● overhead bits for synchronization claimed from channel 1 for Model 604, and from channels 1 or 2 for Model 605; overhead is 0.39 percent composite rate on 604; 3.124 percent composite rate on 605 ● overhead channels not recommended for tail circuits ● EIA RS-232C/CCITT V.24 interface ● channel price included in cost of control unit:

NC/NC mo	NC prch	NC maint

Model 605 Bandwidth-On-Demand ● selectable feature for Model 605 allocates 25 percent of the composite link bandwidth to channels 2, 3, and 4 whenever they are active ● unused bandwidth is assigned to channel 1 ● standard option, Model 605:

NC/NC	NC	NC

604/605 Composite Link

Central control module comes packaged with link ● up to 19.2K bps synchronous full-duplex ● external clock ● RS-232C/CCITT V.24/V.28 interface ● standard feature:

NC/NC mo	NC prch	NC maint

□ Codex 670 Multidrop Statistical Multiplexers

670 Central Control

Control module contains central logic with RAM buffer and power supply; supports 2/4/8/16 channel adapters; contains diagnostics, flow control, and 1 composite link module ●

MO: monthly 1-year/2-year lease charge including maintenance. PRCH: single-unit purchase price. MAINT: monthly maintenance charge for purchased units. NC: no-charge item. Prices are current as of December 1984.

Codex 600 & 670 Series
604, 605 & 670 Multiplexers

operating parameters selectable via internal DIP switches • parameters include asynchronous channel rates; character codes; line/form feeds; EIA control signal enable/disable; flow control functions; asynchronous/synchronous composite link transmission • parameters downline loaded to node (slave) units during power-up.

Codex Model 670 2-Channel Slave Unit • 1.5K-character RAM buffer:

$95/$75 mo	$1,350 prch	$40 maint

Codex Model 670 4-Channel Master/Slave Unit • 7.5K-character RAM buffer:

145/110	2,150	40

Codex Model 670 8-Channel Master/Slave Unit • 14K-character RAM buffer:

205/165	3,100	40

Codex Model 670 16-Channel Master Unit • 14K-character RAM buffer:

345/285	5,300	40

670 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls the flow of data from data terminal equipment at channel inputs by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface, or by generating XON/XOFF (DC1/DC3) control characters; inhibits all channels simultaneously • detects and responds to XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 86 percent total buffer utilization; flow resumption threshold at 62 percent buffer utilization • data lost message sent to affected terminals on buffer overflow • standard feature:

NC/NC mo	NC prch	NC maint

670 Diagnostic Tests

Isolates failures in local/remote channels; local/remote link

modules; or composite link through local/remote loopbacks of data transmitted from terminal equipment • terminal activated test feature allows any terminal to check integrity of local node unit or complete end-to-end system without interfering with other terminals/channels; includes FOX message generator • standard feature:

NC/NC mo	NC prch	NC maint

670 Status Reporting

Status Reporting • LED status display panel indicates results of performance monitoring; indicates line degradation where error rate is greater than 1 in 1000 bits; buffer overflow indication ○ standard features:

NC/NC mo	NC prch	NC maint

670 Channels

Central control module packaged with 2/4/8/16 channels; 2/4/8-channel node (slave) units; 4/8/16-channel master units • asynchronous switch-selectable channel rates of 110/300/ 600/1200/1800/2400/4800 bps; 8 rate combinations and CR/LF/FF character delays via internal DIP switches; maximum aggregate channel rate 19.2K bps for node units; 38.4K bps for master units • 8 data bits • EIA RS-232C electrical interface • channel price included in cost of control unit:

NC/NC mo	NC prch	NC maint

670 Composite Link

Central control module packaged link • up to 2400/4800/9600 bps full-duplex synchronous • external clock • full-duplex asynchronous at switch-selectable rates of 1200/1800/2400 bps • asynchronous link communication reduces maximum aggregate channel rate by 20 percent to accommodate start/stop bits • polling protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24 interface • standard feature:

NC/NC mo	NC prch	NC maint

• END

Codex 6000 Series Intelligent Network & Distributed Communications Processors
6001, 6002, 6005 & 6035 INP and 6050 DCP

■ PROFILE

Function ● statistical multiplexers and network concentrators.

Communications/Networks ● Codex 6001 supports up to 8 asynchronous channels; 6002 up to 16 asynchronous channels; 6005 up to 16 asynchronous/synchronous channels; 6035 combinations of up to 124 asynchronous, BSC synchronous, and bit-oriented protocol channels; 6050 combinations of up to 250 asynchronous, BSC synchronous, HDLC X.25 channels per node ● channel rates up to 9600 bps ● maximum aggregate channel rate of 76.8K bps (6001, 6005); 153.6K bps (6002); 76.8K bps (6035); 19.2K bps (6050) ● 6001/6002/6005 support single composite link in point-to-point configuration ● 6035 supports up to 5 composite links in multinode configuration; addresses up to 16 nodes; 6050 supports up to 32 composite links in multinode configuration; addresses up to 127 nodes ● modified SDLC/CCITT X.25 link protocol.
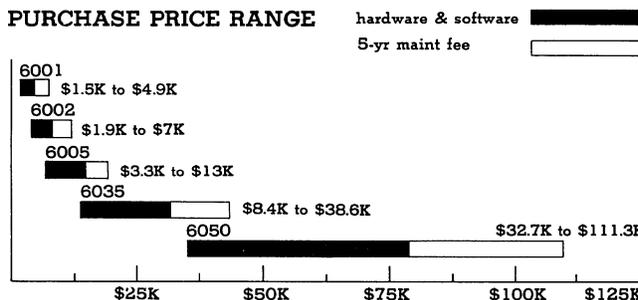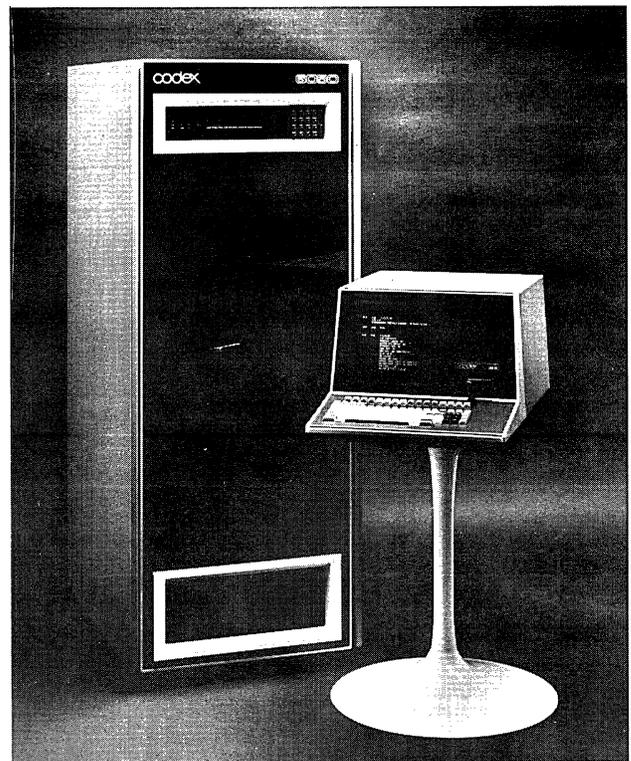
First Delivery ● July 1981 (6001); March 1984 (6002); October 1985 (6005); June 1984 (6035); August 1981 (6050).

Systems Delivered ● undisclosed.

Comparable Systems ● principal competition for Codex 6001/6002/6005 from DCA System 105; Gandalf PIN 9103/9106; Infotron Supermux 480 and 600 Series; Micom Micro800/2; Racal-Milgo Omnimux Models 4/8 ● for Codex 6035/6050 from Infotron 790/792 Network Concentrators, 900/992 Network Processors; Paradyne DCX 840/850; and Timeplex Networking Microplexers.

Vendor ● Codex Corporation, Subsidiary of Motorola, Inc; 20 Cabot Boulevard, Mansfield, MA 02048 ● 617-364-2000.

Canadian Headquarters ● Motorola Information Systems,

PURCHASE PRICE RANGE

hardware & software ▐███████

5-yr maint fee �[   ]

6001
▐ $1.5K to $4.9K
6002
▐ $1.9K to $7K
6005
▐ $3.3K to $13K
6035
▐ $8.4K to $38.6K
6050
$32.7K to $111.3K

| $25K | $50K | $75K | $100K | $125K |

CODEX 6000 PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations (solid bars) and for associated 5-year period maintenance fees (open bars) ● **6001** small configuration consists of 4-channel/1-link mux; large of 8-channel/1-link mux with integral 9600-bps CCITT V.29 link modem ● **6002** small configuration consists of 4-channel/1-link mux; large of 16-channel/1-link mux with integral 9600-bps CCITT V.29 link modem and split-speed option ● **6005** small configuration consists of 4-channel/1-link mux; large of 16-channel/1-link mux with integral 9600-bps CCITT V.29 link modem, synchronous channel support, and split-speed option ● **6035** small configuration consists of 28-channel/1-link mux with autospeed on 8 channels; large of 96-channel/2-link mux with autospeed on 36 channels, 10 HDLC channels, plus 2 mux links, operator console, and control terminal port ● **6050** small configuration consists of 32-channel/2-link primary node plus control terminal; large of 96-channel/2-link primary node including 80 asynchronous ports; 16 synchronous ports, 2 groupband network links, and 2 mux links.

Limited; 9445 Airport Road, Brampton, ON L6S 4J3; 416-793-5700.

Distribution ● nationwide via local Codex direct sales/service offices and worldwide via Codex distributors ● Canada via ESE Limited, Ontario ● Great Britain via Codex (U.K.) Limited, Croyden ● Europe via Codex Europe S.A. Brussels, Belgium ● Asia via Codex Far East, Tokyo, Japan.

GSA Schedule ● listed.

■ ANALYSIS

Codex has consolidated its 6000 Series of Intelligent Network and Distributed Communications Processors over the past year. The mid-range 6010 has been dropped from the line-up and existing 6030 and 6040 functional characteristics have been incorporated into a new 6035 model. Model 6035 is designed to accommodate a variety of applications ranging from simple point-to-point configurations to complex multinode networking environments. In either environment, the 6035 offers advanced network management and control capabilities that can be centralized at one site or distributed to various nodes through the network. Additionally, the 6035 is transmission compatible with all other 6000 Series Intelligent Network Processors.

The Codex 6000 Series represents a mature product line that efficiently addresses the needs of small-, medium-, and

Codex 6000 Series Intelligent Network & Distributed Communications Processors
6001, 6002, 6005 & 6035 INP and 6050 DCP

large-scale networks.

Family members range from the 4- or 8-channel 6001 at the low end through the 4- to 16-channel 6005, to the high-performance, large-capacity 6035 and 6050 at the high end with maximum channel capacities of 124 and 120 channels, respectively. Designed and produced by Codex, the individual family members serve a broad range of network applications and requirements, and can be used in a wide variety of network configurations. The different members can link segments of the same network, where each member supports discrete network links. Link protocol is byte oriented and CCITT X.25 Level 2 (frame level) compatible to facilitate software demultiplexing in the host computer as a possible cost-effective alternative to a central site multiplexer. CRC and ARQ GO-BACK-N error detection and correction procedures ensure virtual error-free performance over the composite link. System operating parameters for individual channels/ports, composite link, and up to 16 nodes at the low end, and up to 127 nodes at the high end are alterable through an ASCII-compatible CRT or printer terminal or a CPU port on all models except the entry-level 6001, where parameter changes are entered through DIP switches on the unit. In large networks that include 1 or more 6035s and 6050s, network parameters for individual 6000 Series INPs can be altered through any 6035 or 6050 operator console channel connected terminal, or CPU port in the network.

The 6001 is designed for small-scale applications satisfied by combining 8 or fewer asynchronous lines or devices on a single high-speed link. It offers the performance advantages of statistical multiplexing to benefit limited requirements. It provides a network link throughput of 2 to 4 times that of a conventional TDM, and there is no restriction on speed intermix of the individual channels. All ports can be set for 9600-bps transmission, an aggregate of 76.8K bps for the 8-channel model; aggregate burst rates up to 76.8K bps are accommodated. Minimum end-to-end character delay time is 20 milliseconds. The 6001 packs a host of useful features including flow control, automatic speed detection for dial-up lines, echoback, and diagnostics, and is available with an integral high-speed modem for the composite link, eliminating the need for separate modems. It is a flexible, versatile unit that satisfies a variety of small-scale applications at a cost-justifiable price.

The 6002 INP is a low-end unit that accommodates up to 16 channels, twice the capacity of the entry-level 6001. It also has the advantage of configuring operating parameters, reporting system statistics, and providing system diagnostics from a dedicated control port. The 6002 is expandable in increments of 4 asynchronous channels, and can communicate upwardly with other members of the 6000 family in point-to-point configurations. Integral 4800- and 9600-bps modems are optional.

The 6005 INP is another low-end unit. It offers the same channel capacity as the 6002 but supports synchronous channel inputs. The 6005 is expandable in increments of 4 asynchronous or optional SDLC or binary synchronous channels. All ports can be set for 19.2K-bps transmission (9600 bps SDLC/HDLC), and the 6005 can communicate upwardly with other members of the 6000 Series in point-to-point network configurations. Selectable autospeed is a standard feature; integral 4800- or 9600-bps modems, and split-channel speeds for videotex public networks are options available to the user.

The 6035 addresses medium-to-large-scale network requirements for asynchronous, BSC synchronous, and HDLC Level 2 communications support. It is an extremely flexible large-capacity unit that can be configured to meet immediate needs as well as those of future expansion. Standard operating firmware allows the user to examine and evaluate network performance. Through this powerful feature, the user can effectively pinpoint operating inefficiencies, be alerted to network degradation or abnormalities, and use the operating statistics to plan for future growth. The 6035 performs as a nodal processor and can be configured for multiple composite network links. It also supports fallback rerouting in case of link failure. The 6035 can communicate with a 6001 or 6005 via an optional 6001- or 6005-compatible multiplex port.

The 6035 is a high-performance unit driven by 2 standard to 6 Motorola M6800 microprocessors. The processor options extend processing power and reduce throughput delay, vital attributes for volume traffic. Channel adapters support asynchronous communications up to 4800 bps, BSC synchronous, HDLC Level 2, and current-loop communications. Asynchronous and BSC synchronous communications are supported by the same dual-channel adapter. Each port of the adapter is parameter independent, which means 1 port can be configured for asynchronous communications while the other can be configured for BSC synchronous transmission. HDLC Level II support is provided by a separate single-port communications adapter and requires an optional firmware package at extra cost. Current-loop channel adapters provide dual ports and are strappable to satisfy all standard operating conditions. Channel parameters are easily alterable to meet changing operating requirements through an operator console, or optionally through an asynchronous ASCII terminal located anywhere in the 6000 network, or a CPU port.

At the high end, the 6050 addresses medium- to very-large-scale network requirements. It is designed for a multinode environment consisting of 3 or more nodes to a maximum of 127 nodes. Each node supports a maximum of 120 ports. The 6050 is a key network element because it interlinks all other 6000 Series models, giving users the flexibility to configure a network according to their present needs and to reconfigure or alter the configuration to accommodate future growth or change.

Call routing is extremely flexible for accommodating different communication requirements and for resolving traffic congestion and line or node degradation or outages. Switched, dedicated, or contention programmable channel assignments can be established for any network node and port. Switched channels can intercommunicate locally or remotely and can also call contention channels. Dedicated channels can be assigned as "fixed," where the origin/destination path is maintained once established, or "controlled," where the path is established only when the originating DTE raises its DTR. Security measures prevent unauthorized connections for switched channels through 8 levels of routing priority, also referred to as "closed user groups" or "restricted resource groups" by the industry. Channel assignments are alterable to satisfy changing traffic requirements.

The user can route calls between 6050 nodes over a fixed, defined path or dynamically over the shortest path available. The 6050 automatically recovers from link failures and remedies high congestion levels through adaptive routing; also called traffic balancing by the industry. Adaptive routing minimizes network congestion by evenly distributing traffic over all network links and protects critical communication from link outages by alternate routing. The user can establish traffic congestion thresholds to reflect predefined load limits at each node.

The 6050 accommodates asynchronous transmission and BSC synchronous transmission with transparent support over a wide range of data rates from 50 to 19.2K bps. It also supports HDLC Level 2 (frame level) with transparency and 2780/3780 protocol with intervention (local spoofing) to compensate for excessive round-trip delays such as encountered with satellite links. Maximum data rates for each are limited to 9600 bps. Asynchronous and synchronous channels are contained on 4-(quad) channel (port) cards, easily expandable to 16 channels (ports) in 4-channel increments to accommodate growth requirements.

The 6050 offers the user a choice of network ports for data rates up to 19.2K bps and for rates up to 64K bps. This choice offers the flexibility to configure each 6050 system according to traffic and economic considerations. High-volume traffic can be routed over DDS or a wideband link, while low-volume traffic can use 1 or 2 voice-band links.

Channel parameters are easily altered to meet changing operating requirements through an operator console (control panel on unit) or through 1 or more asynchronous ASCII terminals designated as supervisory control terminals and located

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anywhere in the 6000 network. Although the operator console can only control its own node, supervisory control terminals can control any and all network nodes. Operating software parameters for the entire network are easily established from a supervisory control terminal via the Configuration Editor, an easy-to-use menu format. An operator can access the configuration parameters of any node or channel (port) and alter any or all of the parameters to satisfy changing requirements. The user can define and store a maximum of 4 network configurations at each 6050 DCP node. Configurations may also be stored on diskette.

☐ Strengths

Link compatibility among 6000 Series members is a paramount benefit for users with sizeable networks as well as for those who plan to expand into a sizeable network to accommodate growing traffic volumes and/or geographically dispersed communication requirements. Link compatibility extends configuration flexibility, allowing a user to configure a network according to current needs with the potential for future expansion. The 6035 can link up with local or remote 6035s, 6005s, and 6001s.

Multinode communication, supported by the large-scale 6035 and 6050, augment configuration flexibility. Multinode support is a significant user benefit because it enables data to be exchanged between the data terminal equipment located at various nodes of a multinode network, and it provides redundant paths to reroute data in case of a link outage. Specific channel/link assignments route data according to user requirements. The 6035 and 6050 function as network concentrators to route data to and from other network nodes, hubs, and termination points occupied by other 6000 INP Series members. Redundant paths can reroute data should a link outage occur. Downtime delays from link outages are eliminated, which is especially important for critical applications. Specific channel/link assignments route data according to user requirements, and the assignments can be changed to accommodate different requirements.

The 6050 augments multinode communication through call routing, which substantially extends multinode communication flexibility over the 6035. User-assigned switched, dedicated, and contention channels strongly benefit intranode and internode communication requirements. Fixed paths can be defined, switched paths can be established, and cost savings can be realized with contention channels, which reduce the number of ports required. Dynamic Routing and Adaptive Routing are strong user assets because they reduce traffic congestion and remedy link failures to eliminate communication downtime. Assignable routing priorities increase communication efficiency by rerouting critical calls to minimize traffic congestion and path length. Another key user benefit for added communication flexibility is the 6050's capability to store 4 network configurations at each node for accommodating different traffic requirements as needed.

Other significant user benefits are derived from the 6050's distributed architecture and its Huffman-encoded data compression scheme. Processing power is distributed throughout the 6050 channels and network ports to support data handling requirements as needed. As the system expands to accommodate increased user requirements, the processing power expands to accommodate each added channel and composite link. Data compression increases communication throughput by about 30 percent.

Configuration flexibility and ease of expansion are the key benefits of the 6035 and 6050. The rackmount units are composed of card frames that accommodate edge-connector circuit cards inserted into slots within the card frame. Individual cards are easily removed, interchanged, or added for network reconfiguration or expansion.

Operating parameters are easily altered to accommodate changing requirements on the 6035 and 6050. These units are designed for operating convenience. The user is offered the option of changing parameters through an operator console located at the top of the equipment cabinet, through a local or remote terminal acting as a control terminal, or through a CPU port. This flexible arrangement serves individual user needs. Operating flexibility is augmented in multinode networks where operating parameters can be altered for any channel/link/node in the network from any one node.

Performance statistics, are extensive on the 6035 and 6050. These units constantly monitor for abnormal or critical conditions within the network and immediately alert the operator if they occur. A user can establish critical operating thresholds according to need. Statistics for channel, link, and node parameters are collected and computed to measure performance; the results are presented to the operator. System event reports, a user option, are logged with date and time. This is a powerful user feature unmatched by most competitive products. It alerts the user to conditions that need remedial action, and provides an ongoing journal of network utilization.

Other useful features include local echoplex, flyback control, and adaptive autospeed. All are standard features for 6000 Series models except autospeed, which is only standard on Model 6050. Echoplex is required by most asynchronous terminals for data verification, while flyback control is necessary to compensate for delays encountered with nonprint functions for unbuffered teleprinter terminals. Finally, the adaptive autospeed feature eliminates the need for dedicated lines or ports to support remote terminals with different data rates and code levels.

☐ Limitations

The 6001 is a fixed-configuration, nonexpandable unit designed for small-scale, point-to-point applications. Users with applications that will soon expand beyond the unit's 8-channel limit should consider the 6002, which can expand up to 16 channels.

The 6002 is limited to a maximum of 16 asynchronous channels. Users with synchronous protocol requirements should consider the 6005.

The 6005 is limited to a maximum of 16 Async or BSC channels. SDLC/HDLC synchronous channel support is optional through an extra-cost firmware module. Users with growing requirements that will quickly expand beyond the unit's 16-channel capacity should consider the 6035, which can expand up to 124 channels.

The 6035 limits channel rates to a 4800-bps maximum. This is not a severe limitation since most asynchronous communications are conducted at rates up to 1200 bps; however, there are applications that transmit asynchronous data at 9600 bps or higher. The prospective user has the option of specifying higher substitute data rates for any of the unit's 7 standard selectable channel rates, but at extra cost for each substitute rate.

Priority control is not provided as a distinct channel selectable function. However, the 6035 allows compensation for channels with greater traffic volume. These channels are serviced more often and are assigned larger buffer capacities. Traffic volume assignments are programmable and can be changed as required.

The 6050 is a complex system and requires careful consideration and planning by the user coordinated with the vendor to effectively implement network requirements. Traffic flow and volume with respect to application demands are critical to system configuration. For example, the total number of terminals supported by a 6050 node is limited by node throughput, addressing, and physical port nest capacity. Steady state aggregate node throughput is limited to 20,000 cps, the sum of inbound and outbound compressed data excluding overhead. Burst rates are substantially higher. Address assignments are limited to 120 per node. Each channel requires an address; a multiplexer channel linking another 6000 Series multiplexer requires its own address plus 1 per each DTE device supported by the linked multiplexer. This is also true for each asynchronous and synchronous channel that supports more than 1 device, for example, through tail circuits. Physical port nest capacity is limited to 59 mounting slots at the primary node and 63 at secondary nodes. An asynchronous or synchronous channel requires from 2 to 5 slots for a maximum of 16 ports. Control

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terminal, diskette drive, and Group Band Network Ports each require 2 slots. The standard network port and multiplexer port each require a single slot.

Channel aggregate data rate capacity also requires careful consideration. Asynchronous and synchronous channels each support an aggregate of 19.2K bps, which means that at 100 percent utilization, each added port will diminish the aggregate by its own rate. Therefore, port utilization is critical to the number of devices that can be supported by a channel.

There are also some additional limitations that may need to be considered. Multiplexer, 2780/3780, and bit-oriented protocol channels are limited to 9600 bps. This may not affect most users, but those that it does will want to consider alternatives. There is no local ACK/NAK spoofing for BSC 3270 terminals. Therefore, extensive delays such as encountered with satellite links will seriously affect response time and may require alternative planning. There is also no support for X.25 Level 3 at the channel or composite link side of the 6050. Therefore, the 6050 cannot be connected to a public packet network such as Telenet or Tymnet. However, Codex plans to introduce a PAD for its 6000 Series multiplexer to provide a gateway to an X.25 network. Codex does not provide composite link modems for the 6050. Although not a serious limitation, it requires external modems and extra cabling.

Intervention or local spoofing is still not supported and seems to be a long way off. In addition, Codex doesn't yet support X.25 Level 3 (packet level) for connection to a public packet network such as Tymnet or Telenet. Codex has also not released a mux/demux PAD for connecting a network port (composite link) of any 6000 family memory to an X.25 packet network.

■ HARDWARE

□ Terms & Support

Terms • available for purchase or for lease under 1-, 2-, or 3-year agreement; leases include maintenance for term of lease • first-year maintenance free of charge for purchased units • lease purchase credit is 75 percent of lease payed out • 1-year warranty for purchased units • quantity discounts available for purchased or leased units.

Support • installed by Codex; installation charges are $138 for 6001; $145 for 6002; $160 for 6005; $246 for 6035; $400 for 6050 Network Node; $175 for 6050 Expansion Nest; $25 for 6050 Control Terminal • installation discounts • minimum installation charge on per unit per site basis; minimum installation charge $165 within 100 miles of Codex service center (Zone A); $340 over 100 miles (Zone B) • 3 service plans: Fixed Price/On-Call/Factory Maintenance • Fixed Price maintenance performed under annual contract during prime-shift hours 8:00 AM to 6:00 PM, Monday through Friday • On-Call maintenance billed for time and materials plus transportation; material replaced or repaired at Codex option • Factory Maintenance includes cost of material and labor • Fixed Price/On-Call maintenance performed by Codex nationwide service organization.

□ Overview

The 5 models of the Codex 6000 Series family are designed for point-to-point and multinode network configurations. The models satisfy a wide range of network requirements from the small-scale 6001 to the large-scale 6050. The 6001 is available with 4 or 8 asynchronous channels. The 6002 is available with 4 to 16 async channels. The 6005 is available with 4 to 16 asynchronous channels; BSC or SDLC synchronous channels are optional. In addition, the 6001, 6002, and 6005 can be equipped with a 4800-bps or 9600-bps integral composite link modem. The 6035 is a large-scale model available in a wide range of configurations. It supports from 28 to 124 asynchronous/BSC synchronous and HDLC X.25 Level 2 channels. Multilink communications in a multinode environment are supported by the 6035 and 6050. The 6035 realistically supports up to 4 or 5 composite links and addresses up to 16 nodes composed of 6035s and 6050s. The 6035 offers fallback routing to recover from a composite link outage. The 6050 supports up to 120 channels (ports) per node

and addresses up to 127 nodes. Its composite links (network ports) are limited only by throughput considerations; realistically, it supports up to ten 9600-bps links and two 64K-bps links. It supports asynchronous, BSC synchronous, bit-oriented synchronous, 2780/3780, and multiplexer channels. Channels can be assigned as dedicated, switched, or contention. Eight levels of security divide switched channels into closed user groups (restricted resource groups) to prevent unauthorized access. Call routing is selectable over user-assigned or dynamically established links. There are 8 assignable call-routing priorities. Adaptive routing automatically reroutes calls over alternate routes in response to user-defined traffic congestion thresholds or line outages. The 6035 and 6050 are parameter programmable from an operator console or a local or remote terminal. Network control through operating parameter alteration can be performed from any point in the network for any network node. The models continuously monitor the network for abnormal conditions defined by the user through programmable parameter thresholds. A detected abnormal condition alerts operating personnel through a printed or displayed message. The models also perform extensive performance measurement through collection and computation of monitored channel, composite link port, and node statistics. The results are reported via an operator console or terminal at any network node. Events can be logged with time and date as they occur or at user-programmable intervals.

The link protocol modified SDLC/CCITT X.25 Level 2 is common to all models. All models employ CRC 16 and ARQ error detection and correction over the high-speed composite link.

6001 INP Configuration • 4- or 8-channel fixed configuration, standalone or rackmountable unit • supports asynchronous channels at rates to 9600 bps; 76.8K-bps maximum aggregate channel rate • single composite network link; synchronous rates to 14.4K bps • optional 4800-bps CCITT V.27/9600-bps CCITT V.29 integral composite link modem • master/slave configuration.

6002 INP Configuration • 2 basic units packaged with 4 asynchronous channels and expandable to 8/16 channels in 4-channel increments • supports asynchronous channel rates to 19.2K bps; 153.6K-bps maximum aggregate channel rate • single composite network link; synchronous rates to 19.2K bps • optional 4800-bps CCITT V.27/9600-bps CCITT V.29 integral composite link modem • master/slave configuration • operating parameters programmable via local/remote terminal.

6005 INP Configuration • 2 basic units packaged with 4 channels and expandable to 8/16 channels in 4-channel increments • supports asynchronous and BSC or optional SDLC/HDLC and half-duplex synchronous channels at rates to 19.2K/9600 bps; 76.8K-bps maximum aggregate channel rate • single composite network link; synchronous rates to 19.2K bps • optional 4800-bps CCITT V.27/9600-bps CCITT V.29 integral composite link modem • master/slave configuration • operating parameters programmable via local/remote terminal.

6035 INP Configuration • rackmounted base and expansion units • 124 channels maximum in any combination of dual asynchronous and BSC synchronous channels, and single HDLC X.25 Level 2 channels asynchronous data rates to 4800 bps; synchronous rates to 9600 bps • 76.8K-bps maximum aggregate channel rate • 1 to 5 composite network links; synchronous to 19.2K bps • operating parameters programmable via operator console or local/remote terminal.

6050 DCP Configuration • rackmounted base and expansion units • 120 channels maximum in any combination of quad asynchronous and transparent BSC synchronous channels, single transparent bit-oriented protocol channels, single 2780/3780 BSC locally spoofed channels, and single 6000 Series multiplexer channels. Asynchronous and BSC synchronous data rates to 19.2K bps • bit-oriented protocol channels, 2780/3780 channels, and multiplexer channels support data rates to 9600 bps • 19.2K-bps maximum aggregate channel rate • maximum composite network links limited by throughput considerations to ten 9600-bps links and two 64K-bps

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links ● maximum link rates are 19.2K bps and 64K bps ● network operating parameters programmable via local/remote terminal; local operating parameters programmable via operator console ● system software loaded from diskette at primary node at initialization and downline loaded to secondary nodes.

☐ Codex 6001 Intelligent Network Processor

6001 INP Central Control

Central control module available in 4- or 8-channel packaged configurations with central logic, power supply, 16K-byte RAM buffer, integral channel adapters, composite link module, and optional 4800-bps CCITT V.27/9600-bps CCITT V.29 link modem ● rackmount option.

4-Channel 6001 INP ● multiplexer configuration with 4 asynchronous channels and composite link:

	NA mo	$1,500 prch	$38/$54 maint

4-Channel 6001 INP/Integral 4800-bps Modem ○ multiplexer configuration with 4 asynchronous channels, composite link and 4800-bps CCITT V.27-compatible integral link modem:

	NA	3,225	38/54

4-Channel 6001 INP/Integral 9600-bps Modem ○ multiplexer configuration with 4 asynchronous channels, composite link, and 9600-bps CCITT V.29-compatible integral link modem:

	NA	4,075	38/54

8-Channel 6001 INP ○ multiplexer configuration with 8 asynchronous channels with composite link:

	NA	2,350	38/54

8-Channel 6001 INP/Integral 4800-bps Modem ○ multiplexer configuration with 8 asynchronous channels, composite link, and 4800-bps CCITT V.27-compatible integral link modem:

	NA	4,075	38/54

8-Channel 6001 INP/Integral 9600-bps Modem ○ multiplexer configuration with 8 asynchronous channels, composite link, and 9600-bps CCITT V.29-compatible integral link modem:

	NA	4,925	38/54

Rackmount Kit ● converts 6001 INP for rackmounting in standard 19-inch equipment rack:

	NA	75	NC/NC

6001 INP Flow Control

Standard 6001 feature that guards against buffer overflow and resultant loss of data; also protects terminal equipment from loss of data resulting from overflow ● controls terminal data flow at channel inputs by lowering or raising Clear-To-Send (CTS) to RS-232C interface, or by generating XON/XOFF control characters ● flow control inhibits all data channels simultaneously ● flow suspension threshold at 75 percent total buffer utilization; flow resumption threshold at 25 percent ● terminal equipment controls data flow via signal on pin 14 of RS-232C interface; DTR can be used to control flow by jumping DTR to pin 14:

NC mo	NC prch	NC/NC maint

6001 INP Diagnostic Tests

Isolates failures in local/remote central controller, local/remote channels, local/remote composite link modems or composite link through integral self tests, data loopback at various loopback points, and test message generation ● self diagnostics run on power-up or initialization ● selectable FOX message broadcast to all ports ● visual failure indication via front-panel LEDs:

NC mo	NC prch	NC/NC maint

6001 INP Status Reporting

Reports abnormal conditions such as errors or failures; buffer utilization, data lost; retransmission in progress; unsuccessful initialization ● front-panel LED display:

NC mo	NC prch	NC/NC maint

6001 INP Channels

Central control module packaged with 4 or 8 channels ● asynchronous switch-selectable channel rates of 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; maximum aggregate input (burst) rate of 76.8K bps ● 5/6/7/8 data bits ● passes 6 EIA control signals end-to-end—DTR/DSR; BUSY/RI; RTS/DCD ● RS-232C/CCITT V.24 interface.

Autospeed ● regulates asynchronous channel rate to rate of dial-up line ○ standard feature enters autospeed mode when DTR active ● selectable on a per unit basis ● 110/134.5/150/300/600/1200/1800/2400/4800/9600-bps rate ● CR convention; CTL D for 134.5 bps:

NC mo	NC prch	NC/NC maint

Echoplex ● autoecho feature loops transmission received at input channel port to output port ● all data except flow control characters echoed ● standard feature selectable on a per unit basis:

NC	NC	NC/NC

Flyback Control ● generates 8/15/37 null (pad) characters following line feed, carriage return, or form feed, respectively, upon transmission of control character from channel port to terminal equipment ● compensates for time required by terminal to perform these control functions ● standard feature selectable on per-unit basis:

NC	NC	NC/NC

6001 INP Composite Link

Central control module packaged link ● synchronous full-duplex up to 19.2K bps ● CCITT X.25 Level 2-compatible protocol ● CRC and ARQ error detection and correction ● RS-232C/CCITT V.24 interface:

NC mo	NC prch	NC/NC maint

Integral Link Modem ● optional 4800-bps CCITT V.27 bis-compatible modem or 9600-bps CCITT V.29-compatible modem point-to-point full-duplex communication over an unconditional 4-wire dedicated Type 3002 line ● option included in 4- or 8-channel unit package price.

☐ Codex 6002 Intelligent Network Processor

Central control module available in 2 basic enclosures, expandable to 8 or 16 asynchronous channels in 4-channel increments; both units come prepackaged with 4 channels already included ● integral 4800- or 9600-bps modem option available with basic packaged units ● basic enclosures include central logic, power supply, 32K-character battery-backed RAM buffer, and composite link module ● rackmount option.

60210 ● multiplexer configuration packaged with link module and 4 channels; expandable to 8 channels maximum:

	NA mo	$1,900 prch	$46/NA maint

60212 ● same as 60210 except includes integral 4800-bps modem:

	NA	3,625	NA/NA

60213 ● same as 60210 except includes integral 9600-bps modem:

	NA	4,475	NA/NA

MO: monthly lease charge; Codex refuses to supply lease pricing. PRCH: single-unit purchase price. MAINT: Zone A/Zone B monthly maintenance charge for purchased units. NC: no charge or included in basic controller module. NA: not available/applicable. Prices are current as of April 1985.

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60220 ● multiplexer configuration packaged with link module and 4 channels; expandable to 16 channels maximum:

NA	2,100	NA/NA

60222 ● same as 60220 except includes integral 4800-bps modem:

NA	3,825	NA/NA

60223 ● same as 60220 except includes integral 9600-bps modem:

NA	4,675	NA/NA

Downline Load ● automatically downline loads channel configuration parameters from master to slave unit ● standard feature:

NC	NC	NC/NC

24060 Rackmount Kit ● converts 8-channel 6002 INP for rackmounting in standard 19-inch equipment rack:

NA	75	NA/NA

24061 Rackmount Kit ● converts 16-channel 6002 INP for rackmounting in standard 19-inch equipment rack:

NA	75	NA/NA

6002 INP Flow Control

Guards against multiplexer system overflow and against buffer overflow at terminals ● controls data flow at channel inputs by generating XON/XOFF control characters, or by raising or lowering Clear-To-Send (CTS) on EIA RS-232C interface ● flow control performed on individual channel basis ● selectable support for Hewlett-Packard, Wang, and Tandem flow control techniques ● flow suspension threshold at 75 percent total buffer utilization; flow resumption threshold at 25 percent ● data lost message sent to supervisory control terminal:

NC mo	NC prch	NC/NC maint

6002 INP Diagnostic Tests

Isolates failures in local/remote channels, composite link, local/remote multiplexers, and optional integral modem ● self-test of internal multiplexer and modem circuitry ● local/remote digital loopback; local/remote analog loopback for integral modem option ● diagnostic tests initiated from front panel switches, or via user-supplied terminal connected to the supervisory control port ● test pattern generation and comparison:

NC mo	NC prch	NC/NC maint

6002 INP Status Reporting

Status information available from LED indicators on mux front panel, or from user-supplied ASCII terminal connected to the supervisory port ● 10 LEDs display mux status including loopbacks, normal/alarm condition, composite link status, carrier detect, and buffer full; units with optional integral modem contain LEDs to display key EIA interface signals ● supervisory control terminal can monitor mux/EIA control signals and provide the user with channel statistics for loading, error rate, and buffer utilization; composite link statistics for loading, error rate, buffer utilization, and frame count; unit statistics for traffic density, error density, statistical loading:

NC mo	NC prch	NC/NC maint

6002 INP Channels

Central control module supports up to 2 or 4 quad-channel adapters, for a maximum of 8 or 16 channels/ports depending on the basic frame size ● basic unit pricing includes 4 asynchronous channels; channel adapters can be added at the factory or in the field, with a proportionately higher cost for field-upgraded channel capacity ● channel parameters established through user-supplied ASCII terminal connected to the supervisory control port ● asynchronous selectable data rates at 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600 bps ● maximum aggregate burst input rate of 76.8K bps for 8-channel models; 153.6K bps for 16-channel models ● 5 through 8 data bits per character ● 1, 1.5, or 2 stop bits ● odd,

even, or no parity ● programmable flyback and data restraint characters.

60291 Quad Channel Adapter ● single-board adapter provides 4 full-duplex asynchronous channels ● requires slot in central control module:

NA mo	$1,000 prch	NC/NC maint

60295 Split (Asymmetrical) Channel Speed Option ● supports terminals operating at receive/transmit data rates of 1200/75 bps or other standard data rate pairs ● applicable to Viewdata and other public information networks ● extra-cost option required per each quad-channel adapter:

NA	50	NC/NC

Echoplex ● echos terminal data from remote multiplexer (local echo) instead of from XPU, improving response time ● standard, selectable feature:

NC	NC	NC/NC

Autospeed (Autobaud) ● selectable feature regulates asynchronous channel rate to rate of dial-up line ● automatically detects and accommodates data rates at 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600 bps ● initiated via CR convention ● standard feature:

NC	NC	NC/NC

Supervisory Control Port ● dedicated port supports 47540 Control Port Terminal or user-provided ASCII terminal ● required for setting channel parameters, and can be used to monitor channel/link statistics, perform diagnostics, and generate system status reports ● selectable Report Command automatically displays reports on control console screen; reports can be printed individually ● reports include Configuration Complete, Framing Acquired/Lost, Buffer Input/Output Overflow, Configuration error, Flow Control (message lost per data channel), Frame Reject, and Protocol Error ● supports asynchonous data rates from 50 to 9600 bps ● RS-232C CCITT V.24/V.28 electrical interface ● standard feature:

NC	NC	NC/NC

47540 Control Port Terminal ● Codex-supplied DEC LA120 KSR terminal ● attaches to Supervisory Control Port; interacts with system and prints reports ● extra-cost option:

NA	1,800	16/22

6002 INP Composite Link

Central control module-packaged link ● synchronous data rates to 14.4K bps ● Codex X.25 Level II, SDLC-like link protocol ● CRC and ARQ error detection and correction ● RS-232C CCITT V.24/V.28 electrical interface ● standard feature:

NC mo	NC prch	NC/NC maint

Integral 4800-bps Modem ● packaged systems Models 60212 and 60222 include integral synchronous 4800-/2400-bps modem for operation over unconditioned 4-wire dedicated Type 3002 lines ● CCITT V.27 bis/V.26 compatible ● automatic adaptive equalization ● standard feature included in 60212/60222 package price:

NC	NC	NC/NC

Integral 9600-bps Modem ● packaged system Models 60213 and 60223 include integral synchronous 9600/7200/4800-bps modem for operation over unconditioned 4-wire dedicated Type 3002 lines ● CCITT V.29 compatible ● automatic adaptive equalization ● standard feature included in 60213/60223 package price:

NC	NC	NC/NC

☐ **Codex 6005 Intelligent Network Processor**

6005 INP Central Control

Central control module available in 2 basic enclosures, expandable to 8 or 16 asynchronous or synchronous channels in 4-channel increments; both units come prepackaged with 4 channels already included ● integral 4800- or 9600-bps modem option available with basic packaged units ● basic enclosures

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include central logic, power supply, 32K-character RAM buffer, and composite link module ● rackmount option.

60510 ● multiplexer configuration packaged with link module and 4 channels; expandable to 8 channels maximum:

	NA mo	$3,300 prch	$55/$75 maint

60512 ● same as 60510 except includes integral 4800-bps modem:

	NA	5,025	55/75

60513 ● same as 60510 except includes integral 9600-bps modem:

	NA	5,875	55/75

60520 ● multiplexer configuration packaged with link module and 4 channels; expandable to 16 channels maximum:

	NA	3,600	55/75

60522 ● same as 60520 except includes integral 4800-bps modem:

	NA	5,325	55/75

60523 ● same as 60520 except includes integral 9600-bps modem:

	NA	6,175	55/75

Downline Load ● automatically downline loads channel configuration parameters from master to slave unit ● standard feature:

	NC	NC	NC/NC

24060 Rackmount Kit ● converts 8-channel 6005 INP for rackmounting in standard 19-inch equipment rack:

	NA	75	NA/NA

24061 Rackmount Kit ● converts 16-channel 6005 INP for rackmounting in standard 19-inch equipment rack:

	NA	75	NA/NA

6005 INP Flow Control

Guards against multiplexer system overflow and against buffer overflow at terminals ● controls data flow at channel inputs by generating XON/XOFF control characters, or by raising or lowering Clear-To-Send (CTS) on EIA RS-232C interface ● flow control performed on individual channel basis ● flow suspension threshold at 75 percent total buffer utilization; flow resumption threshold at 25 percent ● data lost message sent to supervisory control terminal:

	NC mo	NC prch	NC/NC maint

6005 INP Diagnostic Tests

Isolates failures in local/remote channels, composite link, local/remote multiplexers, and optional integral modem ● self-test of internal multiplexer and modem circuitry ● local/remote digital loopback; local/remote analog loopback for integral modem option ● diagnostic tests initiated from front panel switches, or via user-supplied terminal connected to the supervisory control port ● test pattern generation and comparison:

	NC mo	NC prch	NC/NC maint

6005 INP Status Reporting

Status information available from LED indicators on mux front panel, or from user-supplied ASCII terminal connected to the supervisory control port ● 10 LEDs display mux status including loopbacks, normal/alarm condition, composite link status, carrier detect, and buffer full; units with optional integral modem contain LEDs to display key EIA interface signals ● supervisory control terminal can monitor mux/EIA control signals and provide the user with channel statistics for characters transmitted/received, errors, and buffer utilization; composite link statistics for traffic and error density, frame rate, characters received, buffer utilization, and overall throughput:

	NC mo	NC prch	NC/NC maint

6005 INP Channels

Central control module supports up to 2 or 4 quad-channel adapters, for a maximum of 8 or 16 channels/ports depending on the basic frame size ● basic unit pricing includes 4 asynchronous or IBM BSC channels; channel adapters can be added at the factory or in the field, with a proportionately higher cost for field-upgraded channel capacity ● optional half-duplex synchronous and bit synchronous protocols ● channel parameters established through user-supplied ASCII terminal connected to the supervisory control port ● asynchronous and BSC synchronous selectable data rates at 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, or 19.2K bps ● maximum aggregate input rate of 76.8K bps for 8-channel models; 153.6K bps for 16-channel models ● 5 through 8 data bits per character ● 1, 1.5, or 2 stop bits ● odd, even, or no parity ● programmable garble character; programmable flyback delay and fill recognition characters ● passes up to 7 full-duplex EIA control signals in the sequence (DSR, DCD, RI, CTS, DTR, RTS, and MB) ● programmable slot length determines amount of link frame each channel will occupy ● optional synchronous protocols support ASCII, EBCDIC, or BSC Transcode data codes.

60591 Quad Channel Adapter ● single-board adapter provides 4 full-duplex asynchronous channels ● converts to synchronous communication via 60594 firmware option ● requires slot in central control module ● factory-installed upgrade for original-purchase equipment only:

	NA mo	$1,000 prch	NC/NC maint

60536 SDLC Quad Channel Adapter ● provides 4 full-duplex IBM SDLC or HDLC synchronous channels ● data rates up to 9600 bps per channel ● up to three 60536 modules per unit max ● requires 60536 option:

	NA	1,200	NC/NC

60537 Synchronous Protocol Option ● firmware option supports half-duplex or bit synchronous protocols for all data channels, or any mixture of synchronous and asynchronous channels ● protocols including IBM SDLC or HDLC (requires 60536 channel adapter), CDC User 200, Uniscope 100/200, Sperry 1004, Sperry DCT 2000, ISO R1745, Sperry NTR, SITA P1024, ICL 7021, Burroughs 771, Burroughs Poll Select, Honeywell 701, ICL 7180, VIP 7700, or DEC DDCMP selectable on a per-channel basis ● internal or external clock:

	NA	750	NC/NC

60595 Split (Asymmetrical) Channel Speed Option ● supports terminals operating at receive/transmit data rates of 1200/75 bps or other standard data rate pairs ● applicable to Viewdata and other public information networks ● extra-cost option required per each quad-channel adapter:

	NA	50	NC/NC

Echoplex ● echos terminal data from remote multiplexer (local echo) instead of from CPU, improving response time ● standard, selectable feature:

	NC	NC	NC/NC

Autospeed (Autobaud) ● selectable feature regulates asynchronous channel rate to rate of dial-up line ● automatically detects and accommodates data rates at 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600 bps ● initiated via CR convention ● standard feature:

	NC	NC	NC/NC

Supervisory Control Port ● dedicated port supports 47540 Control Port Terminal or user-provided ASCII terminal ● required for setting channel parameters, and can be used to monitor channel/link statistics, perform diagnostics, and generate system status reports ● selectable Report Command automatically displays reports on control console screen; reports can be printed individually ● reports include Configuration Complete, Framing Acquired/Lost, Buffer Input/Output Overflow, Configuration Error, Flow Control (message lost per data channel), Frame Reject, and Protocol Error ● supports asynchronous data rates from 50 to 9600 bps ● RS-232C CCITT V.24/V.28 electrical interface ●

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password protection ● standard feature:

NC	NC	NC/NC

47540 Control Port Terminal ● Codex-supplied DEC LA120 KSR terminal ● attaches to Supervisory Control Port; interacts with system and prints reports ● extra-cost option:

NA	1,800	16/22

6005 INP Composite Link

Central control module packaged link ● synchronous data rates to 19.2K bps ● configured as DTE ● Codex X.25 Level II, SDLC-like link protocol ● programmable frame size ● CRC and ARQ error detection and correction ● RS-232C CCITT V.24/V.28 electrical interface ● standard feature:

NC mo	NC prch	NC/NC maint

Integral 4800-bps Modem ● packaged systems Models 60512 and 60522 include integral synchronous 4800-/2400-bps modem for operation over unconditioned 4-wire dedicated Type 3002 lines ● CCITT V.27 bis/V.26-compatible ● automatic adaptive equalization ● standard feature included in 60512/60522 package price:

NC	NC	NC/NC

Integral 9600-bps Modem ● packaged system Models 60513 and 60523 include integral synchronous 9600/7200/4800-bps modem for operation over unconditioned 4-wire dedicated Type 3002 lines ● CCITT V.29 compatible ● automatic adaptive equalization ● standard feature included in 60513/60523 package price:

NC	NC	NC/NC

☐ Codex 6035 Intelligent Network Processor

6035 INP Central Control

Basic controller frame (mainframe) with power supply, 2 master control modules, 2 processors (Motorola M6800) plus 4 optional processors, 32K or 48K bytes of ROM, 16K or 32K bytes of RAM buffer storage, and an option module ● 1 to 4 port nests (each a card frame) accommodate channel adapters ● each port nest contains a nest interface control module and provides 14 (first port nest) or 16 card slots for channel adapters.

66035 Basic 6035 INP ● includes basic controller frame with 16K-byte RAM buffer and single-port nest with 14 card slots; 28 channels/ports maximum ● 2 rackmountable units; requires 66199 equipment rack or equivalent:

NA mo	$4,000 prch	$76/$106 maint

66919 Second or Fourth Expansion Port Nest for 6035 ● includes single-port nest with nest interface control module and 16 card slots; 32 channels/ports maximum ● single rackmountable unit, requires 66199 equipment rack or equivalent:

NA	2,400	NA/NA

66198 Third Expansion Port Nest for 6035 ● includes single-port nest with nest interface control module and 16 card slots and power supply; 32 channels/ports maximum ● 2 rackmountable units; requires 66199 equipment rack or equivalent:

NA	2,900	NA/NA

66199 Equipment Rack ● 56-inch-high standard rack:

NA	910	NC/NC

66922 Power Supply ● 110-/220-volt rackmountable supply:

NA	1,050	NC/NC

66103 6035 Processor Module ● provides additional processing and throughput capabilities ● 3 additional processors maximum for total of 6 processors ● requires card slot in basic controller frame (mainframe):

NA	850	NC/NC

66114 16K-Byte Buffer Memory ● provides additional buffer storage for up to 80 channels/ports ● requires card slot in basic controller frame (mainframe) for total of 32K bytes of RAM:

NA	700	NC/NC

66122 Configuration Memory Expansion ● provides 16K bytes of additional RAM configuration memory for up to 21 ports ● requires card slot in basic controller frame (mainframe):

NA	100	NC/NC

66121 Operator Console ● located on front panel of basic controller frame (mainframe) ● system operating parameters examined or modified and diagnostic tests initiated through 18-key integral keypad ● results displayed on 32-character self-scan screen ● separate indicator lamps for operating mode, processor ID and status, and interrupts ● keylock switch with power off position selects 3 operating modes (Diagnostic/ Program/Monitor) ● displays status of interface signals of any port in network ● displays condition of transmit and receive links ● performs diagnostic tests and displays results ● may be substituted with 66321 Control Terminal Port Support option which performs all functions except diagnostic tests:

NA	850	NC/NC

66345 Satellite Link/Variable Length ARQ ● standard firmware allows altering number of GO-BACK-N ARQ frames from standard N equals 7 to N equals 15, 31, 63, or 127 where round-trip delay exceeds time to send and acknowledges 7 frames, such as experienced with satellite transmission ● may require additional 66114 Buffer Memory Module for additional frame buffering:

NC	NC	NC/NC

66324 Report Logging/Control Port ● optional firmware module generates system event reports presented at user's Control Terminal; events date and time stamped ● event reports produced from information collected by statistics and performance monitoring module and queued for presentation at user specified time intervals or presented as they occur by user selection ● logs all system events generated by all nodes within a network ● includes battery-protected Time-Of-Day Module (TODM), which occupies single slot in port nest ● logging option assigned to specific 66131 or 66151 Terminal Port Module ● requires 66321 Control Terminal Interface support:

NA	600	NC/NC

6035 INP Flow Control

Data restraint is a standard feature that guards against buffer overflow and resultant loss of data; also protects terminal equipment from loss of data resulting from various conditions that prevent the equipment from accepting data ● controls data from terminal at selected channel ports by controlling Clear-To-Send (CTS) on RS-232C interface, or by generating XON/XOFF control characters ● flow control performed on individual channel basis ● flow suspension threshold at 75 percent total buffer utilization; flow resumption threshold at 50 percent ● terminal equipment controls data flow via control characters recognized at channel port; local multiplexer notifies remote multiplexer to interrupt or continue sending data to respective channel:

NC mo	NC prch	NC/NC maint

6035 INP Diagnostic Tests

Isolates failures in local central controller, local/remote channels, local/remote composite link modules, or composite link through integral self tests, data loopback at various loopback points, and monitored thresholds via the status and performance monitoring firmware (66301) ● diagnostic tests initiated only from operator console and performed under program control ● test results reported at operator console status panel ● remote and local channel loopback ● remote and local composite link loopback test pattern generation and comparison:

NC mo	NC prch	NC/NC maint

6035 INP Status Reporting

66301 Statistics & Performance Monitoring ● standard firmware module for collecting, computing, and reporting statistical measures of network performance, and for monitoring

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and reporting abnormal network conditions and user preset operating thresholds ● monitoring function runs constantly as background activity while statistics gathering is operator selectable on a port basis to prevent unnecessary loading of 6000 processing resources ● statistics collected for network node, composite link ports, and channel ports ● results reported via Operator Console, Control Terminal, or Control Terminal used for 66324 Report Logging option ● statistics gathering deals with long-term averages; monitoring functions are concerned with short-term abnormal conditions ● exponentially weighted moving time average of nodal channel and composite link port statistical counts computed to avoid overflows and maintain record of port performance ● time constant for averaging established through Operator Console or Control Terminal in tenths of hours from one tenth to 24 hours ● statistical information reported in response to user request.

Channel statistics derived from calculations based on channel parameters and number of characters received at channel/port from data source, number of bits resulting from code compression of received characters and number of characters received with parity errors (where parity is used), frame errors, or overrun errors ● reported statistical results include Compression Efficiency, defined as ratio of total number of bits received from source to number of bits resulting from code compression; Statistical Loading, defined as ratio of number of characters received to maximum number which could have been received in specified time period; Compressed Loading, defined as ratio of number of bits resulting from code compression to total number of bits which could have been received in specified time interval; and Character Error Rate, defined as ratio of number of characters received with parity, framing, or overrun errors to total number of characters received.

Composite link port statistics derived from calculations based on link port parameters, number of frames, overhead bits transmitted, and number of negative acknowledgements (NAKs) received ● reported statistical results include Traffic Density, defined as ratio of number of nonoverhead bits to total number of bits transmitted by link port; Error Density, defined as ratio of number of NAKs received to number of frames transmitted (reported as a fractional value if below 1 percent); Apparent Efficiency, defined as ratio of the summation of numerical data rates of all channels/ports routed through the link port to the nominal data rate of the link port (the result normally exceeds 1.0 and measures overall efficiency relative to a TDM); Frame Rate, defined as average number of new frames transmitted per second; and Retransmission Rate, defined as average number of frames retransmitted per second.

Node statistics derived from collective channel and network port information and from 6000 resources such as processors and memory ● reported statistical results include Processor Loading; Buffer Utilization; Node Statistical Loading, defined as weighted average of statistical loading of selected channels/ports with weights proportional to port speeds; Node Compression Efficiency, defined as weighted average of compression efficiencies for selected channels/ports with weights proportional to port speeds; and Node Traffic Density, defined as weighted average of traffic densities for the selected channels/ports with weights proportional to port speeds.

Monitored user thresholds include Compression Efficiency, Character Error Rate, Error Density, Processor Loading, Buffer Utilization, and Retransmission Rate ● actual values for each of these threshold parameters are compared with user-established thresholds for all selected channels/ports, composite link ports, and processing resources ● alert message reports abnormality when threshold is exceeded:

NC mo	NC prch	NC/NC maint

66324 Report Logging ● optional firmware modules generate system event reports presented at user Control Terminal; events dated and time stamped ● event reports produced from information collected by 66301 Statistics and Performance Monitoring firmware module and queued for presentation at user specified time intervals or presented as they occur by user selection ● can log all system events generated by all nodes

within a network ● includes battery protected Time-Of-Day Module (TODM) which occupies a slot in port nest ● logging option assigned to specific 66131 or 66151 Terminal Port Module ● requires 66321 Control Terminal Interface Support:

NA	600	NC/NC

6035 INP Channels

First port nest provides 14 card slots; second through fourth port nests provide 16 card slots for channel adapters/port modules ● maximum of 28/60/92/124 channels/ports ● channel parameters established by operator console or by optional control terminal ● asynchronous selectable rates of 75/150/300/600/1200/2400/4800 bps; optional nonstandard data rates ● BSC synchronous strap-selectable rates of 1200/2400/3600/4800/7200/9600 bps ● maximum aggregate channel rate of 76.8K bps ● 5, 6, 7, or 8 data bits ● BSC synchronous mode supports ASCII or EBCDIC codes; transparent/nontransparent text; character framing via SYN characters; strip/insertion of idle time-fill characters ● RS-232C/CCITT V.24 or 20/40/60-mA current loop standard; MIL 188C optional eletrical interface.

66131 Dual Universal Terminal Port Module ● dual-port full-duplex asynchronous/BSC synchronous channel adapter ● operating mode of each port independently selected ● passes 3 EIA RS-232C control signals; full-duplex ● requires slot in port nest:

NA mo	$300 prch	NC/NC maint

66136 Nonstandard Data Rates ● user specified channel/port rates; charge per rate per base unit ● for 66131 or 66151 Dual Port Module:

NA	200	NC/NC

66331 Autospeed ● regulates asynchronous channel rate to rate of dial-up line ● 150/300/600/1200 bps ● CR convention ● for 66131 Dual Universal Terminal Port Module:

NA	400	NC/NC

66332 Echoplex ● auto-echo feature loops transmission received at input channel port to output port:

NC	NC	NC/NC

66151 Dual Current-Loop Terminal Port Module ● dual-port full-duplex channel adapter for neutral or polar current signaling ● strap-selectable for positive or negative polar or neutral signaling, half-duplex neutral signaling, and for 20-, 40-, or 60-mA current levels ● requires slot in port nest and 66251 Current-Loop Demarcation Strip or 66253 Automatic Current-Loop Regulator:

NA	395	NC/NC

66251 Current-Loop Demarcation Strip ● 7-inch rackmountable panel ● 16 current-loop terminal blocks ● accommodates current limiting and impedance matching resistors and battery:

NA	45	NC/NC

66253 Automatic Current-Loop Regulator ● provides strap-selectable automatic constant current-loop level of 20/40/60 mA for one or two 2-wire current circuits ● cannot exceed 3 watts on either circuit ● assembly attaches to 66251 25-pin connector:

NA	125	NC/NC

66256 Current-Loop Battery ● 4.5-amp 48-volt DC rackmountable power supply ● number of loops supported is function of current levels and distance requirements; typically supports up to 32 loops:

NA	320	NC/NC

66133 HDLC Terminal Port Module ● single-port half- or full-duplex HDLC Level 2 channel adapter ● strap-selectable rates of 1200/2400/4800 bps ● external clock ● operating parameters selected via operator console or control terminal port ● requires 66333 HDLC Software Support firmware module and slot in port nest:

NA	500	NC/NC

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66333 HDLC Software Support ● firmware module required for 66133 HDLC Terminal Port Module ● 1 per system:

	NA	800	NC/NC

66149 Multiplexer Port Module ● single-port channel adapter for transmission to Codex 6001/6005/6050 ● synchronous at rates up to 4800 bps ● operating parameters selected via operator console or control terminal port ● requires 66349 6010 Interface Support firmware module and 2 slots in port nest:

	NA	800	NC/NC

66349 6010 Interface Support ● firmware module required for 66149 Multiplexer Port Module ● 1 per system:

	NC	NC	NC/NC

66321 Control Terminal Port Support ● firmware option adapts any asynchronous port for control terminal use ● substitute for 66121 Operator Console ● supports asynchronous ASCII terminal or CPU port ● equivalent operator console support for program and monitor modes ● requires 66131 Dual Universal Terminal Port Module:

	NA	950	NC/NC

66323 Supervisory Communications Support ● optional firmware module supports 66131 or 66151 Terminal Port Module as a Supervisory Communications Port (SCP) ● 1 SCP per node maximum ● SCP accommodates any asynchronous ASCII terminal as Supervisory Communications Terminal (SCT) for message communications between network control personnel in a multinode network ● message entry in interactive dialogue with 6000 system prompting ● message includes 5-digit sequence number, destination address(es) and up to 480 text characters ● message receipt acknowledged by destination node:

	NA	750	NC/NC

66160 Universal MIL-STD-188 Option Nest ● 7-inch rackmountable nest with 16 card slots ● does not include power supply:

	NA	250	NC/NC

66161 MIL-STD-188 Interface Module ● provides EIA to MIL-STD-188 level conversion between local terminal and terminal port module ● data rates to 2400 bps ● requires slot in 66160 Universal Option Nest and 66131 Dual Universal Terminal Port Module:

	NA	200	NC/NC

66162 MIL-STD-188 Interface Module ● provides EIA to MIL-STD-188 level conversion between local terminal and terminal port module ● data rates from 2400 bps to 9600 bps ● requires slot in 66160 Universal Option Nest and 66131 Dual Universal Terminal Port Module:

	NA	200	NC/NC

66163 MIL-STD-188 Interface Module ● provides EIA to MIL-STD-188 level conversion between tail circuit modem and terminal port module ● data rates to 2400 bps ● requires slot in 66160 Universal Option Nest and 66131 Dual Universal Terminal Port Module:

	NA	200	NC/NC

66164 MIL-STD-188 Interface Module ● provides EIA to MIL-STD-188 level conversion between tail circuit modem and terminal port module ● data rates from 2400 bps to 9600 bps ● requires slot in 66160 Universal Option Nest and 66131 Dual Universal Terminal Port Module:

	NA	200	NC/NC

66166 MIL-STD-188 Interface Module ● provides EIA to MIL-STD-188 level conversion between 6000 network ports and composite link modem for data rates to 9600 bps ● requires slot in 66160 Universal Option Nest:

	NA	200	NC/NC

6035 INP Composite Link

First port nest requires 2 slots for single composite link ● additional composite network links each require 2 slots ●

synchronous link rates to 19.2K bps ● SDLC/CCITT X.25 Level 2 protocol ● CRC and ARQ error detection and correction ● RS-232C/CCITT V.24 interface:

	NC mo	NC prch	NC/NC maint

66140 Network Port Module ● additional composite link port for nodal configurations of 2 to 5 additional network links ● requires 2 slots in port nest:

	NA	500	NC/NC

□ **Codex 6050 Distributed Communications Processor**

6050 DCP Central Control

Basic controller frame (mainframe) contains 2 master control modules (Intel 3000 Series), 6 processor modules (Motorola M6800), two 16K-byte ROM modules, four 16K-byte RAM modules, and an options module ● ROM modules perform start-up diagnostics and load system software from diskette upon initialization ● options module contains mainframe console central logic, configuration memory to store user-established operating parameters for node and each channel/port, and an options PROM to accommodate any options at node ● 1 to 4 port nests (each a card frame) accommodate channel adapters and composite link modules (intelligent interface ports) ● each port nest contains an intelligent nest interface card (INIC) and provides 11 (first port nest) or 16 slots for intelligent interface ports ● mainframe, operator console, first and second port nests, dual diskette drive (primary node only), and power supply occupy a 60-inch mounting cabinet; a second (expansion) cabinet accommodates 1 or 2 additional port nests.

66051 Primary Node 6050 DCP ● includes mainframe, operator console, dual diskette drive, basic system software, single port nest, diskette controller port (I/FDP), control terminal port (I/CTP), power supply, and cabinet:

	NA mo	$20,500 prch	$265/$370 maint

66052 Secondary Node 6050 DCP ● includes mainframe, operator console, basic system software, single port nest, power supply, and cabinet:

	NA	17,500	265/370

66284 Mainframe Redundancy System ● redundant system option ● includes mainframe, port nest, power supply, and cabinet; requires separate switch:

	NA	14,500	265/370

66197 Expansion Cabinet ● includes single port nest and power supply; accommodates a second 66220 Expansion Port Nest:

	NA	9,500	NC/NC

66220 Expansion Port Nest ● includes INIC (Intelligent Nest Interface Card) and provides 16 slots for intelligent interface ports:

	NA	2,500	116/162

Operator Console ● located on front panel of basic controller frame (mainframe) ● system operating parameters examined or modified and diagnostic tests initiated through 18-key integral keypad (multifunction keyboard) ● results displayed on 32-character self-scan screen ● separate indicator lamps for operating mode, processor ID, status, and interrupts ● keylock switch with power off position selects 3 operating modes (Diagnostic/Program/Monitor):

	NC	NC	NC/NC

66262 Intelligent Floppy Disk Controller Port (I/FDP) ● supports 3 double-sided, double-density diskette drives ● microprocessor-based (M6800) with 48K bytes of RAM ● required by primary node only to load system software ● requires 2 slots in port nest:

	NA	1,500	NC/NC

66264 Dual Drive Diskette Unit ● requires 66262 I/FDP ● powered by 15 vac 60 Hz source; 66263 powered by 100 vac 50

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Hz; 66265 powered by 230 vac 50 Hz:

NA	3,500	NA/NA

6050 DCP Flow Control

Data restraint is a standard feature for asynchronous channels/ports that guards against buffer overflow and resultant loss of data; also protects terminal equipment from loss of data resulting from various conditions that prevent the equipment from accepting data • controls data from terminal at selected channel ports by controlling Data Set Ready (DSR) on RS-232C interface, or by generating XON/XOFF control characters • flow suspension threshold at 75 percent total buffer utilization; flow resumption threshold at 50 percent • terminal equipment controls data flow via Data Terminal Ready (DTR) or via XON/XOFF control characters recognized at channel port; local multiplexer notifies remote multiplexer to interrupt or continue sending data to the respective channel:

NC mo	NC prch	NC/NC maint

Codex also uses a flow control technique to prevent a terminal from overloading the network's node resources during periods of high network congestion. The technique controls data flow from source channel/port to destination channel/port by limiting the number of characters transmitted over a link per call to a time period equivalent to the round-trip delay. The source channel/port buffers data received from the associated terminal equipment once the limit is exceeded, until the acknowledgement is received from the destination channel/port that verifies the correct reception of data. Transmission then resumes with another block of data sent across the network path. The data restraint feature is invoked should the user-defined threshold for the channel buffer be exceeded by data received from the associated terminal equipment.

6050 DCP Diagnostic Tests

Isolates failures in local central controller, local/remote channels, local/remote composite link modules, or composite link through integral self test, data loopback at various loopback points, and monitored thresholds via the status and performance monitoring software • diagnostic tests initiated from operator console or control terminal and performed under program control • test results reported at operator console status panel • remote and local channel loopback • remote and local composite link loopback • test pattern generation and comparison:

NC mo	NC prch	NC/NC maint

6050 DCP Status Reporting/Performance Monitoring

Standard firmware module for collecting, computing, and reporting statistical measures of network performance, and for monitoring and reporting abnormal network conditions and user preset operating thresholds • monitoring function runs constantly as background activity while statistics gathering is operator selectable on a port basis to prevent unnecessary loading of processing resources • statistics collected for network node, composite link ports, and channel ports • results reported via Operator Console, Control Terminal, or Control Terminal used for 66324 Report Logging option • statistics gathering deals with long-term averages; monitoring functions are concerned with short-term abnormal conditions • moving time average of nodal channel and composite link port statistical counts computed to avoid overflows and maintain record of port performance • time constant for averaging established through Operator Console or Control Terminal in 6 seconds to 2.25 days • statistical information reported in response to user request.

Channel statistics derived from calculations based on channel parameters and number of characters received at channel/port from data source, number of bits resulting from code compression of received characters and number of characters received with parity errors (where parity is used), frame errors, or overrun errors • reported statistical results include Compression Efficiency, defined as ratio of total number of bits received from source to number of bits resulting from code compression; Statistical Loading, defined as ratio of number of characters received to maximum number which could have been received in specified time period; Compressed Loading, defined as ratio of number of bits resulting from code compression to total number of bits which could have been received in specified time interval; and Character Error Rate, defined as ratio of number of characters received with parity, framing, or overrun errors to total numbers of characters received.

Composite link port statistics derived from calculations based on link port parameters, number of frames, overhead bits transmitted, and number of negative acknowledgements (NAKs) received • reported statistical results include Traffic Density, defined as ratio of number of nonoverhead bits to total number of bits transmitted by link port; Error Density, defined as ratio of number of NAKs received to number of frames transmitted (reported as a fractional value if below 1 percent); Apparent Efficiency, defined as ratio of the summation of numerical data rates of all channels/ports routed through the link port to the nominal data rate of the link port (the result normally exceeds 1.0 and measures overall efficiency relative to a TDM); Frame Rate, defined as average number of new frames transmitted per second and Retransmission Rate, defined as average number of frames retransmitted per second.

Node statistics derived from collective channel and network port information and from 6050 resources such as processors and memory • reported statistical results include Processor Loading; Buffer Utilization; Node Statistical Loading, defined as weighted average of statistical loading of selected channels/ports with weights proportional to port speeds; Node Compression Efficiency, defined as weighted average of compression efficiencies for selected channels/ports with weights proportional to port speeds; and Node Traffic Density, defined as weighted average of traffic densities for the selected channels/ports with weights proportional to port speeds.

Monitored user thresholds include Compression Efficiency, Character Error Rate, Error Density, Processor Loading, Buffer Utilization, and Retransmission Rate • actual values for each of these threshold parameters are compared with user established thresholds for all selected channels/ports, composite link ports, and processing resources • alert message reports abnormality when threshold is exceeded:

NC mo	NC prch	NC/NC maint

6050 DCP Channels

First port nest provides 11 card slots; second through fourth port nests each provide 16 card slots/ports for channel adapters • channel parameters established by operator console or by control terminal • selectable internal data rates of 50/75/110/134.5/150/300/600/1200/1800/2000/2400/3600/4800/7200/9600/19,200 bps • external clock rates • maximum aggregate rate for asynchronous and BSC synchronous channels is 19,200 bps • 5, 6, 7, or 8 data bits • BSC synchronous mode supports ASCII, EBCDIC, or Transcode codes; transparent/nontransparent text; character framing via SYN characters; strip/insertion of idle time-fill characters.

66231 Intelligent Multiple Asynchronous Terminal Port (I/MATP) • 4- (quad) channel (port) full-duplex asynchronous channel adapter • operating parameters established independently for each port • microprocessor based (M6800/M6809) with up to 48K bytes of RAM • expandable to 16 channels (ports) via up to 3 Quad Byte Terminal Port (QBYTE) expansion modules • requires 2 slots in port nest:

NA mo	$1,000 prch	NC/NC maint

66233 Intelligent Multiple Synchronous Terminal Port (I/MSTP) • 4- (quad) channel (port) full-duplex BSC synchronous channel adapter • operating parameters established independently for each port • microprocessor based (M6800/M6809) with up to 48K bytes of RAM • expandable to 16 channels (ports) in 4-channel increments via up to 3 Quad Byte Terminal Port (QBYTE) expansion modules • requires 2 slots in port nest:

NA	1,000	NC/NC

66234 Quad TP (I/QBYTE) Expansion Module • expands

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6001, 6002, 6005 & 6035 INP and 6050 DCP

I/MATP or I/MSTP channel cards by 4 channels (ports) ● maximum of 3 per channel card ● requires slot in port nest:

NA	600	NC/NC

66235 Block Mode Bisynchronous Protocol Intervention Port ● single channel (port) supports IBM 2780/3780 protocol at rates up to 9600 bps ● provides local ACK/NAK to eliminate delays in sending ACK/NAK through network ● nonexpandable; requires slot in port nest:

NA	1,500	NC/NC

66238 HDLC Terminal Port (I/BOP) ● single channel (port) supports full-duplex bit-oriented protocol including SDLC, HDLC, and ADCCP transparently at rates up to 9600 bps ● selectable parameters include extended address or control field (yes/no), logical control field (yes/no), bad frame (discard/abort), information fieldwork length (5, 6, 7, or 8 bits), and speed ● requires slot in port nest:

NA	1,200	NC/NC

66259 Intelligent Control Terminal Port (I/CTP) ● supports Engine 3 version of 66260 ● used with software R.8.1 or later ● requires 2 slots in port nest:

NA	1,200	NC/NC

66260 Intelligent Control Terminal Port (I/CTP) ● supports Codex 66267 Control Terminal or any asynchronous ASCII CRT terminal as a control terminal to establish operating parameters for local or remote nodes ● also provides an additional RS-232C interface to accommodate an asynchronous ASCII serial printer for status reporting ● used with software R.7.3 or earlier versions ● requires 2 slots in port nest:

NA	1,200	NC/NC

66267 Control Terminal ● Codex CDX-68 display terminal:

NA	1,725	16/NA

66244 Intelligent Multiplexer Port (I/MXP) ● single-port channel adapter accommodates transmission between 6050 DCP and 6001, 6002, 6005, and 6035 INPs ● supports data rates to 9600 bps ● RS-232C/CCITT V.24 interface ● operating parameters selected via operator console or control terminal port ● requires software support option 66243 and/or 66245 and slot in port nest:

NA	1,200	NC/NC

66243 Software Support for 66244 I/MXP ● required software supports Intelligent Multiplexer Port for communication with 6001 or 6005 INP ● 1 module per system:

NA	500	NC/NC

66245 Software Support for 66244 I/MXP ● required software supports Intelligent Multiplexer Port for communication with 6001, 6002, 6005, or 6035 INP ● 1 module per system:

NA	2,000	NC/NC

Autospeed ● regulates asynchronous channel rate to rate of dial-up line ● user-defined recognition and substitution characters ● user-defined autospeed parameters ● for 66231 I/MATP channel only ● standard feature selectable on a per channel/port basis:

NC	NC	NC/NC

Echoplex ● auto-echo feature returns characters received from terminal to terminal via loopback at channel interface ● standard feature selectable on a per-channel/-port basis:

NC	NC	NC/NC

Flyback Control ● generates null (pad) characters following carriage return or user-defined character upon transmission of this control character from channel port to terminal equipment ● number of pad characters user-selectable compensates for time required for printer terminal to perform carriage return, line feed, or form feed ● standard feature selectable on a per channel basis:

NC	NC	NC/NC

Data Compression ● adaptive data compression feature eliminates transmission of repetitive data or blanks for increased communication efficiency ● monitors data stream at each source channel/port and assigns codes to frequently received characters and character sequences ● Huffman algorithm assigns shorter codes to frequently received repetitive characters, longer codes to less frequent repetitive characters ● compression tables generated dynamically at each port channel; tables dynamically updated to reflect changes in frequency of character occurrence ● decompression performed at destination node/port ● automatically performed on all channels/ports ● standard feature:

NC	NC	NC/NC

Priority Control ● user-assigned channel/port priority; 8 priority levels ● composite link bandwidth available to terminal is directly proportional to assigned channel/port priority; high-priority channels allocated full bandwidth for terminals operating speed at congestion levels up to 90 percent; low-priority terminals allocated full bandwidth only at congestion levels of 20 percent or less ● standard feature:

NC	NC	NC/NC

Call Routing

All channels/ports can be configured for 1 of 4 connection modes to establish a communication path between 2 compatible devices in the network. A path is established between source and destination channels (devices) only if the devices are compatible with one another, and the called device is not busy. The call originating device is notified with an error message if the destination device is not compatible, or with a busy signal if the destination device is occupied with another call.

Security measures prevent unauthorized connections between network nodes/ports to secure sensitive information. This is established by assigning a security level to each channel/port. Eight levels of security are provided; calls can only be originated with devices assigned the same or lower security level.

Programmable channel connection assignments include selection (switched) channels, dedicated channels, and contention channels.

Switched Channels—Dial Mode ● calls established to selected destination nodes/channels (port) for asynchronous devices only ● node/port address required for routing ● call terminated by transmitted EOT character from call originating device.

Dedicated Channels—Permanent Mode ● fixed path assignment between source and destination node/ports ● path maintained once established.

Dedicated Channels—Controlled Mode ● same as Permanent Mode except path between source and destination node/ports not established until channel/port of call originating device receives DTR control signal from device; path terminated with loss of DTR signal from device.

Contention Mode Channels ● do not originate calls; call destination channels/ports accept calls on a first-come, first-serve basis ● other contending devices receive busy signal while call in progress.

Routing Priority ● calls routed according to user-defined routing priority; calls from devices with low routing priority routed only if noncongested path to destination device is available; calls from devices with high routing priority routed regardless of network congestion ● minimum delay route established for initial call; calls rerouted to minimize congestion.

Call routing between network nodes is established by the user. User-assigned channel parameters specify either Preferred or Dynamic Routing, and Routing/Priority. Transmit and receive paths between 2 devices are routed independently.

Preferred Routing ● routes call between source and destination nodes over user-defined path ● path dynamically routed to remedy link failure.

Dynamic Routing ● routes call between source and destination nodes over shortest available path at time of call ● shortest path automatically calculated by monitoring traffic congestion levels and equivalent delays for all network links.

Adaptive Routing ● congestion levels of all network links

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continuously monitored; calls rerouted over alternate network links when congestion level of any link exceeds user-defined threshold or when link fails ● transmitting device notified if call cannot be rerouted over alternate link as result of link failure.

Adaptive Routing minimizes network congestion by evenly distributing traffic over all network links and protects critical communication from link failure.

6050 DCP Composite Link

Two types of network ports that interface network link ● both types can be combined on single system node ● maximum number of network ports per system limited by throughput considerations to eight 9600-bps links and two 64K-bps Group Band links.

66240 Intelligent Network Port (I/NP) ● supports single link at operator-selectable synchronous rates up to 19.2K bps ● microprocessor-based (M6800) with 16K bytes of RAM ● modified HDLC protocol ● CRC and ARQ error detection and correction ● operator-defined frame length; 16 frames minimum ● RS-232C interface ● logically addresses 127 nodes ● requires slot in port nest:

NA mo	$1,200 prch	NC/NC maint

66242 Intelligent Group Band Network Port (I/GBNP) ● supports single link at synchronous rates of 48K bps to 64K bps ● microprocessor-based (M6809) with 16K bytes of RAM ● modified HDLC protocol ● CRC and ARQ error detection and correction CCITT V.35 (AT&T 303 optional) interface ● requires 2 slots in port nest:

NA	1,500	NC/NC

● **END**

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■ PROFILE

Function ● bit-interleaved TDM designed for T1/DS1 carrier facilities ● point-to-point applications; downline loading of remote multiplexer ● handles 64 synchronous data or voice channels directly; asynchronous data accommodated by submultiplexing devices such as statistical multiplexers or async-to-sync converters ● composite link speeds from 56K to 1.544M bps or 2.048M bps; uses bipolar NRZ encoding.

Communications/Networks ● supports synchronous data channels at speeds of 2400 to 760K bps; asynchronous data speeds up to 19.2K bps through submultiplexer ● voice channels employ Continuously Variable Slope Delta (CVSD) and quantize at 16K/24K/32K bps ● channel interfaces are RS-232C/V.24, V.35, RS-449/422, and MIL STD 188/114 ● single composite link (trunk); RS-449/442; MIL STD 188/144 and CCITT V.35 interfaces ● point-to-point applications ● cascaded multiplexers handled on channel side.

First Delivery ● 1984.

Systems Delivered ○ undisclosed.

Comparable Systems ● Amdahl Model 2211, Avanti Ultra-Mux, Bayly Omniplexer, Coastcom D/I Mux, Datatel DCP 9100, DCA Netlink, General DataComm Megamux 1258, Infotron T Mux, Paradyne DCX-T1, Scitec BSPT1, and Timeplex Link/1.
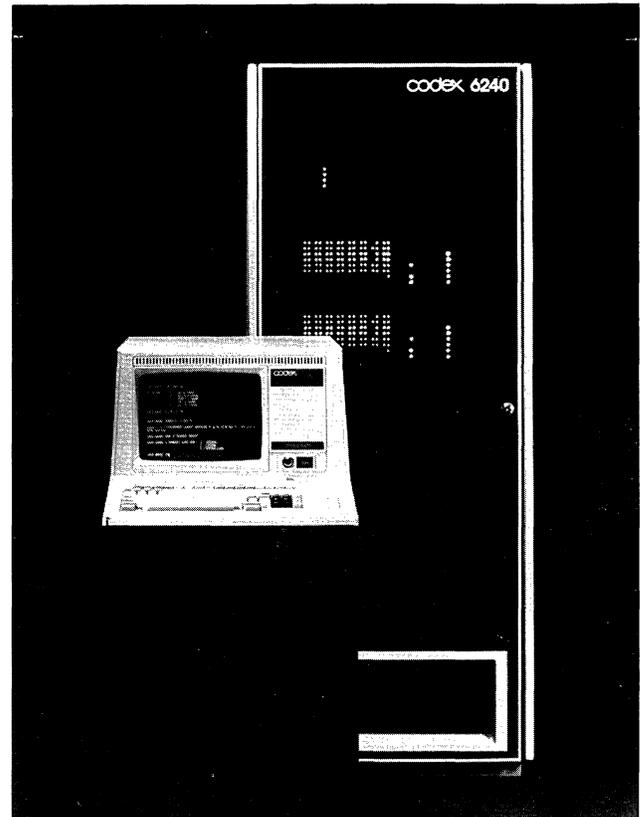
Vendor ● Codex Corporation; 20 Cabot Boulevard, Mansfield, MA 02048 ● 617-364-2000.

Distribution ● worldwide through direct sales force and distributors.

■ ANALYSIS

Model 6240 is a specialized time-division multiplexer designed specifically to combine a wide range of data- and voice-input channels on a single broadband link referred to as a T1 carrier. T1 carrier facilities have been used by the telephone company since the early 1960s to carry digitized voice and data. Until early 1983, however, T1 was unavailable as a tariffed service to private users. Those who required it had to subscribe to independent carriers or install their own microwave links. Users can now order the service under AT&T ACCUNET T1.5 Service, or from independent vendors such as MCI, SBS, and RCA.

T1 offers the end user a high-volume communication facility at low cost. For example, a single 1.544M-bps link can support up to 24 64K-bps channels, and transmission quality is also excellent. AT&T guarantees a point-to-point, full-duplex link with an error

PURCHASE PRICE RANGE

hardware ▮▮▮▮▮

5-yr maint/serv fee ▭

Codex 6240 ▮▮▮▮▭ $16.8K to $63.8K

| $20K | $40K | $60K | $80K | $100K |

CODEX 6240 PURCHASE PRICING bar graph covers price range between "small" and "large" configurations of hardware (solid bar) and associated 5-year maintenance (open bar) ● **SMALL** configuration consists of 3-shelf cabinet, T1 driver and control logic module, power supply, 4 synchronous dual-port data channel cards (RS-232C), and 4 voice dual-port channel cards ● **LARGE** configuration consists of 5-shelf cabinet, redundant control logic and T1 driver modules, redundant power supplies, 8 synchronous dual-port data channel cards (RS-232C), and 8 voice dual-port voice channel cards ● all prices are single-quantity purchase; multiple quantity discounts offered.
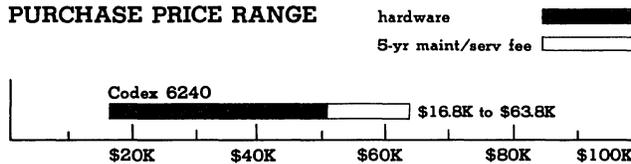
rate of no more than 1 bit in 1 million over a 1-day period. The T1 bandwidth is ideal for combining a large number of communication links and is suitable to applications such as office automation. For example, digital voice requires 32K or 64K bps for toll-quality reproduction; mainframe-to-mainframe file transfers need at least 64K bps; and compressed video must have at least 450K bps. The 6240 can accommodate all of these.

The 6240 is a modular system that directly handles synchronous data and analog voice channels. Asynchronous data currently must be interfaced via a submultiplexer (such as a statistical multiplexer) or through an async-to-sync converter. According to Codex, an asynchronous channel card will be available shortly. The synchronous channel cards can be individually programmed to handle half-/full-duplex transmission at rates of 2400 to 760K bps in multiples of 1200 or 8000 bps—**not powers of 2** as is the normal case. Thus, nonstandard speeds can be handled without requiring special engineering changes, as is often the case with less flexible products. Each channel card is a dual-port unit, offering 2 separate I/O channels.

The voice channel uses CVSD to convert analog voice to digital data. CVSD divides the 4-KHz voice into 8-bit words and samples each bit 16,000, 24,000, or 32,000 times a second. Only the direction of change (delta) in the slope between the current and previous sampling is transmitted. As a result, a CVSD channel

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only requires 16K, 24K, or 32K bps to produce a digitized voice output, less than half the 64K-bps bandwidth required by the popular alternative, Pulse Code Modulation (PCM). Each voice channel is also a dual-port unit. For those needing PCM, this is also provided but requires 64K bps.

The 6240 is offered with 3- or 5-shelf cabinets. Within each cabinet, 1 shelf is reserved for power supplies; the others are used for control logic, T1 drivers and voice/data channel cards. Each shelf accommodates 8 dual-port cards, which means a 3-shelf unit supports up to 32 channels while a 5-shelfer supplies up to 64. A 3-shelf unit can be upgraded to a 5-shelf configuration.

For those concerned with system integrity, the 6240 can be fitted with redundant control logic, power supplies, and T1 drivers without reducing the number of voice/data channels handled. Switchover from primary to secondary is automatic.

The 6240 is unique in that each channel shelf has its **own T1 driver**. Thus a 3-shelf unit supports 2 independent T1 links, while the 5-shelf model allows 4.

The 6240's principal competition will come from the Amdahl 2211, Avanti UltraMux, Bayly Omniplexer, Coastcom D/I Mux, DCA Netlink, General DataComm Megamux 1258, Datatel DCP 9100, Infotron T Mux, Paradyne DCX-T1, Scitec BSPT1, and Timeplex Link/1. Tellabs has also announced a product, but we have yet to receive details. Of those mentioned, the Avanti, DCA, Scitec, and Timeplex products most closely duplicate the 6240's facilities. For example, all are soft-configured systems, whereby an asynchronous terminal is used to configure and control the multiplexer; all offer a voice channel with CVSD; and all claim a multitrunk capability either now or in the near future.

In contrast, the remaining competitors are hardware configured; i.e., they require manual setting of DIP switches, jumper cables and/or rotary switches to configure their products. While none are currently controlled by a terminal, all claim this facility is under development. All also state that a multitrunk facility will be announced this year. Finally, of this group, only Amdahl has yet to introduce a voice channel card; we have learned, however, that a CVSD version is being tested and slated for Fall introduction.

Another facility most are developing—including Codex—is drop-and-insert, a technique whereby selected channels originating at one multiplexer can be dropped at an intermediate multiplexer while the remainder continues on to a third multiplexer. At the intermediate site, channel data can be inserted into the message stream targeted for the third multiplexer. Currently, only Bayly and Coastcom have drop-and-insert as a deliverable product. Timeplex recently demonstrated a form of drop-and-insert, but its technique employs what appears to be a back-to-back channel bank approach, whereby the digital composite link is converted to analog channels, passed through a PBX, and then remultiplexed through another Link/1. This technique is anything but ideal due to the distortion introduced by each analog-to-digital conversion and vice-versa. Neither Bayly nor Coastcom use it.

Overall, the 6240 should be one of the easiest products of its type to use. The operator can configure system parameters, monitor operation, and perform diagnostics from an RS-232C-interfaced terminal. All system functions are menu driven, and commands are easy to understand. For those wishing to employ a supervisory computer to handle the 6240, this is supported also.

□ Strengths

The 6240 has a number of facilities that makes the product extremely attractive. Its redundant control logic, power supplies, and T1 drivers, for example, guarantee uninterrupted service should any of these vital primary components fail. The product is also easy to use, thanks to its menu-driven, supervisory-console facility.

The multiple T1 link support makes the 6240 a very attractive product for organizations with large dispersed offices. Users can program each link independently, and target them to separate locations. Without this facility, users would have to use a switching device capable of handling independent channel routing. Those products, incidentally, are not cheap.

One of the really clever facilities of the 6240 is the "bit stuffing" technique that it employs with channels using external clocks. While generally this technique poses no problems, any deviation between clocked-in data rate and the programmed channel rate will cause an overflow/underflow condition within the channel buffers. A higher rate causes either an overflow condition or initiates a flow-control procedure such as XOFF. A rate lower than the programmed channel rate causes a problem in the framing of data which, in turn, affects the overall aggregate. Through "bit stuffing," the 6240 adjusts the channel's rate to compensate for either condition. For example, if the channel is programmed to receive 9600 bps but data is being clocked at 9601 bps, the difference is compensated for and the change reflected in the aggregate. Thus, overflow/underflow can never happen.

The 6240's message train conforms to the unframed message specifications (DS1) established by AT&T for connection to the ACCUNET T1.5 service. Under that specification, any 24-bit interval must have at least 3 "ones" and no more than 15 consecutive "zeros." This is done to keep the carrier timing aligned. If a multiplexer conforms, 99.4 percent of the bandwidth is available for data. If the multiplexer does not conform, the phone company requires the use of a Model 306 modem to establish compatibility. Besides the extra cost of the modem, the 306 reduces available bandwidth by 12.5 percent. This is equivalent to 1.34M bps using 306 versus 1.53M bps for a multiplexer that conforms.

□ Limitations

The lack of an asynchronous channel is a drawback, as is the absence of drop-and-insert. Currently, asynchronous channels must be interfaced to the 6240 via a statistical multiplexer or an async-to-sync converter. Although a viable solution, the statistical multiplexer reduces overall reliability, introduces increased delay, and also increases overall system costs since 2 such devices—one at each end—are required. According to the vendor, an asynchronous channel card will be introduced in the near future.

Drop-and-insert is a facility that allows the selective dropping and inserting of channel data along various nodes in a network. For example, in a 3 node network, a multiplexer at location A has certain data channels targeted for locations B and C. At location B, its multiplexer is programmed to drop those targeted channels while allowing the location C channels to pass through without demultiplexing. Also at location B, its multiplexer is programmed to insert channel data into the message stream targeted for location C. Organizations such as large banks and companies with large regional centers are typical candidates for this operating arrangement. Of the multiplexers on the market that actually work, only Bayly's Omniplexer and Coastcom's D/I Mux support this level of service.

While we feel that the multilink facility is a big plus for the 6240, we aren't that enthusiastic about the way it is implemented. By associating a T1 driver with each channel shelf, what the user gets is a point-to-point 16-channel multiplexer. In short, all terminals associated with that channel shelf must be targeted to the same location. Whether this proves to be a limitation is a matter of application, of course. However, we'd prefer a scheme whereby users can switch targets without having to swap channel shelves.

■ HARDWARE

□ Terms & Support

Terms • standard components and options are available for purchase or lease on 1/2/3/4-year term • quantity discounts are available.

Support • installed by user or by Codex; installation charge is $132 for 600 Series; $142 for 670 series; installation charge on per-unit-per-site basis; minimum installation charge within 100 miles of Codex service center; $290 over 100 miles • 3 service plans: Fixed Price/On-Call/Factory maintenance • Fixed Price maintenance performed under annual contract during prime-shift hours (8:00 AM to 5:00 PM, Monday through Friday) • On-Call maintenance billed for time and materials plus

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transportation; material replaced or repaired at Codex option ● Factory maintenance includes cost of material and labor ● Fixed Price/On-Call maintenance performed by Codex nationwide service organization.

□ **Overview**

The 6240 is a bit-interleaved time-division multiplexer designed to interface up to 64 synchronous data or up to 64 voice channels to a T1 carrier facility. The multiplexer operates point-to-point and can be configured as a multinode network. Drop-and-insert is not currently available, but is under development. The 6240 is offered with fully redundant control logic, power supplies, and T1 drivers—all of which switch over automatically should a failure occur. The 6240 is a terminal-controlled, soft-configured system.

The multiplexer handles synchronous data and digitized voice directly; asynchronous inputs must be interfaced via a submultiplexer (such as a statistical multiplexer) or through an async-to-sync converter. We understand that an asynchronous data channel card is under development. The voice channel card employs the Continuously Variable Slope Delta (CVSD) quantization technique, and produces a digital output at 16K, 24K, or 32K bps. By employing CVSD, the 6240 "fits" 2 voice input channels into a standard 64K-bps channel. For those deserving PCM encoding, this is also provided but requires 64K bps per channel.

The synchronous channel cards provide 2 I/O ports; each port can be configured to handle data inputs from 2400 to 760K bps. Each channel also has 64-bit transmit and 16-bit receive buffer. Channels can be configured to interface as DTE or DCE; up to 3 control signals are passed per channel. Interfaces offered consist of RS-232C/V.24, CCITT V.35, RS-449/422, and MIL STD 188-114. The voice card also contains 2 I/O ports and is offered with 2- or 4-wire E&M, loop start and ground start interfaces.

The 6240 is packaged in cabinets that accommodate 3 or 5 shelves. Shelves provide space for control logic, power supply, T1 driver, and the data/voice channels, plus **redundant** control logic, power supplies, and T1 drivers. Each shelf accommodates up to 8 dual-port voice or data channel cards in any combination. A 3-shelf unit can be upgraded to a 5-shelfer, but you'll have to swap cabinets since the 5-shelf unit is 18 inches higher (37 versus 55 inches). The 3-shelf unit configuration allows 2 separate T1 links to be interfaced and targeted to different locations. The 5-shelf unit supports 4 T1 links. The multitrunk capability is quite an advantage for the 6240 (see Strengths).

Each T1 link operates at speeds of 56K to 1.544M bps or 2.048M bps. The latter is employed for T1 facilities outside of North America and Japan. The message framing technique at 1.544M bps conforms to the unframed DS1 format required for connection to AT&T ACCUNET T1.5 service.

The 6240 is configured and controlled via an RS-232C-interfaced asynchronous terminal. The system is menu driven and passwords restrict the level of control an operator may exercise. The 6240 can be configured at any point in the network, if the proper operator passwords permit. In addition to an operator console (CRT or keyboard printer), a micro, mini, or larger host mainframe can also be used for system control.

Diagnostics are initiated from the operator console and include local/remote channel digital loopback; local/remote aggregate loopback; and local/remote modem loopback. The synchronous channel cards also have front-panel switches for initiating local loopback tests. The system alarms are relay-actuated and consist of loss of sync; transmit frame error (redundant systems only); loss of incoming signal; buffer empty/full; channel card removed or nonoperational; power failure; control logic failure; and low battery voltage.

□ **6240 Multiplexer**

Central Control

The 6240 consists of 3 major system elements: cabinet shelves; control logic and aggregate network port (T1) interface; and data/voice cards. Codex packages the 6240 in 3-and 5-shelf cabinets. The shelves provide space for control logic, power supplies, data/voice channels, and T1 drivers. A 3-shelf unit will accommodate up to 32 channels, while the 5-shelf provides for as many as 64 channels. One shelf is devoted to power supplies and the remainder are used for voice/data channel cards, control logic, and T1 drivers. In redundant systems, control logic, power supplies, and T1 drivers automatically switch over should a failure occur.

One of the more notable features of the 6240 is its multitrunk-handling capability. The 3-shelf unit can have 2 independent T1 links, and the 5-shelf unit can have 4. Under the packaging scheme, a T1 driver is associated with each channel-card shelf. Further, each T1 link is independently targeted to a remote host.

Cabinets ○ 3- or 5-shelf cabinets house power supply, control logic T1 driver, and data/voice channels ● accommodates redundant control logic, redundant power supplies, and additional T1 drivers ● measures 24 (L) x 22 (W) x 37 (H) inches for 3-shelf unit; 5-shelf unit has same length and width but is 55 inches high.

3-Shelf Cabinet ● accommodates all control logic, power supplies, and up to 16 dual-port channel cards (32 channels) ● accommodates 2 T1 drivers:

	$105/$65 mo	$2,000 prch	NA maint

5-Shelf Cabinet ● accommodates control logic, power supply, and up to 32 dual-port channel cards (64 channels) ● accommodates 4 T1 drivers:

	120/75	2,300	NA

Primary Power Supply ● 48 vdc unit:

	105/65	1,970	NA

Redundant Power Supply ● 48 vdc unit:

	165/105	3,115	NA

Channels

The 6240 offers dual-port channel cards that support synchronous data and voice channels. Asynchronous data requires the use of a submultiplexing device like a statistical multiplexer, or an async-to-sync converter. Voice/data channel cards can be intermixed in module shelves without restriction. Channels can be inserted or removed while power is on without interruption of service to other channels.

The synchronous channel card contains 2 ports, each of which can accommodate channel speeds ranging from 2400 bps to 760K bps in multiples of 1200 or 8000 bps, not just powers of 2 which is the most common practice. Each channel also operates at any standard or nonstandard rate when timing is supplied externally. Each channel can be programmed to provide transmit and receive timing (for connecting terminals); to accept timing (for network connections like DDS service).

Individual channels can be programmed to pass any 3 of the following 8 control signals: DTR, DSR, RTS, CTS, BO, RI, and CD. Controls are passed inband. Versions of the synchronous channel card are available that do not pass control signals at all. Each channel also has 64-bit transmit and 16-bit receive buffers.

The voice channel cards, also dual-port units, employ Continuously Variable Slope Delta (CVSD) quantization. Users can select voice transmissions at 16K, 24K, 32K, or 64K bps per channel. Each voice channel also contains 64-bit transmit and 16-bit receive buffers. Interfaces offered are 2- or 4-voice E&M signaling, loop start, and ground start.

Each synchronous data channel card's front panel has LED indicators for monitoring RTS, CTS, TD, RD, RLSD, Test Mode, and Buffer Error. Front panel switches provide manual local loopback tests for each channel.

Synchronous Channel Card (RS-232C/V.24) ● accommodates 2 data channels ● soft-configured data rates from 2400 bps to 760K bps in multiples of 1200 bps or 8000 bps ●

MO: monthly charge including maintenance based on 1-/3-year lease. PRCH: purchase price. NA: not available/ applicable. All prices single quantity. Prices effective as of August 1984.

Codex 6240
Digital Transmission Multiplexer

64-/16-bit transmit/receive buffer • can be configured to interface with DTE/DCE equipment • passes 3 control signals • RS-232C/V.24 interface:

$64/$40 mo	$1,225 prch	$5 maint

Synchronous Channel Card (CCITT V.35) • same as RS-232C, except has CCITT V.35 interface:

90/60	1,745	5

Synchronous Channel Card (RS-449/422) • same as RS-232C, except has RS-449/422 interface:

90/60	1,745	5

Synchronous Channel Card (MIL STD 188-114) • same as RS-232C, except has MIL STD 188-114 interface:

65/40	1,225	5

Synchronous Channel Card: No Controls (RS-232C/V.24) • same as RS-232C, except passes no control signals:

55/35	1,010	5

Synchronous Channel Card: No Controls (CCITT V.35) • same as CCITT V.35, except passes no control signals:

80/50	1,500	5

Synchronous Channel Card: No Controls (RS-449/422) • same as RS-449/422, except passes no control signals:

80/50	1,500	5

Voice Channel Card (E&M) • accommodates 2 voice channels • employs CVSD quantization at 16K, 24K, or 32K bps • 64-/16-bit transmit/receive buffers • 2- or 4-wire E&M signaling interface:

52/33	990	8

Voice Channel Card (Loop Start) • same as E&M, except employs loop-start interface:

65/40	1,240	8

Voice Channel Card (Ground Start) • same as E&M, except employs ground-start interface:

65/40	1,240	8

Composite Link

The interface to the composite link can be an internal 6240 T1 driver module, or a digital interface to an external, customer-provided driver or modem. Programmable link speeds are from 56K to 1.544M bps or 2.048M bps using bipolar NRZ-encoded transmission. The internal driver provides the proper framing to accommodate the unframed DS1 format required to attach a T1 multiplexer to the ACCUNET T1.5 service (see Strengths). For international operations, the internal driver also meets the CCITT framing formats for transmission at 2.048M bps. The T1 driver module can also be configured with redundancy and will automatically switch over should the primary driver fail. The digital interfaces for connection to an external customer-provided driver of modem include RS-449/422 CCITT or V.11, CCITT V.35, and MIL STD 188-114. The T1 driver module also encompasses the central control logic for the entire multiplexer. This logic can also be specified for full redundancy.

Network Port Interface • internal T1 driver module provides the DS1 framing for connection to T1 facilities in North America and Japan at 1.544M bps or CCITT T1 circuits (G732) operating at 2.048M bps • also provides central control logic for entire multiplexer operation:

$210/$135 mo	$4,010 prch	$36 maint

Redundant Network Port Interface • provides redundant backup services to Network Port Interface:

325/210	6,200	36

• END

Codex 6520
Front-End Processor

■ PROFILE

Function ● programmable communication front-end processor for data communication and real-time control applications ● operates as plug-compatible replacement for IBM 270X Communications Controller and for IBM 3704/3705 Communications Controllers operating in **emulation program (EP) mode**; can front end up to 4 IBM host computers ● supports up to 18 Codex 6000 Intelligent Network Processors (INPs) operating as remote cluster controllers.

Associated Systems & Networks ● IBM System/360, 370, 303X, and 4300 host computers ● Codex 6000 network ● terminals supported: Codex Color Console, IBM types 1030, 1050, 2250, 2260/2848, 2770, 2780, 3270, 3780, 1130, 3622, 3271, 3275, 2740-I, 2740-II, 2747, and compatible devices; TTY Models 28/33/35/37; HASP/RJE workstations.

Communications/Networks ● up to 8 Asynchronous Line Sets (ALS) are interfaced through an Asynchronous Line Interface Base (ALIB); maximum 30 ALIBs support 240 lines; data rates up to 9.6K bps over half-/full-duplex lines ● up to 4 Synchronous Line Sets (SLS) are interfaced through Synchronous Line Interface Base (SLIB); maximum 14 SLIBs support up to 112 synchronous lines at data rates up to 56K bps in half-/full-duplex; also connects to 230.4K-bps lines through Wide Band Line Set (WBLS) interface ● supports communication with Codex 6000 INPs at data rates up to 19.2K bps ● up to 4 channel adapters; each connects to 1 IBM host byte-multiplexer channel.

Operating System ● Network System Software—Level 1 (NSS-1); supports IBM commands provided by 270X or 370X.
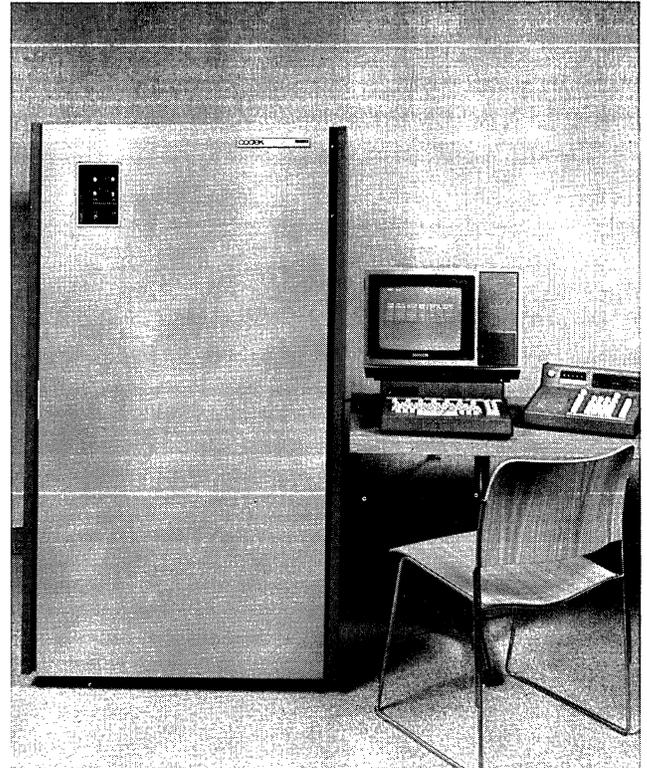
Language/Program Development ● no user program development ● NSS-1 software loaded to 6520 diskette or disk from host computer by BOOTS or TIME utilities.

Processor ● 16-bit processor supports up to 64K bytes of memory; minimum 256K-byte diskette; practical maximum 40M-byte disk.

First Delivery ● January 1981.

Systems Delivered ● about 75.

Comparable Systems ● IBM 3705 II operating in EP mode; supports up to 352 HDX lines at 9600-bps data rates, 4 channel-attached hosts, up to 512K-byte memory; no disk support

PURCHASE PRICE RANGE

hardware & software ██████████
5-yr maint ▭▭▭▭▭

system hardware & software
██████▭▭▭ $43.3K to $143.5K

I/O & communications
████▭▭ $2.03K to $107K

	$50K	$100K	$150K	$200K	$250K

total system (sum of above)
██████████▭▭ $45.3K to $250.4K

	$100K	$200K	$300K	$400K	$500K

CODEX 6520 FRONT-END PROCESSOR ● bar graphs illustrate price range for small to large systems ● solid bars reflect hardware bundled with software purchase prices ● **SMALL SYSTEM** is based on a basic 6520 package for single host support and includes 48K-byte CPU, 1 CA, 256K-byte diskette, and 1 color SCT; also 1 ALIB and 1 ALS is included for a minimum 8-line asynchronous communication configuration ● **LARGE SYSTEM** is based on a 6520 package plus the following hardware: 16K-byte memory module, expansion module, 5 SCTs, 1 Memory Bus Extension, hard disk controller, and 40M-byte disk; 3 additional CAs for 4-host support; and 30 ALIBs, 8 ALS for maximum 240-line asynchronous communication configuration.

● Comten 3670 II: supports up to 384 HDX/FDX asynchronous/synchronous lines, up to 4 channel-attached hosts, up to 256K-byte memory; removable disk storage up to 300M bytes; 24M- and 48M-byte fixed-disk drives; Comten system can operate in NCP and EP modes ● CC1-CC8: supports up to 240 lines at data rates from 50 to 9600 bps, synchronous/asynchronous, FDX/HDX mode; 64K-byte memory.

Vendor ● Codex Corporation, Subsidiary of Motorola, Inc; 20 Cabot Boulevard, Mansfield, MA 02048 ● 617-364-2000.
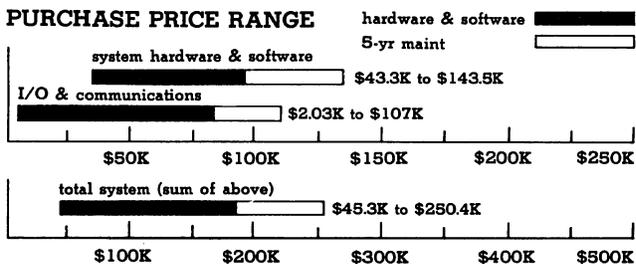
Distribution ● nationwide via local Codex direct sales/service offices.

■ ANALYSIS

The Codex 6520 is not produced by Codex. It is an OEM product from CCI used for large systems sales. It does not receive marketing emphasis from Codex. The 6520 FEP is maintained as an attractive member within the Codex networking product line and for the user who specifically requests it. The 6520 is not marketed internationally.

The Codex 6520 Communications Front-End Processor can connect networks of terminals to IBM hosts and effectively replace the older hardwired IBM 270X data adapters or the IBM 3704/3705 Communications Processors running in EP (270X) mode. The 6520 offers a number of advantages over its replacement systems. The IBM 270X is a hardwired controller no longer marketed, and the IBM 3704 is programmable but no

Codex 6520
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longer marketed. The IBM 3705-80 is limited to 16 communication lines, while the 3705-II supports over 300 half-duplex lines but is considerably more expensive and more complex to configure than the 6520. Also, the 6520 supports disk storage, while the 3705 does not. Codex does not use the disk except to store copies of the operating system and dumps for automatic dump/load operations in case of equipment failure.

The 6520 also provides as much reliability as the user needs, ranging from partial redundancy, where 3 front-end systems are configured to provide backup for each other if one system fails, to totally redundant systems.

The 6520 can operate as the entry point to host systems in networks of Codex 6000 Intelligent Network Processors (INPs) connecting to remote terminals. However, Codex no longer markets the MNI (Multiplexed Network Interface) feature that was designed to support up to 10 INPs directly connected to the 6520 through 1 communication line. It was one of its most attractive features, and it has been withdrawn.

The 6520 cannot support NCP or ACF/NCP environment or reside on SNA networks except in a secondary BSC network capacity.

☐ Strengths

Codex offers a range of network products in its 6000 family of Intelligent Network Processors (INPs) that provide multiplexing and line concentration for 8 to 248 lines. In addition, networks of INPs can be configured to combine more effectively a small number of communication links. The INPs can operate in conjunction with the 6520 to provide support for large dispersed networks connected to multiple host processors.

Codex limits the 6520 to the EP (270X-mode) environment, which is only a secondary network in the IBM SNA environment. On the other hand, a large installed base still operates in this mode so the 6520 is an alternate solution for many IBM users operating in this environment.

☐ Limitations

The Codex 6520 can replace only a portion of the IBM 3705-II environment. It cannot run NCP or ACF/NCP, thus **it cannot function as a component in a primary SNA network**. In addition, withdrawing its most attractive feature, the MNI, which supported the Codex 6000 INP network environment, definitely further limits the functions of the 6520 FEP.

■ SOFTWARE

☐ Terms & Support

Terms ● no charge; bundled with hardware.

Support ● hardware service terms apply.

☐ Operating System

Network System Software—Level 1 (NSS-1) ● operating system consists of Basic Virtual Storage Programs that monitor the 6520 and provide network communication control, debugging, and dynamic reconfiguration ● supports single I/O processor and 4 Channel Adapters (CAs), each attached to an IBM 360/370/303X/43XX byte-multiplexer channel; provides Emulation Program compatibility; command support includes IBM-1, BSC/SDA II, TTY-I, TTY-II, and IBM-III protocols ● commands stored on either 256K-byte diskette or 40M-byte disk; commands entered from Supervisory Control Terminal (SCT) to monitor and reconfigure network, as well as control debugging facilities ● provides operational commands via STC for system control and monitoring function; features 270X/370X Channel Trace, System Monitor Report Text (with English text explanations), system monitor logging, and line statistic reports ● supports online utility programs ● features Dynamic Application Selection (DAS) that allows single-terminal access to up to 16 applications on 4 different hosts ● Multipoint Dynamic Application (MDAS) extends application selection to IBM 3270-class terminal users ● Multiple Subchannel Line Selection (MSLS) allows a communication line to be assigned to more than 1 of 240 subchannels; DAS/MDAS defined lines cannot be

defined for MSLS ● polling techniques include Slow Poll and Auto-Poll ● provides code conversions for communication between terminals and hosts with dissimilar codes/protocols ● software operates with IBM access methods in IBM hosts: BTAM, QTAM, RTAM, TCAM, as well as HASP, IMS, TSO, CICS software ● supports Automatic-Dial Adapter; Reverse Channel functions.

☐ Network/Communications

Communications functions run under NSS-1 program control and include the following:

Asynchronous Line Interface Support ● verifies control characters, monitors system status condition, buffers/unbuffers characters ● supports IBM-1, TTY-I, TTY-II, and IBM-III line protocols at data rates from 75 bps to 9600 bps (see Hardware ALIB).

Synchronous Line Interface Support ● provides interrupt processing; data output initiation, function initiation, table contraction, control block formatting, and initialization for line interfaces ● supports data rates from 1,200 to 56K bps and 230.4K bps (see Hardware SLIB) with WBLS ● BSC data rates up to 200K cps.

Automatic-Dial Adapter ● enables host computer to dial-select terminals via the 6520; useful with unattended terminal operations.

Reverse Channel Support ● allows asynchronous terminal on half-duplex line to halt transmission from host computer ● available only for buffered terminals ● operates with the reverse channel board (see Hardware).

Automatic Baud Rate Detection (ABRD) ● allows asynchronous devices with dissimilar baud rates to share a single 6520 port: TTY, 2741, and 3767 devices can share 1 adapter when ABRD is combined with Code Conversion feature ● applies to TTY-II terminals operating at 110, 150, 200, or 1200 bps; and IBM-1-type terminals operating at 134.5 or 600 bps.

Code Conversion ● converts TTY code to standard IBM code so that TTY terminals appear as 2741 or 3767 terminals to the host; user selects single- or multiple-code translation: ASCII to BCD; ASCII to Correspondence Code; Bit-paring APL ASCII to Correspondence Code; Type-pairing APL ASCII to Correspondence Code.

Dynamic Application Selection (DAS) ● supports leased or dial-up lines; polled lines not supported; allows user to assign 1 terminal to as many as 16 applications resident on 4 hosts ● with ABRD, allows a variety of synchronous terminals to share serially a point-to-point communication line; code conversion feature supports TTY terminal switching among applications normally dedicated to 2741 terminals.

Multipoint Dynamic Application Selection ● allows 3270-type terminals to select from up to 16 application programs resident on 4 hosts; requires no changes to host software or host access method ● supports up to 32 CRTs and printers per communication line; devices can be connected to 3271 cluster control units or to 3275 standalone controllers; maximum number of terminals supported by MDAS determined by maximum terminal support in each IBM application program ● MDAS supports specific, general, and auto-poll from IBM application via command translation into specific polls for NSS-1 control of 3270 MDAS lines.

Multiple Subchannel Line Selection (MSLS) ● allows a communication line to be assigned to more than 1 of 240 subchannels; diverts traffic from heavily loaded host to lightly loaded host; can switch host application program from one host to another in event of primary host-channel/access-method failure; consolidates line resources by allowing same or different processor to share communication lines; requires no operator intervention from 6520 SCT ● limitation: lines defined for DAS or MDAS, which are responsive to terminal requests for subchannel address selection cannot be defined for MSLS.

Polling ● includes Slow Poll feature, which provides 400-millisecond delay between polls on WRITE/READ polled line; auto-poll command feature; 6520 polling via auto-poll command from host.

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Teletype Special Character Handling ● enables users to specify nonstandard input characters for selected TTY-II lines; system, therefore, is customized to support specialized TTY-II-compatible terminals.

☐ Program Development

Program Development ● no user program development ● NSS-1 is loaded from system disk; if disk is unavailable, it can be loaded from host computer by BOOTS (simply loads) or TIME (loads and sets time and data in NSS-1 to time/data in host) commands; both BOOTS and TIME initiate execution of NSS software system ● NSS-1 can also be loaded from a backup disk if it has been configured with the system ● automatic dump/automatic load feature during system failure provides auto-dump of 6520 memory to disk and automatic reload of NSS-1 from disk; requires 20 to 60 seconds from diskette but is almost instantaneous from hard disk ● user can store 8 NSS-1 systems on 1 40M-byte disk, 4 for backup or test version of other 4 systems.

Off-Line Utility ● operates independent of NSS-1; supports program dumping and dump printing in off-line mode.

■ HARDWARE

☐ Terms & Support

Terms ● the Codex 6520 Communications Front-End Processor is available for purchase or on a 2- or 3-year lease; maintenance is unbundled from lease prices: within 100 miles maintenance costs $305 monthly; 101 miles and beyond, maintenance costs $435 monthly ● installation charges are $1,500 ● lease/purchase credit is 75% of lease paid ● 1-year warranty for purchased units.

Support ● Codex 6520 can be installed by Codex or by user ● 3 service plans are available: Fixed Price/On-Call/Factory Maintenance ● Fixed Price maintenance performed under annual contract during prime-shift hours (8:00 AM to 5:00 PM, Monday through Friday) ● On-Call maintenance billed for time and materials plus transportation; material replaced or repaired at Codex option ● Factory maintenance includes cost of material and labor ● Fixed Price/On-Call maintenance performed by Codex nationwide service organization.

☐ Overview

The Codex 6520 Front-End Processor is a programmable communication controller designed for data communication and real-time control functions. It can support up to 4 IBM host computers, and can serve as a direct replacement for the IBM 270X communication controller or the IBM 3704/3705 communications controller operating in Emulation Program (EP) mode. Modular in design, the 6520 includes several essential hardware components: the Communication and Control Processor (CCP) with an attached System Control Panel (SCP), memory modules for expanded configurations, an I/O Processor (IOP), Channel Adapters (CAs), mass storage units, Supervisory Control Terminals (SCTs), and Line Interface Modules.

The Communication and Control Processor (CCP) is a 16-bit minicomputer with 48K-byte memory expandable by 1 16K-byte increment to 64K bytes. Integral to the CCP are 2 system buses: the character I/O Bus handles data transfers and control information transfers between the CCP and up to 256 slow-/medium-speed devices/controllers; the Memory Access Bus addresses up to 64K bytes of memory and supports data transfers between memory and high-speed Direct Memory Access (DMA) devices, which include the CCP, IOP, and Synchronous Line Interface Bases. The System Control Panel attaches to the CCP for system operation, test/debugging functions, and for device/host communication with the CCP.

The I/O Processor (IOP), a high-speed DMA device, under the control of the CCP, provides block transfers between the 6520 memory and its attached disks and host computers. Mass storage consists of either the 256K-byte diskette or the 40M-byte removable disk; both diskette and disk cannot be used on the same system. The IOP can support up to 4 host computers and 1 mass storage device concurrently in a practical maximum configuration.

The Codex Supervisory Control Terminal (SCT) is a buffered CRT controller with color display; it provides dynamic reconfiguration and monitoring functions via commands to NSS-1 operational software programs stored on the systems diskette or disk. The SCT interfaces the NSS-1 to programs on the CCP through the Asynchronous Line Interface Base (ALIB). A TTY-II terminal can be used instead of the Codex color SCT; however, the system monitor and line trace options are more difficult to read than those on the color display. Each system can support up to 8 SCTs as control terminals on dedicated or dial-up point-to-point lines.

Line Interface Modules are used to interface the 6520 to modems attached to communication lines or to locally attached terminals for both synchronous and asynchronous operations. The number of lines supported depends on the number and type of line adapters selected and the user throughput requirements. Theoretically, a 6520 FEP can support a maximum of 112 synchronous or 240 asynchronous lines, or a combination of each dependent on configurations and throughput requirements.

The 6520 has redundancy, offered in 2 versions: a complete backup system configured with 2 complete FEPs with duplicated channel adapters, CCP, IOP, memory, disk and all line interface units (only the modem switch is shared); or a partially redundant configuration where only the more critical system components are replicated, such as processors, memory, and disk and the more important lines and line interfaces.

A basic 6520 front-end system includes 48K-byte memory, an IBM channel adapter, 256K-byte diskette, 1 SCT; and a minimum 8-line configuration that requires, for example, 1 Asynchronous Line Set (ALS) and 1 Asynchronous Line Interface Base (ALIB) or 1 Synchronous Line Set (2 lines) with associated Synchronous Line Interface Base (SLIB).

A large or maximum system supporting up to 4 IBM hosts in a 240-asynchronous or 112-synchronous line configuration would require, in addition to the basic system (above), the following: 1 16K-byte memory module (for maximum 64K-byte memory capacity), an expansion module, 3 additional Communication Adapters (CAs), up to 8 SCTs, 40M-byte Removable Disk Drive (instead of 256K-byte diskette), Disk Controller, 8 ALS and 30 ALIBs or 7 SLS and 14 SLIBs.

☐ CPU & Memory

Packaged Components

86520 6520 Communications Front-End Processor ● with 48K-byte memory, 1 CA, 256K-byte diskette, and Codex color SCT:

$1,750/$1,628 mo	$43,300 prch	$279 maint

86391 Expansion Module ● cabinet; requires Memory Bus Extender:

450/419	9,000	25

85317 Memory Bus Extender ● required when expansion cabinet is included in system; also required in redundant configurations:

130/113	3,000	35

Processor & Options

Communications & Control Processor (CCP) ● 16-bit minicomputer ● interfaces 2 system buses: the character I/O Bus and the Memory Access Bus ● features include: up to 8 groups of 16 general-purpose 8-bit registers (primary and secondary register sets); instruction set with immediate operand, memory reference, program state and sense, I/O and interrupt instructions, 32 hardware priority interrupt levels, and 4 addressing modes ● system control panel (SCP) attaches to the CCP and contains switches, keys, LED display; has direct access to CCP registers and address memory.

Processor Redundancy ● 2 versions: full redundancy and partial redundancy ● full redundancy requires 2 6520 front-end

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MO: monthly charge for 2-/3-year lease term; includes maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for purchased equipment. Prices effective as of August 1984.

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processors sharing a modem switch that supports the backup system; requires replicated channel adapters, CCP, IOP, memory, disk, and all line interface units (only shared unit is the modem switch) ● partial system redundancy can be configured in a variety of ways; 1 configuration requires line interface units to be shared by 2 FEPs and duplicate only critical areas such as processors, memory, and disk; a second configuration requires duplication of the more important lines and line interfaces while sharing remaining lines, and replicating critical hardware components; a third configuration provides fractional redundancy using independently switchable line interface units to allow sharing of 2 sets of line interface units between 3 processors (FEPs); this multiple-FEP configuration requires hardware backup to be controlled by a single Master Configuration Switch (86175) which remotely controls the Memory Bus Switch (86177), the Character I/O Bus Switch (86178), the Two-Channel Switch (86182), and the IOP Switch.

86175 Master Configuration Switch ● controls switching to backup components:

$91/$83 mo	$2,000 prch	$5 maint

86176 Input/Output Processor Switch ● connects channel adapter to either of 2 IOPs in a redundant system:

176/163	4,000	15

86177 Memory Bus Switch ● switches line interface buses from one 6520 memory bus to another:

215/199	5,000	30

86178 Character I/O Switch ● switches a group of line interface bases from one 6520 character I/O bus to another:

65/60	1,500	10

86182 Two-Channel Switch ● connects to 1 channel adapter to either of 2 multiplexer channels:

150/138	3,500	25

Memory

Each 6520 supports from 48K bytes to 64K bytes of memory incremental by 16K bytes.

85309 16K-Byte Memory Module ● add-on memory; requires 85317 memory bus extender:

$64/$59 mo	$2,400 prch	$12 maint

☐ Communications Lines

The Communications and Control Processor (CCP) interfaces with 2 system buses: the Character Input/Output Bus and the Memory Access Bus. The Character I/O Bus transfers data and control information between the CCP and up to 256 slow-/medium-speed (50- to 9600-bps) external devices or device controllers. The Memory Access Bus addresses up to 64K bytes of memory in the CCP, and supports data transfer between system memory and high-speed Direct Memory Access (DMA) devices. The IOP supports up to 4 CAs which attach up to 4 hosts and 1 mass storage device simultaneously. Each CA interfaces an IBM or IBM-compatible host to the 6520 using the IBM Byte Multiplexer Channel.

Line interface modules interface the 6520 to modems attached to communications lines or locally attached terminals. The Synchronous Line Interface Base (SLIB) operates concurrently with the CCP in half-/full-duplex mode and supports up to 4 2-line Synchronous Line Sets (SLSs) at data rates from 1200 to 56K bps; or 2 Wide Band Line Sets (WBLS) up to 230.4K bps, and provides BSC support with data rates up to 200K cps. The SLIB suports BSC/SDA-II protocol; therefore it can attach IBM 2770, 2780, 3270, 3780; IBM 1120, 3622 terminals. SLIB operates as a scanner; it buffers I/O data and transfers information between lines and memory via control information provided by the CCP. Up to 14 SLIBs, each interfacing up to 4 2-line SLSs (112 synchronous lines), can be supported by a single 6520.

The Asynchronous Line Interface Base (ALIB) supports up to 8 Asynchronous Line Sets (ALS) and data speeds of 50 to 9600 bps over half-/full-duplex lines. ALIB provides program control of transmission speed, character length, parity, and number of stop bits. It supports IBM-1, TTY-I, TTY-II, and IBM-III protocols;

therefore, it can attach 2740-I, 2740-II, 2747, 1050 and compatible devices under IBM-1; TTY Model 28 and compatible devices under TTY-I; TTY Model 33/35/37 and compatible devices under TTY-II and 2260/2848 and compatible devices under IBM-III. Up to 30 ALIBs (240 asynchronous lines) can be supported by a single 6520.

Optional equipment includes an Automatic Dial-Out Adapter Base (ADAB) to connect terminals to Bell System Auto-Dial Unit and a Reverse Channel Board that provides reverse break support for a maximum of 4 lines. ADAB can interface up to 8 Auto-Call Units (ACUs) to the 6520 CCP.

85513 IBM Channel Adapter (CA) ● 1 attaches to each IBM host byte-multiplexer channel:

$307/$285 mo	$8,500 prch	$50 maint

85728 Synchronous Line Interface Base (SLIB) ● supports up to 4 2-line SLS units at data rates from 1200 to 56K bps or 2 WBLS at data rates from 19.2K to 230.4K bps ● supports both half-/full-duplex lines:

100/93	2,800	13

85729 Synchronous Line Sets (SLS) ● interfaces up to 2 half-/full-duplex lines at data rates between 1200 bps and 9600 bps ● requires SLIB:

35/33	1,200	4

85730 Synchronous Wide Band Line Set (WBLS) ● interfaces up to 2 half-/full-duplex lines at transmission speeds of 19.2K to 230.4K bps ● requires SLIB:

130/113	3,000	30

85735 Asynchronous Line Interface Base (ALIB) ● supports up to 8 ALS at data rates of 50 bps to 9600 bps; external clocking required above 1800 bps; 1 9600-bps line dedicated to any SCT supported with internal clocking:

105/98	1,800	9

85736 Asynchronous Line Set (ALS) ● interfaces 1 half-/full-duplex line at data rates of 50 to 9600 bps ● requires ALIB:

17/16	225	1

85731 Autodial Dial-Out Adapter Base (ADAB) ● each ADAB connects to Bell System Auto-Call Unit (ACU), 801A or 801C, giving the host computer dial-out capability ● ADAB interfaces up to 8 ACUs to CCP:

111/103	2,500	20

85738 Reverse Channel Option ● provides reverse break capability for up to 4 terminals transmitting at 600, 1200, or 1800 bps over 2-wire, half-duplex lines via 202-type modems:

46/42	1,000	10

85739 Dual-Code Option ● allows single line to accommodate 2 different codes:

33/30	800	6

85740 WB Dual-Code Option ● allows WBLS to accommodate 2 different codes:

33/30	800	6

☐ Disk

Each 6520 system includes at least 1 mass storage device—a 256K-byte diskette or 40M-byte disk—which stores the NSS-1 operational software programs. The diskette and disk are mutually exclusive. Theoretically, 3 mass storage devices are supported by the 6520; a practical maximum is 1 40M-byte disk.

85967 256K-Byte Diskette ● replaceable medium-speed, movable-head device with data transfer rate at 31.8K bytes per second; track-to-track access time is 10 milliseconds; unformatted storage capacity is 262,144 bytes ● cannot be used with 85972 Disk; included in basic package.

85972 40M-Byte Moving-Head Disk Drive ● high-speed, movable-head, random-access device utilizing a 5-surface, removable disk pack storage medium; data transfer is 806K bytes per second; average positioning time is 30 milliseconds;

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formatted storage capacity of 1 disk pack is 41,728,000 bytes o cannot be used with 85967 Diskette o requires controller:

$429/$398 mo	$10,000 prch	$100 maint

85971 Hard Disk Controller o required on 85972 Disk Drive:

520/481	12,000	120

85975 Disk Access o required to attach 85972 Disk Drive:

46/42	1,000	10

☐ **Consoles**

86092 Supervisory Control Terminals (SCT) o buffered CRT; color display; provides various NSS-1 system control/monitoring functions o attaches to 6520-character I/O Bus via ALIB; data rates of 300 to 9600 bps o only 1 9600-bps SCT is supported per ALIB o up to 8 ACTs supported by 6520:

$163/$108 mo	$3,800 prch	$35 maint

o **END**

Comm-Pro Associates IBM 3705
Performance Enhancements
Communications Controller Enhancements

■ **PROFILE**

Function ● IBM 3705 selectable performance enhancement packages.

Computers/Operating Systems Supported ● any IBM System/370-class mainframe or compatible computer capable of supporting the IBM 3704/3705 or the Amdahl 4705 communications controller; any corresponding IBM operating system.

Networks & Protocols ● SNA; asynchronous, bisynchronous, SDLC, HDLC, X.25, and Datapac (Canada).

TP & File Access Methods ● all standard IBM access methods; CICS, TSO, APL, and VM/CMS.

Terminals ● all IBM and compatible terminals supported by host computers and protocols, TWX terminals, and Tektronix graphics terminals.

Special Hardware/Software ● IBM Type 1 or 4 channel adapters; Type 2 or 3 scanners; 110-baud oscillator for speed select options ● IBM Emulator Program at Version 3 Mod 0 level or above.

Security ● all console routines are password protected by SYSGEN-defined passwords.

Logging/Accounting ● includes facility to collect line statistics and CCW counts.

Failure Recovery ● utilizes 3705 recovery facilities.

Current Version ● Version 21.

**Installations** ● over 200 worldwide.

Comparable Systems ● only IBM 3704/3705 support software.

Vendor ● Comm-Pro Associates; 121 West Torrance Boulevard, Suite A2, Redondo Beach, CA 90277 ● 213-376-1344.

■ **ANALYSIS**

For years the 3704/3705 has been the IBM communications controller associated with their System/370 mainframe line of computer systems. For almost the same length of time Comm-Pro has offered owners of this equipment a set of packages that is designed to address the shortcomings and deficiencies of these devices. Not surprisingly, these packages have been given the very unglamorous name of 3705 Performance Enhancements. Although some of the enhancements are offered as extra-cost options, the majority of these packages are bundled into standard sets. All packages and options, with the exception of the NCP Virtual Line Switching and the Extended NCP Multi-Terminal Access modules, are implemented as modifications to the IBM EP (Emulator Program) and operate in the EP portion of the PEP support area.

PURCHASE PRICE RANGE

5-yr license acquisition price

$20K	$40K	$60K	$80K	$100K

$6K to $75K
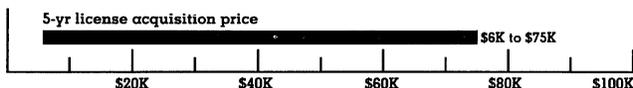
COMM-PRO IBM 3705 PERFORMANCE ENHANCEMENTS PRICING ● package licenses are available only on monthly lease arrangements; lease fee includes maintenance; solid bar shows min/max lease payments calculated for a 5-year (60 mos) period ● **MINIMUM CONFIGURATION** consists of the PP01 module ● **MAXIMUM CONFIGURATION** consists of the PP04, VLSW, and NAS modules.

For more than 10 years Comm-Pro has concentrated on this set of enhancements. There has been a concentrated effort on the part of the vendor to consistently keep abreast of all the technological changes that have taken place within 3704/3705 devices. This continues to be true with IBM's recent 3275 announcement. As we pointed out in our prior report, we expected Comm-Pro to offer support for IBM's new controller, the IBM 3725, and it appears that this will finally happen during the second quarter 1985. New and old customers of Comm-Pro are currently being advised of that pending support. An evaluation of 3725 support will be made at that time.

Since the IBM 3705 has proven to be a very reliable product, we do not anticipate a large immediate change by users from the 3705 to the 3725. Comm-Pro can be expected to continue support of both controllers for some-time even though IBM intends for the 3725 to replace the 3705.

IBM has announced that it will cease to update ACF/NCP past version 3 for the 3705, and all new enhancements will be for the 3725 only. Comm-Pro plans to support version 3 of ACF/NCP in late 1985 for both the 3725 as well as the 3705, with support for the 3725, in terms of implementation, taking precedence.

It is expected that Comm-Pro's pricing will remain the same for both controller performance enhancement packages. Interestingly enough, Comm-Pro, as a company, has not had a history of frequent price changes. Once a price is established for a product it appears to remain stable.

☐ **Strengths**

The major strengths of the Comm-Pro packages are the significant economies and operational flexibilities they can offer to 3704/3705 users. In addition to significantly reducing the amount of hardware resources required to support a complex 3705 environment, the modules can be used to ease a conversion into an SNA environment. The packages permit users to utilize terminals that are not normally supported in a 3705 configuration, and a general code conversion facility provides a valuable addition to any operating environment. Above all, the highly modular nature of Comm-Pro's offering gives users considerable configurational flexibility to meet the pressures of expansion and upward growth.

☐ **Limitations**

The Comm-Pro packages/options represent a collective solution to limitations in IBM's 3704/3705 support software. In this context, the Comm-Pro software has very few "limitations" in the accepted sense because problems not addressed by Comm-Pro are residual limitations in the IBM software, not Comm-Pro's. Comm-Pro offers to develop special, additional 3704/3705 functions, not currently supported by IBM or Comm-Pro, on custom contracts.

One marginal limitation is the strict X.25 protocol support provided in the NAS module. In a world where there is no true standard for X.25 protocol at this time, a user with the NAS module could encounter some incompatibilities in a CCITT (1980 Standard) environment.

■ **OVERVIEW**

☐ **Terms & Support**

Terms ● each of the 7 packages is offered on a monthly use fee basis only; the use fee license covers 3 370X controllers at a given site; educational discounts are available for the PP04, VLSW, and NAS packages only; the amount of discount depends on the options selected with the package ● a 30-day free trial is available on request.

Comm-Pro Associates IBM 3705 Performance Enhancements
Communications Controller Enhancements

Support ● the monthly use fee covers maintenance and all changes required to support the IBM operating system, program modifications, and PTFs (Program Temporary Fixes).

☐ Component Summary

The Comm-Pro 3705 system is designed using a building-block approach. The 7 packages form a logical pyramid, starting with a basic enhancement package and becoming more sophisticated as the design criteria become more sophisticated. Features in the less sophisticated packages are usually carried upward into the more sophisticated packages to assure compatibility. The packages, starting from the base module, are: Speed Select (PP01), Code Conversion (PP02), Speed Select with Code Conversion (PP03), Network Facilities (PP04), NCP Virtual Line Switch (VLSW), X.25 Network Access Support (NAS), and TYMNET Network Access Support (TAS). The TAS package is a modified version of the NAS package implemented for use with a TYMNET remote processing network.

Computers/Operating Systems

The Comm-Pro 3705 enhancements run on any mainframe computer with an associated operating system that can support the IBM 3704, 3705-I, 3705-II, or the Amdahl 4705 communications controllers.

Minimum Operating Requirements

Each of the 7 basic packages carries its own 3705 memory requirements. Because the controller is a 16-bit processor, all memory requirements are given in hexadecimal words: PP01-100; PP02-400; PP03-500; PP04-1000; VLSW-1800; NAS-4800; and TAS-3000. Some of the options also require additional memory: CONS-3000; STAT-300; SPCM-300; TEKG-100; PTSO-200; XL41-300; and XMTA-200.

A Type 2 Scanner is required to support start/stop lines. A Type 3 Scanner is used for BSC and SDLC lines. The 110 baud oscillator is required for speed select options, and a separate oscillator is required for each supported speed. Type 1 or 4 channel adapters are required for multihost support.

■ BASIC ENHANCEMENT PACKAGES

Speed Select (PP01) ● permits 3705-connected TWX terminals to operate at baud rates of 10, 15, 30, or 120 cps on the same synchronous line interface by allowing bit clocking rate to be established after a telephone connection is completed to the 3705; IBM 2741s can be supported on the same interface, providing the host access method can accommodate both device types on a single UCB (Unit Control Block) address ● supports IBM 3704, 3705-I, 3705-II, and Amdahl 4705; requires Type 2 scanners for start/stop lines (Type 3 can be used for BSC and SDLC lines); requires 110-baud oscillator for each supported clocking rate:

	NA lcns	$100 mo	NA serv

Code Conversion (PP02) ● provides ASCII-to-BCD (or Correspondence) code conversion facilities to permit TWX terminals to interface with host systems that support 2740-1 or 2741 terminals:

	NA	125	NA

Speed Select with Code Conversion (PP03) ● combination of PP01 and PP02; the speed select routines are set at telephone connect time; the conversion feature is activated if the connecting terminal is a TWX device:

	NA	150	NA

Network Facilities (PP04) ● includes all PP03 facilities as a proper subset; functions as a compatible multiplexing controller between a low-speed line interface and mixed protocol/speed/address subchannel on the 3705-resident console control program; permits one telephone rotary to service multiple CPUs running various mixes of applications (e.g., TSO, CICS, APL, and IMS); non-SYS-GENed asynchronous subchannels can be handled in contention mode; can assign 3705 operator console status to an asynchronous terminal; can accumulate and display important line statistics:

	NA	225	NA

NCP Virtual Line Switch (VLSW) ● extension to PP04; permits an asynchronous terminal user unrestricted selective access to any number of NCP or EP host applications over the same communications line by redefining channels into NCP as virtual channels at SYSGEN time:

	NA	425	NA

X.25 Network Access Support (NAS) ● provides an SNA-X.25 gateway; permits asynchronous and IBM 3270-type terminals to access host IBM systems through X.25-based network (TELENET, Datapac, etc); 3270 support accommodates Canada's Datapac 3303 packet-level protocol; can also be used for single-ended multiplexing in X.25-based statistical multiplexers in private networks ● supports HDLC or BSC link-level framing on Type 2 or 3 Scanners, normal or extended control mode, ARM or ABM link access procedures, and DTE/DCE operations:

	NA	500	NA

TYMNET Network Access Support (TAS) ● similar to NAS but designed specifically for worldwide TYMNET users; allows 3705 to interface to TYMNET packet-switched networks; supports remote asynchronous terminal-to-3705 communications via a BSC line with TYMNET-designed 2790-like protocol ● fees for this package are paid directly to TYMNET; the cost is a function of the number of virtual circuits and the amount of traffic.

☐ Optional Enhancement Features

Discounting the basic single host option, 10 mix and match options can be appended to the basic packages. Some are mutually exclusive of certain packages, some are standard options that are incorporated into the package, and others are added as no-cost options in certain configurations. The chart below outlines the relationship (logical and cost add-on) between options and packages. The 10 options are: Dual Host Support, which supports 2 Type 4 channel adapters; Multiple Host Support, which supports up to 4 Type 4 channel adapters; PEP (EP support in an NCP environment), which supports multiple Type 4 channel adapters; CONS (3705 operator's console support); STAT (EP statistics support); SPCM (special CCW processing); TEKG (Tektronix graphics support), which requires one of the packages with TTY code-conversion support; PTSO (TSO paper tape spooling); XL41 (BCD/Correspondence translation), which requires one of the packages with speed select support; and XMTA (Extended MTA support). The VLSW speed select support is equivalent to the XMTA support in other packages, and NAS PEP support provides virtual circuit switching across NCP/EP boundaries.

Options	Package	Add-On
Dual-Host Support	PP01, PP02, PP03 PP04, TAS VLSW, NAS	std $200 NC
Multiple-Host Support	VLSW, NAS all others	NC $200
PEP	PP01, PP02, PP03 VLSW, TAS PP04/NAS	std NC $100/$200
CONS	PP01, PP02, PP03 PP04, VLSW, NAS, TAS	NA NC
STAT	all packages	NC
SPCM	VLSW, NAS all others	NC $50
TEKG	PP01 PP02, PP03, PP04 VLSW, NAS, TAS	NA $40 NC

MO: monthly use fee for license that covers all 3704/3705 devices at a given site. NA: no purchase or lease plans offered; maintenance is included in the monthly use fee. Prices effective as of August 1984.

Comm-Pro Associates IBM 3705 Performance Enhancements
Communications Controller Enhancements

Options	Package	Add-On
PTSO	VLSW, NAS, TAS	NC
	all others	$50
XL41	TAS	NA
	VLSW, NAS	NC
	PP01, PP02, PP03, PP04	$50
XMTA	VLSW, NAS	NA
	all others	$100

▦ USER INTERFACES

☐ Special Features

System Select Feature ● part of PP04 package ● allows a terminal operator to select the target host system; host subchannels are grouped into pools with Stage One SYSGEN macros; up to 4 host CPU line interfaces can be supported ● on a system with 4 Type 4 adapters, load sharing if possible is the related host system is active on all 4 CPUs.

Contention Feature ● part of PP04 package ● subchannels in a pool are dynamically assigned to lines on a first-come, first-served basis; no relationship exists between the number of subchannels in a pool and the number of line interfaces that may attempt allocation in the pool.

3705 Message Facility ● part of PP04 package ● a "system down" message is sent to the operator if no subchannel in the selected pool is enabled; a "system busy" message is sent if all subchannels in the pool are assigned; special text can be SYSGEN-defined by Stage One macros.

3705 Console Facility ● part of PP04 package ● allows a start/stop terminal to be used as a 3705 operator's console; the 3705 command language provides commands that permit control of the 3705 trace facility, modification of PP04 control areas, and display of 3705 line statistics ● access to the console routines is password protected.

Statistics Gathering Facility ● collects line statistics such as characters transmitted and received, CCWs executed (by type), and unit check endings ● can be used independently of any package but is normally used with the PP04 console facility to display current values of the statistics counters.

Datapac 3303 Support ● an NAS support function designed to accommodate Canadian Datapac 3303 packet-level protocol; device polling and selection is handled by Network Interface Machines (NIM), which act as substitute hosts for real 3270s; data from a 3270 is packetized by NIM and sent to 3705; NAS unpacketizes data before passing it to the host via standard poll channel programs; outgoing traffic is handled in reverse order ● all channel sequences are handled by NAS to simulate activity of any X.25 network that adheres to Datapac 3303 protocol specification.

TEKG Option ● provides conversions that permit a Tektronix 4013 in APL mode to communicate with the Tektronix 2741 Graphics Package in the host; it is a software replacement for the Tektronix code conversion card (part number 021-0119-00) ● provides a means for generating ASCII control character strings from 2741 character strings; can be used to provide support for terminals with special features (e.g., screen clear) that require generation of ASCII control characters.

PTSO Option ● allows TSO editor to read paper or cassette tapes in a continuous fashion; TSO/TCAM must be configured with TWX support ● normally used when reading tapes prepared on non-IBM systems or prepared off-line.

SPCM Option ● permits the Emulator Program to decode a CCW command of X'24' (which would, under normal circumstances, result in a Unit Check with Command Reject sense); delivers a record containing line information such as current terminal speed and line interface address; data can be used for session accounting ● option provides framework for installations with requirement for direct communication between host and 3705 control program.

■ USER REFERENCE LIST

Data Decision's policy is to publish user references only when both the vendor and the users authorize their publication. Authorization was not received from Comm-Pro Associates.

● END

CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85
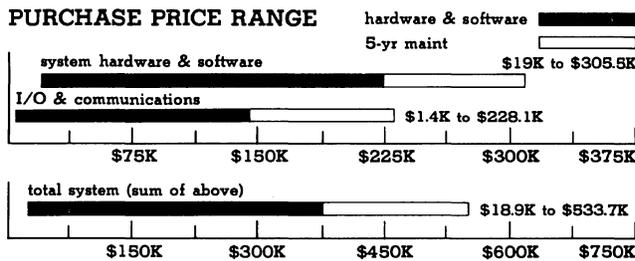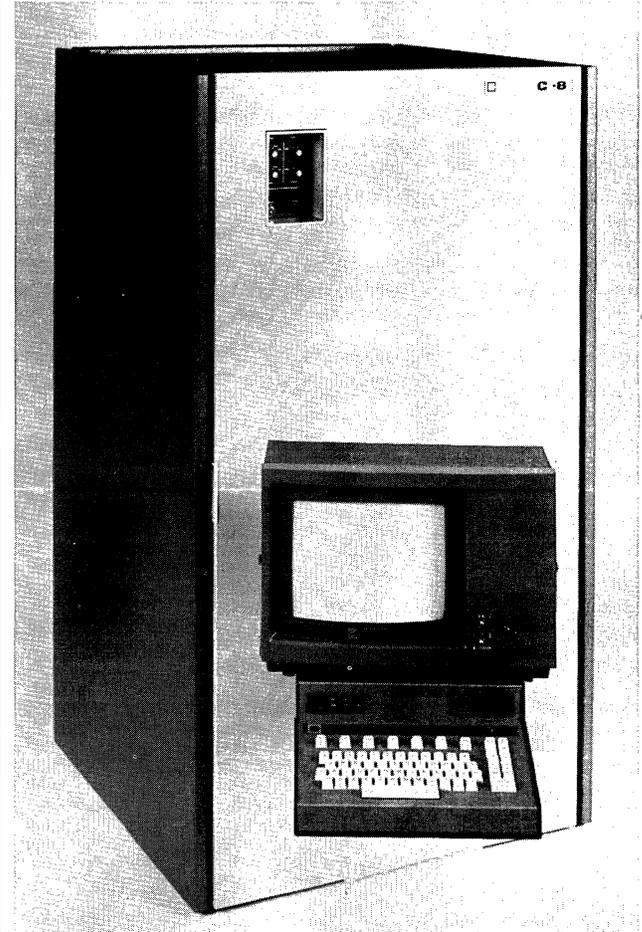
■ PROFILE

Function ● front-end processors to IBM S/360/370-compatible computers or remote concentrators; field-upgradeable ● provide IBM 270X/370X system emulation, emulation of 370X running in **EP mode only**; plug-compatible replacement for 3704/3705 controllers; independent front-end processing; networking (including remote concentration); message switching ● X.25 support ● offers multiple host support, diagnostics, code conversion, polling, terminal emulation, dynamic application selection, and multiple subchannel line selection.

Associated Systems & Networks ● IBM S/360/370-compatible hosts; terminal/protocols supported include IBM 2740, 2740-I, 2740-II, 2741, 1050; 2770, 2780, 3270, 3735, 3770, 3780, 3790 terminals, remote IBM S/3, S/32, S/7, 1130, S/360, and S/370 computers; TTY models 28/32/33/35 ● gateway to Telenet and Tymnet public data networks via X.25 support.

Communications ● Model CC-6 supports up to 32 asynchronous/BSC/mixed lines at data rates from 75 to 9600 bps; up to 4 lines can be wideband with synchronous data rates up to 56K bps ● Model CC-8F supports up to 240 lines at data rates from 50 to 9600 bps (asynchronous) and 1200 to 230.4K bps (synchronous); 200K-cps sustained aggregate throughput on synchronous lines ● Model CC-8.5, logical extension of CC-8F, doubles aggregate sustained throughput to 400K cps ● Model CC-80 supports 240 lines expandable to 1,232 in mixture of speeds/protocols; aggregate sustained synchronous throughput 200K cps ● Model CC-85 supports up to 1,232 lines; aggregate sustained synchronous data rate up to 400K cps.

Operating System ● NCS-1.4 operating system support for CC-6 (trimline version), CC-8F, and CC-8.5; CPS operating system for CC-80 and CC-85 ● support independent front-end processing, remote line concentration, IBM 270X/370X emulation; X.25 support ● CPS supports message switching, electronic mail, and airline reservation applications.

Program Development ● turnkey configurations; modular expansion; CCI assembler runs on CC-X processors; IBM

PURCHASE PRICE RANGE

hardware & software ▮▮▮▮

5-yr maint ▭

system hardware & software $19K to $305.5K

I/O & communications $1.4K to $228.1K

| $75K | $150K | $225K | $300K | $375K |

total system (sum of above) $18.9K to $533.7K

| $150K | $300K | $450K | $600K | $750K |

CCI COMMUNICATIONS PROCESSORS PURCHASE PRICING ● bar graphs illustrate price range for small to large systems ● solid bars reflect hardware bundled with software purchase prices ● **SMALL SYSTEM** is based on basic CC-6 package for single host support and includes 40K-byte memory, a control console, a CCP with operating software, an IOP, memory base, 1 channel adapter to support 1 IBM host, cabinet with power and chassis; also 1 LIB and 1 LS for support of 8 communication lines ● **LARGE SYSTEM** supports 10 IBM hosts and 960 communication lines and includes the basic CC-85 package (512K-byte memory, CCP, IOP, Console, Memory Base, Memory Interface Controller, one CA, one LIB/LS, Cabinet) plus the following additional hardware: 1 disk controller, 3 disk drives (480M bytes), 5 consoles; also I/O & communication equipment such as 3 CAs, 3 LIPs (744 lines), 1 BSC-W 230.4K (4 lines), 3 BIB/BSC (12 lines), 24 LIBs/LS (192 lines), ADA Base, ACU Line Set, Dual Code Feature ● large system price configuration includes 5-year maintenance costs.

S/360/370-compatible host can assemble CC-X programs and channel-load them into CC-X processor for execution.

Processor ● Communications Control Processor supports from 40K to 512K bytes of main memory ● from 256K-byte diskette to 320M-byte disk storage ● supports up to 8 consoles; up to 256 devices.

First Delivery ● 1975 (CC-80), 1976 (CC-8F), 1979 (CC-85), 1981 (CC-6).

Comparable Systems ● IBM 3705-II supports up to 352 HDX lines at 9600 bps; 4 channel-attached hosts; up to 512K-byte memory, no disk support ● Comten 3670-II supports up to 384 HDX/FDX asynchronous/synchronous lines; up to 4 channel-attached hosts, up to 256K-byte memory; removable disk storage up to 300M bytes; 24M- and 48M-byte fixed disk drives ● Codex 6520 supports up to 240 FDX asynchronous and 112 FDX synchronous lines up to 9600 bps; wideband up to 230.4K bps; 4 channel-attached hosts; up to 64K bytes of memory; 256K-byte diskette to 40M-byte removable disk storage.

CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85

Vendor ● Computer Communications Inc (CCI); 2610 Columbia Street, Torrance, CA 90503 ● 213-320-9101.

Distribution ● through 8 direct sales offices throughout U.S. and Canada.

■ ANALYSIS

CCI has specialized in the communication processing market since it was founded in 1966. The company has been providing alternative front-end processors for IBM's 270X hardwired controllers and for the IBM 3705 operating in 270X emulation mode since 1975. The systems operate in the asynchronous/BSC environment and **not in the IBM SDLC environment**, which is the predominant mode of communication for most users of the IBM S/360/370-compatible processors.

The CCI systems offer more flexibility, higher performance, and/or lower prices than users can obtain from old IBM 270X systems or IBM 3705 front-end processors operating in emulation mode. Further, CCI offers turnkey customized systems and software for its large CC-80 and CC-85 systems. The company has displayed an impressive amount of experience in interfacing its systems into networks of IBM S/360/370-compatible hosts and IBM terminals. Its customer reference list ranges from telephone companies to colleges to airlines. CCI processors can perform conversions so that TTY terminals look like IBM terminals to the host processor.

CCI offers a broad range of processors from the small CC-6 system that supports only 40K bytes of memory and 32 data communication lines to the large CC-85 that supports 512K bytes of memory, up to 300M bytes of disk storage, and 1,232 data communication lines.

□ Ease-of-Use Features

A good feature of the CCI processors is the capability to switch lines from one host processor to another. The network operator can enter commands from the console/system supervisor to shift lines from one host processor and connect them to another. The configuration changes can be accomplished in a matter of minutes. The CCI processors require no changes in host software.

□ Modes of Operation

The CCI processor can operate as a front-end processor for 1 to 13 IBM S/360/370-compatible host processors and support from 32 to 1,232 communication lines. The systems can also function as remote front-end (concentrators), network processors, and message switches. CCI has developed software to support terminal access to multiple IBM hosts and to multiple applications within a single host.

□ Strengths

The greatest strengths of the CCI processors lie in their flexibility and range of capabilities. The processor architecture and its operating software are mature products and CCI has considerable experience fitting them into IBM S/360/370-compatible networks. The CCI processors are also less expensive than the IBM 3705 for comparable configurations or they provide more features for comparable prices. For example, the smallest IBM 3705-80 communication processor model costs $36K for 4-line support while the CCI-6 costs $30K for a system that can support 32 lines. Furthermore, CCI has managed to maintain its purchase price structure throughout the year to date.

□ Limitations

The CCI processors **cannot function in an SNA environment**. They are not plug-compatible replacements for the IBM 3705 Communications Processor. They cannot run NCP (Network Control Program). The CCI processors can replace the IBM 3705 **only when it is running in 270X emulation mode**. The 3705 runs either the EP (Emulation Program) or PEP (Partitioned Emulation Program) to emulate the 270X. EP runs as a standalone program and PEP runs under NCP. Thus, the CCI processors can function as a 3705 running EP.

■ SOFTWARE

□ Terms & Support

Terms ● bundled with hardware.

Support ● refer to hardware service and support.

□ Operating System

CCI's Network Communications Systems software (NCS) provides communication-oriented modules that include the NCS-1.4 operating system and data communications processing for the CC-6/8/8.5 communication processors. The CC-6 system runs under a trimline version of the NCS-1.4, which provides all standard features but no options (see CC-6 Hardware). The CC-80/85 systems require a customized operating system called the Communications Processing System (CPS), which provides all the features of the NCS-1.4 plus capability to support message switching, electronic mail, and airline reservation application functions.

Network Communications Systems-1.4 (NCS-1.4) ● operating system resides in Communications Control Processor (CCP); allows sysgen selectable/deletable features ● consists of Basic Virtual Programs that support 270X/370X emulation, independent front-end processing for IBM S/360/370-compatible computers, line concentration, message switching ● provides X.25 protocol support for access to public networks; certified by Telenet and Tymnet ● supports single I/O processor and up to 6 channel adapters, each attached to byte-multiplexer channel on an IBM host ● operates via basic 270X/370X commands and includes IBM-I, BSC/SDA-II, IBM-III, TTY I and II protocols; commands stored on either 262K-byte diskette or 40M-/160M-byte disk; entered from Supervisory Control Terminal (SCT); provides dynamic reconfiguration and self-diagnostic functions ● supports Automatic Dial Adapter that allows host computer to dial selected terminals via the CC-X processor; Reverse Channel; Automatic Baud Rate Detection; Automatic Dump and Automatic Load, 270X/370X Channel Trace, System Monitor Logging to Mass Storage, and Line Statistics ● provides online and off-line utility programs ● optional features include Dynamic Application Switching (DAS) to allow single terminal access to up to 16 applications residing on up to 6 hosts (depends on CC-X processor model); Multipoint Dynamic Application Switching (MDAS) extends application selection to IBM 3270-class terminal users; Multiple Subchannel Line Selection (MSLS) allows multiple subchannels to share one line; lines can be switched from 1 subchannel on a host to a subchannel on another host if first host fails or becomes overloaded; TTY code conversion to standard IBM code so TTY terminals appear like IBM 2741 or 3767 terminals to the host computer; VM extension allows multidrop IBM 3270-cluster controllers and on a single line ● features slow poll and auto-poll command.

NCS-1.4 Trimline Version ● provides all standard features of the NCS-1.4 operating system including sysgen selectable/deletable features but does not support such optional features as DAS, MDAS, TTY/2741 code conversion, and MSLS.

Communication Processing System (CPS) ● customized operating system for special communication requirements of CC-80 and CC-85 systems ● provides all standard and optional capabilities/features of NCS-1.4 operating system plus special functions such as message switching, electronic mail, and airline reservation application requirements.

□ Communications/Networks

Communications functions run under NCS-1.4 or CPS program control.

Asynchronous Line Interface Support ● provides line interface control for each asynchronous line connected to the CC-X's line adapters; verifies control characters, monitors status conditions, buffers/unbuffers characters, and detects termination of data sequences; optionally can perform Teletype code conversion (see below); at least 1 asynchronous line adapter required on SCT for operator commands ● supports IBM-I, IBM-II, TTY-I, TTY-II protocols and data rates from 75 to 9600 bps.

CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85

Buffered Interface Base Support ● provides line interface control for each bisynchronous line connected to CC-X line adapter; interrupt processing; data output initiation; function initiation; table construction; control block formatting; and initialization ● support BSC line protocol at data rates of 2K to 230.4K bps.

Dynamic Application Switching (DAS) ● supports leased or dial-up lines; polled lines not supported; allows user to assign 1 terminal to as many as 16 applications resident on up to 6 hosts; combined with ABRD, allows user to share a point-to-point communication line serially with variety of asynchronous terminals provided with DAS ● combined with code conversion feature, TTY terminals can switch among applications normally dedicated to 2,741 terminals.

Multipoint Dynamic Application Switching (MDAS) ● allows 3270-type terminal users to switch from 1 application in host to different application in same or another host; terminal selects from up to 16 applications resident in up to 6 hosts ● supports up to 42 switchable CRTs and nonswitchable CRTs and printers per communication line; devices can be connected to 3271 cluster control units or to 3275 standalone controllers; maximum number of terminals supported by MDAS determined by maximum number of terminals supported by each IBM application ● MDAS supports specific, general, and auto-poll from IBM host applications via command translation into specific polls for NCS control of 3270 MDAS lines.

Teletype Code Conversion Support ● converts TTY code to standard IBM code: TTY terminals appear as IBM 2741 (or 3767) terminals to host computers; enables Teletype-compatible terminals to communicate with host supporting 2741 devices but not Teletype devices ● translations include: ASCII to BCD; ASCII to Correspondence Code, bit-pairing APL ASCII to Correspondence Code, Type-pairing APL ASCII to Correspondence Code.

Teletype Special Character Handling ● enables users to specify nonstandard input characters for selected TTY-II lines; system, therefore, is customized to support specialized TTY-II-compatible terminals.

VM Extension ● allows user to multidrop IBM 3270 cluster controllers on a single communication line; requires no host software changes only changes system definitions.

☐ Program Development

Program Development ● turnkey configurations; CCI assembler runs on CC-X processor ● NCS operating programs generated on the IBM S/360/370-compatible host computer and transmitted online to CC-X memory; online program also available on disk to allow system to recover its programs in the event of power or system failure ● the host-load-diskless feature provides user with backup procedure for loading the NCS from host: requires no operator intervention; accomplished by either BOOTS or TIME command ● NCS can also be loaded from another disk, if system has been configured with a backup mass storage unit ● user can store 8 NCS systems on 40M-byte disk; can load any of the 8 different systems on CC-X processor.

☐ Other Program Modules

Online Utility ● programs such as Print Dump/Memory/Statistics/Monitor reports.

Off-Line Utility ● programs independent of NCS for program dumping and dump printing in off-line mode.

X.25 Protocol Support ● based on 1980 CCITT X.25 recommendations; HDLC protocol; provides access to Telenet and Tymnet public networks; performs CCITT level-2 function such as protocol conversions and level-3 PAD (packet assembly/disassembly, statistics collection); supports 240 virtual asynchronous circuits on up to 4 trunks ● requires IBM mainframe (or PCM equivalent) using BTAM or TCAM access method and compatible CC-X processor.

■ HARDWARE

☐ Terms & Support

Terms ● CCI offers its systems for purchase, month-to-month

rental (MRC), and monthly lease; the CC-6, CC-8F, and CC-8.5 are offered under 2/3/4/5-year monthly leasing plans that include maintenance; CC-80 and CC 85 systems are available under 3/4/5-year monthly leasing plans that do not include maintenance ● full payout lease rates are available for the CC-6/8F/8.5 systems.

Support ● from CCI service centers nationwide in major cities ● standard maintenance described in text occurs during 8-hour business day, Monday through Friday; on-call ● other plans available for 10/12/16-hour day, on-call ● on-site maintenance available for large system users ● no third-party maintenance.

☐ System Overview

The CCI family of communication processors consists of field-upgradeable models: CC-6, CC-8F, CC-8.5, CC-80, and top-of-the-line CC-85. The CC-6/8F/8.5 systems run under the NCS-1.4 operating system, and the CC-80/85 systems run under the CPS customized operating software. All are designed around the same hardware architecture. Basically, they provide local/remote front-end functions for IBM S/370-compatible hosts. The CC-80/85 processors can also function as communication controllers or line concentrators. Built around modular components, the 16-bit Communications Control Processor (CCP) serves as the central unit for the CC-6/8F/80 systems, while the Communications Processing Unit (CPU) serves as the central unit for the higher throughput requirements of the CC-8.5 and CC-85 systems. The CCP supports from 40K to 512K bytes of memory, which is expandable in 8K- or 16K-byte modules. The CCP and CPU support 1 I/O Processor and a combination of such additional components as channel adapters (up to 13), line adapters for (up to 240 lines), mass storage devices (up to 320M bytes), and supervisory control terminals (up to 8). The CC-80/85 processors can also support up to 4 Line Interface Processors for a maximum 1,232-line support. Each I/O processor (IOP) supports up to 7 high-speed Direct Memory Access (DMA) devices. The Channel Adapter (CA) interfaces the CCP/CPU to an IBM or IBM-compatible host's byte-multiplexer channel.

Line adapters interface the processors to modems attached to communication lines. The number of lines supported per system depends on the type of communication processor and the number/type of line adapters. Generally, from 32 to 240 asynchronous lines can be supported on the smaller systems. The CC-80/85, however, can support up to 1,232 lines with the use of multiple Line Interface Processors (LIPs), each LIP supports up to 248 asynchronous communication lines. The CC-80/85 can be purchased as customized products.

The Control Console included in the CC-6 system package is for the service engineer to monitor or debug the system. Control and monitoring for system and communications functions on the CC-8F and CC-80 are supported on the CC-40 Control Console (includes color CRT); a system can support up to 8 Control Console Terminals (CCTs). The CC-8.5 and CC-85 systems require the System Operations Console (SOC) as the primary CCT, which is included in the basic system package. The CC-40 is added as additional CCTs are required (up to 7). A TTY-II terminal can also be used as the CCT, but its white/black display is more difficult to read than the CCT's color display when requiring system monitor and line trace functions.

The CC-8X systems can be configured with full or partial redundancy. A Master Configuration Switch in the system's cabinet provides switching to either a complete or partially redundant system. Redundant configurations require such additional hardware as an IOP Switch, Memory Bus Switch, Dual Access I/O Controller Switch, and expansion cabinet and redundant power.

A minimum configuration requires at least 40K-byte memory on the CCP, an IOP, 1 CA to support 1 IBM host, 1 Line Interface Base (LIB) and 1 Line Set (LS) to support up to 8 communications lines.

CC-6 Basic Emulation Processor ● programmable, field-upgradeable front-end system for up to 2 IBM S/360/370-compatible host computers; can serve as functional replacement for the IBM 2701/2702/2703 Transmission Control Units and

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CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85

the IBM 3704/3705 Communications Controllers in 270X emulation mode ● runs under the trimline version of the NCS-1.4 operating system; supports 32K to 64K bytes of single access memory (SAM); up to 32 communications lines (asynchronous/ BSC/mixed) at up to 9600 bps; up to 4 can be wideband lines up to 56K bps ● supports the following terminals and compatible devices: 3270-type (3271, 3275, 3277, 3280, 3286); the IBM-I, 2740-I/II, 2741, 1050; TTY-I and II models 28, 33, 35, 37; and IBM-III, 2260/2848 terminals ● features host load diskless system ● options include Asynchronous Line Interface support, Buffered Interface Base support, auto-dial adapter, reverse channel, ABRD, auto-poll command, and dial command ● sustained throughput up to 100K cps synchronous, field upgradeable to CC-8F.

CC-8F Enhanced Emulation Processor ● front-end processor for up to 4 IBM S/360/370-compatible host computers; plug-compatible replacement for IBM 270X/370X and operating in 270X emulation mode; compatible with BTAM, QTAM, TCAM, HASP, IMS, and CICS ● supports up to 64K bytes of single access memory (8K-byte modules); 256K-byte diskette; 1 Control Console; up to 7 CC-40 System Consoles; 1 IOP; and up to 4 CAs ● supports mixture of up to 240 communication lines; sustained throughput at 200K cps for BSC communication ● supports the following terminals/systems: IBM 1030, 1050, 2260, 2265, 2741, 2740-I/II, 2270, 2780, 3270, 3735, 3770, 3780, 3790; CC-40; TTY models 28, 32, 33, 35; remote IBM S/3, S/32, S/7, 1130, S/360, and S/370 computers and all compatible terminals; non-IBM terminals attached with no program changes in host 370/360 ● field upgradeable to CC-8.5, CC-80, and CC-85.

CC-8.5 Advanced Emulation Processor ● logical extension of the CC-8F; supports all standard and optional features of the CC-8F, plus X.25 support ● provides over twice the processing power of the CC-8F; up to 400K-cps sustained throughput for BSC communications ● upgrades to the CC-85.

CC-80 Enhanced Communication Processor ● customized front-end processor for 7 to 13 IBM S/360/370-compatible host computers; can function as local controller, remote concentrator, or front-end replacement for IBM 270X and 370X in 270X emulation mode ● runs under CPS operating system in local or remote environment for complete independent processing in more complex emulation processing networks; provides message switching and airline reservations systems applications; runs under NCS-1.4 operating system in emulation environment requiring high number of communications lines or high memory support ● supports up to 512K bytes of memory and up to 320M bytes of disk storage ● supports up to 240 lines expandable to 1,232 communication lines with use of up to 4 Line Interface Processors (LIPs); sustained throughput of 200K cps for BSC communication ● upgrades to a CC-85.

CC-85 Advanced Communications Processor ● top-of-line model runs under CPS ● supports all standard and optional features of the CC-80 ● provides over twice the processing power of the CC-80 for sustained synchronous throughput of 500K cps.

Packaged Components

CC-6 Basic Emulation Processor ● includes 40K-byte memory, 600 Control Console, 601 CCP, 604 IOP, 606A Memory Base, 613 Channel Adapter, and 690-3 Cabinet for CC-6 with Power and Chassis:

$1,152/$882/$807 mo	**$27,489 prch**	**$151 maint**

CC-8F Enhanced Emulation Processor ● includes 64K-byte memory, 800 Control Console, 892 CC-40 System Console (color), 801 CCP, 804 IOP, 806A Memory Base, 813 CA, 835-M 9600 bps Asynchronous Modification, 835 Asynchronous LIB, 836 Asynchronous LS, 867 Single-Sided Diskette and Controller, 880 Modem Bypass Adapter, 890-3 Cabinet for the CC-8F with Power and Chassis:

1,706/1,346/1,232	43,824	299

CC-8.5 Advanced Emulation Processor ● includes 64K-byte memory, 8506 Memory Base, 8500 System Operations Console, 8501 CCP, 804 IOP, 8511 Memory Interface Controller, 813 CA, 835 Asynchronous LIB, 836 Asynchronous LS, 867 Single-Sided Diskette and Controller, and 890-1 Cabinet for CC-8.5 with Power and Chassis:

2,860/1,787/1,191	71,500	393

CC-80 Enhanced Communications Processor ● includes 32K-byte memory, 8006B Memory Base, 8000 Control Console, 8001 CCP, 8004 IOP, 8013 CA, and 8090-0 Cabinet for CC-80 with Power and Chassis:

NA/1,479/1,331	74,800	248

CC-85 Advanced Communications Processor ● includes 64K-byte memory, 8506 Memory Base, 8500 System Operations Console, 8501 CCP, 8004 IOP, 8511 Memory Interface Controller, 8013 CA, 8035 Asynchronous LIB, 8036 Asynchronous LS dedicated to the 8500, and 8090-2 Cabinet for the CC-85 with Power and Chassis:

NA/2,579/2,018	107,800	430

Components

Master Configuration Switch ● remotely controls the 877/8077 memory bus switch, 878/8078 dual access I/O controller switch, and the 881/8081 multiplexer channel switch ● required in redundant configurations.

875 Master Configuration Switch ● required for CC-8F/8.5 redundant configurations:

$106/$82/$75 mo	**$3,003 prch**	**$6 maint**

8075 Master Configuration Switch ● required for CC-80/85 redundant configurations:

NA/75/68	2,310	6

IOP Switch ● switches 8004 peripherals between CC-8X processors in redundant configuration.

876 IOP Switch ● required for CC-8F/8.5 redundant systems:

231/177/161	6,567	12

8076 IOP Switch ● required for CC-80/85 redundant systems:

NA/165/148	5,500	12

Memory Bus Switch ● switches group of BSC controllers between processors in redundant configuration.

877A Memory Bus Switch ● required on CC-8F/8.5 redundant systems:

231/177/161	6,567	12

8077A Memory Bus Switch ● required on CC-80/85 redundant systems:

NA/165/148	5,500	12

Dual Access I/O Controller Switch ● switches group of line adapters between processors in redundant configuration.

878 Dual Access I/O Controller Switch ● required on CC-8F/8.5 redundant systems:

101/77/70	2,838	6

8078 Dual Access I/O Controller Switch ● required on CC-80/85 redundant systems:

NA/71/63	2,750	6

890-5 Expansion Cabinet ● includes power; for CC-8F/8.5:

344/264/240	8,525	60

8090-5 Expansion Cabinet ● includes power; for CC-80/85:

NA/217/199	8,525	60

691-3 Redundant Power for CC-6 Base Processor Cabinet ● provides redundant power supply, I/O and power control, card cages, mechanical housing, and connectors for CC-6 processor:

132/101/92	3,245	24

891-3 Redundant Power for CC-8F Base Processor Cabinet ● provides similar components as for the 691-3 and connectors for CC-8F processor:

132/101/92	3,245	24

MO: monthly rental/3-year/5-year lease terms include maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for purchased equipment. NA: not applicable. NC: no charge. Prices effective as of August 1984.

CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85

891-5 Redundant Power ● for CC-8F/8.5 Expansion Cabinet:

85/66/60	1,859	24

8091-0/2 Redundant Power for CC-80/85 Base Cabinet ● provides similar components as for the 691-3 and connectors for either CC-80 or CC-85 processors:

NA/83/77	3,245	24

8091-5 Redundant Power ● for CC-80/85 Expansion Cabinet:

NA/47/44	1,859	24

CPU

Communication Control Processor (CCP) ● central processing unit supports from 40K- to 512K-byte memory; provides initial control of all data transfers between memory and communications lines, memory and host, or memory and disk; provides for up to 256 specific interrupt conditions ● includes 128 general-purpose registers that utilize bit-micro register reference instructions to define 512 distinct operations that can be performed on the contents of these registers ● required for CC-6, CC-8F, CC-80 communications processors ● included in basic package.

Communications Processing Unit (CPU) ● faster version of the CCP; features increased use of multiple general-purpose (128) registers and a multilevel interrupt architecture ● provides 32 unique vectors for interrupt processing ● internal minor cycle time is less than 90 nanoseconds ● required on CC-8.5 and CC-85 communications processors ● included in basic package.

Input/Output Processor (IOP) ● attaches to character I/O bus of CCP; also attaches to memory access bus ● supports up to 7 devices or device controllers via the IOP bus ● provides its own DMA access and handles data transfer rates in excess of 8M bps ● included in packaged systems.

Memory

608A/808A 8K-Byte Memory Module ● semiconductor memory; 520-nanosecond cycle time ● maximum 64K bytes on (8 modules) on CC-6 and CC-8F System; maximum 512K bytes (64 modules) on CC-80 system ● requires 606A/806A memory base:

$28/$22/$19 mo	$735 prch	$4 maint

8508 8K-Byte Memory Module ● 270-nanosecond memory cycle time; used in the CC-8.5 system with maximum of 64K bytes (8 modules); in the CC-85 with maximum 512K bytes (64 modules) ● requires 8506 memory base:

NA/58/36	1,760	9

8008B 32K-Byte Memory Module ● semiconductor memory; 360-nanosecond cycle time; 180 nanosecond access time ● maximum 64K bytes (2 modules) per CC-8F; maximum 512K bytes (16 modules) per CC-80 ● requires 806B/8006B memory base:

NA/123/105	5,500	38

606A/806A Memory Base ● accommodates 608A/808A memory modules ● maximum 1 806A per CC-6/8F system for total 64K-byte memory; included in packaged system.

606A Memory Module ● 40K bytes; included in CC-6 packaged configuration.

806A Memory Module ● 64K bytes; included in packaged CC-8F systems.

8006A 64K-Byte Memory Base ● available for CC-80 system only for up to 8K-byte memory modules ● 8 per CC-80 system:

NA/181/162	8,167	60

8006B 256K-Byte Memory Base ● provides necessary housing and connections to accommodate 256K bytes of semiconductor memory; 8 8008B memory modules per base ● 2 8006B memory bases can be configured with 8001 CCP and its memory bus for 512K bytes of memory:

NA/181/162	8,167	60

8506 64K-Byte Memory Base ● single access for CC-8.5 and CC-85 only; each base supports up to 8 8508 memory modules ● maximum of 1 8506 per CC-8.5 and 8 per CC-85 system:

NA/181/162	8,167	60

☐ I/O & Communications

The CC-X processor is based on a 3-bus structure that includes the IOP bus, the character input/output (CIO) bus, and the memory bus. The IOP reads programs stored in memory and controls all data transfers on the IOP bus attached to channel adapters (CAs) interfacing host computers. The IOP also attaches to the CIO bus (connected to the CCP) which supports up to 7 devices or controllers interfaced with the IOP. The IOP responds to data transfer interrupts between the IOP and Memory buses; therefore, data between the disk controller and memory or between CA and memory is passed through the IOP; but data transfers between the disk controller and a CA cannot be made through the IOP.

Channel adapters (CAs) provide the interface between the IOP bus on the CCP and the host computer; each CA attaches to 1 byte-multiplexer channel on an IBM S/360/370-compatible host. A minimum system can support 1 or 2 host computers; a maximum system can support as many as 13.

The CC-X system provides 5 types of line adapters and line sets that interface processors to modems attached to communication lines. The line adapters/line sets each support up to 8 FDX or 16 HDX/FDX asynchronous or bisynchronous lines. Depending on the model, from 32 to 1,232 communication lines are supported by a single system.

Model CC-6 supports up to 32 asynchronous/BSC/mixed lines at data rates from 75 to 9600 bps and up to 4 wideband lines with data rates up to 56K bps. Model CC-8F can support up to 240 lines at data rates from 50 to 9600 bps asynchronous and 1200 to 230.4K bps synchronous (BSC) with a sustained synchronous throughput of 200K cps. Model CC-8.5, logical extension of the CC-8F, doubles the aggregate throughput to a total sustained synchronous rate of 400 cps. The higher models, CC-80/85, each can support up to 1,232 lines with the addition of Line Interface Processors (LIPs). Each LIP supports up to 248 asynchronous lines. Up to 4 LIPs can be added to a single CC-80/85 system for a total of 992 lines added to the 240 lines supported by the basic system.

8012 Channel Adapter ● attaches directly to IBM byte-multiplexer channel of IBM S/360/370-compatible computer ● maximum of 4 can be connected in each 8090 cabinet ● not compatible with the 8013 in the same system ● available only to existing CC-80 and 85 customers with 8012s:

NA/$209/$188 mo	$9,350 prch	$60 maint

6/813/8013 Channel Adapter ● microprocessor-driven channel adapter for attachment to host computer's byte, block, or selector channels; enables processor to function as a communications controller to the host ● maximum of 4 can be connected in each 8090 cabinet; more than 4 requires an 8090 expansion cabinet ● maximum CA support is 2 in each CC-6; 4 in each CC-8F/8.5; 13 in each CC-80/85.

613 Channel Adapter ● requires CC-6 system:

313/239/220	7,590	60

813 Channel Adapter ● requires CC-8F or CC-8.5 system:

313/239/220	7,590	60

8013 Channel Adapter ● requires CC-80 or CC-85 system:

NA/209/188	9,350	60

Asynchronous Line Interface Base (LIB) ● asynchronous LIB control for up to 8 asynchronous line sets; provides interface to CIO bus ● only 1 9600-bps line can be supported per LIB and requires 9600-bps asynchronous modification ● uses 1 CIO address per line ● line speeds of 50 bps to 9600 bps controlled in either half- or full-duplex mode.

635 LIB ● requires CC-6; system supports up to 4 LIBs:

61/47/44	1,188	22

835 Asynchronous LIB ● requires CC-8F/8.5; system supports up to 30 LIBs:

110/85/79	2,640	22

8035 Asynchronous LIB ● requires CC-80/85; system supports up to 30 LIBs:

NA/75/69	1,815	22

CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85

Asynchronous Line Set ● interfaces 1 asynchronous, start/stop line operating at speeds up to 9600 bps ● up to 8 line sets controlled by 1 LIB.

636 Asynchronous Line Set ● for CC-6:

9/7/7	231	2

836 Asynchronous Line Set ● for CC-8F/8.5:

8/6/6	198	2

8036 Asynchronous Line Set ● for CC-80/85:

NA/5/4	220	2

830 Line Set, Wideband ● requires CC-8F/8.5 system and 828-W BIB:

137/105/97	3,036	36

8030 Line Set, Wideband ● requires CC-80/85 system and 8028-W BIB:

NA/71/62	3,300	36

9150 Line Interface Processor (LIP) ● runs under CPS operating system; supports up to 248 asynchronous lines ● up to 4 LIPs supported on CC-80 and CC-85 processors:

NA/375/337	18,005	143

Auto Dial Adapter (ADA) Base ● dial-out controller for use with AT&T ACU 801A (Rotary Dial) or 801C (Touch Tone) ● each ADA can handle up to 8 ACUs.

631 ADA Base ● for use on CC-6 system:

115/88/80	2,904	18

831 ADA Base ● for use on CC-8.5 system:

115/88/80	2,904	18

8031 ADA Base ● for use on CC-80/85 systems:

NA/71/62	3,300	18

9124 X.25 Line Controller ● for X.25 support on CC-8F/8.5 systems:

309/254/211	9,350	77

9125 X.25 Line Set ● for X.25 support on CC-8F/8.5 systems:

102/82/70	3,080	22

9130 Universal Micro Controller (UMC) ● for high-speed asynchronous support in an interactive environment on CC-8X/NCS systems; supports up to 64 asynchronous half- or full-duplex lines operating at 50 to 9600 bps; provides maximum aggregate throughput of 100K cps ● includes control unit, interface to CC-8X bus interface, LIF line adapter interface, and LA line adapter; LA provides modem control, serial-parallel conversions, parity generation and checking, start-stop bit insertion for 4 full- or half-duplex communication channels; LIF provides communication between LAs and UMC; UMC control contains 1K 16-bit words of local storage divided into 128 control blocks, 2 per supported line ● UMC is under control of CC-8X through function commands implemented in the UMC firmware:

309/254/211	9,350	76

9134 CCITT 56K-Byte Line Set ● for CC-8F/8.5 systems:

86/79/70	3,300	36

Auto-Call Unit (ACU) Access ● each access requires one ACU; up to 8 ACUs can be supported per 631/831/8031 on the basis of 1 address for asynchronous lines and 2 addresses for synchronous lines.

631-1 ACU Line Set ● for use on CC-6 system:

4/4/4	137	NC

831-1 ACU Line Set ● for use on CC-8F/8.5 systems:

4/4/4	137	NC

8031-1 ACU Line Set ● for use on CC-80/85 systems:

NA/2/2	82	NC

9600-bps Asynchronous Modification ● modification to an 6/835/8035 enables an asynchronous terminal to communicate at 9600 bps via the 8035 to the CC-6/8F/80 systems ● only 1 6/835-M/8035 can be supported on each 6/835/8035.

635-M 9600-bps Asynchronous Modification ● for use on

CC-6 systems:

24/18/17	660	2

835-M 9600-bps Asynchronous Modification ● for use on CC-8F/8.5 systems:

24/18/17	660	2

8035-M 9600-bps Asynchronous Modification ● for use on CC-80/85 systems:

NA/16/14	550	2

Reverse Channel Capability ● allows high-speed Teletypes (120 cps) to use break protocol of AT&T 202-type modems (dial-up, HDX) ● 638/838/8038 is used with the 636/836/8036 line sets.

638 **Reverse Channel** ● 4 lines ● used on CC-6 system:

47/38/36	1,059	12

838 Reverse Channel Capability ● 4 lines ● used on CC-8F/8.5 systems:

47/38/36	1,059	12

8038 Reverse Channel ● 4 lines ● used on CC-80/85 systems:

NA/22/19	880	12

Dual Code Feature ● allows either EBCDIC or ASCII codes to be used on BSC lines ● supports software definition for either IBM 2701 or 3705 code specified by IBM S/360/370-compatible systems ● used with 829/8029 medium-speed BSC line sets ● configuration requires one-for-one dual code feature and line sets.

839 Dual Code Feature ● used on CC-8F/8.5 systems with 829 line sets:

42/31/29	924	12

8039 Dual Code Feature ● for 8029 on CC-80/85 systems with 8029 line sets:

NA/22/19	880	12

840 Dual Code Feature ● for 830 line sets on CC-8F/8.5 systems:

42/31/29	924	12

8040 Dual Code Feature ● for 8030 line sets on CC-80/85 systems:

NA/22/19	880	12

Buffered Interface Base (BIB), BSC/Netlink ● BSC/Netlink controller with direct access to memory; supports up to 4 BSC/Netlink wideband line sets for a total of 8 BSC/Netlink or wideband lines ● BIB uses 2 CIO addresses for each synchronous or wideband line.

628 BIB, BSC ● requires CC-6 ● system supports 2:

122/94/86	2,277	24

828 BIB, BSC ● requires CC-8F/8.5 ● system supports up to 15:

100/77/71	2,277	24

8028 BIB, BSC ● requires CC-80/85 ● system supports up to 15:

NA/82/73	3,520	24

Wideband Buffered Interface Base ● supports up to 2 BSC wideband line sets at 230.4 bps for a total of 2 230.4-bps lines.

628-W BIB ● requires CC-6 system:

137/105/97	3,036	36

828-W BIB ● requires CC-8F/8.5 systems:

100/77/71	2,277	24

8028-W BIB ● requires CC-80/85 systems:

NA/82/73	3,520	24

Line Set BSC/Netlink ● interfaces up to 2 full- or half-duplex synchronous communication lines with data rates between 1200 and 9600 bps ● 4 line sets are controlled by 1 BIB for a total of 8 BSC/Netlink lines.

629 BSC Line Set ● requires CC-6 and 628 BIB BSC:

55/42/39	1,166	12

829 BSC Line Set ● requires CC-8F/8.5 and 828 BIB BSC:

35/26/24	687	12

CCI Communication Processors
Models CC-6, CC-8F, CC-8.5, CC-80 & CC-85

8029 BSC Line Set o requires CC-80/85 and 8029 BIB/BSC:

NA/27/24	1,980	12

BSC Wideband Line Set/230.4 bps o interfaces up to 2 full- or half-duplex wideband communication lines with data rates from 19.2K bps to 50K bps or 1 full- or half-duplex 230.4K-bps line.

630-W BSC Line Set o requires CC-6 system and 628-W BIB:

137/105/97	3,036	36

□ Disk & Tape

From 1 256K-byte diskette to 3 160M-byte disks for total 320M-byte disk storage can be supported on the CC-8X systems, depending on models and configuration requirements. The CC-6 supports no disk storage.

Diskette/Controller o single-/dual-sided diskette supports 256K/512K bytes; 10-millisecond track-to-track access; 250K-bps data transfer rate o uses Shugart drive; features write protect o used for storage/retrieval of NCS overlay and diagnostics/utility programs.

867 Diskette/Controller o single-sided; for CC-8F/8.5 systems:

$286/$220/$201 mo	$8,580 prch	$60 maint

8067 Diskette/Controller o single-sided; for CC-80/85 systems:

NA/220/201	8,580	60

8067-01 Diskette/Controller o dual-sided; for CC-80/85 systems; 1 drive:

NA/203/182	8,580	60

8067-02 Diskette o second drive:

NA/95/56	3,850	60

8071 Moving Head Disk Drive Controller (Trident) o supports 4 8072s or 1 8073 disk drives; 8 IOP accesses o data transfer at up to 500K bytes per second; 280-byte FIFO storage for data transfer helps prevent overruns o requires CC-80/85 system:

NA/639/462	17,050	145

8071-1 Disk Controller Access o configured with up to 8 per 8071 controller:

NA/55/49	2,090	12

8072 T-50 Moving Head Disk Drive o provides 40M bytes of storage o average access time 30 milliseconds; data transfer rate 806K bytes per second:

NA/515/372	13,750	103

8073 T-200 Moving Head Disk Drive o provides 160M bytes of storage o average access time is 30 milliseconds; data transfer rate 806K bytes per second:

NA/907/656	24,200	181

□ Consoles & Printers

CC-40 System Supervisor/Monitor Console o color CRT display terminal with keyboard; displays line conditions o used by system operator for start-up, restart, recovery, supervisory control of system/network.

892 CC-40 System Console o with color CRT display o supported by CC-8F/8.5 systems:

$232/$178/$162 mo	$5,676 prch	$42 maint

8092 CC-40 System Console o with color CRT display o supported by CC-80/85 systems:

NA/137/123	4,180	42

System Alarm Panel o audible alarm notifying operators when problem condition exists with temperature, AC power, DC power, watchdog timer; notifies up to 8 separate CC-8X systems or individual expansion cabinets o consists of LED display on panel and alarm buzzer; enables or inhibits 1 or more systems o panel can be 100 feet away from sensors o wall or table mounted.

894 System Alarm Panel o for CC-8F/8.5 systems CC-40 console:

103/80/74	2,728	12

8094 System Alarm Panel o for CC-80/85 systems CC-40 console:

NA/68/62	2,728	12

894-1 System Alarm Panel Access o for 894 on CC-8F/8.5 systems; up to 8 per 894:

24/29/19	359	12

8094-1 System Alarm Panel Access o for 8094 on CC-80/85 systems; up to 8 per 8094:

NA/8/7	359	12

o END

Concord Data Systems Token/Net
Broadband Local Area Network

■ PROFILE

**Architecture** ● Net/One broadband token bus LAN.

Type ● broadband token bus based on the IEEE 802.4 token bus standard, adopted as standard by over 150 members of GM Manufacturing Automation Protocol (MAP) users group ● uses token-passing access method ● Concord Data provides GM-HDL implementation of Token/Net for compatibility with 6M-MAP specification.

Transmission Speed ● 5M bps on each of 6 channels.

Cable Length ● up to 25 miles on standard CATV single-cable midsplit.

Applications ● multipurpose LAN ● currently only LAN implementing GM MAP for factory environment ● Swedish PTT certified Token/Net as the only broadband token bus LAN for use in Sweden for hospital and industrial market segments.

Configurations ● consists of any number of TIM-200 and TIM-220 Token/Net Interface Modules (TIMs) interconnected with up to 25 miles of CATV cable; requires a Token/Net HR-105 Head End Remodulation or Head-End Translator to translate low-frequency down cable (transmit) signals to high-frequency up cable (receive) frequencies ● can implement up to six 5M-bps channels ● options include a Token/Net Token/Scope Network Analyzer and Network Control Computer (NCC) Analyzer monitors network performance in real-time, storing partial subset of events in buffer memory; command mode allows user to set parameters and access monitor, trace, analyze, and memory modes ● NCC provides complete network management independent of real-time network operation ● TIMs include RF modem to connect to cable, access controller board, and control unit; support asynchronous and synchronous communications using RS-232C and RS-449/422 interface range interfaces; asynchronous data rates over RS-232C from 75 to 19.2K bps asynchronous and 1200 to 19.2K bps synchronous and over
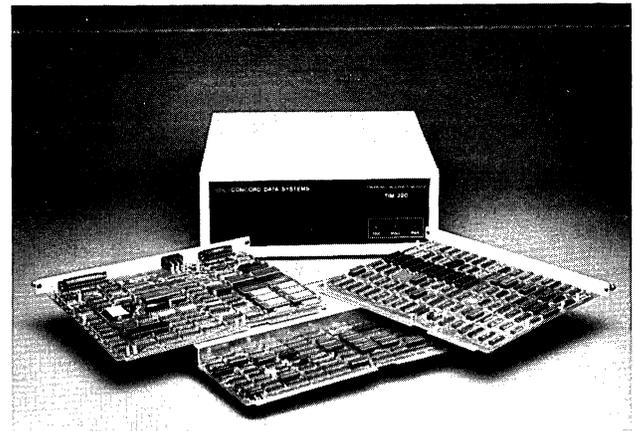
Concord Data Systems Token/Net Interface Module, the TIM 220, supports 4 serial ports with 2 additional card positions for field upgrade to 12 serial ports.

RS-449/422 from 9600 bps to 128K bps, see **Figure 1**.

Interface ● through Token/Net Interface Module (TIM) Model 200 or 220; user interface is RS-232C or RS-449/422 synchronous or asynchronous interface.

Gateways ● none; HDLC Host Interface Package forms gateway between host computers running MAP software and TIM's control unit.

Support of Foreign Devices ● none; provides standard interfaces that virtually all vendors support; RS-232C and RS-449/442.

Network Management ● through console that can attach to TIM and use network management functions of the control board in the TIM; console can be any ASCII terminal ● through Network Control Computer (NCC based on IBM PC/XT) and Token/Scope Network Analyzer ● NCC provides network management independent of real-time network and analyzer provides real-time monitoring for quick isolation and diagnosis of protocol problems.

Protocols ● IEEE 802.4 standard media access protocols and IEEE 802.2 logical link standard protocols for Token/NET; also implements ISO/NBS Transport Layer, Session Layer, and Port Application Layer protocols.

Distributed Functions ● network management in TIMs can be automated and centralized in Network Control Computer (NCC); network access in TIMs token bus access is a peer-to-peer protocol.
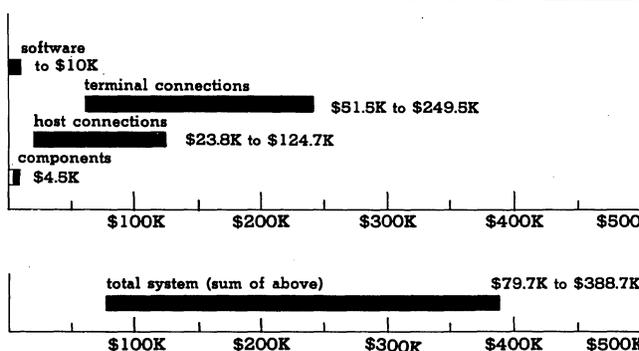
Support Software ● provides switched and permanent datagram and virtual circuit transport services, multipoint/multicast datagram transport services, name services dialing, unrestricted rotary configuration, interactive call and queuing, configuration control of user service classes, and component/system diagnostic services.

First Delivery ● Beta test site in 1984; general deliveries began end of January 1985.

**Systems Delivered** ● 50 pilot networks installed.

Comparable Systems ● only LAN compatible with IEEE 802.4

PURCHASE PRICE RANGE hardware & software ▬▬▬▬

software
■ to $10K
   terminal connections
   ▬▬▬▬▬▬▬▬ $51.5K to $249.5K
host connections
▬▬▬▬▬ $23.8K to $124.7K
components
▮ $4.5K

| $100K | $200K | $300K | $400K | $500 |

total system (sum of above) $79.7K to $388.7K
▬▬▬▬▬▬▬▬▬▬

| $100K | $200K | $300K | $400K | $500K |

CONCORD DATA TOKEN/NET PURCHASE PRICING ● SMALL SYSTEM interconnects 100 terminals with 2 host computers; provides 24 ports per host for a ratio of about 2.1 terminals per host port; configuration includes 12 LO-TO5X-550 TIM 220s with 12 ports each, an LO-TO5X-5500 TIM 220 with 4 ports, and an L5-RO5X-2000 HR-105 Head-End Remodulation ● **LARGE SYSTEM** interconnects 500 termianls with 4 host computers; provides 252 ports per host for a ratio of over 1 per 2 terminals; configuration includes 53 LO-TO5X-550 TIM 220s with 12 ports each, an L5-RO5X-2000 HR-105 Head-End Remodulator, and Network Control Computer software ● neither the small nor the large configuration includes the cable; the large configuration requires the user to supply the IBM PC-AT/XT and the A.L.C. expansion board.

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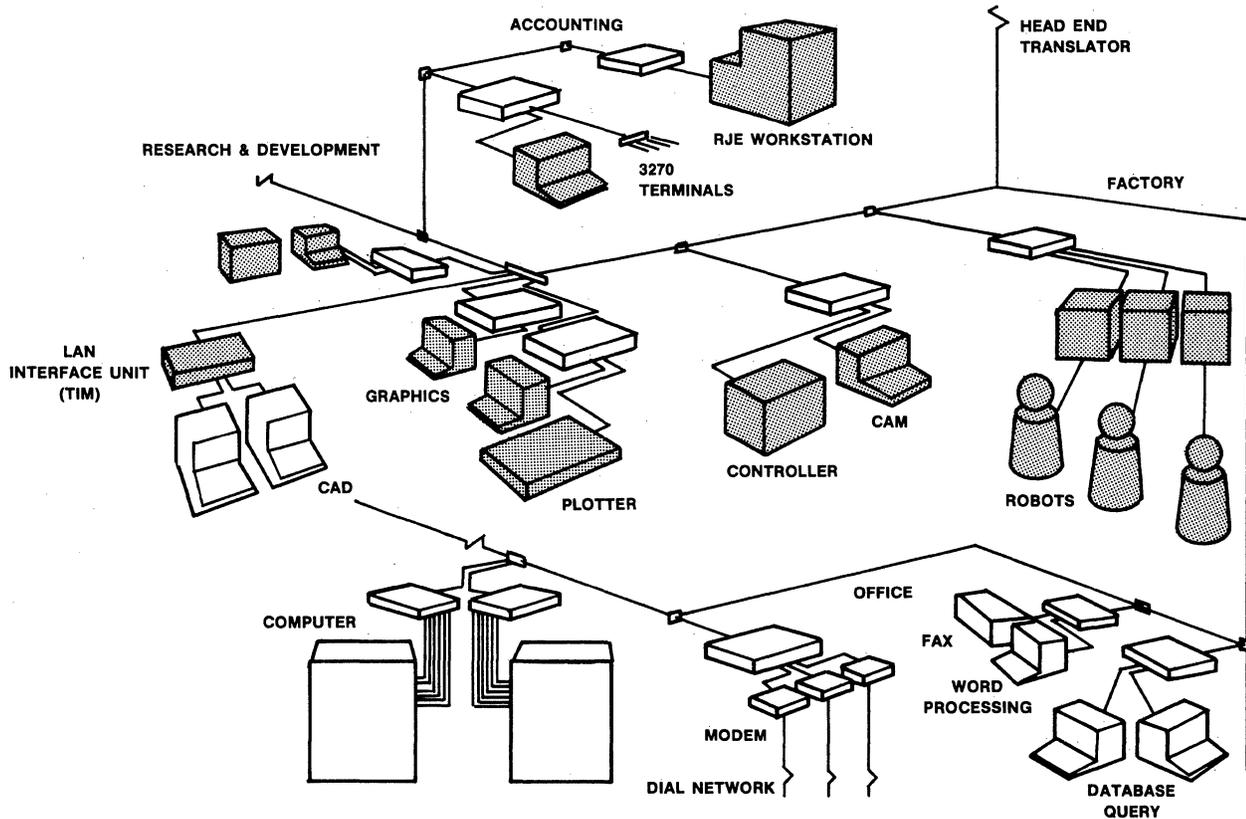
Figure 1 ● typical Token/Net LAN configuration.

token bus LAN standard currently on market; Datapoint ARC and Prime Ringnet also token bus LANs, but they are baseband LANs while Token/Net is broadband ● proteon ProNet is baseband token ring LAN that has many of the LANs have same advantages of token bus LAN, such as predictive access times ● other broadband LANs have same advantage as Token/Net broadband technology: 25-mile cable length; ability to mix voice, data, and video on one cable; and ability to add channels to expand capacity.

Vendor ● Concord Data Systems; 303 Bear Hill Road, Waltham, MA 02154 ● 617-890-1394.

Distribution ● through 4 sales offices in USA ● through OEMs, such as Texas Instruments and Allen-Bradley ● through distributors, such as with Swedish Postal Telephone and Telegraph (PTT) Authority ● Allen-Bradley will sell Token/Net under its own VistaNet trade name; Texas Instruments will sell Token/Net Interface Modules (TIMs) directly under private label as part of TIWAY II LAN system.

Canadian Distribution ● Electro-Net Canada Ltd; P.O. Box 6190, Station F, Hamilton, ON L9C 5S3 ● 416-575-0436.

GSA Schedule ● unlisted.

■ **ANALYSIS**

Concord Data Systems, formerly Miller Associates, was formed in 1980 to develop modems for wide area networks and token bus LANs. The company worked closely with the IEEE 802 committee to form the 802.4 token bus standard. In fact, Concord Data Systems chaired the 802.4 subcommittee that developed the standard.

Token/Net was announced in February 1983, but general deliveries of the LAN components did not begin until the end of

January 1985. Currently, 50 pilot Token/Net LANs are installed, where users are testing the system to determine if they wish to install a full-blown network.

Concord Data has received a considerable boost in the marketplace with GM's choice of the IEEE 802.4 standard to implement its GM-MAP specification. GM demonstrated MAP interconnecting several vendor's computers through a Token/Net LAN at the National Computer Conference (NCC) in June 1984. Allen-Bradley, a leading manufacturer of industrial automation equipment, has signed a long-term OEM agreement with Concord Data Systems to purchase Token/Net components for Allen-Bradley's broadband, token bus VistaNet LAN.

Concord Data was awarded a contract over Ungermann-Bass and Sytek to supply the Swedish PTT with a certified LAN for sale in Sweden. The PTT is planning to use Token/Net for hospital and industrial applications.

Gould AMI and Concord Data Systems have entered into an agreement to develop jointly a VLSI implementation of the IEEE 802.4 LAN standard. The customized chip set will also implement the IEEE 802.2 Logical Link Control (LLC) functions, which are usually implemented in software, as well as the IEEE 802.4 **priority** and **immediate response** options. It will also comply with the Proway process control LAN standard (a superset of 802.4). The chip set is expected to be available in products **early** in 1986. In the meantime, Token/Net presently uses medium-scale integration and discrete components to implement the TIMs.

Concord Data should have a busy and exciting 1985/1986. Its networks are being installed at a rapid rate. Interest in MAP is growing and Token/Net is the only network implementing MAP. In October 1984, Concord Data received a third round of financing, new equity investment worth $7 million. The company is using the money to develop, market, and support Token/Net.

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□ Strengths

Token/Net's biggest strength is its compatibility with the IEEE 802.4 token bus LAN standard. The IEEE 802.4 has been selected as the access protocol for General Motor's MAP, the foundation for the "factory of the future."

Concord Data is a small company and has focused its development efforts in a relatively narrow segment of the communications marketplace. The company has produced a unique product that fulfills a market niche. Undoubtedly, other companies will provide products to compete in that marketplace. But until they do, Concord Data has the only LAN to implement MAP.

The token bus access protocol is **far superior** to CSMA/CD for networks with high traffic loads. It also provides a deterministic access time. Also, the protocol accommodates 4 levels or classes of priority traffic, so high priority traffic cannot be shut out.

□ Limitations

Concord Data is a small company, but it appears to be well financed. Its product line is relatively small. The company, however, provides all the products needed to implement a token bus LAN. Time will tell how well the company markets and supports them. The company has been successful with its line of modems, which it has been delivering for several years. Token/Nets have only been delivered since the end of January 1985.

■ NETWORK SUMMARY

Concord Data Systems offers a complete line of hardware and software products to implement Token/Net. These products consist of 2 sets: 1 set includes software to implement all 7 levels of the OSI model; the other set implements the lower 2 levels and interfaces to a host computer that implements the other levels.

All Token/Nets are constructed with the Token/Net Interface Modules (TIMs), microprocessor-based communication controllers that provide local user connections to a broadband cable. The TIM includes a frequency agile RF modem over the 6 IEEE 802-recommended, 6-MHz-wide CATV channels, operating at 5M bps.

TIM also includes an Access Controller that implements the IEEE 802.4 token bus access protocol and a control unit to provide network management functions. The control board provides a console port so a user can control the network from the console. The user must manually initiate the functions performed from the console.

For more automatic centralized network control, the Token/Net requires a Network Control Console based on an IBM PC/XT running a UNIX-type operating system. Concord Data provides the network management software for the user-supplied PC/XT.

Concord Data provides 3 head-end units to amplify and remodulate the upcable signals for transmission downcable. Two of the head-end units translate 1 channel. The other is a wide-band translator that translates all 6 channels. The head-end can be configured with redundant remodulation for fail-safe operation.

Concord Data also provides a Token/Scope Network Analyzer for real-time network troubleshooting.

The user can begin small with starter a kit of 4 TIMs, a translator, and cable to test the network.

Token/Net is completely compatible with the IEEE 802.4 token broadbank bus standard. The only feature not implemented is the optional immediate response mechanism. That will be implemented in the chip set being developed with Gould AMI.

■ SOFTWARE

□ Terms & Support

Terms ● NCC software available for a one-time charge; the TIM software/firmware is bundled with the hardware.

Support ● assumes user spaces, provides spares, and returns boards to factory for repair.

□ Token/Net Software

The TIM-resident software provides switched and permanent datagram and virtual circuit transport services. Datagram transport services can be multipoint or multicast. Other features include "name services" dialing, port contention resolution, unrestricted rotary configurations, support of user service classes, interactive call and queuing, and extensive system and service diagnostics.

TIM versions of the Manufacturing Automation Protocols (MAP) provide a software interface from the ISO Level 2 software in the TIM to the Level 2 in a host processor running the upper levels of MAP. The non-MAP TIMs provide a full implementation of all 7 levels of the ISO model. The software is "compliant" with MAP software.

The major software package offered with Token/Net is the Network Control Computer software. Firmware supports the Token/Scope Network analyzer.

LA-M050-9200 Network Control Computer Software ● runs on an IBM PC-XT/AT; includes applications software, database management system, and UNIX-type operating system ● provides complete network management independent of the real-time network with an assortment of control and diagnostics packages ● provides network configuration management, network performance and status monitors, and network diagnostics and maintenance ● provides a library of pre-defined configuration profiles ● a number of parameters are associated with each TIM: physical address, logical address, and descriptive configuration tables; each RS-232C port can be defined with data rate, level-of-service, and method-of-operation; all parameters are stored in nonvolatile memory and the network manager can access and/or modify them ● network performance and status is measured and stored by layers: application, transport, LCC, media access control (MAC) and physical; session state, status, packets sent and received, timeouts, number of stations in ring, token rotation rate, token pass repeats, claims won, total valid frames, head-end mode, and ROM ● the network manager can test operation of entire Token/Net, a Network Diagnostic Exerciser (NDE) in each TIM allows TIM to source test frames without interfering with normal network operation, network manager can vary frame size and content and polling repetition rate ● report generator provides user-definable report for management purposes ● requires the user to supply an IBM PC-XT/AT, 10M-byte disk, 256K-byte memory, graphics monitor and controller; also requires A.S.T. Corporation Expansion board with 512K-byte memory, serial port, parallel port, and time-of-day clock; also requires 132-column printer:

$10,000 **prch**

■ HARDWARE

□ Terms & Support

Terms ● available for purchase only; discounts are available for unit volume purchases.

Support ● assumes the user spares system and returns faulty boards to factory for repairs.

□ Token/Net Components

Token/Net Interface Modules (TIM)

A principal component of Token/Net, which conforms to IEEE 802.4 token-passing broadband bus standard. It supports a 5M-bps network data rate and contains 4 to 12 user ports to connect synchronous or asynchronous devices. A TIM consists of an access controller board, control unit, and RF modem. The access controller board implements IEEE 802.4 token-passing protocol. The control unit supports TIM management functions and includes configuration memory, interface to front panel, and variety of software services. A single port can serve as a console or data port. The frequency agile RF modem transmits on the following frequencies: 59.75 to 65.75 MHz, 65.75 to 71.75 MHz,

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PRCH: purchase price. Prices are current as of June 1985.

Concord Data Systems Token/Net
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71.75 to 77.75 MHz, 77.75 to 83.75 MHz, 83.75 to 89.75 MHz, and 89.75 to 95.75 MHz, receive frequencies are: 252 to 258 MHz, 258 to 264 MHz, 264 to 270 MHz, 270 to 276 MHz, 276 to 282 MHz, and 282 to 288 MHz ● ports provide RS-232C synchronous (1200 to 19.2K bps) or asynchronous (75 to 19.2K bps) or RS-449/422 (9600 to 128K bps) interfaces ● software bundled with hardware ● all models can be configured for 110 to 220 VAC power.

LO-T05X-2200 TIM 220 ● MAP-compatible with HDL software running on host; provides 2 RS-232C/RS-449 ports:

$5,200 prch

LO-T05X-0200 TIM 200 ● MAP-compatible with HDL software running on host; provides 2 RS-232C/RS-449 ports:

4,735

LO-T05X-0500 TIM 200 ● Serial Port Application (S.P.A.); MAP-compliant; provides full implementation of ISO model ● provides 4 RS-232C ports, nonexpandable:

3,485

LO-T05X-0600 TIM 200 ● same as LO-T05X-0500 except with 2 RS-232C ports and 2 RS-449 ports:

4,135

LO-T05X-2500 TIM 220 ● same as LO-T05X-0500 except expandable to 12 ports ● includes 4 RS-232C ports:

3,950

LO-T05X-5500 TIM 220 ● same as LO-T05X-0500 except includes 12 RS-232C ports:

5,940

CATV Equipment

L5-R05X-1Y00 Head-End Translator ● 1-channel pair; y=outbound channel P, Q, R, S, T, U:

$3,200 prch

L5-R05X-1600 Wide Band Translator ● 6 channel pairs for all 6 channels:

3,600

L5-R05X-2000 HR-105 Remodulator ● head-end remodulator designed for single cable; provides common clocking; improves signal-to-noise characteristics ● can be configured redundantly ● frequency agile and operates on any 1 of the 6 Token/Net channel frequencies at 5M bps:

4,450

L5-M050-3000 Cable Starter Kit:

350

L5-R05X-4000 Head-End Redundancy Switch ● allows configuring redundant head-end:

2,495

L5-R05X-5000 Remodulator Package ● includes 2 HR-105s and a redundancy switch:

9,950

RF Modem ● frequency agile; can be used for any Token/Net channel:

1,725

☐ Network Management

Network Management provided in TIM, on Network Control Computer (NCC), and Token/Scope Network Analyzer. The user must supply the IBM PC XT/AT to run the NCC software supplied by Concord Data. The Token/Scope Network Analyzer is controlled by its own firmware.

L4-T05X-7000 Token/Scope Network Analyzer ● consists of an IEEE 802.4 frequency-agile, 5M-bps RF Modem an Access Unit, and a specially configured Control Unit with Token/Scope firmware; access to Token/Scope is through a user-supplied DEC VT 100 or compatible display terminal ● includes 16K-byte buffer for data collection; monitors particular network events in real-time without interfering with normal network operation; operates in trace and analyze mode to test network:

$30,000 prch

Starter Systems

L4-M05X-2200 MAP Starter System ● includes 4 TIM 220s, a head-end translator, and cable kit:

$20,697 prch

L4-N05X-2600 SPA Starter System ● includes 4 TIM 220s, an HR-105, and a cable kit:

17,510

■ SPECIFICATION

Token/Net is compatible with the IEEE 802.4 standard for token-bus LANs. In this standard, a token controls the right to medium access. The standard provides for the medium access control (MAC) sublayer of Level 2 and the Physical Layer 1 of the OSI model. It uses the IEEE 802.2 Logical Link Control (LLC) standard sublayer to make up the other part of the Level 2 Data Link Control layer of the OSI model. See **Figure 2**.
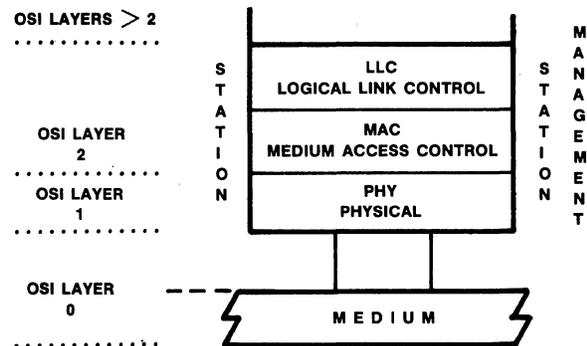
Figure 2 ● relation to OSI Model.

The Physical Level specification of 802.4 provides for 3 types of buses: baseband coaxial cable using Phase Continuous FSK (Frequency Shift Keying) signaling for a data rate of 1M bps; baseband coaxial cable using Phase Coherent FSK signaling for data rates of 5M and 10M bps; and broadband coaxial cable using Multilevel Duobinary Amplitude Modulated/Phase Shift Keyed (AM/PSK) signaling for data rates of 1M, 5M, and 12M bps. Token/Net implements the 802.4 broadband token bus specification using Multilevel Duobinary AM/PSK signaling with a 5M-bps data rate. Token/Net provides 6 channels.

The token bus standard specifies a physical bus that forms a logical ring. The standard also specifies a broadcast media, with all stations on the bus receptive to all signals/messages transmitted. The access method is sequential; the right to transmit (token) is passed from station to station around the ring. This means that stations can be attached to the bus and receive messages without being part of the logical ring. For example, Stations F and H in **Figure 3**, can be addressed and receive messages, but they cannot send messages because they are **not included** in the logical ring. Only stations A, B, C, D, E, and G are attached to the logical ring and can both receive and transmit messages.

Packet Format

Packets range in size from 2 to 8193 bytes, excluding preamble. Token/Net uses a 4K-byte preamble.

PRCH: purchase price. Prices are current as of June 1985.

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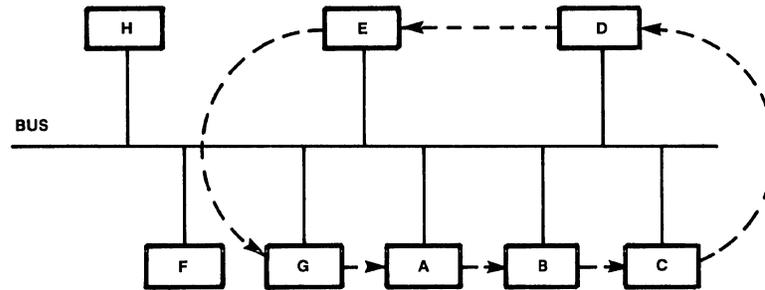
Figure 3 ● logical access ring on physical bus.

Format ● as shown in **Figure 4**, a packet consists of a preamble of 1 or more bytes to synchronize the receive modems, start delimiter (SD) of 1 byte to signal the beginning of a frame, frame control (FC) of 1 byte to indicate the class of frame being sent, destination address (DA) of 2 or 6 bytes, source address (SA) of 2 or 6 bytes, data of 0 to 8172 bytes, frame check sequence (FCS) of 4 bytes to check accuracy of transmission, and end delimiter (ED) of 1 byte to signal the end of a message ● a frame of SD followed by ED is an abort sequence ● all addresses on a single LAN must be of the same length, either 2 or 6 bytes long ● the first 2 bits of the FC indicate the contents of the frame: Medium Access Control (MAC), Logical Link Control (LLC) data, station management data, or special-purpose data (reserved for future use) ● the last 6 bits of FC in MAC control frames specify the type of control frame: claim token, solicit successor, who follows, resolve contention, token, and set successor; see **Figure 5** ● the last 6 bits of FC for data frames contains a 3-bit MAC-action specification and 3-bit frame priority code: MAC action can specify request with or without response or response frame; see **Figure 6** ● both Source and Destination Addresses use the same format ● for LANs using 16-bit addresses, the first bit specifies whether it is an individual (I) or a group (G) address; the other 15 bits specify the address; for LANs using 48-bit addresses, the first bit also specifies an I/G address, the second bit specifies whether the address is locally administered or globally administered (universal form) ● a G address of all ones is a broadcast address to which all stations connected to the LAN respond ● local administration means the address is administered within the LAN; global administration is not specified in the standard ● the data field can contain management information, information associated with a control frame, or data; data fields combined with DA, SA, and FCS fields can be up to 8191 bytes long; the end of the data field is triggered by the End Delimiter (ED); the receiving station knows the 4 bytes preceding ED contain the Frame Check Sequence (FCS); the receiver generates an FCS based on the bits in the FC, DA, SA, and data fields and compares it with the FCS field; if the 2 FCSs disagree the receiver sets an error bit in ED.
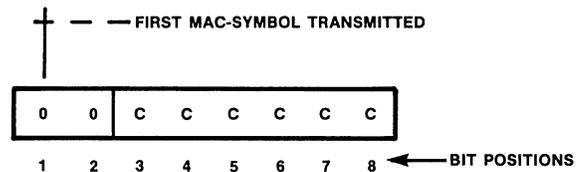

WHERE

PREAMBLE = PATTERN SENT TO SET RECEIVER's MODEM CLOCK AND LEVEL (1 OR MORE BYTES: TOKEN/NET USES 4 BYTES)

SD = START DELIMITER (1 BYTE)
FC = FRAME CONTROL (1 BYTE)
DA = DESTINATION ADDRESS (2 OR 6 BYTES)
SA = SOURCE ADDRESS (2 OR 6 BYTES)
DATA = INFORMATION (0 OR MORE BYTES)
FCS = FRAME CHECK SEQUENCE (4 BYTES)
ED = END DELIMITER (1 BYTE)

Figure 4 ● packet frame format.

CCCCCC = TYPE OF MAC-CONTROL FRAME AS FOLLOWS:

| C C C C C C	
3 4 5 6 7 8	◄——— BIT POSITIONS
0 0 0 0 0 0	CLAIM TOKEN
0 0 0 0 0 1	SOLICIT SUCCESSOR 1 (HAS 1 RESPONSE WINDOW)
0 0 0 0 1 0	SOLICIT SUCCESSOR 2 (HAS 2 RESPONSE WINDOWS)
0 0 0 0 1 1	WHO FOLLOES (HAS 3 RESPONSE WINDOWS)
0 0 0 1 0 0	RESOLVE CONTENTION (HAS 4 RESPONSE WINDOWS)
0 0 1 0 0 0	TOKEN
0 0 1 1 0 0	SET SUCCESSOR

Figure 5 ● FC field of MAC-control frame.

Transmission Characteristics ● the IEEE 802.4 standard contains 3 physical specifications; only the one used by Token/Net will be discussed here; it is for broadband token bus LANs transmitting at 5M bps ● direct encoding of data and nondata symbols, each symbol is represented by an integral number of cycles of constant frequency with frequency changes only at zero crossings of the wave form; 2 frequencies are used: 5 MHz (lower) and 10 MHz (higher) ● uses 3-symbol encoder: "0"=2 full cycles of the higher frequency; "1"= one full cycle of lower frequency; pair of nondata symbols=one full high-frequency cycle, followed by one full lower-frequency cycle, followed by another full high-frequency cycle ● the nondata symbols are used in ED and SD to distinguish them as delimiters as shown in **Figure 7**; the I (intermediate) bit in ED allows a station to hold the token for transmission of a special frame: the E bit indicates whether or not an error was detected in the frame.

Data Rate ● 5M bps per channel equals 200 nanoseconds per symbol transmitted over Token/Net ● up to 6 channels can be implemented.

Carrier ● multilevel duobinary AM/PSK modulated rf carrier ● channels are 6-MHz wide; transmit frequencies are from 59.75 MHz to 95.75 MHz and receive frequencies are from 252 MHz to 288 MHz ● the head-end frequency translator converts lower transmit frequencies to higher receive frequencies ● Pad-idle consists of alternating 1s and 0s, beginning with 1 ● when head-end receives no signals, it sends out "Reported Silence" signaling; the sequence has a period of 4 symbols: nondata,

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┼ — — FIRST MAC-SYMBOL TRANSMITTED

F	F	M	M	M	P	P	P

1 2 3 4 5 6 7 8 ◄— BIT POSITIONS
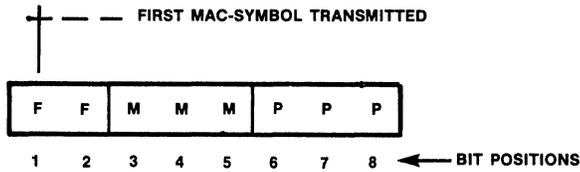
WHERE

F F = FRAME TYPE

(1 2 ◄— BIT POSITIONS)

0 1 = LLC DATA FRAME
1 0 = STATION MANAGEMENT DATA FRAME
1 1 = SPECIAL PURPOSE DATA FRAME—RESERVED

M M M = MAC-ACTION

(3 4 5 ◄— BIT POSITIONS)

0 0 0 = REQUEST WITH NO RESPONSE

0 0 1 = REQUEST WITH RESPONSE

0 1 0 = RESPONSE

P P P = PRIORITY

(6 7 8 ◄— BIT POSITIONS)

1 1 1 = HIGHEST PRIORITY

1 1 0

1 0 1

1 0 0

0 1 1

0 1 0

0 0 1

0 0 0 = LOWEST PRIORITY

Figure 6 ● FC field of MAC-data frame.

nondata, 0, 1 sequence; receivers can set their automatic gain control (AGC) and determine signaling mode of system by the sequence; bad-signal is any MAC symbol period during which an inappropriate signal is received ● the 802.4 standard provides for self-synchronizing scrambler to increase the average number of transistors within a transmission.

Control Procedure

Token/Net uses a token-passing scheme for bus access. When a station finishes transmitting its frames, it passes the token to its successor station in the ring. The token is passed around the network from the station with the highest address to the station with the next lower address. The token passes from the station with the lowest address on the network to the station with the highest address to complete the logical ring. If a station has information to transmit, it captures the token and transmits one or more packets of information. A station can continue to transmit packets until the token hold time runs out. The token hold time is a network parameter set by station management.

Token/Net implements an optional 4-level priority level for transmissions. The FC field in the MAC data format is 3 bits, thus 8 priority levels can be specified, but the 3-bit code is mapped into 4 levels by ignoring the least significant bit. Service classes 0 and 1 correspond to access class 0, service classes 2 and 3 correspond to access class 2, service classes 4 and 5 into access class 4, and service classes 6 and 7 to access class 6 (the highest priority). If the priority option is unused, all traffic is mapped into class 6.

When priority transmissions are used, all stations maintain 3 rotation timers, one for each of the lower priority transmissions. Each access class also has a queue of frames for transmission. When a station receives the token, it transmits its highest priority frames first. If there is time left on the token hold timer, the station can transmit lower priority frames until the timer runs out or the queue is empty.

A station can withdraw from the network by simply ignoring the token, allowing the fault recovery mechanisms to patch it out. A more orderly way is for the station leaving the network to capture the token and send a set-successor frame to its predecessor with the address of its successor in it. This causes the logical ring to bypass the exiting station.

Each station in the ring retains the address of its predecessor and successor in the ring, called previous station (PS) and next station (NS), as well as its own address, this station (TS). Predecessor and successor addresses are dynamically determined and maintained. When a station changes its NS, it passes the information to station management.

A station can temporarily delegate its right to transmit by sending a Request-with-Response frame. The station receiving such a frame responds with a Response frame that causes the right to transmit to revert back to the station sending the Request-with-Response frame.

After a station sends a Token frame, it "listens" to determine if its successor "heard" the frame and is active. If the station hears a valid frame, it assumes all is well. If the station hears noise or a frame with an incorrect FCS, it cannot be sure which station transmitted the frame. If the station hears noise, it sets an internal indicator, enters check-token-pass state and listens for up to 4 time slots. If nothing more is heard, the station retransmits its token. If it hears anything during the 4 time slots, the station assumes its successor has the token.

If the station hears nothing after it has transmitted the token the second time, it assumes its successor has failed and sends out a Who-Follows frame with its successor's address in it. Each station compares the address with the address of its predecessor, and the station with that predecessor responds by sending a Set-Successor frame with its address in it to the station holding the token.
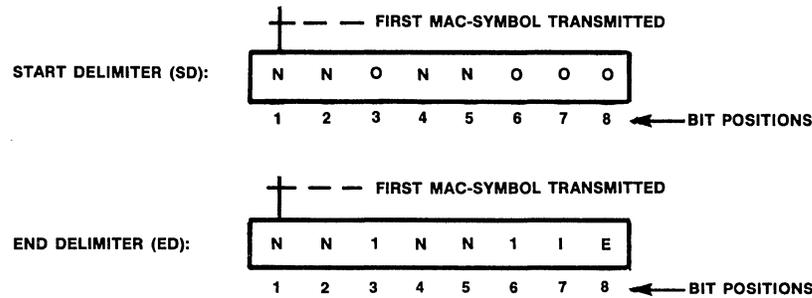
If the station receives no response to the Who-Follows frame, it repeats the transmission. If there is still no response, it sends out a Solicit-Successor frame with its run address in both the DA and SA fields asking any station to respond to it. A Solicit-Successor frame is followed by a response window, during which a station desiring to join the ring can send a Set-Successor frame with its address in it.

When a valid Set-Successor frame is received, the station passes the token to it. If multiple stations respond, the station receives unrecognizable noise, and then sequences an arbitration algorithm to identify a single station.

The worst-case token rotation time determines the maximum time a station will wait to gain access to the network. If many stations attempt to add new stations with the solicit successor procedure, this limit could be exceeded. A ring-maintenance timer prevents stations from soliciting successors (adding new stations) if the maximum time set for token rotation will be exceeded. When the token is rotating fast enough, new stations can be added.

Initialization of the network is a special case of adding new stations. Initialization is triggered when an inactivity timer in one station runs out. That station then sends a Claim-Token frame and builds the network using response windows in Solicit-Successor frames. If more than one station tries to claim the token simultaneously, then transmissions are sorted out on the basis of

Concord Data Systems Token/Net
Broadband Local Area Network

FIRST MAC-SYMBOL TRANSMITTED

START DELIMITER (SD):

N	N	O	N	N	O	O	O
1	2	3	4	5	6	7	8

◄── BIT POSITIONS

FIRST MAC-SYMBOL TRANSMITTED

END DELIMITER (ED):

N	N	1	N	N	1	I	E
1	2	3	4	5	6	7	8

◄── BIT POSITIONS

WHERE

N = NONDATA MAC-SYMBOL

0 = ZERO MAC-SYMBOL
1 = ONE MAC-SYMBOL
I = INTERMEDIATE BIT (1 = MORE TO TRANSMIT, 0 = END OF TRANSMISSION)
E = ERROR BIT (0 = NO ERROR, 1 = ERROR)

MAC SYMBOL TIME = 0.2 MICROSECONDS

Figure 7 ● use of nondata MAC-symbol.

using an algorithm selected bits in the stations' addresses. Once a valid token is on the network, the logical ring is built as previously described.

Transmission Medium

Token/Net uses 75 ohm, CATV-like, bidirectional, broadband, semirigid, trunk cable with flexible drop cable. Token/Net uses standard CATV midsplit broadband amplifiers. Token/Net uses either a head-end translator for 1 or 6 channel(s) or a single channel head-end remodulator for converting the transmit

frequencies to receive frequencies.

Use

Token/Net is a general-purpose LAN, but it will initially be sold to users implementing the General Motors Manufacturing Automation Protocols (MAP). Currently, it is the only LAN implementing MAP.

● **END**

Contel ContelNet
Baseband & Broadband Local Area Networks

■ PROFILE

Architecture ● ContelNet Local Area Network; see Figure 1.

Type ● baseband/broadband packet-switched network, based on intelligent interface (see Figure 2) and using standard 75-ohm coaxial cable as bus; baseband system can be converted to broadband by substituting RF modem for transceiver; standard broadband system uses midsplit frequency converter on single bus but specially designed modem allows dual cable topology or conversion can optionally be done at BIU ● access method consistent with IEEE 802.3 Committee recommendation; uses CSMA/CD access method with protocol similar to HDLC as the link protocol ● provides datagram service and HDLC asynchronous balanced mode service, called asynchronous peer mode (APM).

Transmission Speed ● 2M-/10M-bps data rate standard for both baseband and broadband systems; 1M- and 5M-bps data rates also available by retuning BIUs.

Cable Length ● up to 5-mile radius or 10 miles end-to-end for 2M-bps system; up to 1-mile radius or 2 miles end-to-end for 10M-bps system ● generally baseband used for short networks (up to 4,000 feet) and broadband for long ones.

Applications ● general-purpose network for interconnection of multivendor hosts and terminals and sharing of network controller, file server, authorization server, and gateways to Ethernet, PBX, and X.25 public data networks ● modular flexible system that can be used for intraoffice communication for distributed processing applications with gateways to company PBX (future), X.25 public data networks (GTE Telenet available but not certified), and Ethernet LAN (third quarter 1984); users can share file servers (third quarter 1984), authorization server (third quarter 1984), network control center, and gateways ● future plans for voice interfaces, additional gateways/interfaces;

PURCHASE PRICE RANGE   hardware & software ■■■■■■■

5-year maint/serv fee ▭

- software
- ▨ to $52K
- computer interfaces
- ▨ $2K to $4K
- terminal interfaces
- ■■▭ $43K to $351K
- wiring components, NCC, gateways, headend
- ▨ $6K to $45K

	$200K	$400K	$600K	$800K	$1M

- total (sum of above)
- ■■▭ $61K to $452K

	$200K	$400K	$600K	$800K	$1M

CONTELNET PURCHASE PRICE ● SMALL SYSTEM includes all basic components to connect 100 terminals and 2 computers to 2M-bps baseband ContelNet including all interconnecting units and cables, software, and network control; includes 6 702-16 BIUs, 2 702-4 BIUs, Micro NCC, Async Domain software, Sync Domain software, TICOS, 100-foot bus cable, 102 20-foot drop cables, and 8 Taps ● **LARGE SYSTEM** includes all basic components to interface 500 terminals and 4 computers to broadband ContelNet (single channel, 2M-bps system); includes 31 802-16 BIUs, 2 802-4 BIUs, Standard NCC, SNCC operating system (includes UNIX), TICOS, Async Domain software, Sync Domain software, X.25 PAD, X.25 Gateway, 1009 Frequency Converter (headend), 300-foot bus cable, 504 20-foot drop cables, and 33 Taps ● maintenance/service fee for 5 years is 60 percent of purchase price/license fee of all items except wiring components.

satellite transmission (datagram service now); X.25 expansion, and additional bus interface units (BIUs) ● when economically feasible, will allow data, voice, and video information to share same network components: Dial in/Dial out through PBX, no announced schedule; and Digital T1 (no scheduled date).

Configurations ● up to 251 BIUs per network: 1,000 stations per segment on baseband or per channel on broadband network ● single baseband channel can operate at 2M bps or 10M bps ● broadband system uses 5 6-MHz standard CATV channels for transmission (T10 through T14) and 5 for reception (8 through 12); on single cable, can use midsplit organization with head-end converter or no headend and distributed conversion in BIUs; on dual cable system with headend, the 10 6-MHz channels can be organized to provide 5 data channels or can be organized with various combinations of distributed conversion at BIUs to implement up to 40 channels ● each 2M-bps to 5M-bps broadband data channel uses 1 5-MHz CATV channel; each 10M-bps broadband data channel uses 2 5-MHz CATV channels making it possible to configure 1 10M-bps channel and 3 2M- to 5M-bps channels or 2 10M-bps channels and 1 2M- to 5M-bps channel ● once initiated, a small network can run without a Network Control Center (NCC), but one is required for initiation or reconfiguration; Micro NCC is BIU-based system with some additional buffering to store status information; it can handle a network with up to 15 BIUs; Standard NCC is required on network with more than 15 BIUs; it includes Micro NCC plus 16-bit minicomputer based on the Motorola 68000; only 1 required for any size network but can be duplicated for backup ● baseband and broadband systems can be expanded using repeaters/ amplifiers, but they are generally not recommended because they are expensive; baseband systems are generally relatively short while broadband systems are recommended for longer runs.

Interface ● Bus Interface Unit (BIU), see Figure 3; available in 4/8/12/16-port models for both baseband and broadband systems; user terminal interface is RS-232C serial port operating at 50 bps to 19.2K bps; 56K bps will be available third quarter 1984; a 16-bit parallel port is available for interfacing to a mainframe or printer ● a high-speed host computer interface is planned.

Gateways ● through BIU to Ethernet (third quarter 1984) host computer, and GTE Telenet (available but not yet certified).
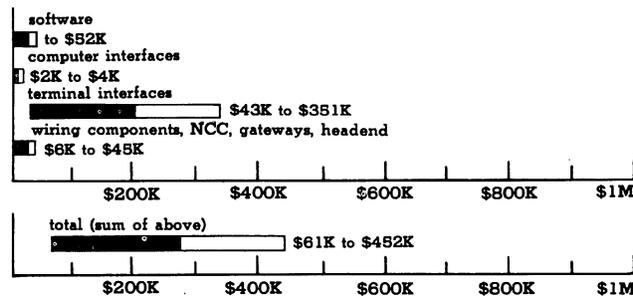
Support of Foreign Devices ● ASCII TTY-compatible terminals and X.25-compatible devices ● special software required in BIU to operate as protocol converter for foreign hosts and to provide bisync point-to-point RJE facility.

Communication Management ● BIU manages access method and message traffic on network; requires a Network Control Center (NCC) for initializing system, downline loading BIUs, configuring system, and establishing system parameters ● NCC available in Micro NCC version for system with up to 15 BIUs and the Standard NCC version for larger systems ● NCC initializes system and loads BIUs; manages system resources and configuration; monitors system status, traffic volume, and statistics; and performs diagnostics ● Micro NCC primarily a manual system that controls Levels 1 through 3 protocols of Open System Interconnection (OSI) model of ISO; Standard NCC is automatic system that provides additional features; it includes 16-bit microcomputer that performs Levels 4 through 7 of OSI model ● see Figure 3.

Protocols ● Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method with IEEE 802.2 Committee link layer protocol that is similar to HDLC ● BIU can be

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Contel ContelNet
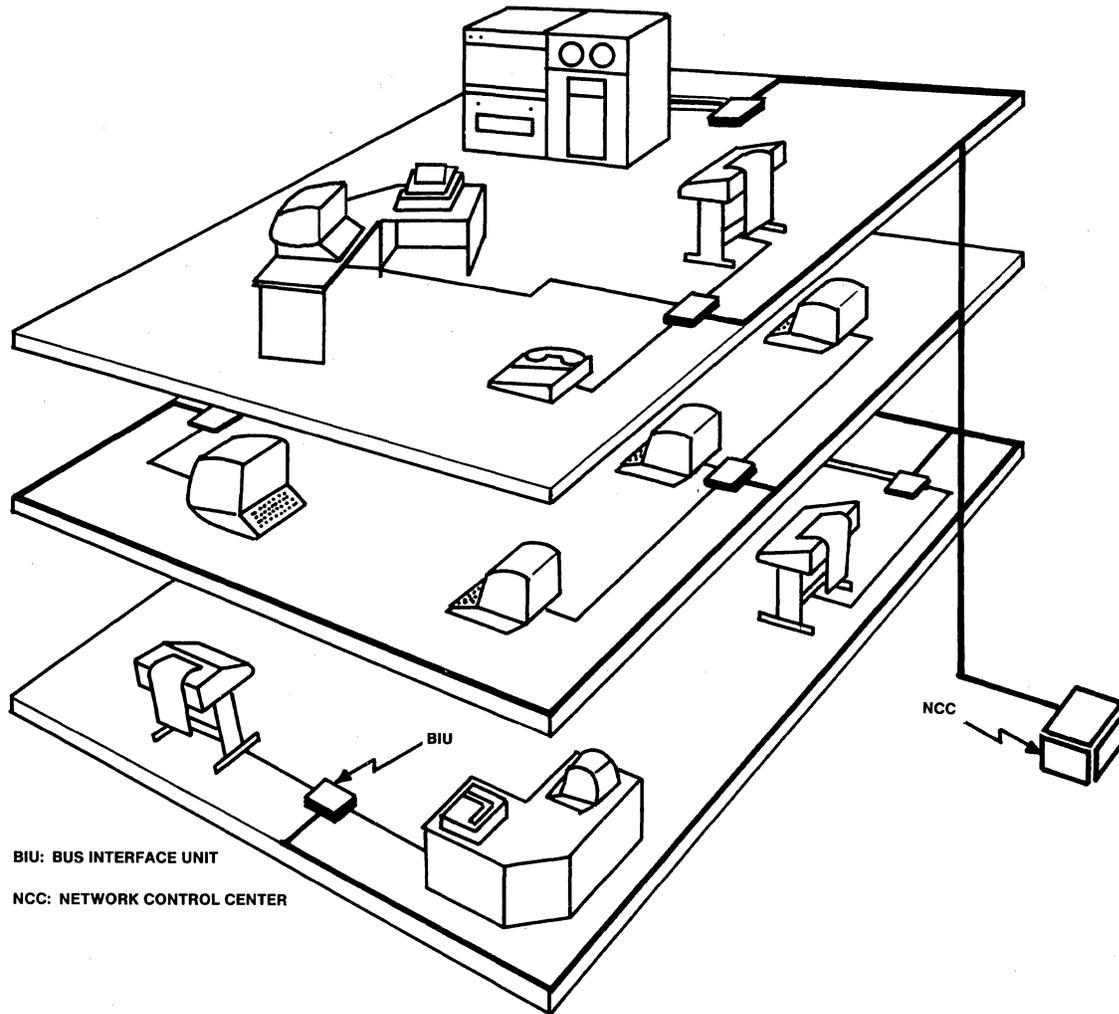## Baseband & Broadband Local Area Networks

Figure 1 ● ContelNet typical layout.

programmed to handle token-passing access protocol if application requires a deterministic access method.

Distributed Functions ● frequency conversion in BIUs can eliminate need for headend in single-cable broadband system; control distributed among BIUs and NCC ● distributed applications processing not part of ContelNet, must be developed by user and run in user hosts and terminals ● Contel has a file server and an authorization server in beta test; they will be available third quarter 1984; the file server will allow devices on ContelNet to share disks; the authorization server will allow user to develop secure network; X.25 Gateway and X.25 PAD can be shared by devices on ContelNet.

Support Software ● BIU runs under TICOS operating system (resident in EPROM) which includes a real-time, multitasking executive, cable bus software which implements CSMA/CD and modified HDLC frame protocols, and support modules for initialization, down-line loading, up-line dumping, online diagnostics, status reports, error reports/alarms, and network statistics ● NCC software includes BIU software for microcomputer plus additional buffering in board for Micro NCC; Standard NCC also includes a 16-bit minicomputer that runs under UNIX operating system and provides network

configuration and resource control, security and user access control, and application service control; UNIX can also be used for application development.

First Delivery ● August 1982.

**Systems Delivered** ● over 25; about 800 nodes.

Comparable Systems ● other generic local area networks (LANs) include Interactive Systems/3M Videodata LAN/1, Network Systems Corporation HYPERbus, Sytek LocalNet 20, and Ungermann-Bass Net/One; LAN/1 and LocalNet 20 are broadband networks, HYPERbus is a baseband system, and Net/One has both baseband and broadband versions; like ContelNet, Net/One baseband can be upgraded to Net/One broadband if more bandwidth or facilities are required.

Vendor ● Contel Information Systems (subsidiary of Continental Telecom, Inc), Information Products Division; 130 Steamboat Road, Great Neck, NY 11024 ● 516-829-5900.

Distribution ● through offices in New York; Boston; Fairfax, VA; Bethesda and Columbia, MD; Dayton, OH; Denver and Colorado Springs, CO; Sunnyvale, CA; and Houston, TX ● also through Government Systems Division in Fairfax, VA, Fairborn, OH, and Littleton, CO; Consulting and Technical Services Division is also

Contel ContelNet
Baseband & Broadband Local Area Networks

* OPTIONAL ON BROADBAND NETWORK

BIU: BUS INTERFACE UNIT
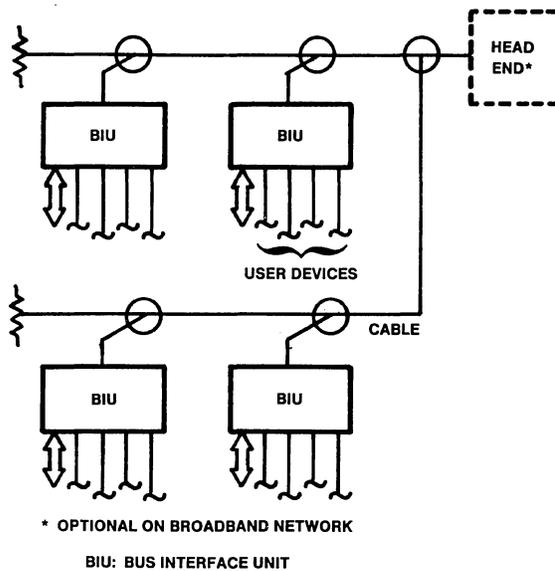
Figure 2 ● ContelNet network configuration.
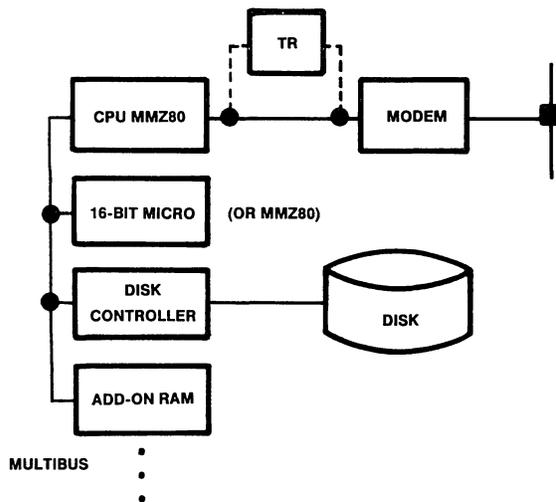
Figure 3 ● processor module configuration; serves as file server, authorization server, standard network control center, and gateway.

located in Great Neck, NY; Software and Systems Division is located in Bethesda, MD.

■ ANALYSIS

Contel Information Systems is a wholly owned subsidiary of Continental Telecom, Inc (CONTEL), the third largest non-AT&T telephone company in the United States. Contel Information Systems was formed in 1982 when CONTEL acquired Network Analysis Corporation (NAC), a prestigious communication consulting and network design firm, and International Computing Company (ICC). Contel Information Systems has about 430 employees and $37 million annual revenues (estimated for 1984).

CONTEL has expanded into business communication (Cado Systems, Executone, Contel Supply and Service, and Contel

Credit), international consulting and contracting (Continental Page Engineers, Services, Consultants, and Building), network services (equity position in American Satellite and Space-Com), and other information services (National Bancard, Contel Data, Leland Mast Directory, and STSC). Current CONTEL revenues are $2 billion on assets of $4 billion; 75 percent of the revenues are from telephone operations.

In its years as an independent company, NAC was involved in the design and development of some of the best-known networks in the country, such as Arpanet and the congressional local area network. This was due to the high caliber of the data communication consultant staff, which is now involved with ContelNet. That staff is second to none in the industry.

ContelNet is a flexible system that can be easily customized to satisfy a variety of applications. Flexibility extends from type of network (baseband/broadband), data communication rate (1M/2M/5M/10M bps), type of network control center (Micro NCC or Standard NCC), number of processors used in a BIU, and access method (CSMA/CD standard/token passing custom-designed). The system uses standard CATV components. The 16-bit microcomputer in the NCC runs under UNIX, a popular, powerful operating system that can support all kinds of software.

Current ContelNet products are designed for data communication. The designers' belief is that twisted-pair telephone wire and cable local area data networks will reside side-by-side in most office buildings for the next 5 years. By then voice and data will begin to be transmitted over the same broadband network.

The design of ContelNet reflects that philosophy. Emphasis is placed on a flexible single-channel system, which is all that is needed for most data traffic. The biggest need today is to connect hosts to ASCII TTY terminals. As the authorization and file servers become available and systems share them, the high-speed interface to computers will be needed to transfer large files.

Plans for ContelNet include interfaces to the T1 carrier (1.544-bps data rate) and satellite facilities for high-speed communication, expansion of X.25 facilities, IBM 3270 connections, very high-speed (10M bps standard but up to 20M bps) host connection, and BIU variations. Currently, ContelNet can interface to satellite communications with its datagram service. One BIU variation is a 56K-bps port for graphics application.

Contel Information Systems has installed most ContelNets as customized systems, but current trends are toward off-the-shelf installations. Federal government networks consist of about 90 percent customized products and 10 percent standard products. Most commercial installations consist of about 50 percent customized products and 50 percent standard products. The company and its personnel are well prepared to handle virtually any networking application.

Contel Information Systems and Bridge Communications announced on June 7, 1984 that the two companies have signed OEM and joint development agreements. Bridge is well-known for its Ethernet-compatible products. Bridge will provide high-performance microprocessor architecture, interface protocols, including TCP/IP, Ethernet baseband compatibility, and Ethernet and IBM 3270 gateway servers. Contel will provide its network control technology, broadband interfaces at 1.5444, 2, and 10M bps, tempest technology, interchannel bridge, and software. Over 3 years, Bridge will supply Contel with $10M of LAN products. Shipments have already begun.

Contel has also realigned its commercial and government marketing organizations. Its LAN R&D organization and product division are now co-located at Fairfax, VA. These groups will be responsible for integrating the Contel and Bridge technologies for both government and commercial customers. Contel's Software and Systems Division in Bethesda, MD is responsible for LAN sales and turnkey system development for commercial markets. The Government Systems Division in Fairfax, VA will provide LAN sales and turnkey system development for the government market.

☐ Strengths

ContelNet is a flexible local area network for most applications.

Contel ContelNet
Baseband & Broadband Local Area Networks

The personnel is experienced and can help the user design and implement a LAN. The sophisticated Standard NCC runs under UNIX, which can be used to develop virtually any kind of network services a user requires.

Current plans are to offer all 7 levels of the Open System Interconnection (OSI) recommendation of ISO. The BIUs and the MMZ80A microcomputer in the NCC implement the lower 3 levels while the 16-bit microcomputer in the NCC will implement the higher 4 levels.

Other vendors, such as Xerox on Ethernet, implement all 7 layers also, but only on their own equipment. ContelNet will offer generic facilities that can be used with any/multiple vendor(s') equipment.

ContelNet also offers 2 different services: datagram and HDLC's asynchronous balanced mode (called "APM" for asynchronous per mode) transmissions. Most LANs using the CSMA/CD access method offer only a datagram service. The APM transmissions provide for message acknowledgement and retransmission when messages are in error.

The new joint development and OEM arrangement should strengthen ContelNet considerably, Bridge has been supplying its Ethernet-compatible products since 1982 with over 1000 nodes installed. Contel is trying to develop more standard products that customers can choose from, thus cutting down on the number of custom products they must develop. Bridge can supply a number of standard products now.

☐ Limitations

ContelNet does not use frequency agile modems on its broadband systems, thus bridges are required between channels on a multiple channel network. Currently the bridge is through a port on a BIU on each channel. The maximum port data rate is 56K bps, which becomes the maximum bridge data rate. This arrangement is very simple and does not incur the delay required to switch frequencies using frequency agile modems.

■ NETWORK SUMMARY

ContelNet is a flexible, modular local area network system that can be implemented in a variety of ways. The intelligence of the Bus Interface Unit (BIU) and the basic network design make it relatively simple to implement a system to fit almost any application. ContelNet can be designed as a simple baseband system that operates at 1M/2M/5M bps; it can run without a Network Control Center (NCC) once initiated.

The next level includes a Micro NCC for a system with up to 15 BIUs. A larger system with the standard NCC can accommodate up to 1,000 devices per segment and can be configured in a tree-like structure with radius of up to 5 miles.

If more bandwidth is required, the data rate can be increased to 10M bps, but the cable radius is reduced to 1 mile and end-to-end distance to 2 miles. Upgrading a 1M-/2M-bps system to a higher speed system up to 5M bps requires returning BIUs only; upgrading to a 10M-bps system requires adding a high-speed transceiver to each BIU connected to the system.

Upgrading a 2M-bps baseband system to a broadband system requires adding an RF modem to each BIU and adding either a headend frequency converter or a conversion module in each BIU for a single cable mid-split configuration.

A 2M-bps broadband data channel requires a 6-MHz CATV channel. Upgrading to a 10M-bps broadband channel requires 2 6-MHz CATV channels.

The NCCs and BIUs perform the same functions in both baseband and broadband systems. The BIU contains 4 to 16 ports to connect user devices to ContelNet. Multiple processor BIUs can be constructed to concentrate up to 64 ports at 1 connection to ContelNet. The BIU is based on an MMZ80 microprocessor; it implements the CSMA/CD access method and the HDLC-like link control. The BIU can be customized to run a token-passing access method. Message length is variable up to 228 bytes. The BIU runs under the TICOS software.

The NCC provides network control functions. The Micro NCC performs rather rudimentary network functions in response to network commands entered from an operator console. It provides facilities to down-line load the BIUs, configure/reconfigure the network, initiate the system, perform diagnostics, and collect network statistics.

The Standard NCC contains a 16-bit microcomputer or minicomputer which can perform network control functions automatically. Additional functions include security, user access control, and application service control.

Using the BIU and TCOS software, Contel provides an asynchronous "domain" (environment/interface) to connect TTY terminals to ContelNet and an X.25 domain to bridge X.25 public data networks to ContelNet; see Figure 4. The first one to be certified will be for GTE Telenet. Contel provides an X.25 DCE gateway and an X.25 PAD for TTY terminals. Future plans call for using ContelNet to connect IBM 3278 terminals to an IBM 3274 controller (through Bridge communications) and for expansion of the X.25 interfacing to other public data networks. The datagram service is currently available over satellite links; the virtual circuit connection is not.

Current development projects include using the NCC multiple processor base of the MMZ80 and a 16-bit microprocessor to provide a file server and authorization server. Bridge communications will provide protocol converter gateway and bridge to Ethernet.

Future product plans include voice interfaces (Dial in/out, Analog, and digital T1 carrier), gateways/interfaces (expanded X.25 facilities, IBM 3270), and other BIUs (half-port, terminal-imbedded, very high speed for host attachment).

Users can buy custom-designed turnkey ContelNet Systems with complete maintenance or they can buy off-the-shelf components and perform their own network design and integration.

■ SOFTWARE

☐ Terms & Support

Terms ● TICOS and Asynchronous/Synchronous Domain software for BIU is free with a hardware purchase of up to 10 BIUs; other software is available under a one-time license fee for each site.

Support ● available from third-party with back-up support from CONTEL national sales offices; standard maintenance is 1 percent of purchase price per month.

☐ Operating Systems

Two operating systems are used: TICOS for MMZ80A in BIU, Micro NCC, and Standard NCC; and UNIX for the 16-bit microcomputer in the Standard NCC. ContelNet provides support to user devices through interfaces called "domains." Current supported interfaces include synchronous, asynchronous, and X.25 domains.

TICOS ● resident in EPROM; consists of a queue-driven, real-time, multitasking executive, cable bus software, and support modules ● cable bus software uses a modified HDLC frame and CSMA/CD access method ● support modules provide functions for initialization, downline loading, upline dumping, online diagnostics, status reports, error reports/alarms, and network statistics:

	NC lcns

Asynchronous Domain (TTY) ● module providing support for TTY message interchange using ASCII asynchronous communication:

	NC

Synchronous Domain (SYN) ● module supports transparent synchronous message interchange between homogeneous devices:
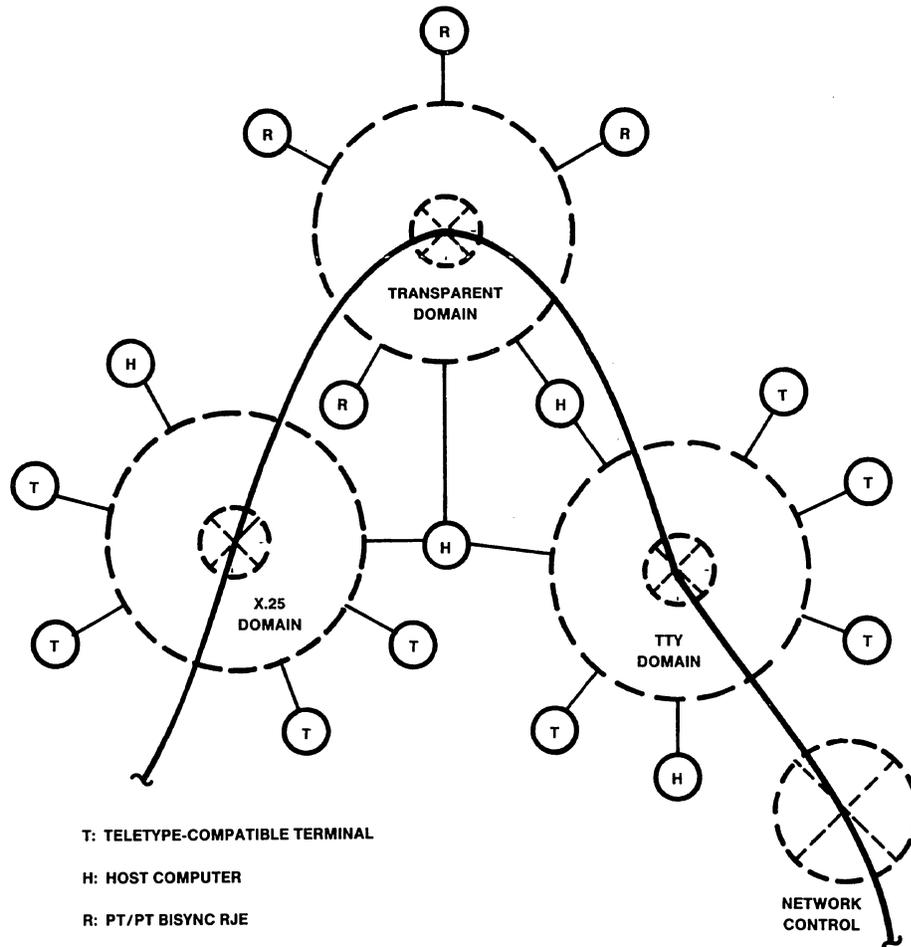
	NC

X.25 PAD (TTY) ● loaded in NCC which downline loads all BIUs

LCNS: one-time license fee per site. NC: no charge. Prices effective as of July 1984.

Contel ContelNet
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T: TELETYPE-COMPATIBLE TERMINAL

H: HOST COMPUTER

R: PT/PT BISYNC RJE

NETWORK CONTROL

Figure 4 ● terminal and computer interfaces (domains) to ContelNet.

on network connected to TTYs; provides packet assembly/ disassembly between TTY and X.25 network:

	7,500

X.25 Domain (X.25) ● DCE, gateway to X.25 public data network; GTE Telenet will be first network certified ● gateway shared by all BIUs on network:

	15,000

NCC Operating System (NCC) ● includes UNIX real-time operating system which can be used to develop application programs ● provides network configuration and resource control, system control, security and user access control, and application service control ● provides network databases and files ● hardware directory, configuration table, authorized reconfiguration log, configuration status table, software directory, traffic log codes, user directory, function directory, user menu, and operator command log ● system command language processor used to call functions manually from command terminal operator (CTO), automatically on start-up, or remotely by special request over the network:

	10,000

■ HARDWARE

□ Terms & Support

Terms ● components are available for purchase only; Contel Information Systems does not provide the standard CATV components used in ContelNet; the user must acquire these from a local source; for turnkey systems, the company acquires them and includes the cost in the network price.

Support ● standard maintenance is performed through a third party backed up with support by CONTEL national sales offices; maintenance is 1 percent of purchase price per month.

□ Bus Interface Unit (BIU)

The ContelNet BIU includes the MMZ80A microprocessor, ports to connect user devices, and the bus interface: driver, transceiver, or RF modem. It runs under the TICOS operating system. The 702 Series baseband models include a bus driver which can be tuned to operate at 1M- to 5M-bps data rate; see Figure 5. The 710 BIU option provides a transceiver (TR) board for operating the BIU at 10M bps. The 802 Series of BIUs include an RF modem for a single 6-MHz CATV data channel; see Figure 6. The 810 BIU option increases channel data rate to 10M bps via 2 6-MHz CATV channels.

Multiboard processor can be constructed to provide a 64-port concentrator into ContelNet; see Figure 7.

A distributed headend option is available for the BIU to eliminate the requirement of a separate headend converter.
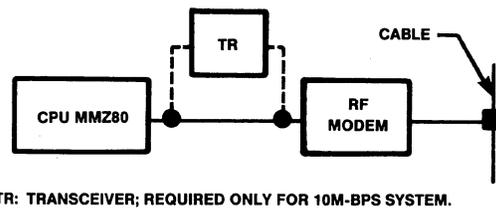
BIUs provide RS-232C, RS-449, and V.29 ports; port data rates range from 50 to 19.2K bps. The V.35 port (56K bps) is available
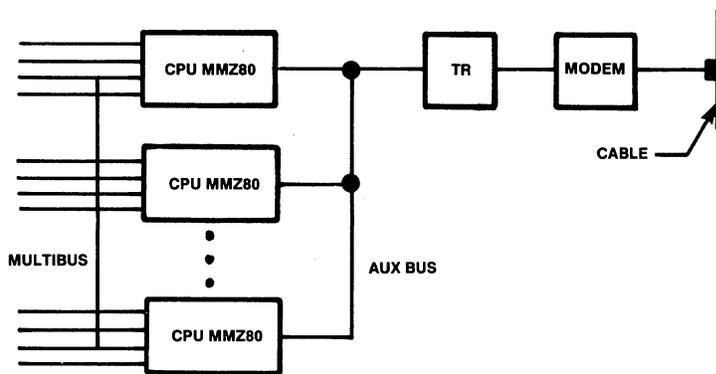
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TR: TRANSCEIVER; REQUIRED ONLY FOR 10M-BPS SYSTEM.
BD: BASEBAND DRIVER.
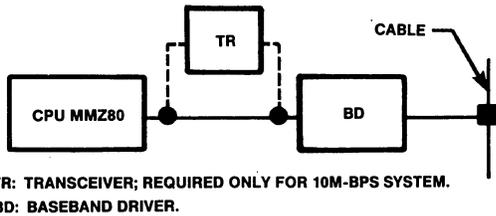
Figure 5 ● baseband system 702 Series BIU (2M/10M bps) configuration.

TR: TRANSCEIVER; REQUIRED ONLY FOR 10M-BPS SYSTEM.

Figure 6 ● baseband system 802 Series BIU (2M/10M bps) configuration.

Figure 7 ● multiboard processor as 64-port concentrator.

now. Generally, port difference is in the software, not the hardware.

702-4 Baseband BIU—4 Ports ● provides 4 ports to connect user devices and standard bus driver:

$2,250 prch

702-8 Baseband BIU—8 Ports ● provides 8 ports to connect user devices and standard bus driver:

3,750

702-12 Baseband BIU—12 Ports ● provides 12 ports to connect user devices and standard bus driver:

5,250

702-16 Baseband BIU—16 Ports ● provides 16 ports to connect user devices and standard bus driver:

6,750

710 BIU Option ● adds transceiver to 702 BIU to increase network data rate to 10M bps:

1,500

802-4 Broadband (RF) BIU—4 Ports ● provides 4 ports to connect user devices and RF modem:

2,500

802-8 Broadband (RF) BIU—8 Ports ● provides 8 ports to connect user devices and RF modem:

4,000

802-12 Broadband (RF) BIU—12 Ports ● provides 12 ports to connect user devices and RF modem:

5,500

802-16 Broadband (RF) BIU—16 Ports ● provides 16 ports to connect user devices and RF modem:

7,000

810 BIU Option ● provides facility to operate broadband data channel at 10M bps:

7,000

Distributed Headend Option ● eliminates need for headend converter; provides conversion in BIU ● 1 required for each BIU:

200

□ Network Control Center (NCC)

An NCC is required to initialize or reconfigure the network, although a network, once initialized, can run without a control center. The NCC is available in 2 versions: Micro NCC and Standard NCC. The NCCs perform the same functions for both baseband and broadband networks.

Both are BIU-based, but the standard model includes a 16-bit microcomputer that runs the UNIX operating system in addition to the MMZ80A in the BIU. The BIUs are initialized through downline loaded parameters and software from NCC.

Micro NCC (MNCC) ● BIU-based system that maintains initialization routines and files to allow network control through manual operation ● allows operator to request limited system status information, execute short stored diagnostic routines, and initialize system ● hardware is expandable to Standard NCC with multiple processors:

$5,500 prch

Standard NCC (SNCC) ● BIU-based with additional 16-bit microcomputer based on the Motorola 68000 microprocessor ● 16-bit microcomputer includes 256K bytes of RAM expandable to 1M bytes and additional magnetic media storage including diskettes, Winchester or other hard disks, or tape ● will be used as base for print server, and file server ● requires NCC operating system:

20,000

□ Network Components

Contel Information Systems does not supply cables, connectors, taps, splitters, and other standard CATV components. It purchases

PRCH: purchase price. NC: no charge. Prices effective as of July 1984.

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them from a local supplier for turnkey systems, and the user supplies them for user-designed off-the-shelf systems. The ContelNet price list does include a frequency translator.

Repeaters are available to extend the length of the cable, but they are generally not recommended for ContelNet. Generally, a baseband network will be upgraded to a broadband channel to extend length.

1009 Frequency Translator (Headend) ● optional for single-cable broadband system; conversion can be distributed in BIUs; required for dual-cable installations:

$6,650 prch

☐ Specification

ContelNet is a packet-switched baseband or broadband network that provides one or more data channels ranging from 1M bps to 5M bps or 10M bps. The standard access method is CSMA/CD, but a system using token-passing access method can be developed as a special network. ContelNet provides 2 services: datagram service with no retransmission or a reliable service using asynchronous per mode (APM) which is similar to HDLC asynchronous balanced mode. The APM must be established prior to use and acknowledgement frames are required. When APM has not been established or it is in disconnected mode, the network sends datagram messages.

ContelNet uses a tree topology with a maximum radius of 5 miles (broadband) for a maximum end-to-end transmission distance of 10 miles. For a system with 10M-bps data channel, the radius is reduced to 1 mile for a maximum end-to-end transmission distance of 2 miles. Baseband networks are generally short (up to 4,000 feet end-to-end).

ContelNet claims it is consistent with the IEEE 802 Committee recommendation, access protocol with 802.3 and link level protocol with 802.2.

The baseband system implements a single data channel operating at 1M to 5M bps or 10M bps.

A broadband system can implement up to 5 channels operating at a data rate of 1M to 5M bps using 5 6-MHz CATV channels for the receiver and 5 for the transmitter. Transmit channels operate in the frequency range of 29.75 MHz to 54 MHz and receive channels operate in the frequency range of 180 MHz to 210 MHz.

One or 2 10M-bps data channels can be implemented; each uses 2 6-MHz CATV channels. The remaining bandwidth can be used to implement 1 to 3 1M- to 5M-bps data channels.

Bridges between channels are established using 2 BIU ports; each BIU is connected to a different channel.

Packet Format ● frames are variable in length, up to 228 bytes; datagram service is standard service; it sends only unnumbered frames (UFs), which are not acknowledged ● APM must be established before it can be used; sends HDLC Receiver Ready (RR) frame containing N/R (not ready/ready) to acknowledge I-frames; I-frames contain the addresses of both the sender and receiver; when disconnected, network reverts to datagram service ● unlike Ethernet, address field is only single byte long and only 251 BIUs can be addressed on the network; of the 5 additional addresses available, 1 is for the NCC and 4 are for bridges.

Transmission Characteristics

Channel Encoding ● uses modified form of Manchester encoding.

Data Rate ● 1M to 5M bps or 10M bps.

Control Procedures

ContelNet uses the IEEE 802.3 Committee recommendation for CSMA/CD as standard access method and 802.2 Committee recommendation for the link level protocol. Token-passing access is available as a special feature.

Transmission Medium

ContelNet uses standard 75-ohm CATV cable, taps, band splitters, and connectors.

Use

ContelNet users include a major stock exchange, a large medical library, and a large bank. Contel Information Systems includes a Software and Systems Division, Government Systems Division, and Consulting and Technical Services Division in addition to the Information Products Division. Thus the company can handle almost any network application. Most variations on the standard product offerings are done through software, not through hardware. The number of orders for user-developed off-the-shelf systems is growing. Initially most networks were custom designed.

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