

NCR 7950 Clustered Terminal System

■ PROFILE

Function • clustered display-terminal system for inquiry/update, data entry, interactive program development, and report generation • all processing and database services performed by host processor • emulates IBM 3274 cluster controller Models 1C, 21C, 31C, 41C, 51C, and 61C; 3178, 3180, and 3278-2 or -3 terminals plus 3287 Models 1 and 2 printers.

Architectures Supported • used with IBM S/370 and 43XX processors under SNA/SDLC • remote connection via leased lines or switched dual-up facilities to 3705/3725 front-end communication processors.

Communication • CICS/VS under ACP/VTAM or ACF/TCAM for OS/VS and DOS/VS; ACF/NCP in IBM 3705/3275 or NCR-Comten 36 environment • single line; 1200/2400/4800/9600 bps half-/full-duplex, SNA/SDLC or BSC • ASCII/EBCDIC codes • point-to-point/multipoint • RS-232C interface.

Operating Systems • service through the host processor under OS, DOS, DOS/VS, OS/VS1, OS/VS2, and DOS/VSE.

Database Management • none; only in association with host CICS/VS facilities.

Transaction Processing • primarily through CICS which acts as a terminal-oriented transaction monitor with file-processing facilities • supports send/receive batch and inquiry tasks.

Support Software • supported by and employs software and program facilities of host processors • no local independent (from host) off-line programming/processing capabilities.

Terminals/Workstations • up to 32 CRTs and printers per cluster.

First Delivery • 1984.

Systems Delivered • not available.

Comparable Systems • Davox 1000/2000, Harris 9200+ Challenger, IBM 3270, ITT Courier 9000, Lee Data 300/400, Memorex 2070, Telex TC27X and others.

Vendor • NCR Corporation; 1700 Patterson Boulevard, Dayton, OH 45479 • 513-445-5000.

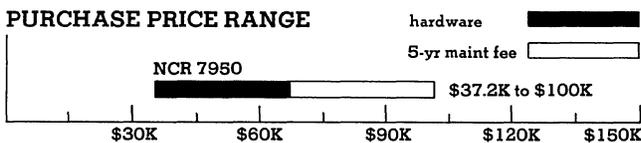
Canadian Headquarters • NCR Canada Ltd; 6865 Chetary Avenue, Mississauga, ON L5N 2E2 • 416-826-9000.

Distribution • worldwide through NCR sales/service offices.

GSA Schedule • unlisted.

■ ANALYSIS

When we evaluated the 7950 shortly after its introduction last



NCR 7950 PURCHASE PRICING bar graph covers price ranges between "small" and "large" configurations for hardware products (solid bar) and for associated 5-year period maintenance (open bar) • small system consists of basic 7954 cluster controller with 16 standard terminal adapters, eight 7958-2 keyboard displays and four 7957 printers • large configuration consists of basic 7954 with 8 optional terminal adapters, twelve 7958-2 and six 7958-3 keyboard displays, and six 7957 printers • all prices single-quantity purchase; actual prices should be lower with volume discounts.



The NCR 7950 competes against the IBM 3274 C models and supports up to 32 terminals/printers. No color display or personal computer support is offered, however.

year, we felt that it had the basic components to compete in the IBM 3274C remote cluster marketplace, but was a little light in advanced features. The product, for example, offered no multifunction terminal, had no 7-color display facility, lacked a personal computer facility, and had no dual-mode cluster communications.

Since the 7950 was a new product in an established marketplace where technical innovation and price-cutting are the norm, we figured that NCR would enhance the unit to make it competitive with the likes of Lee Data, ITT Courier, Telex, Memorex, Davox, and of course IBM. It did not! In fact, the product line was **weakened** by the dropping of the Model 7959 color workstation (a 3279-S2A and S2B replacement) and the withdrawal of the 7958 Model 5 workstation—a 132-column format unit similar to the IBM 3278-5.

Of course, we are not privy to the reasons for the withdrawal of these products and the decision not to introduce the personal computer NCR claimed was being readied for release last year. It seems strange, however, that products clearly targeted for sophisticated business applications—the arena where the greatest growth is projected—would be pulled while NCR competitors are constantly introducing new products geared for that market segment.

Last year, the 7950's strong suit was its low price. While NCR continues to enjoy an advantage, the gap is narrowing due to the recent price cuts by IBM and the aforementioned leading competitors. As the price gap diminishes, users begin to consider other factors such as growth and technical innovation in the selection hours. Currently, this is not what the 7950 offers.

We are not suggesting that the 7950 is not competitive. For basic inquiry/update operations, it should do the job at a very competitive price. In addition, the system transmits data between the cluster controller and workstations via 4-wire twisted pairs instead of more costly coaxial cables. The 7950 also is the only

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unit to our knowledge that provides a local print-spooling buffer (see Strengths). So the potential is there.

□ Strengths

Besides its lower price, the 7950 offers facilities which make it an extremely attractive product. For example, the workstations employ an RS-232C interface and 4-wire twisted pairs to attach to the cluster controller. If the wiring is not installed already such cabling is cheaper to buy and "pull" than the coaxial cable used by IBM 3270 systems and most of its look-alikes. However, remember that the coaxial arrangement employed by IBM supports data transfers in the range of 2.3M bps, while the RS-232C interface taps out at 20K bps. The highest speed between the NCR 7954 and 7958 is 9600 bps. Thus, the terminal response timer could be a little slow.

The interface protocol between the cluster controller and workstations/printers is an NCR proprietary protocol called Data Link Control-In House (DLC-IH). This protocol permits 2-way simultaneous multipoint communication over the twisted-wire pairs, and can be used to configure multidropped off a single twisted pair.

Another notable facility available with the 7950 is the Model 7954-K501 Network Transfer Switch. This 3-position rotary switch allows redundant cluster-controllers and workstations/printers to be configured and switched it should be primary cluster controller fail. However, the switch limits the total workstation/printer combination for both clusters to 32 devices maximum.

The NCR 7950 also provides a **local print** spooling facility whereby users can transfer screen contents to the cluster controller for local printing. Under the spooler, a 12K-byte buffer is reserved to service the terminals and is employed to hold the data should all printers be busy. The major advantage of the spooler is that it allows data to be transferred for printing regardless of whether a printer is available, and it frees the terminal for continued use. Without the spooler, the operator would have to wait until a printer was available, thus tying up the terminal. Please note that the print spooler is for **local data** printing only. It **does not** buffer print data sent from the host (see Limitations).

□ Limitations

The original limitations of the 7950 are its lack of a multihost communication facility; a multifunction terminal; a color terminal; a local/remote communication facility; a personal computer workstation; and a direct terminal-to-printer attachment. In addition, the 7950 offers no terminal multiplexer, no data encryption, no remote data spooler, and no facility for handling dial-in users.

The lack of multihost addressing capability could present a limitation for those considering distributed processing. The ability to exchange data is extremely important in that environment, and having a multihost facility is a definite benefit. Under NCR's architecture, the host must perform switching operations. If the host is some distance from the target 7950, the user incurs increased communication costs as well. IBM also lacks this facility, but Lee Data, Harris, and Telex have it.

A multiscreen-format terminal, such as the IBM 3180, ITT Courier Model 9230, and Lee Data Model 1220 All-In-One, allows users to easily switch the number of displayable lines and/or columns to meet changing needs. Otherwise, separate terminals are required. Now that IBM has officially embraced this concept, it will probably become a 3270 standard.

A dual-mode cluster controller that handles local and remote hosts would also be a strong user benefit. This facility would permit users to configure a local host for the more commonly used applications, while also allowing access to a remote host for specialized services. Both Harris 9220 and Lee Data 321 and 421 offer a local/remote capability.

While the 7950 supports printing on a local level, it shares printers attached to the cluster controller. Some vendors (e.g., Telex and Davox) dedicate a printer to a terminal via an RS-232C interface. This allows users to transfer data from the screen to the printer at demand and with no concern that the printer will be busy.

While this problem of printer unavailability is somewhat tempered by the 7950's print spooler (see Strengths) the dedicated printer approach eliminates any chance that (1) print buffers might be filled when a print request is initiated and (2) printing might be delayed if only a number of limited shared printers are available.

Just about every major 3270 competitor offers a personal computer capability in one form or another to allow users to off-load some processing from the host. In fact, IBM's 3270 PC is designed specifically for the 3270 environment and provides extremely sophisticated features such as multiwindow display handling concurrent host sessions. The fact that IBM is selling a plethora of these and other vendors are scrambling to catch up must mean a demand exists. The 7950 would certainly benefit from a similar facility.

Other areas where everyone including IBM is deficient deal with remote dial-in, data compression, and print spooling. A dial-in capability, whereby a remote terminal can connect to the cluster controller over the public telephone network, is not difficult or expensive to implement, however. Many protocol converter vendors offer this with their 3274-like cluster controllers, and we are aware of no problems in using that method.

When you have up to 32 devices operating online, as the 7950 permits, you want every bit of the available bandwidth to count. A data compression capability provides such a service by eliminating unnecessary data such as zeros, blanks, and redundant characters. NCR should consider this facility.

Print spooling is a technique whereby information bound for a relatively slow device like a printer is placed on an auxiliary device (usually a disk). This allows the printer to operate at its normal speed and suffer its normal problems without effecting the overall data communication function.

IBM is ahead of everyone when it comes to data security. Through an encryption/decryption facility, data transmitted between the 3270s are encoded via a combination of hardware and software. The encryption technique itself is an IBM implementation of the Federal Data Encryption Standard (DES). The lack of security measures is a limitation of all 3270 replacement manufacturers.

■ COMMUNICATIONS FACILITIES OVERVIEW

□ Distributed Communications

The NCR 7950 operates under ACF/VTAM and ACF/TCAM access methods. For a detailed description of these products, see report 950-1048-3270.

□ Distributed Configurations

The NCR 7950 consists of a remote cluster controller, a monochrome keyboard-display terminal, and a serial dot-matrix printer. The cluster controller, Model 7954, emulates the IBM 3274 Models 1C, 21C, 31C, 41C, 51C, or 61C, and can attach up to 32 terminals/printers in any combination. The basic 7954 contains 16 I/O ports, with 16 additional optional.

The Model 7958 keyboard-display workstation emulates the display characteristics of the IBM 3278 Models 2 and 3, IBM 3178, or IBM 3180-1. The NCR product does not emulate the 3564 or 3440 display characteristics of the 3180-1, however. Only 2560-/1920-character display formats (equivalent to the IBM 3278-2 and -3) are provided.

The NCR 7957 printer corresponds to the noncolor IBM 3287 Models 1 and 2. The 7957 also differs from its IBM counterpart in that the NCR unit is faster, has greater column printing width, and a larger print buffer.

□ Distributed Utilities

The 7950 runs the same IBM utilities available to the 3270. These include the Display Exception Monitoring Facility, the Device Independent Display Operator Console Support, the Network Problem Determination Application, the Status Display Support, Interactive Instruction System, and the Service Level Reporter, Version 2. For a description of these Utilities, see report 950-1048-3270.

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■ SOFTWARE

The 7950 operates under the same applicable systems software as comparable IBM 3270 components. The following is a brief list of the Operating Systems, Data Management, Communications/Networks, and Applications Development Aids software that can be used by the 7950. For a detailed description of this software, see report 950-1048-3270.

□ Operating System

The 7950 operates under OS, DOS, OS/VS1, OS/VS2(SVS), OS/VS2(MVS, MVS/SE, MVS/SP), DOS/VS, and DOS/VSE. It also runs under the Time Sharing Option (TSO).

□ Data Management

Applicable data management software includes the advanced Text Management System II (ATMS-II), Airline Control Program, (ACP), Customer Information Control System (CICS/VS), and Storage and Information Retrieval System (STAIRS/VS), and Information Management System (IMS and IMS/VS). See report 950-1048-3270.

□ Communications/Networks

Protocol support for the 7950 is SNA/SDLC only. Communications access methods include ACF/VTAM and ACF/TCAM. In addition, the 7950 can take advantage of the facilities offered by ACP/NCP, the Network Communications Control Facility (NCCF) and the Network Problem Determination Application (NPDA). See report 950-1048-3270.

□ Applications Development Aids

There are a host of application development aids available for the IBM 3270 that will also run on the NCR 7950. For example, the Display Management System (DMS/VS), Generalized Information System (GIS/VS), Structured Program Facility (SPF), Interactive System Productivity Facility (ISPF), Virtual Storage Personal Computing (VSPC), and Graphical Data Display Manager & Presentation Graphics Feature (GDMM & PGF) all run on the NCR 7950. See report 950-1048-3270.

■ HARDWARE

□ Terms & Support

Terms • the 7950 is available for purchase or on a 30-day rental based on a 1-year lease; rental units include maintenance • quantity discounts available.

Support • on-site support/maintenance is available through NCR • typical NCR basic service contract covers Monday through Friday, 9:00 AM to 5:00 PM; premium charge for weekends, holidays, and after hours.

□ Packaged Components/Overview

The NCR 7950 consists of a remote cluster controller emulating the SNA/SDLC or BSC versions of the IBM 3274 Model C control units (cluster controllers) with attached 3178, 3180, or 3278 display stations and 3287 Models 1 or 2 serial-dot printer. The system supports a single high-speed link and communicates with the host front-end processor (IBM 3705/3725 on NCR-Comten 3150) over leased or dial-up facilities at speeds up to 9600 bps.

The 7950 cluster controller (the 7954) can be configured to emulate the IBM 3274 Model 1C, 21C, 31C, 41C, 51C, and 61C. The basic 7954 is delivered with 16 channel adapters which accommodates any combination of up to 16 terminals (workstations) and printers. Sixteen additional terminal adapters are optional for a total subsystem capacity of 32 workstations/printers. While the 7954 could theoretically attach 32 printers, the vendor recommends at least a single workstation to configure the system. The 7954 can attach to a local host front-end or communication adapter provided that the distance between the 7954 and the front-end communication processor does not exceed 50 feet.

The workstation, called Model 7958, is a monochrome unit offered in versions displaying 1920 or 2560 characters, making them comparable to the IBM 3178, 3278-2 or -3, and certain versions

of the 3180-1. Keyboards included are either typewriter-style or data-entry formats.

The 7957 printer corresponds to the IBM 3287 Models 1 and 2. The NCR product however, offers higher print speeds, a larger standard print buffer, and a wider selection of print column widths. Currently, NCR does not offer a color printer version of the 3287.

the NCR/DLC Network Transfer Switch is a beneficial option offered with the 7950. Essentially, this manually controlled switch allows users to configure a redundant 7954 and switch over in case the primary fails.

The NCR 7950 also allows the use of a 4-wire twisted pairs to connect workstations/printers to the cluster controller. For organizations that require the use of coaxial cable in place of twisted pairs, an optional NCR/DLC-Coax Star Adapter provides interface.

□ Controllers

The 7954 is a remote cluster controller that emulates the IBM 3274 Models 1C, 21C, 31C, 41C, 51C, or 61C operating under SNA/SDLC or BSC. The controller communicates point-to-point to a single host over leased (dedicated) or dial-up facilities at transmission speeds of 1200/2400/4800/9600 bps, half-/full-duplex. The 7954 attaches, via an RS-232C interface, to the remote host processor (all IBM S/370s and 43XXs) through IBM 3705/3725 and the NCR-Comten 3650 communications processors.

The 7954 can support up to 32 terminals/printers in any combination. However, a minimum of a single keyboard-display (workstation) is required to generate system software. The basic 7954 is delivered with 16 channel adapters; users can field-expand the channel capacity to 32 by adding 2 groups of 8 channel adapters. The channel adapters connect keyboard-displays (workstations) and printers. Workstations/printers communicate with the 7954 via a protocol called NCR/DLC-IH (NCR Data Link Control-In House), which supports 2-way simultaneous multipoint communications networks. An NCR/DLC employs shielded twisted-pair cable, with a pair connecting the workstation/printer and the second pair connecting the workstation/printer to the 7954. Two types of network arrangements are supported: daisy-chain and cluster (star). The daisy-chain arrangement is made up of main cable with the 7954 and the secondary devices connected into the main cable with the 7954 and the secondary devices connected into the main cable via terminal blocks and taps. The star arrangement uses a junction (common point) near the 7954 to which the cluster controller and the workstation/printer cables are connected.

For installations with existing coaxial cable runs, NCR provides an adapter which converts the NCR/DLC protocol to a comparable coax signal. The Model 7951-0101 NCR/DLC-Coax Star Adapter consists of a freestanding unit that has one port connected to the 7954 and 16 coaxial input/output ports which accept RG-62A/U, RG-59/USTD, or RG-9/U coaxial cable. Two 7951-0101s can be daisy-chained to handle up to 32 workstations/printers.

Another option is the Model 7954-K501 NCR/DLC Network Transfer Switch. this 3-position rotary switch permits a large secondary network to be shared by two 7954 controllers. This switch transfers workstation/printer control from a failed 7954 to a standby unit. No more than 32 workstations/printers can be attached to both 7954s when this switch is used.

The 7954 controller employs a Motorola 68000 microprocessor (32-bit internal architecture with 16-bit I/O), 512K bytes of RAM, and a 5.25-inch diskette drive for configuration/systems software. An interactive configurator is provided for creating custom system software. Also provided is a 12K-byte print spooler buffer which allows the user to transfer screen images to buffer for local printing. This buffer stores data to be printed until the assigned printer(s) is free to print. The 12K-byte buffer can simultaneously accommodate up to 6 full workstation screens of up to 1920 characters each.

Model 7954 Controller • tabletop unit supporting any combination of 16 workstation/printers; up to 32 workstations/printers optional • 32-bit Motorola 68000, 512K-byte RAM,

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12K-byte RAM local print buffer • integrated 5.25-inch diskette drive for cluster software • RS-232C communication interface; SNA/SDLC or BSC protocol; 1200/2400/4800/9600 bps:

\$300 mo \$6,000 prch \$32 maint

8-Port Workstation/Printer Interface • provides first 8-port workstation/printer I/O expansion adapters for 7954:

103 2,000 NC

8-Port Workstation/Printer Interface • provides second 8-port workstation/printer I/O expansion adapters for 7954:

190 4,000 NC

I/O Channels

The controller communicates with the host processor via leased communication lines or the public telephone network, communication and control is handled by an IBM 3705/3725 or NCR-Comten 3650 communications processor. When the distance between the communication controller and 7954 is 50 feet or less, a direct RS-232C connection can be made between the two. Using this approach, a built-in business machine communication clock feature clocks the data.

Workstations/printers attach directly to the 7954 via a 4-wire twisted-pair shielded cable, which connects terminal interface adapters on the 7954. The basic 7954 has 16 standard adapters, with an additional 16 optional. While the 7954 supports IBM 3178/3180/3278-like workstation/printers, their protocol is not BSC or SNA/SDLC. Rather, they employ an NCR-proprietary protocol called NCR/DLC. See Controller section for a description of that protocol. Workstation/printers can be daisy-chained or clustered. A daisy-chain employs one 4-wire twisted-pair cable with blocks and taps to connect up to 32 multidropped devices. The cluster configuration uses a junction (common point) near the 7954 to which workstation/printer cables are attached.

7951-0101 NCR/DLC-Coax Star Adapter • performs NCR/DLC-to-coax signal conversion to allow workstations/printers with RG-62A/U, RG-59/U STD, or RG-9/U coaxial cable to interface with 7954 • supports up to 16 devices:

\$12 mo \$2,325 prch NA maint

7954-K501 NCR/DLCN Network Transfer Switch • 3-position, manual rotary switch • allows 2 workstation/printer/controller configurations to be constructed as a redundant configuration; no more than 32 workstations/printers can be configured:

NA 448 NA

Communications

The 7954 operates as a remote cluster controller which communicates in half-/full-duplex mode over point-to-point or multipoint facilities to a host processor at speeds of 1200/2400/4800/9600 bps. Either leased or switch network (DDD) facilities can be used; communication interface is RS-232C. Block transmission is employed.

Communication between the 7954 and the IBM 3705/3725 or NCR-Comten 3650 communication controller is via SNA/SDLC or BSC. Communication between workstations/printers is NCR/DLC-IH (NCR Data Link Control-In House) protocol which supports a 2-way simultaneous multipoint facility at 48K bps. Cable between workstations/printers and controller is a 4-wire shielded twisted-pair cable, unlike coaxial cable used by IBM and other vendors. Organizations that require coaxial cable can specify the NCR 7951-0101 coaxial adapter. See Controllers and I/O sections for details.

The NCR/DLC protocol employs an 8-bit EBCDIC character and Manchester encoding. The maximum cable length is 9,000 feet, which is also the maximum distance any device can be located from the controller. The NCR/DLC protocol employs a modulo-8 synchronous framing protocol; frames are 8-bit BCD bytes that contain addressing, control data, and checking information.

The 7954 operates in an SNA environment appears to the host as a PU-2 and LU-1, -2 and -3. Logical Unit (LU) Types 2 and 3 relate to the 7958/7959/7957 and support IBM 3270 Data

System Control message level protocol. Logical Unit Type 1 applies to the 7957 printers and supports the SNA Character String.

As part of the overall systems software, the 7954 automatically logs operating, hardware, software, and communication error statistics. A hardware diagnostic routine isolates problems. As yet, NCR has not implemented a terminal-response-time routine.

Diskette

A single-drive 5.25-inch diskette unit is integrated into the cluster controller. The drive stores systems configuration tables, emulation, and utility software. Users may modify the contents of the diskette from the display station keyboard, and may create duplicate copies of the configuration or develop multiple configurations which may be loaded into the cluster controller as the processing needs dictate. The diskette may not be used for any other functions, such as local storage for housing applications.

By using the Copy Utility, the user may copy the system configuration table from one diskette to another. Since the system contains only 1 drive, however, such a copy requires that the system diskette (source) and the destination diskette be alternately loaded and unloaded until the copy is completed. Prompts are displayed to indicate when the exchange is to be made. New diskettes being used as destination diskettes must first be initialized.

Workstations/Terminals

NCR offers only a monochrome keyboard-display unit to support the 7954 controller called Model 7958, it is offered in versions with a 1920- or 2560-character display format, and is designed to compete against the IBM 3178, 3278-2 and -3, or the 3180-1.

The no extra-cost keyboards are detached, low-profile 109-key EBCDIC units with a 10-key numeric pad, 22 program function keys, and 3 program access keys. Models are available with typewriter or data-entry layouts. The 7958 has nice ergonomic features like glare-free screen, tilt and swivel bases, and an 80-Hz refresh rate. The latter should greatly minimize the display flicker problem that plagues a good number of displays on the market. The 7958 is also offered with green or amber characters on a black background.

7958 Workstations

Configuration • cluster display employed with 7954 controller • modular detached typewriter or data-entry keyboards.

Display • 15-inch diagonal tilt and swivel • 7x9 dot matrix • 2560-character, 32-line x 80-character format (Model 3); 1920-character, 32-line x 80-character format (Model 2); both have extra status line • 96 EBCDIC or ASCII character set; up to six 190-character custom character sets • blink/nonblink/underscore/block cursor.

Edit & Format Features • cursor up, down, left, right, home • protected and numeric fields • tab, backtab, and backspace key functions • underline, reverse video, or flashing fields/characters • insert/delete characters; null-character suppression; protected, nondisplay, normal intensity, and high-intensity field attributes • erase all unprotected characters to null codes • character addressing.

Keyboards • see Keyboards section.

Communications • via controllers; see Controller and Communications sections for details.

Peripherals • cluster printers via controllers.

7958 Model 2 • 1920-character display station:

\$80 mo \$1,395 prch \$14 maint

MO: monthly charge under 1-year lease including maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for purchased units. NA: not available. NC: no charge. Prices are for single quantity purchase only; discounts available. Prices current as of June 1985.

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7958 Model 3 • 2560-character display station:

<u>98</u>	<u>1,795</u>	<u>15</u>
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Keyboards

The 7958 employs the same detachable keyboards. Both keyboards are low-profile 109-key units with such key-control functions as screen brightness/contrast, alarm tone volume, and keyclick on/off. Both also have a 10-key keypad, 22 program function keys, and 3 program attention keys. They differ in that one employs a typewriter-style layout and the other a data-entry format.

Typewriter-Style Keyboard • 109 keys with typewriter layout:

<u>NC mo</u>	<u>NC prch</u>	<u>NC maint</u>
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Data Entry-Style Keyboard • 109 keys with data-entry layout:

<u>NC</u>	<u>NC</u>	<u>NC</u>
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Printers

The Model 7957 printer offered with the 7950 is listed by the vendor as corresponding to IBM 3287 Models 1 and 2 noncolor printers. Actually, the NCR printer is more powerful. The printer speed, for example, is 200 cps versus 80 or 120 cps and the

print columns are 132/158/174/198/218 versus 132 columns for the IBM 3287. The 7957 also provides a 4K-character print buffer, while the 3287 has a 1920-character buffer. IBM does, however, offer a 3564-character buffer as an option for the 3287.

Like the IBM, the NCR printer attaches to the cluster controller, and is shared by the attached workstations. NCR, also like IBM but unlike competitors such as Telex, Davox, Memorex, etc, cannot attach a printer directly to its workstations.

Model 7957 Character Printer

Configuration • tabletop dot-matrix impact printer • microprocessor controlled (Motorola 6809) • interface with cluster controller • 145K-character print buffer • 24-key keyboard.

Printer • 200-cps bidirectional dot-matrix impact • EBCDIC or ASCII character sets; up to 6190-character custom character sets • 132/158/174/198/218 columns at 10/12/13.3/15/16.7 cpi, respectively; 6/8 lpi; upper-/lowercase, single/double space • 6-part forms; cut-sheet capability • selectable pitch, page length, forward, or reverse paper motion:

<u>\$275 mo</u>	<u>\$5,000 prch</u>	<u>\$47 maint</u>
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• **END**

NCR Comten 3600 Series

Models 3650II & 3690 Communication Processors

printers, and disk drives. The Network Definition Procedure (NDP) and the assembler CODEL are similar to IBM's System Support Programs and BAL assembler. The 3600 processor utilizes memory interface modules (MIMs) to interface communication lines. Each MIM can interface 16 half-duplex or 8 full-duplex lines. Up to 512 lines can be interfaced. Line speeds can range from 300 bps to 9600 bps or higher (230.4K bps) depending upon available service and scanning strategy.

The Comten 3600 processors provide an X.25 packet-switching interface for public data networks offering a gateway from an SNA environment to an X.25 public data network. When the Sub Area Routing Manager (SRM) module is coupled with the Multiple Access Facility (MAF) and Network Control Program (NCP), IBM 3270 BSC terminals can initiate cross-domain sessions using SNA access methods resident in the channel-attached hosts. SRM allows dynamic routing at these devices to EP or SNA host applications.

Ease of Use

The Comten 3600 Series processors make it easy for the typical IBM user to migrate to Comten because the procedures and coding schemes are similar to those of IBM including some of the same basic instructions. For example, the Network Definition Procedure (NDP) is very similar to that of IBM's. In addition the basic assembler, CODEL, uses coding schemes and conventions that are similar to IBM's BAL.

This design approach used by Comten makes it very easy for an experienced IBM-trained systems programmer to work with the 3600 Series processor.

Modes of Operation

The 3600 utilizes a comprehensive family of compatible software products called System Control Software. It incorporates IBM-compatible Emulation Processing (EP), Network Control Program (NCP), Advanced Communications Functions/Network Control Programs (ACF/NCP) and Partitioned Emulation Processing (PEP).

The 3600 series can also provide such features as trunking between nodes, automatic data rate detection, terminal/site-initiated line switching, and protocol conversion.

In an SNA Network, the Comten 3600 appears as an IBM 270X or 370X front end to the host systems; it requires no modification to host access or application programs.

Strengths

The Comten 3600 Series processors offer the IBM user a competitive alternative to the IBM 3705/3725 Communication Controllers. The NCR Comten NCP and ACF/NCP programs using IBM ACF/VTAM or ACF/TCAM host access methods are completely compatible and transparent to the user.

The NCR Comten System Control Software offers 3 types of IBM-compatible software. Communications operating systems such as NCP, ACF/NCP, and EP, are similar to IBM products in name and function. Communication Product software supports requirements beyond those offered by IBM 3705 network software. These features include automatic data rate detection, site-initiated line switching, a full range of start/stop and pre-SNA terminal support, as well as network measurement software. The Partitioned Emulation Processing (PEP) capability provides the user the flexibility to configure networks to meet current as well as future requirements. This allows the user to migrate from an EP to an NCP environment or an ACF/NCP environment while maintaining currently installed operations.

NCR Comten continues to enhance both its software and hardware to provide added value over the IBM Communications Processors. The 3600 hardware and software now support 4M bytes of memory and network functions independent of the host processor.

Limitations

The Comten 3600 Series processors were designed to support a channel-attached S/370-compatible IBM host environment. Although the 3600 System Control Software appears to support

other compatible host systems, Comten has not pursued such markets. Comten has taken over the responsibility for the NCR 721-II Communication Processor. Comten has not yet offered any new products to compete with the IBM 3725. A Comten spokesman indicates the Comten 3600 Series already provides the features and the performance offered with the 3725. Although this is probably true, the 3725 has certainly narrowed the gap between the offerings from the 2 companies. So far, the IBM 3725 has promised much more than it has delivered in terms of new facilities.

■ SOFTWARE

Terms & Support

Terms • NCR Comten offers the 3600 Series processors and software on an unbundled basis • purchase price covers equipment, while software products are licensed on a monthly or yearly basis which includes updates • a limited lease program is available for both hardware and software; includes software updates with equipment maintenance priced separately; available under a monthly or yearly license fee plan • many software products offered at no charge; these include CODEL, CLSS, NCP, SCS, and some versions of EP.

Support • supported through the NCR Comten central site in St. Paul, MN for no charge; local sites serviced by same group that services hardware; software products are individually licensed and are updated on an individual basis as part of license fee • performance measurement software available for monitoring and evaluating an installed network permits user to fine tune the system, including any IBM 370X Communications Controller; these products available on separate lease basis.

Operating Systems

The COS2 operating system in the Comten 3600 Series Communications Processors (CP) serves to perform the network control operations formerly part of the host function. The Comten operating system functions under supervision of the host, utilizing the host access method. The IBM host access methods are: VTAM, TCAM, ACF/VTAM, or ACF/TCAM. The COS2 operating system isolates the NCR Comten 3600 hardware dependent functions from the other software functional modules. COS2/50 runs on either the 3650 or 3690 hardware (with 3690 operating in 3650/3670 mode). COS2/90 runs only on 3690.

A Comten 3600 can run under Network Control Program (NCP), Emulation Processing (EP) program or Advanced Communications Function/Network Control Program (ACF/NCP). Comten also provides the CODEL 58 Communication Language Service Support (CLSS) and System Control Software (SCS-63). The EP and NCP or ACF/NCP operating systems can co-reside in 1 3600 processor to support a Partitioned Emulation Processing (PEP) network. The CODEL Monitor provides the capability to develop custom program features that can be added to the user's task library. The SCS-63 and CLSS software offer the various software features to support the EP, NCP, or ACF/NCP products further.

All System Control Software above Release 62 has the SCS 63 System Nucleus as a prerequisite.

Communications Operating System Version 2 (COS2) • provides data, job, and link management for multiple applications programs • isolates all the hardware dependent code from the modular product software, such as MAF and ACF/NCP, into COS • operates with CodeL 59, CLSS Release 2, EP4 Release 5E (optional), NSS1 Release 2E, CAF1 Release 1E (optional), X.25-1 Release 3E (optional), CNS3 Release 1E (optional), ACF/NCP3 Release 1E (optional), NTO2 Release 1E (optional), SRM1 Release 3E (optional), SEAC2 Release 2E (optional), MAF3 Release 3E (optional), DLC6 Release 2 (optional), APS Release 2E (optional), and FAM Release 1E (optional) • restructures interfaces between software modules and operating system.

COS2/50 Release 2 • runs under 3650/3670 or 3690; supports memory beyond 1M bytes when running on 3690; amount of memory supported limited by other software packages; can co-exist in same network with SCS63 and COS2/90, providing a phased migration • available third quarter 1984:

NC mo NC yr

NCR Comten 3600 Series Models 3650II & 3690 Communication Processors

COS2/90 Release 1 • expands memory and line connectivity to that supported by 3690: 4M-byte memory and 512 half-duplex lines; can co-exist with COS2/50 and SCS63, providing a phased migration • available third quarter 1984:

NC NC

System Nucleus (SCS 63) • basic nucleus around which system software is built; prerequisite for all System Control Software communication systems; includes common system modules and macros, such as dispatcher and basic utilities • requires IBM S/370-compatible host, Comten 3600 Communications Processor and CODEL Release 57 or higher.

S-SY00.1 System Nucleus (SCS 63) Release 1 • prerequisite for all SCS communication systems above Release 62 software:

NC NC

S-SY00.2 System Nucleus (SCS 63) Release 2 • replaces Release 1:

NC NC

S-SY00.4 System Nucleus (SCS 63) Release 4 • replaces SCS 63 Release 2 • consists of dispatcher, common console utilities, common modules and features, and common generation macros • all load and dump functions have been removed from SCS 63 Release 4 and packaged as Network Support Services (NSS) Release 1 • a release of SCS 63 is required to install the System Control Software products and individual products determine which release to install • requires IBM S/370-compatible host running under OS/MVS and 3600 CP running CLSS Release 1, CODEL R58, and NSS1 Release 1:

NC NC

Network Support Services 1 (NSS1) Release 1 • collection of host and communication processor-resident programs to perform load, dump, and program load device (PLD) functions for SCS-based 3600 networks • requires SCS 63 Release 4, CLSS1 Release 1, and CODEL Release 58; remote configurations also require CNS2 Release 1.

S-SY01.1 NSS1R1 OS/MVS • for use with S/370-compatible hosts running under OS/MVS:

NC NC

S-SY11.1 NSS1 R1VM • for use with S/370-compatible hosts running under VM:

NC NC

S-SY21.1 NSS1 R1 DOS/VSE • for use with S/370-compatible hosts running under DOS/VSE:

NC NC

Emulation Processing (EP) • permits a Comten 3600 Communications Processor (CP) to function as an IBM 270X Transmission Control Unit or an IBM 370X Communications Controller operating in emulation mode; completes the data path from the terminal line circuit to the host subchannel address while performing the same data organizational functions as the IBM 270X/370X device • each communication line from a terminal is assigned to a host subchannel; each host channel can support up to 256 communication lines, depending on the Comten 3600 model; up to 8 host channels can be supported • can replace many IBM 270X/370X devices, provide multiple host support, uses 270X/370X host access methods without modification, can co-reside with NCP or ACF/NCP, will support communications networking system (CNS) and data link control • supports terminal initiated line switching (TILS), site initiated line switching (SILS), automatic baud rate detection (ABRD), automatic dialing (DIAL), and multisubchannel line access (MSLA).

S-EM04.1 Emulation Processing 4 (EP4) Release 1 • initial release • requires S/370-compatible host with emulation access support, Comten 3600 System, SCS 63 nucleus, and CODEL 57 or higher assembler:

NC NC

S-EM04.2 Emulation Processing 4 Release 2 (EP4R2) • replacement for EP4 Release 1 • adds support for NCR STORES retail system and TRACS terminal monitor • requires host emulation mode application to communicate with NCR terminal network as well as IBM S/370-compatible host, emulation access method in host, Comten 3600 System, SCS 63 nucleus Release 2

or higher, and CODEL 56 or higher assembler:

NC NC

Network Control Program (NCP) • serves as the network control; assumes many network control functions formerly performed by host processors; exchanging data and control information under supervision of the host access method; basically provides a logical path between the terminal and the host application using VTAM or TCAM as the access method • network control features include: polling, addressing, dialing, automatic answering, dynamic buffering, transmission control, code translation, automatic network slow-down (manages a number of network buffers), and automatic error recovery • compatible with IBM NCP5 and offers the same functions and features • can co-reside in a single Comten processor with Emulation Processing (EP) to support Partitioned Emulation Processing network • can utilize Communications Networking System (CNS) and other licensed software products to establish a remote network with concentrator processors and NCP running in the front-end processor; CNS system provides for the interconnection of remote Comten 3600s through trunks and eliminates the need for individual lines between terminals and the front-end processor (FEP).

S-NC05.3 NCP5 Release 3 • initial release of NCP; supports tightly coupled multiprocessors (TCMP), remote NCP systems, multiple terminal access (MTA), automatic baud rate detection (ABRD), and terminal-initiated line switching • requires IBM S/370-compatible host, IBM SNA access method (VTAM 2, ACF/VTAM R1, TCAM 10, ACF/TCAM V1R1, ACF/TCAM V2R1, ACF/TCAM V2R2), Comten 3600 System, DLC5 or higher if using DLC-MIMS, CNS2 if remote PEP required, and CODEL 57 or higher assembler:

NC NC

S-NC05.4 NCP5 Release 4 • same as Release 3 except also supported under ACF/VTAM R2 access method; also requires SCS Release 2 or higher, DLC5 Release 2 or higher if using bit-oriented protocols, and CNS2 Release 1 if using remote PEP.

NC NC

Advanced Communications Function/Network Control Program (ACF/NCP) • program product comparable to the IBM ACF/NCP/VS Release 2; it provides the network control functions of NCP plus many advanced features • supports multiple hosts with both single and multiple domain networks, when operating with the IBM multisystem networking facility (MSNF) • provides the facility for cross-domain sessions, sharing resources with a host application program; resource location is transparent to the application program • also provides alternate resource location and sharing as well as the routing of data through intermediate domains in the case of device or computer failures; can also automatically switch a network from the control of one host to another during processor failure • supports IBM Communication Management Configuration (CMC) to concentrate control of several networks with multiple IBM host processors into a single processor • also supports dynamic reconfiguration, intensive mode error recording, user-written coded routines for inclusion of user-written network addressable units; allows certain pre-SNA Start/Stop devices (IBM 2741, 2740, TWX 33/35, and WTTY) to work in cross-domain operations, but requires NTO • supports Remote Concentrator Processor (RCP), connected through an SDLC link or a CNS trunking arrangement • supports IBM host software: Network Communication Control Facility (NCCF), Network Problem Determination Application (NPDA), and Multi-System Network Facility (MSNF) • when CNS and ACF/NCP are located in the RCP, remote PEP operations are also possible; all of the special programs available under EP are also available under ACF/NCP, such as automatic baud detection, multiple terminal access, terminal initiated line switching, and DIAL • provides support for a system console interface, block handling routines, and diagnostic aides which monitor data flow, provide dump facilities, and trade functions • does not support start stop devices except

MO: monthly license charge. YR: yearly license charge. NA: not available/applicable. NC: no charge. Prices effective as of May 1984.

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through Comten Network Terminal Option (NTO) Release 1.0 • supports subarea routing management (SRM) • can run in both front-end and remote communication processors • requires IBM S/370-compatible host, SNA access method (VTAM, TCAM, ACF/VTAM, or ACF/TCAM), MSNF if cross-domain sessions required, Comten 3600, DLC-MIN for bit-oriented protocols, and CNS2 for remote PEP systems.

S-NC021.1 ACF/NCP2.1 R1 • provides same features and functions as earlier ACF/NCP versions • new features support link problem determination aids (LPDA) and IBM 386X Series of modems, dynamic modem speed change, TWX read-ahead feature • requires special MIM-to-modem cable to use IBM 386X modems, IBM S/370-compatible host, IBM SNA access method VTAM 2, TCAM 10, ACF/VTAM R1 or R2, or ACF/TCAM R1 or R2, MSNF for cross-domain sessions, NPDA and LPDA to support 386X diagnostic modems, Comten 3600, CODEL Release 57 or higher, SCS 63 Release 2 or higher, DLC-MIM for bit-oriented protocols, and DLC6 Release 1 for LPDA or modem speed change requirements:

194 2,134

S-NC03.1 ACF/NCP3 R1 • provides same functions and features as IBM counterpart: parallel communication links, transmission groups, multiple routes, multiple priority levels, and extended NCP interconnection and ownership; supports for NTO Release 2 • does not support NTO1 and requires new releases of SRM and MAF • requires IBM S/370-compatible host, ACF/VTAM R2, R3, or V2R1, or ACF/TCAM V2R1, R2, or R3, and MSNF for cross-domain sessions • also requires 3600 Communications Processor CLSSR1, CodeL 58 or higher, SCS63 R4 or higher, DLC-MIM (for bit-oriented protocols), DLC6R1 (if LPDA, modem speed change or DLC-MIM is required) NTO2R1 (if host requires start/stop, or BSC 3780 device support), SRM/R3 (if SRM required), and MAFR3 (if MAF required):

194 2,134

S-NC11.1 Network Terminal Option (NTO) R1.0 • provides SNA support for pre-SNA start-stop devices; operates with ACF/NCP to allow these start/stop devices to participate in SNA sessions and to share network resources with other SNA devices • supports IBM 2740 Model 1, 2741, and World Trade Teletypewriter (WTTY) terminals and TTY Models 3 and 35 and MTA/TILS and ABRD capabilities of NCP • requires IBM S/370-compatible host, ACF/VTAM Release 2 host access method, MSNF for cross-domain sessions, Comten 3600, CODEL 57 or higher, SCS 63 Release 1 or higher, and ACF/NCP2 Release 1 or higher:

171 1,881

S-NC12.1 Network Terminal Option 2 (NTO2) Release 1 • enhances capabilities of ACF/NCP3 to allow selected pre-SNA start/stop devices to communicate with an IBM host by using SNA protocols; runs as a program under the Comten ACF/NCP3 • supports single domain and cross-domain sessions; supports IBM 2740 Model 1, IBM 2741, WTTY (dedicated line), TTY 33/35 (switched or dedicated), and IBM 3780 (dedicated, point-to-point only) terminals; compatible with IBM NTO R2; supports MTA/TILS and ABRD capabilities of NCP • does not support dial out capabilities • requires IBM S/370-compatible host running ACF/VTAM V1R3 or ACF/VTAM V2 access method • also requires 3600 communications processor, CODEL 58 or higher, SCS63 R4 or 5, ACF/NCP3 Release 1 or higher, CLSS1, and NSS1:

171 1,881

S-CNO2.1 Communications Networking System 2 (CNS2) Release 1 • common network trunking facility to interconnect Comten 3600s; allows concentration of data from multiple terminals at remote sites for transmission over single high-speed trunk; trunks can be terrestrial, microwave, or satellite links; runs under EP4 Release 1 or higher, NCP Release 3 or higher, or ACF/NCP2 Release 1 or higher • supports bit- or byte-oriented protocols on up to 1024 logical lines • transparent to the terminal user and host • allows remote processing and variety of network configurations • other Comten software features provide additional connectivity and control when residing in system with CNS • console-to-console utilities provide centralized network control; Site Trunk Analysis Routine (STAR) provides statistics and status information, Terminal Initiated Line Switching (TILS) allows

terminal operators to select different host applications from a single device; Site Initiated Switching (SILS) allows console operator to switch terminal to different host or application and perform rerouting at remote nodes, and Remote Initial Load (RIL) allows loading a remote 3600 from central location • requires IBM S/370-compatible host, emulation or NCP access methods, Comten 3600, CODEL Release 57 or higher, DLC-MIM for bit-oriented protocols, and an operating system (EP4, NCP5.3, or ACF/NCP2.1):

120 1,320

□ Networks/Communications

Initialization Message Processing & Definition (MPAD) • runs under EP4 to create and send messages to terminals at logon/logoff: return broadcast switch character dependent or line number/identification message following switch character entry, provide modifiable subchannel assignment messages, and return a prompt message at terminal connect time • functions with Terminal Adapter (TA) 1 or 4 or TGH 2 under Terminal Initiated Line Switching (TILS) feature • not supported through remote processor or NCP • requires IBM S/370-compatible host, emulation access method, Comten 3600, CODEL Release 57 or higher, EP4 Release 1 or higher, and TILS.

S-EM14.2 MPAD Release 2 • billable feature of EP4 Release 2:
\$33 mo \$363 yr

Extended Start/Stop Emulator (SS1) • enhances capabilities of Comten's Emulation Processing; allows Comten 3600 front-end processor to support asynchronous communication • uses DLC-MIM and emulates terminal adapters TA1, TA3, TA4, and TA4F007; supports TILS and SILS; does not support terminals attached to a remote processor and does not support ABRD (automatic baud rate detection); in remote configuration, TA4 supports TTY devices on dedicated links up to 9600 bps.

S-EM44.2 SS1 Release 2 • runs under EP4 Release 2 or higher:
81 891

Data Link Control (DLC) • software to support the DLC-MIM (memory interface module); resides in the DLC-MIM; accommodates multiple protocols concurrently; supports start/stop, BSC, and SDLC protocols plus CNS trunking and extended start/stop (ESS); requires DLC-MIM and ESS requires dedicated MIM.

S-SY56.1 DLC 6 Release 1 • provides support for intelligent modems such as IBM 386X series and 2 extended protocol handlers: EBSC and ESDLC • requires IBM S/370-compatible host, ACF/VTAM2 host access method and LPDA to support diagnostic modems, NPDA, NCCF, Comten 3600, CODEL Release 56 or higher, ACF/NCP2.1 Release 1, and T-2020 DLC-MIM:

NC NC

Multiple Access Facility (MAF) • licensed program product to allow individual IBM 3270 devices on a cluster controller to select any host or host application program defined on the network for a communication session • also includes broadcast feature to allow messages to be sent from Comten console to a single 3270 terminal, all 3270 terminals on a line, all 3270 terminals on a group of lines, or all 3270 terminals defined to MAF • uses NCP5 or ACF/NCP2 for terminal support; works in both local and remote environments • requires IBM S/370-compatible host, emulation access method, Comten 3600, CNS2 for remote systems, NCP5 Release 3 or ACF/NCP2 Release 1 or higher.

S-MF03.1 Multiple Access Facility (MAF)3 Release 2 • all nodes must be at MAF3 level; cannot communicate with MAF2 products • improves trunking for remote MAF and printer performance; supports remote node buffer slow down, intermediate node for remote MAF, and static alternate route; acknowledges remote loads, enhances support for SRM/MAF configurations; and eliminates coordination problems of generating remote MAF:
95 1,048

S-MF10.1 MAF/RHO Release 1 • provides multiple access facility with remote host option; extends communication capabilities for both SNA and BSC 3270 terminals to non-IBM

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host computers as long as they can support BSC 3270 cluster controller; terminal operators can access applications residing on channel-attached, CNS-attached, or RHO-attached hosts • provides same features as earlier MAF versions: polling and addressing of terminals, terminal control on 3270 cluster controller, and error recovery capabilities • can be used in conjunction with X.25 to access public data networks and with CNS for trunking between nodes:

\$3,200 initl \$585 mo \$6,435 yr

Sub-Area Routing Manager (SRM) • provides the capability for BSC 3270 terminals to establish cross-domain sessions in conjunction with SNA access methods resident in channel-attached host processors; it also provides for dynamic routing of messages from BSC 3270 devices to EP or SNA host applications: establishes up to 8 System Service Control Points (SSCPs) comparable to those implemented in IBM's SNA; the Sub-area Routing Manager (SRM) counts as an SSCP • operates as a logon/logoff manager for BSC 3270 terminal devices, provides static routing of all other traffic, and supports Automatic Network Shutdown (ANS) capability of NCP.

S-NC21.2 SRM • program product:

146 1,606

X.25 Interface to Public Data Networks • series of licensed program products to interface to packet-switching networks that follow CCITT X.25 recommendations such as DATAPAC, TELENET, TYMSHARE, and UNINET • can support more than 1 Public Data Network interface in the same 3600 CP, functioning as Packet Mode Data Terminal Equipment (DTE) • also performs call establishment, virtual circuit management, packet assembly/disassembly, and statistics collection functions of packet mode DTEs • supported only in front-end processor and cannot handle BSC, SNA, or CNS traffic • runs under EP4 Release 2 only; requires IBM S/370-compatible host, emulation access method, Comten 3600, CODEL Release 58 or higher, SCS63 Release 4 or higher, ACF/NCP 2.1 Release 1 or higher, MAF3 Release 1 or higher, CNS2 Release 1 or higher, DLC6 Release 1 or higher, and DLC-MIM. X.25-1 does not support CNS traffic.

S-XN01.0 X.25 11F Network Services Interface Release 1 • basic core of modules required to interface to X.25 network:

300 3,300

S-XN01.2 X.25 I/F Network Services Interface Release 2:

300 3,300

S-XN01.3 X.25 I/F Network Services Interface Release 3:

300 3,300

S-XN20.0 EP Start/Stop Packet Adapter (PA1) • supports start/stop device under EP:

160 1,760

S-XNPA 2.1 PA2 • NCP Start/Stop Packet Adapter:

300 3,300

S-XNPA 3.1 PA3 • NCP IBM NIA Packet Adapter:

200 2,200

S-XNPA4A.1 EP SITINTEL Packet Adapter (PA4A) • EP interface to TRANSPAC in France:

200 2,200

S-XNPA5A.1 PA5 NCP SITINTEL • NCP interface to TRANSPAC in France:

200 2,200

S-XNPA5D.1 NCP 3303, 3270 • NCP Datapac 3303 BSC 3270 Packet Adapter:

200 2,200

S-XNX SWX.1 XSWX-EP RCP • EP Remote Communications Processor (RCP) Interface:

320 3,520

S-SN10.0 DATAPAC Services Control R1 • interface to DATAPAC in Canada:

48 528

S-XN11.0 GTE TELENET Services Control R1 • interface to

TELENET:

48 528

S-XN12.0 TYMNET Service Control R1 • interface to TYMNET:

48 528

S-XN13.0 TRANSPAC Services Control • supports TRANSPAC in Canada:

48 528

SXN14.0 Datex-P Services Adapter • interface to Datex-P in Germany:

48 528

S-XN15.0 UKPSS Services Control • interfaces to PSS in United Kingdom:

48 528

S-XN17.0 DN1 Services Control:

48 528

Packet Adapters • PA1 is EP access method support for start/stop devices accessing PDN through X.3 PAD • PA2 is SNA access method support for start/stop devices accessing PDN through X.3 PAD • PA3 is SNA access method support for IBM NIA pad; equivalent to IBM NPSI feature • PA4A is emulation access method support for BSC 3270 devices accessing a PDN through a Sitintel pad available in France for Transpac network • PA5A is SNA access method support for BSC 3270 devices accessing PDN through Sitintel pad • PA5D is access method support for BSC 3270 devices accessing Datapac through a Datapac 3303 pad • XSWX is emulation access method support for PDN attached to RCP; not required for PDN attached to remote NCP system.

□ Program Development/Languages

The CODEL product family consists of software support programs that provide a means of creating and maintaining system libraries of source and object code files. All Comten software products that execute on a Comten processor are written in CODEL assembler language.

CODEL operates under a control program called the MONITOR. The MONITOR calls functional programs to perform specific functions: assembler (CODEL), Procedure Librarian (PROCLIB), OBJECT Librarian (OBJLIB), and WHISK, a program that maintains file pointers for the temporary OBJECT Library and for temporary procedures in the Procedures Library.

Depending on the version, CODEL can also run on IBM S/370-compatible systems. CODEL resembles BAL and the 3600 CP instruction repertoire is a subset of the 360/370 instruction set, thus, experienced IBM-trained programmers will not have difficulty using CODEL.

S-CL08.1 CODEL 58 OS/MVS • runs under and is compatible with IBM OS/MVS:

NC mo NC yr

S-CL18.1 CODEL 58 VM • runs under and is compatible with IBM VM/370:

NC NC

S-CL28.1 CODEL 58 DOS/VSE • runs under and is compatible with IBM DOS/VSE:

NC NC

S-LS01.1 Comten Language Support System (CLSS)1 R1 OS/MVS • utility programs supporting CODEL system under IBM OS/MVS:

NC NC

S-LS11.1 Comten Language Support System (CLSS)1 R1 VM • utility programs supporting CODEL system under VM/370:

NC NC

S-LS21.1 Comten Language Support System (CLSS)1 R1 DOS/VSE • utility programs supporting CODEL under DOS/VSE:

NC NC

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Other Program Modules

S-EM24.1 Statistics & Extended Access Control (SEAC)2 Release 1 • extends user system access control and communication network data gathering of Comten 3600 CP • places data gathering in the same sphere as source information so the user can properly control the communication environment • adds security screening process in the communication processor to reduce the risk of system security breach; system user must go through 2 levels of security checks:

\$48 mo \$528 yr

S-EM 34.2 SDA5 Broadcast Facility • a billable feature of EP4 to allow EP4 users to send broadcast messages from Comten 3600 console to polled 3270 devices; messages can be to single terminal, to a group of terminals, or to all terminals in the systems; requires EP4:

33 363

DYNAPAR • collection of licensed software products for performance measurement; provides data reduction and report generation for data captured by a DYNAPROBE monitoring system; reports using statistical and graphical formats easy to use and read; 6 types available • executes in IBM, IBM compatible, Sperry, Honeywell, and other host environments; requires 300K-byte memory, line printer, and 9-track, 1600-bpi tape drive.

Measurement Technology 3705-II • software product enables the performance analyst to collect, report, and interpret performance data about key performance aspects of the IBM 3705-II Communications Controller transparent to the device; processor utilization, program-level analysis, scanner byte count, line utilization, and channel adapter byte counts • used in conjunction with the data capture process of the DYNAPROBE monitoring system.

LEM Software • Link Evaluation Model provides statistical data on performance of BSC and SDLC links; designed to run on IBM S/370-compatible host.

S-AB00.0 LEM Basic Model • basic module; requires at least one protocol module:

NA 1,800

S-AB10.0 LEM BSC-Model • BSC protocol module:

NA 600

S-AB20.0 LEM SDLC Model • SDLC protocol module:

NA 1,200

HARDWARE

Terms & Support

Terms • NCR Comten 3600 Series Communications Processors are available to purchase or to lease on a 2-, 3-, or 4-year basis; a portion of the lease can be applied to the purchase of the equipment at the end of the lease; lease rate is for unlimited use of the system; maintenance is **not** included in the lease.

Support • maintenance is standard throughout NCR, with a basic service contract covering Monday through Friday, 9:00 AM to 5:00 PM; a premium is charged for weekends, holidays, and after hours; maintenance includes parts • modems are under on-call repair maintenance contracts: \$150 per year for purchased modems and \$90 per year for leased modems.

Overview

The NCR Comten 3600 Series Communications Processors are hardware/software compatible with IBM host processors and are a direct replacement for the IBM 370X or 270X Communications Controllers. They are designed to assume the communication overhead of a host processor, and meet a wide range of data communication requirements. They utilize the IBM VTAM, TCAM, ACF/VTAM, and ACF/TCAM access methods and provide an IBM 270X/370X compatible interface with a channel interface adapter. Up to 8 host processors can be interconnected.

Communication and network control software includes a complete array of network control software modules that incorporate such features as multiple host interconnection, local/remote processing, host application selection, data

switching, and data multiplexing. It also supports trunking between nodes in a network as well as special features such as Automatic Baud Rate Detection, and terminal on-site initiated line switching. There is also special software support for X.25 with an interface to public packet-switched networks.

Configuration • includes a central processor with main storage capacity from 256K bytes at the low end to 4M bytes at the high end • links to a host processor through a direct channel interface adapter (CIA) to an IBM selector, byte-multiplexer or block-multiplexer channel; from 2 to 8 CIAs are supported • a block-multiplexer channel on the 3600 can interface to IBM-standard peripheral devices, such as a disk subsystem and tape drives; transfer rate is 806K bytes per second • communication interface is through a Modem Interface Module (MIM) which can accommodate 16 half-duplex, 8 full-duplex communication lines at speeds from 300 to 9600 bps, depending upon the service being interfaced; wideband line speeds to 19.2K, 56K, 230K bps are also available; up to 512 lines can be supported.

Models 3650 II and 3690 only are currently marketed. The 3670 models have been replaced by low-end models of the 3690.

The 3690 can also operate in 476 mode; the 476 was an earlier Comten Communications Processor.

CPU & Memory

CPU

Based on a 32-bit word processor that executes 62 (3650) or 101 (3690) instructions; 54 in IBM S/370 format. Processor contains 16 full word general registers and 2 direct storage access channels to accommodate up to 4 IBM channel interface adapters (CIAs) each or a block-multiplexer channel. Initial program load is from a local IPL device or through a network trunk. Memory is 256K to 1M bytes on 3650 and 512K to 4M bytes on 3690. Memory cycle time is 650 nanoseconds on 3650 and 520 nanoseconds on 3690.

3650II Communications Processor • can be configured with up to 2 CIAs, 128 communication lines, 256K- to 1M-byte memory, peripheral interface, block-multiplexer channel, and integral diskette drive for diagnostics and program loading.

T-3650-G9 Front-End Processor • CPU with 512K bytes of memory and single CIA channel; supports 1M bytes of memory; second CIA channel or Block Multiplexer Channel to attach peripherals; and up to 8 MIMs to attach up to 128 communication lines:

\$2,004/\$1,713/\$1,542/\$1,456 mo \$43,900 prch \$363 maint

T-3650-HP Front-End Processor • CPU with 512K-byte memory and single CIA channel; supports up to 1M bytes of memory, second CIA or Block Multiplexer Channel to attach peripherals, up to 13 auto-call adapters or MIMs to attach up to 214 communication lines:

2,387/2,040/1,836/1,734 54,400 363

T-3650-J9 Remote Communications Processors • CPU with 512K-byte memory and DLC-MIM to support multiple communication protocols on up to 16 communication lines; can support up to 1M-byte memory, 2 CIA channels, and 2 auto-call adapters or MIMs, or up to 4 auto-call adapters or MIMs to connect up to 64 communication lines:

2,100/1,795/1,616/1,526 46,100 381

T-3650-K9 Remote Communication Processor • CPU with 512K-byte memory and DLC-MIM to support multiple communication protocols on up to 16 communication lines; supports up to 2 CIA channels with 12 auto-call adapters or 12 MIMs to attach up to 232 communication lines or up to 14 auto-call adapters or 14 MIMs to attach up to 224 communication

MO: monthly 1-year/2-year/3-year/4-year lease charges not including maintenance. PRCH: single-unit purchase price. MAINT: monthly maintenance charge for leased or purchased units. NA: not available/applicable. NC: no charge. Prices effective as of May 1984.

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lines:	2,492/2,130/1,917/1,811	56,600	401
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T-3650-S8 Front-End Processor • CPU with 256K-byte memory, single CIA channel, and DLC-MIM with 4 communication lines; attachments support up to 512K bytes of memory, second CIA channel, single auto-call adapter, and 16 communication lines:

1,463/1,250/1,125/1,063	41,000	261
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T-3650-R8 Remote Communication Processor • CPU with 256K-byte memory and DLC-MIM with 4 communication line attachments; can support up to 512K bytes of memory, 2 CIA channels, auto-call adapter, and 16 communication lines:

1,463/1,250/1,125/1,063	41,000	261
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3690 Communication Processors • can be configured with up to 8 CIA channels to attach to IBM S/370-compatible processors, from 1M to 4M bytes of memory, up to 32 Memory Interface Modules (MIMs) to attach 512 communication lines • 3690 can run in 476, 3650/3670, or 3690 mode to provide for easy transition from one environment to another; the 476 was an earlier Comten communication processor • the 3690 can be configured with dual processors for load sharing or backup • the dual-ported memory has a 520-nanosecond cycle time; a Direct Storage Multiplexer on each memory port provides 4 additional ports to attach Channel Interface Adapters (CIAs) which accommodate host computers • features such as Block Multiplexer Channels, Memory Interface Modules (MIMs), Auto-Call Adapters (ACAs), Communication Adapters, and CIAs attach to the system through Logic Modules (LMs); configurations differ by the number and types of LMs they can accommodate • communication lines connect to the system through the MIMs; each MIM can connect up to 16 half-duplex or 8 full-duplex lines, the number of lines per MIM is dependent on line speed.

T3690-A8 Communications Processing System • CPU with 512K-byte memory; communication controller for up to 8 MIMs, and Block Multiplexer Channel • hardware can support up to 4M bytes of memory, 3 CIAs or 2 CIAs and second Block Multiplexer channel, and 2 communication adapters that can attach up to 8 MIMs each • when it runs in 476 mode, S/W supports only 16 MIMs:

5,000/4,000/3,600/3,600	116,080	509
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T-3690-B8 Remote Communication Processing System • CPU with 512K-byte memory and communication controller for up to 8 MIMs; 1 DLC MIM is integral; supports up to 4M bytes of memory, 2 Block Multiplexer Channels, and 2 communication adapters that can attach up to 8 MIMs each:

4,500/3,600/3,240/3,240	105,450	442
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T-3690-C8 FEP Communication Processing System • CPU with 512K-byte memory, single CIA, and communications controller for up to 8 MIMs; supports up to 4M bytes of memory, second CIA, and 2 communication adapters that can attach up to 8 MIMs each:

4,565/3,652/3,287/3,287	105,000	415
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T-3690-D8 FEP Communication Processing System • CPU with 512K-byte memory, 4-port Direct Storage Multiplexer (DSX), single CIA and communication controller that can attach up to 8 MIMs; supports up to 4M bytes of memory, 3 additional CIAs, and 2 communications adapters that can attach up to 8 MIMs each:

5,428/4,342/3,908/3,908	124,625	465
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T-3690-E8 FEP Communication Processing System • CPU with 512K-byte memory, 2 4-port Direct Storage Multiplexers (DSXs) with single CIA channel included, and single communication controller to attach up to 7 MIMs; supports up to 4M bytes of memory, additional CIAs which connect to the 2 DSXs, and 2 communication adapters that attach up to 8 MIMs each:

6,772/5,418/4,876/4,876	155,750	517
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T-3690-F8 Communication Processing System • CPU with 512K-byte memory, Block Multiplexer Channel to attach peripherals to the system, and one communication controller to attach up to 7 MIMs; supports up to 4M bytes of memory, 3 CIAs or additional Block Multiplexer Channel and 2 CIAs, and 3

channel adapters that attach up to 8 MIMs each:	5,000/4,000/3,600/3,600	116,080	509
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T-3690-G8 Remote Communication Processing • CPU with 512K-byte memory, communication controller with DLC-MIM to provide support for multiple protocols on up to 16 communication lines • supports up to 4M bytes of memory; block multiplexer channel, second DLC MIM or interface adapter; 6 additional MIMs on integral communication controller; and 3 communication adapters to attach up to 8 MIMs each:

4,500/3,600/3,240/3,240	105,450	442
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T-3690-H8 FEP Communication Processing System • CPU with 512K-byte memory, single CIA channel and communication controller for connection of up to 8 MIMs • supports up to 4M bytes of memory, second CIA channel, 8 MIMs on integral controller, and up to 3 communications adapters that attach 8 MIMs each for a total of 512 communication lines:

5,428/4,342/3,908/3,908	124,625	465
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T-3690-J8 FEP Communications Processing System • CPU with 512K-byte memory, Direct Storage Multiplexer (DSX) with 4 ports, single CIA channel, and communication controller to attach up to 8 MIMs • supports up to 4M bytes of memory; 3 additional CIA channels, MIMs, or auto-call adapter on DSX; additional CIA, MIM, or auto-call adapter on second memory port; 3 communications adapters that attach up to 8 MIMs each providing a system total of 32 MIMs to connect up to 512 communication lines:

5,428/4,342/3,908/3,908	124,625	465
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T-3690-K8 FEP Communication Processing System • CPU with 512K-byte memory; 2 Direct Storage Multiplexers (DSX) providing 8 ports to connect CIAs, MIMs, or auto-call units; single CIA and integral communication controller to connect up to 8 MIMs (128 lines) • supports up to 4M bytes of memory; 7 additional CIAs, MIMs, or auto-call adapters; 3 communication adapters to attach up to 8 MIMs each for a system total of 32 MIMs (512 communication lines):

6,772/5,418/4,876/4,876	155,750	517
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T-3690-T8 Communication Processing System • with 512K-byte memory and integral communication controller to attach up to 8 MIMs • supports up to 1M bytes of memory, 1 CIA channel plus a second CIA channel or block multiplexer channel to attach peripherals and up to 8 MIMs for a total of 128 communication lines:

2,821/2,257/2,032/2,032	65,900	366
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T-3690-K8 FEP Communications Processing System • CPU with 512K-byte memory; 2 Direct Storage Multiplexers (DSXs) providing 8 ports to connect CIAs, MIMs, or Auto-Call Units; single CIA and integral communication controller to connect up to 8 MIMs (128 lines) • supports up to 4M bytes of memory; additional CIAs, MIMs, or Auto-Call Adapters; 3 communication adapters to attach up to 8 MIMs each for a system total of 32 MIMs (512 communication lines):

6,772/5,418/4,876/4,876	155,750	517
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T-3690-T8 Communications Processing System • with 512K-byte memory and integral communication controller to attach up to 8 MIMs • supports up to 1M bytes of memory, 1 CIA channel plus a second CIA channel or block multiplexer channel to attach peripherals and up to 8 MIMs for a total of 128 communication lines:

2,821/2,257/2,032/2,032	65,900	366
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Memory

F-3608-A8 Storage Expansion • for T-3690-X8 models; 256K-byte 520-nanosecond memory:

\$328/\$280/\$252/\$238 mo	\$9,400 prch	\$36 maint
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F-3609-A8 Storage Expansion • for T-3650-II; 128K-byte module of 650-nanosecond memory:

164/140/126/119	4,700	18
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Processor Upgrades

Processors can be expanded or upgraded from one model to another by adding memory modules and module controllers:

NCR Comten 3600 Series Models 3650II & 3690 Communication Processors

T-3651 models for 3650 II systems and T-3951 and T-3692 models for 3690. The controllers can support 6, 12, 18, 24, 30, or 36 additional logic modules (LMs) which can be Block Multiplexer Channels, Channel Interface Adapters (CIAs), Communication Controllers, Auto-Call Units (ACUs), or Memory interface Modules (MIMs). All controller models have self-contained power supplies and receive power control through internal wiring or EPO cables. All require the F-1044-AX Peripheral Power Sequence. COMTEN supplies total upgrade kits to go from one model to another with an adjacent model number or adjacent alphabetic character in the model number. The T-3691 also provides mounting space for T-2023-B1 Extended Distance Communications Adapters.

T-3651-A8 Module Controller, 6-LM • connects up to 6 additional MIMs that can attach up to 16 communication lines each for total of 96 lines:

\$380/\$325/\$310/\$290 mo	\$10,500 prch	\$20 maint
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T-3651-A9 Module Controller, 6-LM, 2-CPU • for dual-system configurations:

435/370/355/330	12,000	43
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T-3651-B8 Module Controller, 12-LM • provides space for up to 12 MIMs; single-processor configurations:

745/635/605/565	20,600	40
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T-3651-B9 Module Controller, 12-LM, 2-CPU • for dual-system configurations:

855/730/695/650	23,600	86
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T-3691-A8 Module Controller, 6-LM • provides space for up to 6 logic modules and for mounting T-2023 Extended Distance Communication Adapters:

450/360/324/324	12,000	20
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T-3691-A9 Module Controller, 6-LM, 2-CPU • for dual-system configurations:

518/414/373/373	13,800	43
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T-3692-A8 Module Controller, 7-LM, Adjacent • must be installed adjacent to the connected CPU:

431/345/311/311	11,500	20
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T-3691-B8 Module Controller, 12-LM • allows connection of up to 192 additional communication lines • for single-processor configuration:

883/706/635/635	23,500	40
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T-3691-B9 Module Controller, 12-LM, 2-CPU • for dual-processor configuration:

1,018/814/733/733	27,100	86
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T-3692-B8 Module Controller, 14-LM, Adjacent • must be adjacent to connected CPU:

845/676/608/608	22,500	40
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T-3691-C8 Module Controller, 18-LM • for single-processor configuration; allows connection of up to 288 additional communication lines:

1,314/1,051/946/946	35,000	60
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T-3691-C9 Module Controller, 18-LM, 2-CPU • for dual-processor configurations:

1,516/1,213/1,092/1,092	40,400	129
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T-3692-C8 Module Controller, 21-LM, Adjacent • must be adjacent to connected CPU:

1,258/1,006/905/905	33,500	60
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T-3691-D8 Module Controller, 24-LM • for single-processor configuration; allows connection of up to 24 additional logic modules:

1,745/1,396/1,256/1,256	46,500	80
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T-3691-D9 Module Controller, 24-LM, 2-CPU • for dual-processor configuration:

2,016/1,613/1,452/1,452	53,700	172
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T-3691-E1 Module Controller, 30-LM • for single-processor configuration; allows connection of up to 30 additional logic

modules:

2,178/1,742/1,568/1,568	58,000	100
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T-3691-E9 Module Controller, 30-LM, 2-CPU • for dual-processor configuration:

2,515/2,012/1,811/1,811	67,000	215
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T-3691-F8 Module Controller, 36-LM • for single-processor configuration; allows connection of up to 36 additional logic modules:

2,609/2,087/1,878/1,878	69,500	120
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T-3691-F2 Module Controller, 36-LM, 2-CPU • for dual-processor configuration; allows connection of up to 36 additional logic modules:

3,014/2,411/2,170/2,170	80,300	258
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F-1044 Peripheral Power Sequence • provides required power sequencing for up to 8 self-powered cabinets; 1 maximum per 3600 processor.

F-1044-A8 • for 3650 II:

54/46/42/39	1,500	9
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F-1044-D8 • for 3690:

54/46/42/39	1,500	9
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T-3650-II System Options

F-1034-A8 IBM Channel Program Loader • adds 2K bytes of read-only storage; performs confidence testing and loads initial loader; 1 per system; not usable on RCPs:

\$47/\$40/\$36/\$34 mo	\$1,075 prch	\$14 maint
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F-2200-A8 Remote Initial • adds remote initial load:

25/21/19/18	565	6
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F-2207-A8 Remote Initial Load (DLC-MIM) • adds remote initial load function to a second communication line; requires 3650-J4 or -K4 system; requires wideband interface; 1 per system:

33/26/23/23	735	6
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T-3029-A8 IBM Channel Interface Adapter • interfaces an IBM S/370-compatible processor selector, byte-multiplexer, or block-multiplexer channel; uses 1 control position on IBM channel; supports up to 256 subchannels; maximum of 1 per 3650 front-end processor and 2 per 3650 remote communication processor:

341/273/246/246	8,000	16
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T-3030-B8 NCR Bit Serial Link (BSL) Channel I/F Adapter • provides an interface to an NCR IOSS bit serial link channel for V-8000 host computer; combined total of IBM CIAs and BSL CIAs cannot exceed total system maximum:

341/273/246/246	8,000	16
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F-2205-A8 3650 Extended Distance Interface Adapter • accommodates up to 8 Extended Distance Interface DLC-MIMs at distances up to 50 feet; 1 per system:

4/3/3/2	100	2
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F-2239-A8 EIA RS-232C/CCITT V.24/Low Speed DDS • attaches 4 local terminals; speeds may not exceed 20K bps for RS-232C applications or 9600 bps for DDS applications; up to 3 per 3650-S8 or R8:

175/140/126/119	3,000	10
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F-2233 Measurement Interface Facility • connects measurement products to T-3650 systems; gives access to 30 processor signals; 1 per system:

32/26/24/23	800	4
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T-3690 System Options

F-1049-A8 IBM Channel Program Loader • read-only storage; performs CPU confidence test and loads initial loader to allow cross channel loading of system software:

\$18/\$14/\$13/\$13 mo	\$440 prch	\$4 maint
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F-2207-A8 Remote Initial Load (RIL)-DLC-MIM • adds RIL; uses full-duplex CNS trunk; 2 per T-3690-T1/-U1; requires

NCR Comten 3600 Series Models 3650II & 3690 Communication Processors

wideband interface:

33/26/23/23	735	6
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F-2207-B8 Remote Initial Load (RIL)-BSC-MIM • adds remote initial load to 3690 models; uses full-duplex CNS trunk:

33/26/23/23	735	6
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T-3029-A8 IBM Channel Interface Adapter (CIA) • interfaces to standard IBM S/370-compatible processor selector, byte-multiplexer, or block-multiplexer channel; uses single control position on IBM channel; supports 256 subchannels; up to 4 per T-3690-A5/B5/F5/G5, 1 per T-3690-C5/-H5, 2 per T-3690-T1/-U1, 3 per T-3690-D5/-J5, and 7 per 3690-E5/-K5:

341/273/246/246	8,000	16
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F-3030-A8 NCR Bit Serial Link (BSL) Channel Interface Adapter • provides an interface to an NCR IOSS bit serial link channel for V-8000 host computer; combined total of IBM CIAs and NCR BSLs cannot exceed total system maximum:

341/273/246/246	8,000	16
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T-2023 Communications Adapter (CA) • attaches 8 MIMs to single communication channel through K models, 2 per 3690 A through E, and 1 per 3690-T.

T-2023-A • single-processor interface; up to 3 can be installed in 3690; must be within 10 cable feet from CPU connect port:

220/176/158/158	4,900	15
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T-2023-B8 • extended distance CA for single-processor interface; up to 3 per module controller; must be located within 100 cable feet of CPU connect port:

296/237/213/213	6,600	27
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T-2023-C8 • extended distance CA for dual-processor configuration; up to 2 per module controller; each computer can be located up to 100 feet from CA:

416/333/300/300	9,350	46
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I/O & Communications

The Comten 3600 provides an IBM block-multiplexer interface to accommodate peripheral devices that can connect to an IBM block-multiplexer channel.

T-3023-E1 Block-Multiplexer Channel • compatible with IBM block-multiplexer I/O channel; provides interface to peripheral controllers • certified for operation with IBM 3830-2 storage control, IBM 3333-11 and 3330-11 disk control and storage, CDC 38302 storage control, CDC 33332 disk control, and CDC 33301/2 disk storage unit:

\$735/\$558/\$529/\$500 mo	\$18,020 prch	\$101 maint
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Communications Lines

Data communication control equipment consists of modem interface modules (MIMs) with line attachment features. MIMs are logic modules (LMs) within the Comten 3600 system or in the 36X1 module controller. Interface features attach to a variety of modems. Comten provides for communication fallback switching through shared load for redundant configurations.

T-2016-A2 16-Line A-MIM • accommodates up to 16 asynchronous lines through 2-line interface features; multipurpose unit and can attach most start/stop communication terminals; inherent automatic baud rate detection (ABRD) up to 1800 bps • requires 1 full row in enclosure:

\$115/\$98/\$88/\$83 mo	\$3,600 prch	\$15 maint
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T-2017 MIM • supports one full-duplex high-speed synchronous communication line; supports data rates from 130K to 230K bps • limited availability; new product under development:

NA/NA/NA/NA	4,250	25
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F-2026 Wide Band Interface • provides a single full-duplex high-speed interface for data rates up to 230K bps:

NA/NA/NA/NA	725	4
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T-2027-A1 16-Line A-MIM • accommodates up to 16 asynchronous lines through 2-line interface units; multipurpose unit and can attach most start/stop communication terminals;

inherent auto based rate detection (ABRD) up to 1800 bps; non-ABRD speeds up to 9600 bps • requires one-half row of space in enclosure:

215/172/160/155	5,000	16
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F-2027-03 Multi-Baud Rate Feature • provides set of 8 speeds for T-2016-A2; prewired speeds range from 74.24 to 1800 bps; alternate speeds range from 45.5 to 400 bps; maximum 1 per MIM:

11/9/8/8	295	3
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F-2027-04 Multi-Baud Rate Feature • for T-2016-A2; prewired speeds range from 50 to 1050 bps; alternate speeds range from 45.5 to 200 bps:

11/9/8/8	295	3
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F-2027-05 Multi-Baud Rate Feature • for T-2016-A2; no speeds prewired; alternate speeds range from 45.5 to 1800 bps:

11/9/8/8	295	3
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F-2068-01 Telegraph Interface Base • for 2016-A2; can connect up to 16 DC loop telegraph wire terminations; maximum 1 per T-2016-A2 MIM:

5/4/4/3	125	2
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F-2074 2-Line Telegraph Interface • for 2016-A2; up to 8 per F-2068-01:

7/6/5/5	190	3
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F-2072-A1 2-Line EIA RS-232C Interface • for 2016-A2; accommodates 2 start/stop communication lines at speeds up to 1800 bps; up to 8 per T-2016-A2 MIM; prewired for 113B, 103A, and 202-type modems and IBM-compatible line adapters:

7/6/5/5	190	3
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F-2072-A2 2-Line RS-232C Interface • for 2016-A2:

7/6/5/5	190	3
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T-2018-A2 16-Line BSC-MIM • accommodates up to 16 synchronous communication lines through 1- or 2-line interface features; accommodates IBM BSC protocol lines, IBM 2260 clocked start/stop lines, CNS trunk lines, and general-purpose full-duplex synchronous lines; can be EIA RS-232C, AT&T Wideband or DATAPHONE Digital Service; requires 1 row in enclosure:

211/180/162/153	6,700	20
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F-2053-A1 RS-232C/CCITT V.24 2-Line Interface • accommodates 2 half-duplex or 1 full-duplex line; up to 8 per T-2018-A2 MIM; IBM BSC or low-speed DDS, up to 9600 bps:

18/14/13/12	345	5
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F-2053-B1 RS-232C/CCITT V.24 1-Line Interface • IBM BSC; required for CNS trunk line:

18/14/13/12	345	5
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F-2053-C1 RS-232C/CCITT V.24 2-Line Interface • clocked start/stop half-duplex for use with 2260/2265 and TTY-compatible terminals through synchronous modems; 226X supported by TA3 and TTY-compatible terminals supported by TA4 at speeds of 2000 to 9600 bps:

18/14/13/12	345	5
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F-2064-A1 Wideband 1-Line Interface • accommodates single wideband 4-wire line or local terminal operating in full- or half-duplex mode; compatible with AT&T 300 Series modems; operates with switched, leased, or private lines; up to 4 per T-2018-A1 BSC-MIM:

26/21/19/18	630	5
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F-2064-B1 Wideband 1-Line Interface • full-duplex protocol similar to IBM BSC; required for CNS wideband trunk; maximum of 2 per T-2018-A1 BSC-MIM:

26/21/19/18	630	5
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F-2092-A1 Wideband DDS 2-Line Interface • accommodates 2 56K-bps half-duplex or 1 full-duplex line per T-2018-A2 BSC-MIM; IBM BSC:

39/31/28/26	1,010	6
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F-2092-B1 Wideband DDS 1-Line Interface • full-duplex protocol similar to IBM BSC; required for CNS trunk line; when RIL

NCR Comten 3600 Series Models 3650II & 3690 Communication Processors

(Remote Initial Load) required; maximum of 2 per MIM:		
	23/18/16/15	580 4
F-2092-C1 Wideband DDS 1-Line Interface • full-duplex protocol similar to IBM BSC; required for CNS trunk line when RIL not required; maximum 2 per MIM:		
	23/18/16/15	580 4
F-2095 BSC EIA Synchronous Clock, 2-Line Interface • accommodates 2 1200-bps BSC lines through unlocked modems; attaches half-duplex or full-duplex modems; operates over auto-answered switched or dedicated lines; maximum 8 per MIM:		
	33/26/23/22	815 6
T-2020-A4 DLC MIM • accommodates up to 16 communication lines through 1- or 2-line interface features; multipurpose units for attaching start/stop, clocked start/stop, IBM BSC, CNS trunk, and IBM SDLC lines; interfaces for EIA/CCITT, EIA RS-366 for auto-calling, AT&T wideband 300 series modems, DDS/CCITT V.35, MIL Std 188C, and parallel AT&T 407 touch-tone receiving modems; requires 2 rows high and half row wide space in enclosure • capacity based on line speeds; limitations on number of lines imposed when line speeds are 9600 bps or above; distance to communication adapter connect port limited to 10 feet:		
	220/181/165/158	6,800 34
T-2020-B4 Extended Distance Interface DLC-MIM • logic cable length to CPU connect port must be specified at 25, 50, or 100 feet:		
	270/221/201/192	8,300 43
T-2020-C4 Extended Distance Dual Interface DLC-MIM • provides 2 extended distance interfaces; 25, 50, or 100 feet:		
	352/287/260/248	10,800 57
F-2223-A4 Storage Expansion 2K Instruction • increases DLC-MIM storage by 2K bytes; for T-2020-X4s only:		
	25/18/15/13	700 1
F-2297-A4 Operand Storage Expansion • extends storage from 512 to 2K bytes for configuring variety of protocols; for T-2020-X4s only:		
	18/11/9/6	500 1
T-2020-A6 DLC-MIM • same as T-2020-A4 DLC-MIM except includes enough operand and instruction storage to handle multiple protocols:		
	263/210/189/179	8,000 36
T-2020-B6 Extended Distance Interface DLC-MIM • same as T-2020-B4 DLC-MIM except includes enough operand and instruction storage to handle multiple protocols:		
	313/250/225/213	9,500 45
T-2020-C6 Extended Distance Dual I/F, DLC-MIM • same as T-2020-C4 DLC-MIM except includes enough operand and instruction storage to handle multiple protocols:		
	395/316/284/269	12,000 59
F-2083-C1 EIA RS-232C/CCITT V.24 Low-Speed DDS 2-Line Interface • accommodates 2 lines or 2 terminals; RS-232C at up to 19.2K bps and DDS at 2400/4800/9600 bps; connects to full- or half-duplex modems; operates over switched auto-answered lines or dedicated leased or private lines:		
	22/19/17/16	700 4
F-2084 Wideband 1-Line Interface • accommodates wideband line or local terminal; compatible with AT&T 300 Series modems; operates over switched, leased, or private lines; 2 per T-2020 DLC-MIM:		
	27/23/21/20	825 6
F-2085 Wideband DDS, CCITT V.35 1-Line Interface • accommodates single 56K-bps half- or full-duplex line via DDS; up to 2 per DLC-MIM:		
	26/22/20/19	800 6
F-2220-AX MIL Std 188-100 2-Line Interface • speeds range from 75 to 19.2K bps; up to 8 per DLC-MIM:		
	46/39/35/33	815 5

F-2221-AX Wideband MIL Std 180-100 1-Line Interface • line speed 38.4K or 52K bps:		
	73/62/56/53	1,290 7
F-2088 Storage Expansion, 2K Instruction • increases DLC-MIM storage by 2K bytes to support all 3 protocols: SDLC, SS, and BSC; maximum of 1 per DLC-MIM; not required for T-2020-X6 models:		
	48/41/37/35	1,500 6
F-2097 Operand Storage Expansion • increases operand storage from 512 to 2K bytes; required only for SS1 support; maximum of 1 per DLC-MIM; not required for T-2020-X6 models:		
	27/23/21/20	800 6

Modems

NCR Comten offers the 7160 series of synchronous SNA-compatible modems. The series will consist of 4 models for switched/dedicated circuits, point-to-point/multipoint configurations, and 4800/9600-bps transmission rates.

7164-0100 Modem • 4800 bps over dedicated line; point-to-point/multipoint configuration:		
	\$132/\$106/NA/NA mo	\$3,700 prch * maint
7164-0200 Modem • 4800 bps over switched line; point-to-point configuration:		
	132/106/NA/NA	3,700 NA

7165-0100 Modem • 9600 bps over dedicated line; point-to-point configuration:		
	193/155/NA/NA	5,800 NA

7165-0200 Modem • 9600 bps over dedicated line; multipoint configuration:		
	193/155/NA/NA	5,800 NA

* \$150 per year for purchased modems and \$90 per year for leased modems.

□ Disk & Tape

Disk

Comten provides a disk subsystem to connect to any of the 3600 Communication Processors. The disk subsystem requires the block-multiplexer channel. Comten disk units use the IBM 2316 Disk Pack; disk capacity available in 58.3M-byte increments. Limited availability and long lead times for disk and tape subsystems.

Comten 7214-B2 Disk Control Unit • supports up to 8 drives, 2 logical disks per drive; requires single control unit position on block-multiplexer channel:		
	\$890/\$710/\$640/\$605 mo	\$21,600 prch \$208 maint

F-7005-132 2-Channel Switch • provides attachment to second block-multiplexer channel for non-simultaneous dual access to 7214/62X4 disk system:		
	120/95/85/80	2,900 21

Comten 6214-B2 Drive • 1 spindle with 58.3M-byte capacity:		
	470/375/335/320	11,500 131

Comten 6224-B2 Drive • 2 spindles with 116M-byte capacity:		
	940/750/670/640	23,000 259

Magnetic Tape

Comten uses magnetic tapes for off-line data storage. Tape drives interface through block-multiplexer channel.

Comten 7322-B2 Magnetic Tape Unit & Controller • 9-track, 800/1600 bpi, 75 ips; includes controller and 1 drive; controller supports up to 4 drives:		
	\$950/\$760/\$685/\$645 mo	\$24,250 prch \$223 maint

Comten 6322-B2 Magnetic Tape Drive • 9-track, 800/1600 bpi, 75 ips:		
	430/345/310/295	11,000 141

F-7004-B2 2-Channel Switch • provides non-simultaneous dual access to 7322/6322 magnetic tape subsystem:		
	104/83/75/71	2,500 10

NCR Comten 3600 Series Models 3650II & 3690 Communication Processors

Console & Printers

T-4008 NCR Comten Console • for 3650 and 3670 only:
 \$146/\$125/\$113/\$106 mo \$3,500 prch \$26 maint

T-4034-A5 NCR Comten Console • for 3690 systems only;
 display, keyboard, and printer on pedestal; 80-character x 24-line
 display operating at 1200 bps; bidirectional impact printer, 80
 columns operates at 1200 bps:
 152/130/117/110 3,650 28

T-4034-B5 Monitor Console, CRT • same as A5 model but

without printer:

69/59/53/50 1,645 6

T-7406-A2 Line Printer • only 1 offered • up to 136 columns,
 600 lpm:

770/610/580/545 20,000 244

Other Peripherals

Comten 7305-A2 Card Reader • 80-column cards, 600 cpm:
 \$340/\$275/\$260/\$245 mo \$9,000 prch \$130 maint

• **END**

NCR Comten 5600 Series Communications Processors

Model 5620

■ PROFILE

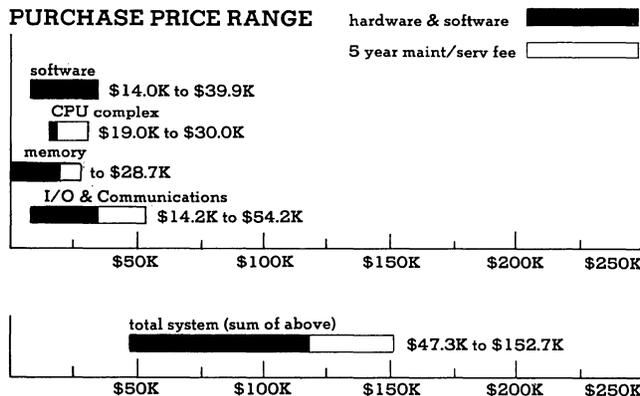
Function • programmable local front-end communications processor; remote concentrator; standalone data switching system; or combination front-end and data switching system.

Associated Systems/Networks • IBM 360/370, 303X, and 43XX single multiprocessor systems, IBM S/370-compatible processors such as Amdahl 470 Series, NCR, 8500/8600 VRX systems • compatible interface (emulation) with IBM 270X transmission control units and IBM 370X Communications Controllers • X.25 gateway from SNA • requires no changes to IBM operating system software.

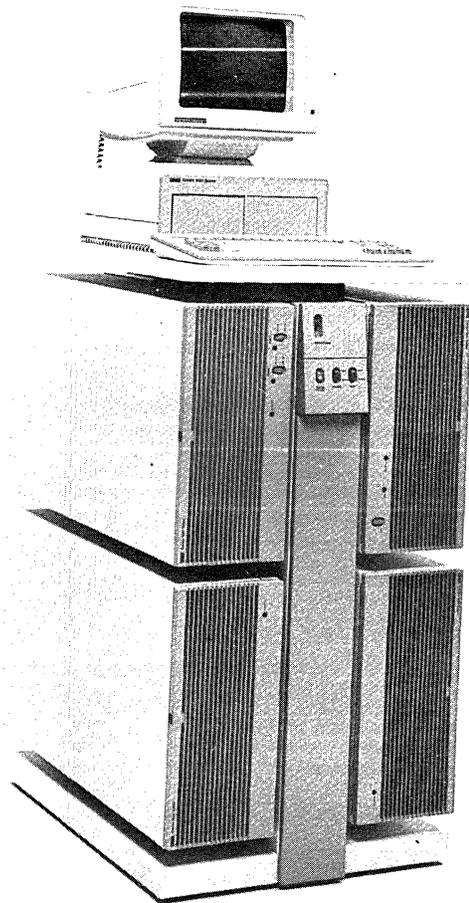
Communications/Networks • supports up to 32 half-duplex/full-duplex communication lines, up to 2 hosts with multiple channel interface adapters and accompanying software; hosts can be IBM, NCR, or combination of IBM and NCR systems.

Operating Systems • Comten version of Network control Program (NCP) and Advanced Communications Function/Network Control Program (ACF/NCP) are used to control operations of the network • Comten NCP can coreside with Emulation Processing (EP) in a Partitioned Emulation Processing (PEP) network • ACF/NCP works with ACF/VTAM or ACF/TCAM in the host and supports the IBM Multi-System Networking Facility (MSNF) that allows access to up to 8 hosts (5620 limited to 2 hosts).

Languages/Program Development • using CODEL, the Comten communication definition language, executes under the Comten monitor; language structure similar to IBM BAL; CODEL can be run on IBM 370/303X/308X/43XX, or equivalent processors.



NCR COMTEN 5620 SERIES PURCHASE PRICING • bar graphs illustrate price ranges for small to large systems, with solid bars reflecting software/hardware purchase pricing and open bars reflecting 5-year service/maintenance fees associated with large systems • **SMALL SYSTEM** is a remote communications processor (RCP) system; includes 5620 with 1M-byte memory, 10M-byte disk subsystem, 24 full-duplex RS-232C line interfaces with mix of line speeds up to 19.2K bps and 1 V.35 line interface (56K bps); software includes the COS 2/20 operating system and ACF/NCP 3 RIE networking software • **LARGE SYSTEM** is a front-end processor for 2 IBM S/370-compatible processors; includes 5620 with 4M bytes of memory, 10M-byte disk, console, 2 IBM Channel Interface Adapters (CIAs), 31 full-duplex RS-232C line interfaces with mix of line speeds up to 19.2K bps, and V.35 interface (56K bps); software includes COS 2/20 Operating System, ACF/NCP 3 RIE Networking software, Emulation Processing (EP) 4, Multiple Access Facility (MAF), Sub-area Routing Monitor (SRM) and Communications Networking System (CNS). NCR Comten includes software maintenance with hardware maintenance.



Processors • 32-bit processor with 16-bit wide data path to memory; 1M/2M/4M-byte memory; 1 disk subsystem; 10M-byte maximum storage capacity.

First Delivery • scheduled for fourth quarter 1985.

Systems Delivered • none; 80 to 100 are scheduled for delivery by end of 1985.

Comparable Systems • Comten is unique vendor in replacement market for IBM Communications Controllers; only vendor to provide own NCP software and to encompass complete IBM 3705 communication environment including emulation of IBM 270X controllers • CCI CC-8/CC-80/CC-85 and Amdahl 4705 Models similar to some Comten models • Amdahl 4705 runs IBM software.

Vendor • NCR Comten; 2700 Snelling Avenue, North, St. Paul, MN 55113 • 612-638-7777.

Canadian Headquarters • NCR Comten; 515 Consumers Road, Suite 304, Willowdale, ON M2J 4Z2 • 416-496-1300.

NCR Comten 5600 Series Communications Processors Model 5620

GSA Schedule • listed.

■ ANALYSIS

The NCR Comten 5600 Series is a new series of communications processors developed by Comten. Currently, only the Model 5620 has been introduced, but other models will follow and eventually replace the aged 3600 Series. Like the IBM 3705 that it can replace, the Comten 3600 Series was introduced in the early 1970s. Models have been added to spruce up the product line, but the series has remained viable primarily because IBM did not replace the 3705 with the 3725 until the end of 1983 and early 1984. NCR Comten enhanced the 3600 Series to maintain competitive price/performance with the 3705.

The 3705 hardware has been in limited production since September 29, 1983. Now that IBM has frozen its software development for the 3705 at ACF/NCP 3.0, the 3705 era has come to a close. All new software development will be for the IBM 3725.

In addition, IBM has introduced the new 3710 Network Controller, which can function as a remote concentrator. It **cannot**, however, run the networking software that runs on the 3705 or 3725.

Prior to the introduction of the 3710, IBM had no remote concentrator; the function was performed in some applications by a 3270 cluster controller and in other applications by a remote front-end communication processor. The 3270 cluster controller was applicable as a concentrator only for 3270 terminals and the front-end processors were expensive even though IBM did introduce the small 3705-80 configurations in 1981.

IBM has introduced only Model 1 of the 3710, but other models should follow. The 3710 Model 1 is a relatively modest product. It can support a total of 32 lines which can be divided into any combination of upstream and downstream lines. The upstream lines can be either SNA/SDLC or X.25 links. The downstream lines can support SDLC and "selected" start/stop and BSC protocols, like NTO in the 37X5 processors. On SNA, the 3710 is a Physical Unit Type 2 (PU2) device, the same as an IBM 3270 cluster controller. The IBM 37X5 Communications Processors are PU4 devices, which can function as nodes on SNA. PU2 devices require a PU4 device to provide front-end or network control functions.

The NCR Comten 5620 has been designed to be competitive with the IBM 3710 Model 1. As such, it has many advantages to offer over the 3710. The primary one is that it can function as a Physical Unit Type 4, (PU4) on SNA while the 3710 is a PU2 device. The PU4 devices have considerably more power and flexibility than PU2 devices.

A second advantage of the 5620 over the 3710 is that the 5620 can run the same COS2 software as the Series 3600 and can perform the same functions of front-end processing, remote front-end processing, and line concentration. The 3710 **cannot** run the same software as the IBM 37X5 Communications Processors. It **cannot** function as a local processor or remote front-end processor; it can function only as a **line concentrator**.

The 5620 can function as a Comten Network Gate (CNG) to interconnect up to 64 SNA networks. IBM requires a gateway NCP running in an IBM 37X5 to support its SNA Network Interconnection facility. The 5620 can be configured with 1M/2M/4M bytes of memory. The 3710 can be configured with 384K/512K bytes of memory. IBM supplies **no software** for the 3710; it runs under microcode supplied on a diskette in conjunction with the Configuration Control Program facility of ACF/SSP running on an MVS host. The 5620 can run all the COS2 software developed for the NCR Comten 3600 Series.

Both the 5620 and 3710 are designed to be used with a small number of lines; up to 32 maximum. The NCR Comten 3600 and IBM 37X5 are relatively expensive for small configurations; the cost per line is reasonable **only** for medium-to-large configurations. Both can run unattended at remote sites. For comparable configurations, the 5620 costs less than the 3710. Purchase price of a 5620 with 1M bytes of storage is \$16,000 as compared to \$20,300 for a 3710 with 384K-byte memory. The 5620 does require a 10M-byte disk subsystem (\$3,000) to store software modules and dumps.

The 3710 is very easy to configure; it includes very few modules and no software. The 5620 is more flexible and modular, thus it requires more effort to configure plus it requires the installation of software.

Overall, the 5620 is a very competitive product. Many SNA customers will undoubtedly opt for its features and functionality over the 3710.

In addition to its use in an SNA environment, the 5620 can function as an NCR Comten/ACS Advanced Communications System for NCR hosts. The Comten NCR/ACS can function in a total NCR network environment or in a mixed NCR/IBM SNA network environment.

NCR Comten also provides a general-purpose X.25 interface package with EP and NCP interface adapters to both domestic and foreign packet-switched networks.

□ Ease of Use Features

NCR Comten makes it easy for a typical IBM user to install the NCR Comten 5620 in a network. The software is compatible with the IBM host and communications processor software. Currently, the NCR Comten software releases are from 9 months to 1 year behind comparable IBM releases. The company's goal is to reduce the lead time to 6 months.

Generally, the 5620 will be transparent to the IBM host and 37X5 Communications Processor in a network. NCR Comten also supports the same protocols and interfaces as IBM.

□ Modes of Operation

The NCR Comten 5620 can function as a front-end processor for up to 2 IBM S/370-compatible hosts, 2 NCR VRX 8500/8600 hosts, or a mix of both IBM and NCR hosts. It can also function as a remote front-end processor or as a concentrator. Systems can be connected in a cascaded fashion to any depth to provide concentration for more than 32 lines.

□ Strengths

NCR Comten has been offering an alternative to IBM communications processors since the early 1970s. Generally, the company has succeeded in giving IBM customers more functionality for less money for comparable products. The lag in Comten software releases behind the IBM releases is understandable and does not appear to disturb customers.

The 5620 is the first product of a new series of communication processors using new technology. The 5620 is at the low-end of the product line. The next product under development is a high-performance communication processor that will certainly compete with the IBM 37X5. The 5620 far exceeds the functionality and flexibility of its IBM 3710 competitor.

NCR Comten is very knowledgeable of the IBM SNA environment. Seventy-five percent of its communications processors are installed in SNA networks; 33% in all SNA networks. NCR Comten is the only vendor to offer communication processors that run non-IBM software in the SNA environment. The Amdahl 4705 also offers an alternative to IBM communication processors, but the 4705 runs IBM software.

In addition, the 5620 can also be used in a non-IBM environment. It can provide NCR VRX 8500/8600 an advanced communication network environment.

□ Limitations

Marketing in IBM's shadow has proved to be precarious for many companies. IBM has filed suit against NCR Comten charging the company with copying IBM software. The suit revolves around the ACF/NCP software that runs on the NCR Comten communication processors. The name is the same as the operating system for the IBM 37X5 systems and the functionality is the same. IBM has been notably tough on competitors since its antitrust suit has been settled with the U.S. Justice Department. If the outcome of the suit with IBM goes against NCR Comten, it could change the way the company does business.

Currently, however, NCR Comten's biggest problem is producing 5620s fast enough to satisfy the demand for them. The company

NCR Comten 5600 Series Communications Processors Model 5620

expects to deliver 80 to 100 by the end of 1985, but so many orders are being placed, NCR Comten is considering using a lottery to allocate systems.

The market niche filled by the NCR Comten 5620 and IBM 3710 seems such an obvious one, it is puzzling why IBM and NCR Comten waited so long to produce such products.

■ SOFTWARE

□ Terms & Support

Terms • NCR Comten offers the 5620 Series processor and software on an unbundled basis • purchase price covers equipment, while software products are licensed on a monthly or yearly basis which includes updates • lease programs are available from NCR Comten for the hardware and software; leases are available from NCR Credit Corporation • many software products are offered at no charge; these include CODEL, CLSS, NCP, CAS2, and some versions of EP.

Support • supported through the NCR Comten central site in St. Paul, MN for no charge; local sites serviced by same group that services hardware; software products are individually licensed and are updated on an individual basis as part of license fee • performance measurement software available for monitoring and evaluating an installed network permits user to fine tune the system, including any IBM 370X Communications Controller; these products available on separate lease basis.

□ Operating Systems

The COS2 operating system performs network control operations under supervision of the host, utilizing the host access method. VTAM, TCAM, ACF/VTAM, or ACF/TCAM. The COS2 operating system isolates the hardware dependent functions from the other software functional modules COS2/20 runs on the 5620. COS2/50 runs on either the 3650 or 3690 hardware (with 3690 operating in 3650/3670 mode). COS2/90 runs only on 3690.

A Comten 5620 can run under Emulation Processing (EP) program or Advanced Communications Function/Network Control Program (ACF/NCP). The EP and ACF/NCP operating systems can coexist in one 5620 processor to support a partitioned Emulation Processing (PEP) network.

Communications Operating System Version 2 (COS2)/20 R.3 • provides data, job, and link management for multiple applications programs • isolates all hardware dependent code from modular software products • replaces the older System Control Software (SCS) • runs on 5620 and supports all COS2-based software that is supported on the Series 3600 processors • compatible COS2 software includes ACF/NCP 3 R1E, CAF1 R1E, CAM3 R2E, CNG, CNS3 R1E, EP4 R5E, MAF3 R3E, MAF/RHO R1E, NSS1 R2E, NTO2 R1E, SEAC3 R1E, SRM1 R4E, SS1 R5E, X.25 Network Interface packages R5E/R6E with interfaces to specific networks, VCS1 R1 (in NCR host) and VIM1 R1E:

NC initl	NC mo	NC yr
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S-SY3.2E Network Support Services 1 R2E • collection of host and communication processor-resident programs to perform load, dump, and program load device (PLD) functions:

NC	NC	NC
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S-EMO4.5E Emulation Processing (EP) • permits a Comten Communications Processor (CP) to function as an IBM 270X Transmission Control Unit or an IBM 370X Communications Controller operating in emulation mode; completes the data path from the terminal line circuit to the host subchannel address while performing the same data organizational functions as the IBM 270X/370X device • each communication line from a terminal is assigned to a host subchannel; each host channel can support up to 256 communication lines, depending on the Comten model; up to 8 host channels can be supported • can replace many IBM 270X/370X devices, provide multiple host support, uses 270X/370X host access methods without modification, can coexist with NCP or ACF/NCP, will support communications networking system (CNS) and data link control • supports terminal initiated line switching (TILS), site initiated line switching (SILS), automatic baud rate detection (ABRD), automatic dialing (DIAL),

and multisubchannel line access (MSLA):

NC	NC	NC
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Advanced Communications Function/Network Control Program (ACF/NCP) • program product comparable to the IBM ACF/NCP/VS Release 2; it provides the network control functions of NCP plus many advanced features • supports multiple hosts with both single and multiple domain networks, when operating with the IBM multisystem networking facility (MSNF) • provides the facility for cross-domain sessions, sharing resources with a host application program; resource location is transparent to the application program • also provides alternate resource location and sharing as well as the routing of data through intermediate domains in the case of device or computer failures; can also automatically switch a network from the control of one host to another during processor failure • supports IBM Communication Management Configuration (CMC) to concentrate control of several networks with multiple IBM host processors into a single processor; also supports dynamic reconfiguration, intensive mode error recording, user-written coded routines for inclusion of user-written network addressable units; allows certain pre-SNA Start/Stop devices (IBM 2741, 2740, TWX 33/35, and WTTY) to work in cross-domain operations, but requires NTO • supports Remote Concentrator Processor (RCP), connected through an SDLC link or a CNS trunking arrangement • supports IBM host software: Network Communication Control Facility (NCCF), Network Problem Determination Application (NPDA), and Multi-System Network Facility (MSNF) • when CNS and ACF/NCP are located in the RCP, remote PEP operations are also possible; all of the special programs available under EP are also available under ACF/NCP, such as automatic baud detection, multiple terminal access, terminal initiated line switching, and DIAL • provides supports for a system console interface, block handling routines, and diagnostic aids which monitor data flow, provide dump facilities, and trade functions • does not support start/stop device except through Comten Network Terminal Option (NTO) • supports subarea routing management (SRM) • can run in both front-end and remote communication processors • requires IBM S/370-compatible host, SNA access method (VTAM, TCAM, ACF/VTAM, or ACF/TCAM), MSNF if cross-domain sessions required, Comten Communication Processor and CNS2 for remote PEP systems.

S-NC03.1 ACF/NCP3 R1E • supports link problem determination aids (LPDA) and IBM 386X Series of modems, dynamic modem speed change, TWX read-ahead feature • provides same functions and features as IBM counterpart; parallel communication links, transmission groups, multiple routes, multiple priority levels, and extended NCP interconnection and ownership; supports for NTO Release 2 • does not support NTO Release 1 and requires new releases of SRM and MAF • requires IBM S/370-compatible host, ACF/VTAM R2, R3, or V2R1, or ACF/TCAM V2R1, R2, or R3, and MSNF for cross-domain sessions • also requires Comten Communications Processor, NTO2R1 (if host requires start/stop or BSC 3780 device support), SRM/R3 (if SRM required), and MAFR3 (if MAF required):

1,305	234	2,574
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S-NC12.1 Network Terminal Option 2 (NTO2) Release 1 • enhances capabilities of ACF/NCP3 to allow selected pre-SNA start/stop devices to communicate with an IBM host by using SNA protocols; runs as a program under the Comten ACF/NCP3 • supports single domain and cross-domain sessions; supports IBM 2740 Model 1, IBM 2741, WTTY (dedicated line), TTY 33/35 (switched or dedicated), and IBM 3780 (dedicated, point-to-point only) terminals; compatible with IBM NTO R2; supports MTA/TILS and ABRD capabilities of NCP • does not support dial-out capabilities • requires IBM S/370-compatible host running ACF/VTAM V1R3 or ACF/VTAM V2 access method • also requires Comten communications processor, COS 2/20, ACF/NCP3 Release 1E, and NSS1 R2E:

660	206	2,266
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INITL: initial license charge. MO: monthly license charge. YR: yearly license charge. NA: not available/applicable. NC: no charge. Prices current as of March 1985.

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S-CNO2.1 Communications Networking System 3 (CNS3)

R1E • common network trunking facility to interconnect Comten Communications Processors; allows concentration of data from multiple terminals at remote sites for transmission over single high-speed trunk; trunks can be terrestrial, microwave, or satellite links; runs under EP4 Release 1 or higher, NCP Release 3 or higher, or ACF/NCP2 Release 1 or higher • supports bit- or byte-oriented protocols on up to 1,024 logical lines • transparent to the terminal user and host • allows remote processing and variety of network configurations • other Comten software features provide additional connectivity and control when residing in system with CNS • console-to-console utilities provide centralized network control; Site Trunk Analysis Routine (STAR) provides statistics and status information, Terminal Initiated Line Switching (TILS) allows terminal operators to select different host applications from a single device; Site Initiated Switching (SILS) allows console operator to switch terminal to different host or application and perform rerouting at remote nodes, and Remote Initial Load (RIL) allows loading a remote 5620 from central location • requires IBM S/370-compatible host, Comten Communications Processor, and an operating system (EP4 R5E or ACF/NCP3 R1E):

NC	120	1,320
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NCR/ACS Advanced Communications Systems • for NCR hosts • requires NCR 8500/8600 host computer running VRX/TAM software, an NCR Comten Communications Processor with ANCR/CIA to provide a Bit Serial Link Interface to host, and/or an IBM S/370-compatible host; VRX must be Release 9 plus 4 or above • consists of 3 modules: VRX Comten Support (VCS), VRX Interface Module (VIM), and Communications Access Method (CAM); VCS runs NCR host and VIM and CAM run in Communications Processor • requires ACF/NCP running in the Communications Processor (3600 or 5620); other software that supports NCR/ACS includes Communications Networking System (CNS), Automatic Message Switch (AMS), X.25 Network interface, Subarea Routing Manager (SRM), and HIF 3272 and HIF 3274; HIF software interfaces to IBM hosts to permit host-to-host file transfers between IBM hosts and CAM applications and between CAM-controlled terminals and IBM hosts supported by the Comten SCS software • supports NCR 7900-1/4, NCR 796-101, NCR 2600, TTY-compatible, and IBM 2741 asynchronous terminals; NCR 2950, NCR STORES III/V, NCR TRACS, IBM BSC 3270-compatible, and IBM 370/135 Point-to-Point BSC terminals; and NCR 7950, IBM SNA 3270-compatible, and IBM 3767 SDLC SNA terminals • license fee consists of the license fees for the separate software packages required:

NA	NA	NA
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VRX Comten Support (VCS) • a set of COBOL application programs running in NCR host to support access to data sets, unit record devices, and the operator console and to communicate with NCR Comten Communications Processor • allows V-8000 console operator to load/dump a local/remote communications processor, initiate/process traces, execute network control programs, and resolve addresses:

NC	NC	NC
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VRX Interface Module (VIM) • resides in NCR Comten communications processor and provides the interface between TAM (Telecommunications Access Method) in host to Communications Access Method (CAM) in the communications processor • translates between the protocols used by VRX host and network terminals:

NC	195	NA
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Communications Access Method (CAM) • runs in Comten Communications Processor to support vendor-/customer-written applications programs • acts as central point for network control and works with the Comten ACF/NCP software to establish and control communications sessions; activates/deactivates network devices; displays network information; and provides automatic error recovery:

3,025	550	NA
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Networks/Communications

Extended Start/Stop Emulator (SS1) • enhances capabilities of Comten's Emulation Processing; allows Comten front-end

processor to support asynchronous communication • uses DLC-MIM and emulates terminal adapters TA1, TA3, TA4, and TA4F007; supports TILS and SILS; does not support terminals attached to a remote processor and does not support ABRD (automatic baud rate detection); in remote configuration, TA4 supports TTY devices on dedicated links up to 9600 bps.

SS1 Release 5E • runs under EP4 R5E or higher:

NC initl	NC mo	NC yr
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Multiple Access Facility (MAF) • licensed program product to allow individual IBM 3270 devices on a cluster controller to select any host or host application program defined on the network for a communication session • also includes broadcast feature to allow messages to be sent from Comten console to a single 3270 terminal, all 3270 terminals on a line, all 3270 terminals on a group of lines, or all 3270 terminals defined to MAF • uses ACF/NCP3 for terminal support; works in both local and remote environments.

S-MF03.3E Multiple Access Facility (MAF)3 R3E • all nodes must be at MAF3 level; cannot communicate with MAF2 products • improves trunking for remote MAF and printer performance; supports remote node buffer slow down, intermediate node for remote MAF, and static alternate route; acknowledges remote loads, enhances support for SRM/MAF configurations; and eliminates coordination problems of generating remote MAF:

NC	114	1,254
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S-MF10.1E MAF/RHO Release 1E • provides multiple access facility with remote host option; extends communication capabilities for both SNA and BSC 3270 terminals to non-IBM host computers as long as they can support BSC 3270 cluster controller; terminal operators can access applications residing on channel-attached, CNS-attached, or RHO-attached hosts • provides same features as earlier MAF versions: polling and addressing of terminals, terminal control on 3270 cluster controller, and error recovery capabilities • can be used in conjunction with X.25 to access public data networks and with CNS for trunking between nodes:

3,218	585	6,435
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Sub-Area Routing Manager (SRM) • provides the capability for BSC 3270 terminals to establish cross-domain sessions in conjunction with SNA access methods resident in channel-attached host processors; it also provides for dynamic routing of messages from BSC 3270 devices to EP or SNA host applications; establishes up to 8 System Service Control Points (SSCPs) comparable to those implemented in IBM's SNA; the Sub-area Routing Manager (SRM) counts as an SSCP • operates as a logon/logoff manager for BSC 3270 terminal devices, provides static routing of all other traffic, and supports Automatic Network Shutdown (ANS) capability of NCP.

S-NC21.4E SRM R4E • program product:

NC	175	1,925
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X.25 Interface to Public Data Networks • series of licensed program products to interface to packet-switching networks that follow CCITT X.25 recommendations such as DATAPAC, TELENET, TYMSHARE, and UNINET • can support more than 1 Public Data Network interface in the same CP, functioning as Packet Mode Data Terminal Equipment (DTE) • also performs call establishment, virtual circuit management, packet assembly/disassembly, and statistics collection functions of packet mode DTEs.

S-XN01.5E X.25 I/F 5E • basic core of modules required to interface to X.25 network:

NC	300	3,300
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SN01.6E X.25 I/F R6E • basic core of modules required to interface to X.25 network:

NC	300	3,300
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S-XN01.2 X.25 I/F Network Services Interface Release 2:

NC	300	3,300
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S-XN01.3 X.25 I/F Network Services Interface Release 3:

NC	300	3,300
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S-XN20.0 EP Start/Stop Packet Adapter (PA1) • supports start/stop device under EP:

NC	160	1,760

S-XNPA2.1E PA2 R1E • NCP Start/Stop Packet Adapter:

NC	300	3,300

S-XNPA3.1E PA3 R1E • NCP Start/Stop Packet Adapter:

NC	300	3,300

S-XNPA4A.1E EP SITINTEL Packet Adapter (PA4AR1E) • EP interface to TRANSPAC in France:

NC	200	2,200

S-XNPA5A.1E PA5A NCP R1E SITINTEL • NCP interface to TRANSPAC in France:

NC	200	2,200

S-XNPA5D.1E NCP 3303, 3270 (PA5D R1E) • NCP Datapac 3303 BSC 3270 Packet Adapter:

NC	200	2,200

S-XNPA5D.1E PA5D R1E • for Datapac:

NC	200	2,200

S-XNX SWX.2E XSWX R2E • emulation access method for public data network:

NC	320	3,520

S-SN10.1E DATAPAC Services Control R1E • interface to DATAPAC in Canada:

NC	48	528

S-XN11.1E GTE TELENET R1E • interface to TELENET:

NC	48	528

S-XN12.1E TYMNET R1E • interface to TYMNET:

NC	48	528

S-XN13.1E TRANSPAC R1E • supports TRANSPAC in Canada:

NC	48	528

SXN14.1E Datex-P R1E • interface to Datex-P in Germany:

NC	48	528

S-XN15.1E UKPSS R1E • interfaces to PSS in United Kingdom:

NC	48	528

S-XN16.1E UNINET R1E • interfaces to Uninet:

NC	48	528

S-XN17.0 DN1 R1E • interfaces to DN1 in Netherlands:

NC	48	528

S-XN18.1E LUXPAC R1E • interfaces to LUXPAC in Luxembourg:

NC	48	528

S-XNPCS.1E PCNS R1E:

NC	150	1,650

S-XNT1A1.1E TIA1 R1E:

NC	300	3,300

S-XN19.1E INFONET R1E • interfaces to Infonet:

NC	48	528

S-XN21.1E ITAPAC:

NC	48	528

S-XN22.1E DDX • interfaces to DDX in Japan:

NC	48	528

S-XN23.1E Admin Profiles:

NC	84	924

S-XN24.1E NPSI • comparable to IBM NPSI:

NC	95	1,045

S-XN25.1E PA6 • NC BSC Handler:

NC	200	2,200

S-XN26.1E PA7 • SDA2 Channel Handler:

NC	200	2,200

S-XN27.1E PBH • B-PAD protocol handler:

NC	150	1,650

Packet Adapters • PA1 is EP access method support for start/stop devices accessing PDN through X.3 PAD • PA2 is SNA access method support for start/stop devices accessing PDN through X.3 PAD • PA3 is SNA access method support for IBM NIA pad; equivalent to IBM NPSI feature • PA4A is emulation access method support for BSC 3270 devices accessing a PDN through a Sitintel pad available in France for Transpac network • PA5A is SNA access method support for BSC 3270 devices accessing PDN through Sitintel pad • PA5D is access method support for BSC 3270 devices accessing Datapac through a Datapac 3303 pad • XSWX is emulation access method support for PDN attached to RCP; not required for PDN attached to remote NCP system.

S-MSO1.1E Comten Communications Alerting Facility 1 Release 1 (CAF1 R1) • a network management and control package that gives users real-time status and configuration information on communications lines that connect to a Comten Communications Processor; provides dynamic control over the alarm, logging, and display parameters of the network • allows users to establish performance thresholds and parameters for individual lines or groups of lines; audibly or visually alerts users when monitored lines are outside the defined parameters • user can designate a primary node to access, display, or alter CAF data for network; designated secondary nodes can display information only at the primary node running CAF1 R1 software; on multinode network using CNS software, users can gather statistics on up to 15 CAF sites at one node; also remote CAF sites can be configured to send status to multiple network nodes • consists of a software module, keyboard/display unit, and an optional line printer • runs under SCS and can co-reside on a system with other SCS software:

NC	150	1,650

S-NL53.1E Comten Network Gateway (CNG) Release 1 • provides communication between multiple SNA networks; interconnected networks gain the same communications capabilities as domains within a single network but retain independent network management functions • translates addresses between networks; accepts, processes, and translates SNA commands to establish and terminate sessions across network boundaries • allows large SNA networks to be divided into 2 or more smaller networks that are interconnected; each network retains its own addressing scheme and performs normal network management tasks • software resides entirely in the NCR Comten Communications Processor; requires no change in host software; provides address translations to aid in tracing sessions through gateway; provides automatic error recovery; circumvents SNA network addressing restrictions; implements "Alias Feature" for internetwork sessions; maintains functional transparency to system control points; supports use of Comten CNS, X.25, and ACF/NCP trunking • 1 CNG with 1 NCP can interconnect up to 8 SNA networks; up to 8 NCPs can reside in the communications processor implementing CNG, thus 64 SNA networks can be interconnected with 1 gateway; multiple NCPs can be used to increase performance of the gateway as well as to increase the number of SNA networks supported • a CNG can be established in a node of a network or each network can include a CNG node • using the IBM SNA MSNF 3.0 protocols, CNG appears as pseudo-host to NCPs allowing cross-network sessions; SSCP in host VTAM is aware of a cross-domain session but is not aware the session is across network boundaries; supports customer-defined number of concurrent internetwork sessions; interconnection can be to IBM 37X5 communications controllers • an NCR Comten Communications Processor can be dedicated to the CNG function • Comten Communications Processor must be running COS 2/20 Release 3E or above and ACF/NCP Release 3E; other Comten system software (including pre-COS releases) can coreside in the same network with CNG and share trunks from the gateway to other nodes • host must be running ACF/TCAM 2.4 or ACF/VTAM 1.3 or above; CNG supports only sessions with hosts that support MSNF (Multiple System Network Facility) • can run in networks that include IBM 3705, IBM 3725, and Comten 3600 Communications Processors; supports all devices supported by NCP including BSC 3270 terminals, Network Terminal Option (NTO)-supported terminals, SNA

NCR Comten 5600 Series Communications Processors Model 5620

terminals, and MSNF links • now in Beta test; general availability scheduled for second quarter 1985:

2,200	400	NA
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Program Development/Languages

The CODEL product family consists of software support programs that provide a means of creating and maintaining system libraries of source and object code files. All Comten software products that execute on a Comten 3600 Processor are written in CODEL assembler language. CODEL does not run on the 5620.

CODEL operates under a control program called the MONITOR. The MONITOR calls functional programs to perform specific functions; assembler (CODEL), Procedure Librarian (PROCLIB), OBJECT Librarian (OBJLIB), and WHISK, a program that maintains file pointers for the temporary OBJECT Library and for temporary procedures in the Procedures Library.

Depending on the version, CODEL can also run on IBM S/370-compatible systems, CODEL resembles BAL and the CP instruction repertoire is a subset of the 360/370 instruction set, thus, experienced IBM-trained programmers will not have difficulty using CODEL.

Other Program Modules

S-EM24.1 Statistics & Extended Access Control (SEAC)2 Release 1 • extends user system access control and communication network data gathering on Comten CP • places data gathering in the same sphere as source information so the user can properly control the communication environment • adds security screening process in the communication processor to reduce the risk of system security breach; system user must go through 2 levels of security checks:

NA	initl	\$48 mo	\$528 yr
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S-EM34.2 SDA5 Broadcast Facility • a billable feature of EP4 to allow EP4 users to send broadcast messages from Comten CP console to polled 3270 devices; messages can be to single terminal, to a group of terminals, or to all terminals in the systems; requires EP4:

NA	35	363
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DYNAPAR • collection of licensed software products for performance measurement; provides data reduction and report generation for data captured by a DYNAPROBE monitoring system; reports using statistical and graphical formats easy to use and read; 6 types available • executes in IBM, IBM compatibles, Sperry, Honeywell, and other host environments; requires 300K-byte memory, line printer, and 9-track, 1600-bpi tape drive.

Measurement Technology 3705-II • software product enables the performance analyst to collect, report, and interpret performance data about key performance aspects of the IBM 3705-II Communications Controller transparent to the device; processor utilization, program-level analysis, scanner byte count, line utilization, and channel adapter byte counts • used in conjunction with the data capture processor of the DYNAPROBE monitoring system.

LEM Software • Link Evaluation Model provides statistical data on performance of BSC and SDLC links; designed to run on IBM S/370-compatible host.

S-AB00.0 LEM Basic Model • basic module; requires at least 1 protocol module:

NA	NA	1,800
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S-AB10.0 LEM BSC Model • BSC protocol module:

NA	NA	600
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S-AB20.0 LEM SDLC Model • SDLC protocol module:

NA	NA	1,200
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■ HARDWARE

Terms & Support

Terms • NCR Comten 5620 Communications Processors are avail-

able for purchase only from NCR Comten; they can be leased from NCR.

Support • maintenance is standard throughout NCR, with a basic service contract covering Monday through Friday, 9:00 AM to 5:00 PM; a premium is charged for weekends, holidays, and after hours; maintenance includes parts • modems are under on-call repair maintenance contracts; \$150 per year for purchased modems and \$90 per year for leased modems.

Overview

The NCR Comten 5620 Communications Processor is hardware/software compatible with IBM host processors; it is the first of a new series of communications processors that are compatible with the 3600 Series. The 5620 can function as a direct replacement for the IBM 370X or 270X Communications Controllers. It was designed to operate as a remote concentrator or remote front end as well as a small local front end to a host processor, and meet a wide range of data communication requirements. It can utilize the IBM VTAM, TCAM, ACF/VTAM, and ACF/TCAM access methods and provide an IBM 270X/370X-compatible interface with a channel interface adapter. Up to 2 host processors can be interconnected.

Communication and network control software includes all the COS/2 software available for the Comten 3600 Series of communications software. That software includes a complete array of network control modules that incorporate such features as multiple host interconnection, local/remote processing, host application selection, data switching, and data multiplexing. It also supports trunking between nodes in a network, as well as special features such as Automatic Baud Rate Detection and terminal on-site initiated line switching. There is also special software support for X.25 with an interface to public packet-switched networks.

Configuration • includes a central processor with main storage capacity of 1M, 2M, or 4M bytes • links to an NCR 8500/8600 VRX or IBM S/370-compatible host processor through a direct channel interface adapter (CIA) to an IBM S/370-compatible selector, byte-multiplexer or block-multiplexer channel, or to the NCR 16-MHz Bit Serial Link (BSL) Channel; 1 or 2 CIAs are supported • communications interfaces are through character processors which can accommodate up to 8 full-duplex communication lines at speeds from 300 to 9600 bps, depending upon the service being interfaced; wideband line speeds from 19.2K to 64K bps are also available; up to 32 lines can be supported.

The 5620 is compatible with the Comten Models 3650 II and 3690 Communications Processors.

CPU & Memory

CPU

Based on the 32-bit NCR 32 microprogrammable VLSI chip, the 5620 includes sixteen 32-bit general-purpose registers and sixteen 32-bit control registers. TTL technology is used to implement system logic. The processor executes 101 instructions; 54 in IBM S/370 format. The system uses 256K-bit memory chips, and memory cycle time is 200 nanoseconds. The operator interface is through an operator panel and an optional system console.

Program loading is from an attached disk drive, from a host through Channel Interface Adapter, or from a remote system through a communications link. Power-up or operator reset initiates self-test routines; a displayed error code indicates a failing board and type of error.

Processor supports up to 32 half- or full-duplex communication lines, up to 2 host channel interfaces (NCR or IBM or 1 of each), 1M/2M/4M bytes of memory, and 10M bytes of disk storage.

All domestic installations require a disk subsystem to load software modules.

T5620-A1 Processor • includes CPU and 1M-byte memory; can operate in computer room environment or in business office with standard power or air conditioning:

	\$16,000 prch \$90 maint
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NCR Comten 5600 Series Communications Processors Model 5620

T-8054-A1 System Stand • used to install 5620 components in minimum floor space; required in front-end processor configurations but is optional for remote communications processor configurations:

1,800	2
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Memory

F1169-A1 Storage Expansion • 1M-byte increment; only 1 can be added; implemented using 256K-bit chips; 200-nanosecond cycle time:

\$8,000 prch	\$26 maint
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F1169-B1 Storage Expansion • 2M bytes; requires F1169-A1; expands memory from 2M to 4M bytes:

16,000	52
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F1169-C1 Storage Expansion • 3M-byte increment; expands 1M-byte systems to 4M bytes:

24,000	78
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Channel Interface Adapters (CIAs)

Two types are available: one to interface to a byte or block multiplexer channel on an IBM S/370-compatible host and the other to interface to the 16-MHz bit serial link (BSL) channel of an NCR 8500/8600 VRX host. Up to 2 can be connected: of the same type or 1 of each type.

T-3031-A1 IBM CIA With Cabinet • provides facilities to front end an IBM S/370-compatible host; interfaces to byte or block multiplexer channel • implemented using NCR 32 microprogrammable processor with proprietary VLSI Assist Chip on 2 logic boards; has direct access to 5620 memory; implements 64 soft-addressed subchannels that need not be contiguous • has space for a second CIA, either IBM or NCR model:

\$10,000 prch	\$35 maint
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T-3034-A1 NCR CIA With Cabinet • provides facilities to front end an NCR 8500/8600 VRX host; interfaces to the 12-MHz BSL channel • implemented using Motorola 68000 microprocessor on a logic board; has direct access to 5620 memory • has space for a second IBM or NCR CIA:

10,000	35
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F-3039-A1 Expansion CIA (NCR) • can be installed in either the T-3031 IBM or T-3034 NCR CIA Cabinet:

6,000	30
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F-3040-A1 Expansion CIA (IBM) • can be installed in either the T-3031 IBM or T-3034 NCR CIA Cabinet:

6,000	30
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I/O & Communications

The only I/O devices the 5620 supports are a system console and a 10M-byte disk subsystem.

Communications Lines

The system can attach up to 32 half- or full-duplex communication interfaces. Each line is attached to a Line Interface. Each Line Interface is attached to either a low-speed or high-speed Character Processor. Each Character Processor attaches to a quad, dual, or single Communications Base. Each Communications Base requires a Processor Interface. Line Interfaces, Character Processors, Communications Bases, and Processor Interfaces are housed in a communications cabinet. Up to 16 lines can be attached through 1 communications cabinet and the 5620 can support up to 2 cabinets for a total of 32 lines.

T-2040-A1 Communications Cabinet • required to house and interface up to 16 communications lines to a 5620:

\$1,500 prch	NC maint
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T-2270-A1 Communications Base, Single • can support 1 low-/high-speed Character Processor and can terminate up to 8 communication lines • typical configuration might include eight 1200-bps asynchronous lines, eight 4800-bps half-duplex BSC lines, two 9600-bps X.21 lines, or one 56K-bps SNA SDLC or NCR Comten CNS trunk line • aggregate throughput is 4800

cps using low-speed Character Processor and 64K bps using high-speed Character Processor:

350	40
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T-2235-A1 Communications Base, Dual • can support 2 low/high/mix of low/high Character Processors and can terminate up to 8 communication lines; maximum aggregate throughput is double that of T-2270:

400	45
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T-2236-A1 Communications Base, Quad • can support any mix of 4 Character Processors and can terminate up to 8 communication lines; maximum aggregate throughput is double that of the T-2235:

425	50
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F-2237-A1 Character Processor, Low Speed • multiplexer type; provides the interface between the Line Interface (and communication line) and the 5620 processor; is installed in a Communications Base; can support 1 to 8 full-duplex lines at data rates from 50 to 19.2K bps • number of lines depends on the type of Communications Base in which it is installed: up to 8 lines in single model, 4 lines in dual model, and 2 lines in a quad model • maximum aggregate throughput is 4800 cps • can support F-2241 RS-232C, F-2242 RS-449-423, F-2243 CCITT X.21, and F-2244 MIL 188-114 Unbalanced Line Interfaces:

725	4
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F-2238-A1 Character Processor, Medium Speed • higher speed processor for interfacing 1 full-duplex line to the 5620 at data rates from 19.2K to 64K bps • can support F-2245 MIL 188-114 Balanced, F-2246 V.35, F-2247 AT&T 303, F-2248 RS-449-422, F-2249 NCR DLC, and F-2250 CCITT X.21 Line Interfaces:

750	5
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F-224X-A1 Line Interface • provides for the termination of 1 or 2 communication lines using a specific electrical interface.

F-2241-A1 RS-232C • interfaces 2 lines:

500	4
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F-2242-A1 RS-449/-423 • interfaces 2 lines:

1,300	11
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F-2243-A1 CCITT X.21 • up to 19.2K bps; interfaces 2 lines:

615	5
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F-2244-A1 MIL 188-114 Unbalanced • interfaces 2 lines:

600	5
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F-2245-A1 MIL 188-114 Balanced • interfaces 1 line:

800	7
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F-2246-A1 V.35/DDS • interfaces 1 line:

575	5
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F-2247-A1 AT&T 303 • interfaces 1 line:

600	5
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F-2248-A1 RS-449/-422 • interfaces 1 line:

1,500	12
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F-2249-A1 NCR DLC • interfaces 1 line:

665	6
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F-2250-A1 CCITT X.21 • greater than 19.2K bps; interfaces 1 line:

1,300	11
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Disk

T-7360-A1 10M-Byte Disk Subsystem • required on all domestic installations; used to store system software and memory dumps:

\$3,000 prch	\$35 maint
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PRCH: single-unit purchase price. MAINT: monthly maintenance charge for purchased units. NA: not available/applicable. NC: no charge. Prices current as of March 1985.

NCR Comten 5600 Series Communications Processors

Model 5620

Console & Printers

T-4017 Monochrome Display • used as console for the CAF:
\$714 prch NA maint

T-4030-A1 System Console • includes CRT/keyboard and printer; required for front-end configurations and optional for remote configurations:
1,200 6

T-4032 Printer • for use with T-4017 or T-4050 display:
780 NA

T-4050 Color Display • used as console for CAF:
1,425 NA

Other Components

2200 Matrix Switch • provides for switching communication lines between 2 communications processors to allow configuration of redundant systems for backup; also allows rotational sparing; can support 512 DCE (modem) connections and 512 DTE (communications processor) connections in RS-232C environment or 64x64 in V.35 environment; can be configured in increments of 2 lines • software controlled by commands from a switch console; can switch single lines or groups of lines; transparent to speed, format, code, and protocol; single switch console can control multiple matrix switches • switches 20 interface leads in the RS-232C interface; also supports V.35 interface • monitors lines without affecting traffic; allows operations manager to select names up to 16 characters long to identify lines, processor ports, and other facilities; the file of names to components provides a database for network resources; network changes are automatically logged • lines can be added without disrupting network operation • matrix switch console uses 2 printers: one is used to generate trouble or line status reports, and the other is used to provide an audit trail of all activity (logons, logoffs, alarms with time, date, and name of operator performing action) on the network • console uses a fixed disk to store network configurations • planned availability is second quarter 1985 • price range for a fully configured system is \$300 to \$380 per DTE or DCE connection.

T-2200-A1 Multi-Matrix Controller • can control 1 or more local/remote matrix switches; includes a hard disk, cartridge disk, report printer, log printer, and operator's console; programmable; provides electronic switching and connection under software control • software provides commands for the operator to control the system; the control station can be accessed by up to 15 VT100-compatible terminals; implemented security provides 8 security classes for access • HELP feature provides operator with built-in prompts for entering commands that can be instantly recalled whenever/wherever needed • maintains database of network resources; console used to reconfigure network resources quickly and easily:
\$44,825 prch NA maint

T-2210-A1 Matrix Processor Cabinet • contains the data routing processor, power distribution, cooling fans, backup power supply, and space to mount 2 online power supplies and up to 4 DTE or DCE port banks; power supplies and port banks are added as needed • data routing processor performs connection and switching between DTEs and DCEs:
15,162 NA

T-2215-A1 Matrix Module Cabinet • contains power distribution, cooling fans, backup power supply, and space to mount 3 online power supplies and space to mount 6 DTE or DCE port banks; power supplies and port banks are added as needed:
7,227 NA

T-2220-A1 DTE Port Bank (RS-232) • supports up to 16 DTE port cards and 1 interface card to connect to the Data Routing Processor:
2,524 NA

T-2225-A1 DCE Port Bank (RS-232) • supports up to 16 DCE port cards and 1 interface card to the Data Routing Processor:
2,524 NA

T-2230-A1 DTE Port Bank (V.35) • supports up to 8 port cards and 2 interface cards to connect to the Data Routing Processor:
3,421 NA

T-2235-A1 DCE Port Bank (V.35) • supports up to 8 port cards and 2 interface cards to connect to the Data Routing Processor:
3,421 NA

F-2210-A1 Bank Support Card • 1 required for up to 2 DTE/DCE RS-232C Port Banks for speeds up to 9600 bps; 1 required for each DTE/DCE RS-232C Port Bank for speeds up to 19.2K bps • 1 required for each 4 Port Cards in a V.35 DTE/DCE Port Bank:
1,100 NA

F-2215-A1 Power Supply • added as needed when number of DTE/DCE port banks are increased; 1 power supply supports 2 Port Banks • "hot" spare automatically replaces online failing power supply:
1,668 NA

F-2220-A1 DTE Port Card • provides 2 RS-232C ports:
265 NA

F-2225-A1 DCE Port Card • provides 2 RS-232C ports:
276 NA

F-2230-A1 DTE Port Card • provides 2 V.35 ports:
328 NA

F-2235-A1 DCE Port Card • provides 2 V.35 ports:
328 NA

Comten 7160 Commander Series Modems • high-speed intelligent modems; offer new diagnostic capabilities in SNA and non-SNA networks; provide access to diagnostic information on a new 32-character LCD readout, useful for non-SNA networks that cannot access SNA console applications • diagnostics on multiplexed lines and on tail circuits; built-in externally initiated diagnostics; synchronous operation at up to 9600 bps • compatible with NCR Comten 7160 Series products; compliance with EIA RS-232C (CCITT V.24/V.28) and CCITT V.29 • fully compatible with IBM 3800 Series modems.

Comten 7164 Modem • 4800-bps, leased line modem; point-to-point or multipoint lines:
3,700 NA

Comten 7164 Modem • 4800-bps, switched line modem for point-to-point links:
3,800 NA

Comten 7165 Modem • 9600 bps; can be configured for point-to-point or multipoint configurations; a multiplexer feature permits multiplexing to multiple DTEs through subchannels on a single line • in multipoint configurations, permits separately addressed secondary modems to operate on 1 line under control of a 7165 primary modem:
5,800 NA

Fan-Out Feature • allows up to 4 remote terminals to share a modem: only 1 can transmit at a time but all can receive concurrently • mutually exclusive with Mux Feature:
750 NA

Mux Feature • supports up to 4 channels in any combination of 2400/4800/9600 bps for aggregate data rate of 9600 bps:
870 NA

Switched Network Backup (SNBU) Feature • provides dial backup for modems using leased lines:
340 NA

Extended Diagnostics • performs Remote Power Loss and Special Test Tone tests:
290 NA

• END

NCR Comten 7160 Series Modems

Models 7163, 7164 & 7165

■ PROFILE

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

Communications/Networks • synchronous 2400/4800/9600-bps, point-to-point and multipoint communication over 2- or 4-wire, switched or dedicated Type 3002 unconditioned facilities • compatible with IBM 3860 Series modem • noncompatible with AT&T modems • designed for use in SNA and non-SNA IBM distributed networks.

First Delivery • March 1983 (7164-0100); December 1983 (7165—both models); June 1984 (7164-0200).

Units Delivered • 1,000.

Comparable Systems • principal competition from IBM 3860 Series modems • competitive with other vendor models designed for centralized network control including AT&T/IS Dataphone II Service, Codex CS Series, Infinet NCM Series, Paradyne MP Series, and Racal Milgo CMS.

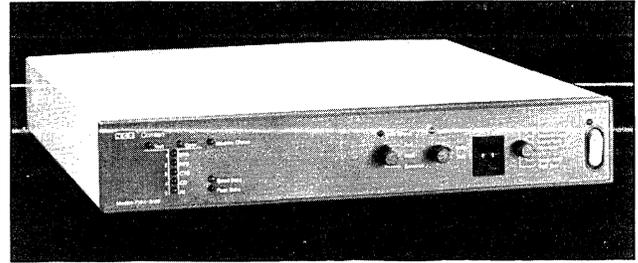
Vendor • NCR Comten; 2700 Snelling Avenue, North, St. Paul, MN 55113 • 612-633-8130.

Distribution • worldwide via NCR and NCR Comten.

■ ANALYSIS

The NCR Comten 7160 Series modems are microprocessor-based, high-performance diagnostic units designed for use in a dedicated point-to-point or multipoint network or on the DDD switched network. Fully compatible and equivalent to IBM's 3860 Series modems, the 7160 Series is designed for network control and management in an SNA environment, and like their IBM counterparts, will run under IBM's Network Communications Control Facility (NCCF) Release 1, and Network Problem Determination Application (NPDA) Version 1 Release 2 or Version 2 diagnostic and control software. The combined hardware/software compatibility of the 7160 Series modems with their IBM equivalents allows them to be intermixed with the IBM modems on the same network at a saving in cost to the user. Unlike their IBM counterparts, the 7160 Series uses newer microprocessor technology for increased performance and are low-profile compact units just under 3 inches high for critical space-saving requirements.

Diagnostic and control functions can be performed manually via front-panel controls or automatically through IBM's NPDA software, which utilizes the primary channel of a communication facility to gather network status information, run diagnostic tests, and issue modem commands. This **inband** approach to network control is an alternative to the secondary-channel **out-of-band** approach used by most vendors of network control systems. The advantages of the inband approach are two-fold. It allows



centralized network control and management under the direction of host-supported network control and diagnostic software, and it eliminates the added cost of expensive standalone network control systems that use the out-of-band approach. The major disadvantage is that the inband approach adds overhead to data communication activity, reducing throughput, and it interrupts activity on the main channel to conduct diagnostic procedures, a key drawback for multipoint operation.

The 7160 Series includes six models categorized according to their IBM counterparts for 2400-, 4800-, and 9600-bps data rates and for dedicated point-to-point or multipoint operation or switched operation over the DDD network. Like their IBM counterparts, they support half-speed operation for degraded circuits, dial-backup (on dedicated line models), anti-streaming, multipoint operation, modem sharing (Fanout), tail circuits, and alternate voice/data operation, **a feature not provided by IBM modems.**

Strengths

Pricing, reduced space requirements, and full IBM 3860 compatibility are the principal strengths of the 7160 Series modems.

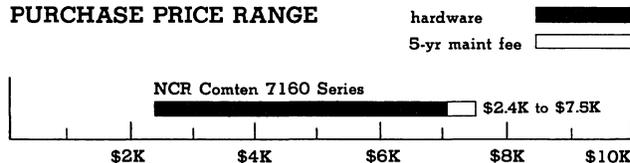
The modems offer particularly flexible diagnostics capabilities, attractive both to users with limited data communications expertise as well as seasoned network professionals. Tests can be run automatically or manually, locally, or remotely. Results can be interpreted by the network manager or by the NPDA software for noncommunication-oriented managers. In addition, an optional extended diagnostics board is available for signaling power losses at remote modems.

All remotely retrieved diagnostic and status data, whether manually or automatically initiated, is transmitted in-band; that is, the same data path and control are used as for user data. Status and test information is interspersed with user data transmissions without interfering with terminal-to-host sessions. This can be viewed as a more reliable diagnostics retrieval method than when separate side channels are used, especially on unconditioned lines.

Limitations

The NCR Comten 7160 Series modems are designed for use in SNA networks. In order to take advantage of the remote diagnostics features, the user must have at least one IBM 3705 or 3725 or NCR Comten 3600 Series Communications Controller running ACF/NCP Release 2.1 or above. NCR Comten maintains that the modems may still be implemented in pre-SNA or non-SNA networks, but to do so requires that all status and diagnostics testing be conducted locally without a storage or hard-copy capability for results—a severe limitation.

PURCHASE PRICE RANGE



NCR COMTEN SERIES PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware (solid bars), and for associated 5-year period maintenance fees (open bars) • **NCR Comten 7163** small configuration consists of 2400-bps model; large of 7165 model with multiplexer option, 4 tail circuit attachments, and Extended Diagnostics.

NCR Comten 7160 Series Modems Models 7163, 7164 & 7165

The in-band approach used by IBM to monitor network performance and perform diagnostics adds some overhead to normal data communication, reducing throughput somewhat. Most of IBM's competitors employ an out-of-band secondary channel technique which is non-interfering with normal data throughput.

Failure recovery is hampered by the absence of a hot-spare modem switch. In other words, there is no provision to switch over to a hot-spare (standby) unit when an NCR Comten modem fails. NCR Comten depends on its field maintenance to handle modem failures quickly, but the user is still faced with a mean time-to-repair which is intolerable for some networks.

Threshold parameters indicating marginal or failed network components are established by NCR Comten and are not open to user manipulation as in systems marketed by Ininet and Codex, among others. The NCR Comten modem user (with NPDA) has only the limited ability to specify his error-to-number-of-transmissions ratio, a figure which sets the tolerable error limit for the network. NCR Comten does not measure analog line parameters, except for received signal quality, which would alert network operators more quickly to degrading line conditions and exactly pinpoint those conditions. Some competing systems, the Codex DNCS in particular, are armed with a battery of measurements for analog parameters such as phase jitter, drop outs, and harmonic distortion.

■ HARDWARE

□ Terms & Support

Terms • available for purchase or for lease under a 1- or 2-year arrangement • lease prices include Extended Warranty • separate maintenance contract available for purchased units • lease/purchase is 45 percent of lease paid out up to 12 percent of purchase • quantity discounts available.

Support • installed by NCR Comten or by user • 100-day warranty on all modem models; Extended Warranty can be purchased for \$60 annually for purchased units; provides factory or service center repair or replacement of failed component • on-call service priced at \$150 annually for locations within 2-hour travel time of service center.

□ Overview

The NCR Comten 7160 Series modems are microprocessor based and support the diagnostic functions of IBM's Network Problem Determination Application (NPDA) software. The six models are fully compatible equivalents of the IBM 3860 Series modems and range in speed from 2400 bps to 9600 bps. Like their IBM counterparts, various models are designed for switched (DDD) or dedicated point-to-point, multipoint, and multipoint applications. Fan-out and tail-circuit configurations are supported as they are with the IBM modem equivalents. The Extended Diagnostics option is available at extra cost as it is with the IBM 3860 Series.

All of the modem models feature automatic remote speed selection between the primary and fallback operating speeds, an anti-streaming feature which prevents any one terminal from occupying a multipoint facility too long, automatic and adaptive equalization, auto-answer for DDD networks or dial backup operations, and the ability to accept timing from an external device (in lieu of its own clock). A customer switch permits the user to alter each modem between a 24-millisecond Ready-For-Sending delay (in multipoint operations) or a 60-millisecond delay.

Diagnostic testing can be performed manually or automatically under software control. The modem operator panel permits the user to conduct a modem self-test of microcode, line transmit and receive tests, local and remote loopback tests, end-to-end loop tests without remote operator assistance, and a lamp test of indicator lights. Automatic, centralized diagnostics require a battery of software products running on the central processor. The required products are: ACF/NCP Release 2.1 in a suitably configured 3705 or 3725 Communications Controller, the Network Communications Control Facility (NCCF) Release 1, and the Network Problem Determination Application (NPDA) Version

1 Release 2 or Version 2.

NPDA uses the modem's diagnostics features for the collection, storage, and retrieval of network error and management data, and contains the logic for determining the probable cause of network errors. The probable causes of problems will identify faults in the communications controller, line, modem, modem interface, or terminal. NCCF supports operator control of the network, and provides itemized and summary formatting of NPDA data.

Switched or dial network backup is an optional feature available with all the modem models. Two 2-wire phone lines are required. Calls are placed manually. When one connection is made, the operator has four minutes to establish connection on the second line. Otherwise, an automatic time-out will disconnect the first line.

□ Packaged Modems

Basic standalone units; include 2 cables; telephone line cable equipped with 4-prong plug (Type 283B) and power cable equipped with 3-prong plug (120V/15A with ground) • FCC certified for direct attachment to DDD network • rackmount optional.

Model 7163-0100 Modem • 2400-bps synchronous modem; 1200-bps fallback speed • full-duplex operation on unconditioned 4-wire dedicated facilities • point-to-point or multipoint configurations:

\$2,450 prch

Model 7163-0200 Modem • 2400-bps synchronous modem; 1200-bps fallback speed • half-duplex operation over 2-wire switched facilities via direct connection:

2,600

Model 7164-0100 Modem • 4800-bps synchronous modem; 2400-bps fallback speed • full-duplex operation on unconditioned 4-wire dedicated facilities • point-to-point or multipoint configuration:

3,700

Model 7164-0200 Modem • 4800-bps synchronous modem; 2400-bps fallback speed • half-duplex operation on 2-wire switched facilities • point-to-point configuration only:

3,850

Model 7165-0100 Modem • 9600-bps synchronous modem; 4800-bps fallback speed • full-duplex operation on unconditioned 4-wire dedicated facilities • point-to-point configuration only:

5,800

Model 7165-0200 Modem • 9600-bps synchronous modem; 4800-bps fallback speed • full-duplex operation on unconditioned 4-wire dedicated facilities • multipoint configuration only:

5,800

□ Application

Point-to-point or multipoint synchronous communication over unconditioned 4-wire dedicated voice-grade facilities or 2-wire switched facilities in point-to-point mode only • SNA compatible; supports IBM's Network Problem Determination Application (NPDA); complete compatibility with IBM 3860 Series Modems • can serve as tributary or central stations • customer-selectable RTS/CTS delay • 24 milliseconds at 4800 bps (prime), 58 milliseconds at 4800 bps full speed (optional), and 50 milliseconds half speed for Model 7164-0100 as multipoint tributary; 60 milliseconds at 9600 bps (long), 24 milliseconds at 9600 bps (short), and 60 milliseconds at 4800 bps for Model 7165-0200 as multipoint network tributary.

□ Operating Parameters

All models designed for synchronous transmission; depending on model, data rates are 2400, 4800, or 9600 bps with half-speed

PRCH: single-unit purchase price. NC: no charge. Prices effective as of July 1984.

NCR Comten 7160 Series Modems

Models 7163, 7164 & 7165

fallback • Model 7165-0100 can be configured as a tail-circuit modem and can include optional 4-channel multiplexing capability • all models operate in full-duplex mode over dedicated 4-wire facilities except Models 7163-0200 and 7164-0200 which operate in half-duplex mode on 2-wire switched facilities • Model 7164-0200 can be configured for communication over satellite link and include echo cancellers • DPSK modulation for Model 7164; 8 phase and 2 amplitude levels at 4800 bps; 4 phase at 2400 bps for Model 7164-0100; DPSK 8 phase at 4800 bps, 4 phase at 2400 bps for Model 7164-0200 • QAM modulation for Model 7165; 8 phase and 2 amplitude levels at 9600 bps; 4 phase at 4800 bps • automatic adaptive equalization on all models • operating modes for Model 7164-0200 are native or CCITT V.27; Model 7165-0100 is CCITT V.29 compatible.

Modem configuration and options are selected via a bank of 8 rocker or slide switches on the rear panel. Settings include internal/external clock, point-to-point primary/secondary, multipoint control/tributary, LPDA/Local Loopback diagnostic option, normal/extended CTS delay, antistreaming option on/off, and carrier detect sensitivity level. A 2-digit (hexadecimal) thumbwheel address switch on the front panel selects modem address in point-to-point or multipoint network configuration.

☐ Channel Functions

Modems are single channel; however, the 9600-bps Model 7165-0100 can be configured with a multipoint multiplexing feature supporting up to four channels. All models except 7164-0200 support Switched Network Backup (SNBU); Models 7164-0100 and 7165-0100 support Fanout. Tail-Circuit feature is supported only on Model 7165-0100.

Data Multiplexer (Model 7165-0100 Only) • supports up to 4 in any combination of 2400, 4800, and 9600 bps for 9600-bps aggregate; required for Tail-Circuit extensions; mutually exclusive with Fanout feature:

\$870 prch

Tail-Circuit Attachment • for 7165-0100 modem with multiplexing option • connects a tail-circuit modem to a port on a remote multipoint modem for communication with Host DTE via central-site modem:

50

Fanout Feature • allows up to 4 remote terminals to share a modem; only one can transmit at a time; all can receive concurrently • available with all modem models except Models 7163-0200 and 7164-0200; mutually exclusive with multiplexing feature:

750

Digital Interface • all models equipped with an EIA RS-232C/CCITT V.24/V.28 electrical interface • 25-pin electrical connector.

☐ Control Functions

FCC-Certified Modems • all modems designed for use over the DDD network are FCC certified for direct connection under FCC Rules Part 68 • do not require separate Data Access Arrangement (DAA) • standard feature included in modem pricing:

NC prch

Failure Recovery • provides immediate recovery from line 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 modem to a lower data rate to restore communication impaired by line degradation • disables modem when communication becomes monopolized on a multipoint line by a streaming terminal; i.e., terminal Request-To-Send (RTS) is on for over 40 seconds.

Switched Network Backup (SNBU) • provides dial backup for

modems using dedicated facilities • requires pair of 2-wire switched lines • provides point-to-point connections only, but can be used as backup in multipoint configurations; each remote multipoint modem must be equipped with the feature • calls must be manually placed; may require transmission rate to be reduced to half speed:

340

Anti-Streaming • integral switch-selectable standard feature on multipoint dedicated line Models 7163-0100, 7164-0100, and 7165-0200 • automatically disconnects streaming terminal when Request-To-Send (RTS) signal from DTE exceeds 40 seconds • feature enabled/disabled through modem rear panel switch:

NC

☐ Diagnostic & Status Indicators

The 7160 Series modems perform a broad range of diagnostic tests conducted manually at the modem front panel or automatically through diagnostic commands issued under the direction of host-supported NPDA software in an SNA environment. Comprehensive diagnostics isolate failures in local or remote modems or dedicated line.

Self-Test • conducts comprehensive test of modem internal circuitry with network disconnected and digital and analog ports looped back to inputs; pass/fail test LED indicator lights for failure; test status along with modem characteristics returned to NPDA software in host • manually or automatically initiated:

NC prch

Loopback Tests • performs local analog loopback (CCITT V.54 Loop 3 configuration) and remote digital loopback (CCITT V.54 Loop 2); remote digital loopback conducted only on dedicated line models • both tests manually or automatically initiated • manually initiated loop/transmit test conducts remote digital loopback (CCITT V.54 Loop 2) test from local modem which generates and checks test pattern sent to remote modem; conducted only on dedicated line models and only by central-site modem in multipoint arrangement:

NC

Transmit/Receive Test • manually initiated test only for switched line models transmits test pattern from specified local or remote modem which is received and verified by modem at opposite end of line:

NC

Status Reports • initiated by host-resident NPDA diagnostic software instructs local modem or local and remote modems to return data transmission quality and link status report to host for tallying by NPDA software; applicable to all models • instructs local modem to enter diagnostic data rate (1200 bps) and send proper command frame to remote modem which snapshots status of EIA digital interface and returns status to host NPDA software; applicable to all models:

NC

Status Indicators • indicates power on: operating mode; test mode; bit-error; half-speed; SNBU mode (where installed); circuit quality (good/poor); EIA interface signal activity (DTR/RTS/CTS/CAR/RD); and multipoint configuration (Model 7165-0100 only).

Extended Diagnostics • performs two additional tests: Remote Power Loss indication and Special Test Tone • Remote Power Loss alerts host-resident NPDA software via alarm signal from remote modem when power failure is detected for 50 milliseconds • Special Test Tone test instructs all remote modems on multipoint line to conduct self-test and return tone if failed; test issued to control modem by host-resident NPDA software:

290

• END

NSC HYPERbus

Baseband Local Area Network

■ PROFILE

Architecture • HYPERbus Local Area Network.

Type • baseband, packet-switched network using coaxial cable, bus topology • uses Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) technique for bus access; CA scheme comparable to token passing, provides predictive delay for access.

Transmission Speed • 10M bps.

Cable Length • dependent on number of taps and type of cable; range is 4,080 feet for cable with 2 taps to 3,120 feet for cable with 100 taps; each tap has 4 ports to connect Bus Interface Units • can be extended up to a total of 15,000 feet using low-loss coaxial cable.

Applications • general-purpose network for interconnection of terminals, minicomputers, and front-end processors; supports high-speed digital communication for computer terminals, graphic subsystems, and test stands in single- or multivendor environment; also operates in IBM 3270 terminal environment.

Configuration • NSC has arbitrarily limited a coaxial cable segment to 100 Bus Interface Units (BIUs); the number of BIUs using multiple segments is virtually unlimited; depending upon type, a BIU can provide 4, 8, or 16 ports to HYPERbus • local HYPERbus segments can be extended geographically and interconnected through communication link BIUs; adjacent HYPERbus segments can be interconnected using direct link BIUs • direct link BIUs can link to HYPERchannel and gain access to mainframe processors • see Figure 1.

Interface • Bus Interface Unit (BIU); models available for RS-232C/RS-422 asynchronous and synchronous devices, IBM

3270 controllers and terminals, minicomputer DMA channel (16-bit), standard communication links, and HYPERchannel.

Gateways • through link BIUs to other HYPERbus segments, HYPERchannel, standard communication links (RS-232C and AT&T T1), and minicomputers.

Support of Foreign Devices • IBM 3274 controllers, IBM 3278 monochrome models, 3279 HS3G graphics display, 3268 printer and 3287 color printer, RS-232C async/sync terminals, and minicomputers using 16-bit parallel ready/resume interface.

Communication Management • Bus Service Center monitor and control center for HYPERbus; monitors BIU activity and organizes information on network activity into Network Transaction Journal; Network Command Processor (NCP) in BSC provides control services to all users on network.

Protocols • Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) creates a virtual token passing system; provides predictable response times and maintains stability under heavy load conditions.

Support Software • NETEX (Network Executive) software supports minicomputer-to-minicomputer communication; NETEX coresides with operating system on each minicomputer • NETEX makes HYPERbus transparent to host operating system, requires application-level programming calls to utility programs or to NETEX services; HYPERbus is transparent to RS-232C or 3270 connections • optional Bus Service Center (BSC) on HYPERbus, includes CP/M-compatible software used for monitoring, directory, and diagnostic services.

Distributed Functions • not part of HYPERbus; must be provided by application programs and hosts interconnected by HYPERbus.

First Delivery • January 1983.

Systems Delivered • 55 network systems (2500 nodes) as of January 1985.

Comparable Systems • similar to Xerox Ethernet and Ungermann-Bass Net/One baseband except collision avoidance technique makes it operate like Datapoint ARCNET token passing scheme; also compatible with HYPERchannel for connection to mainframe hosts • HYPERbus only local area network to provide priority traffic.

Vendor • Network Systems Corporation (NSC); 7600 Boone Avenue North, Minneapolis, MN 55428 • 612-425-2202.

Canadian Headquarters • Network Systems, Ltd; Suite 200, 5955 Airport Road, Mississauga, ON L4V 1R9 • 416-676-1663.

Distribution • through 33 NSC sales offices in United States and Canada, 3 sales offices in Western Europe, and through distributors in Australia and Japan.

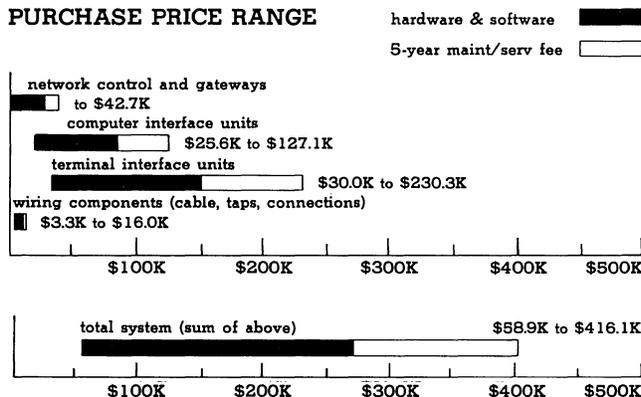
GSA Schedule • listed.

■ ANALYSIS

HYPERbus is a natural extension of Network Systems HYPERchannel local area network, which has been the Cadillac of the industry for over 5 years. The 50M-bps data rate of the baseband HYPERchannel is not required for the terminal and minicomputer traffic HYPERbus was designed to support, thus the HYPERbus data rate is reduced to 10M bps. HYPERbus, however, uses a similar architecture to HYPERchannel, the same CSMA/CA access scheme, similar frame formats, and the same higher level NETEX software.

Interfacing to HYPERchannel is quite expensive, and Network Systems has reduced the cost of interfacing to HYPERbus by the simple technique of providing multiple ports (up to 16) through

PURCHASE PRICE RANGE



NSC HYPERBUS PURCHASE PRICE • SMALL SYSTEM includes all basic components to interconnect 100 terminals with 2 minicomputers on HYPERbus and all interconnecting units and cables; includes 9 B116 16-port async BIUs; 2 B113 4-port async BIUs; 1 B403 Minicomputer DMA BIU; 3 BJT1 combined Jack/Tap units; 12 BG40 40-foot bus drop-cables; and 100-foot BB10 bus trunk coaxial cable • **LARGE SYSTEM** includes all basic components to interconnect 500 terminals with 4 minicomputers on HYPERbus, Bus Service Center (BSC), interface to HYPERchannel, all interconnecting units and cables, and 5-year maintenance fee; includes 47 B116 16-port async BIUs; 1 B113 4-port async BIU, a B403 Minicomputer DMA BIU; BSC1 Bus Service Center, B700 HYPERchannel Access BIU; 13 BJT1 combined Jack/Tap units; 49 BG40 40-foot bus drop-cables; 300-foot bus trunk cable; and 5-year maintenance fee • software/firmware included with hardware • both configurations assume 1 computer port is required for each 2 terminal ports.

NSC HYPERbus Baseband Local Area Network

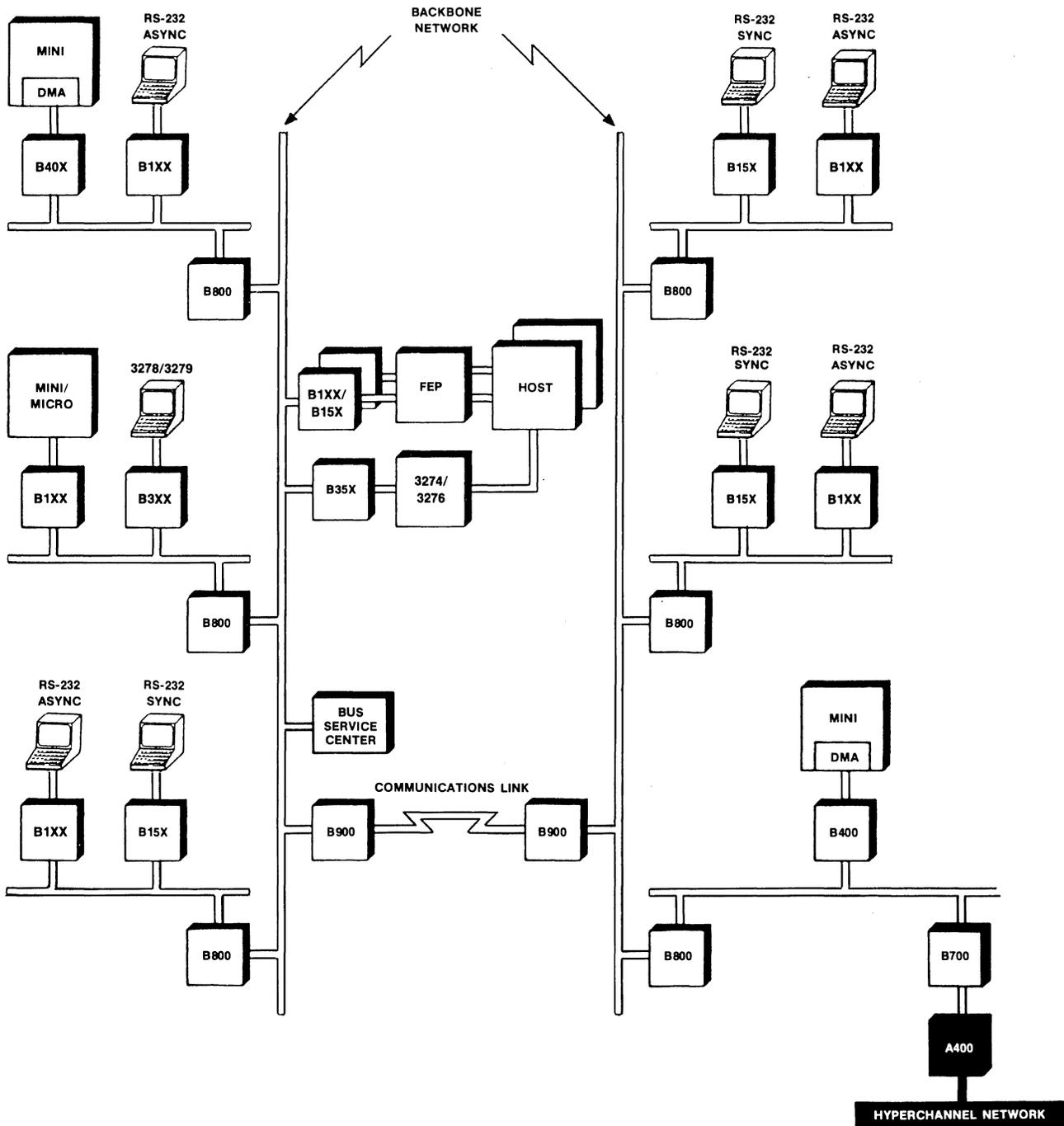


Figure 1 • HYPERbus network configuration.

each Bus Interface Unit (BIU).

HYPERbus reflects Network Systems' long experience with local area networks. It is flexible and comprehensive in its design, allowing configurations with as few as 2 taps, which support up to 8 BIUs and up to 128 terminals. This simple system can be expanded to up to 100 taps or 200 BIUs, which can be attached through as few as 50 taps and can support up to 3,200 terminals.

Local networks can be configured for departments or divisions in a company and interconnected through link BIUs and a backbone network. The backbone network and link BIUs can also provide access to the mainframe computers interconnected through HYPERchannel.

HYPERbus can be further extended by interconnecting remote HYPERbus segments through data communication links.

NSC HYPERbus

Baseband Local Area Network

One or more Bus Service Centers (BSCs) can be interfaced to HYPERbus to operate as monitor stations(s). The Bus Service Center (BSC) can implement sophisticated network services providing for logical addresses on HYPERbus with automatic address translation and routing of messages. Network management facilities also include security provisions to protect network facilities. Data and program protection resides in the interconnected computers.

Also, the CSMA/CA access method provides predictable/deterministic access to the bus, eliminating one of the severest criticisms of the Ethernet CSMA/CD access scheme. Also, HYPERbus provides guaranteed message delivery instead of the Datagram service provided by Ethernet. Each message transmission consists of 4 frames organized in 2-frame pairs. The first frame pair insures that the destination is able to receive the message; the second frame pair consists of the message transmission and its acknowledgement. Network users are notified if messages cannot be delivered and why.

HYPERbus gives Network Systems a local area network that has more universal appeal than HYPERchannel in this era of office automation. Plus, the 2 systems can operate together for larger companies that need to interconnect multiple mainframes with dispersed minicomputers and terminals. Most of the HYPERbus systems currently installed are standalone networks, only a few have gateways to HYPERchannel.

An important market for HYPERbus is in IBM 3270 networks. Using HYPERbus, the IBM 3274/3276 controller can be totally disconnected from the 3278/3279 Display Terminals and 3268 and 3287 Printer Terminals. The controllers and terminals attach to HYPERbus through standard Bus Interface Units (BIUs).

Network Systems has announced that HYPERbus can be integrated with the IBM Cabling System. In IBM 3270 networks, the IBM Cabling System can be used to connect the controllers and displays to BIUs. All traffic beyond the BIU is on HYPERbus. Connection to HYPERbus through the RS-232C ports on the Bus Interface Units (BIUs) is totally transparent to the attached devices. Anything can be attached to the RS-232C port: display terminal, printer, personal computer, minicomputer, or mainframe. Terminals and computers can be located anywhere on HYPERbus. As a rule of thumb, about one RS-232C computer port is required for every 2 terminal ports. Reliance on RS-232C ports for its LAN is not unique with HYPERbus. Other LAN vendors use the same technique to extend connectivity of computer and terminals without requiring any changes to the software of the attached devices.

□ Strengths

HYPERbus is a flexible, well-designed local area network from a long-established and experienced company that produced the well-designed HYPERchannel local area network. The company was founded in 1974 and has produced interfaces to virtually all the large mainframe systems on the current market. HYPERbus uses a proven collision avoidance architecture that does not contain the drawbacks found in CSMA/CD systems. The system can start small and grow to accommodate almost any configuration, both local and remote.

HYPERbus is simple to use. Interfacing to HYPERbus using the RS-232C ports on Bus Interface Units (BIUs) is transparent to the attached devices. It requires no changes to the software running on the attached devices.

□ Limitations

The most severe limitation for HYPERbus is that its architecture does not conform to any of the IEEE 802 Committee's proposed standards.

HYPERbus supports standard RS-232C devices and IBM 3270-compatible terminals and controllers. These 2 types of devices are the most prevalent in the data processing market—both are essentially universal products.

■ NETWORK SUMMARY

HYPERbus is a high-speed communication network system designed to extend high-performance digital networking to users of RS-232C terminals, 3270 terminals, CAD/CAM systems,

mini-micro subsystems and process-control equipment. It provides a common communication facility that can be shared by all attached resources to optimize applications running on the attached computers.

HYPERbus supports a wide variety of asynchronous and synchronous terminals and minicomputers, using different protocols. Many different applications can simultaneously utilize a common network on a peer-to-peer basis. Coaxial cable is the multidrop bus. Data is transmitted in bursts throughout the system at a baseband data rate of 10M bps.

To ensure a continuous flow of messages throughout the system, HYPERbus uses a Carrier Sense Multiple Access, Collision Avoidance (CSMA/CA) contention scheme. The collision avoidance method provides a virtual token passing scheme with predictable response times; it also maintains stability at high usage levels. The virtual-token method allocates the channel using prescribed time slots for units to obtain bus control, thus, there are no collisions to avoid. Traffic on the bus is prioritized into these categories: ALERT, NORMAL, or BACKGROUND.

HYPERbus networks are flexible; multiple HYPERbuses can be interconnected with individual buses utilizing different media and protocols. By organizing HYPERbuses into a hierarchical structure, large complex networks can be configured. In addition to coaxial cable, these networks can use other media such as fiber optic cable. Through connection to common carrier and satellite facilities, multiple local HYPERbus networks can be interconnected across geographic distances.

Equipment is connected to the network through a microprocessor-based Bus Interface Unit (BIU). Each BIU contains 2 microprocessors: 1 on the bus side, the other on the device side; both share common random access memory (RAM). Both microprocessors in a BIU are assured access to the shared RAM via an arbitrator. The bus side microprocessor uses preset contention settings in its associated bus jack unit to designate the contention position of a BIU. An electrically erasable programmable read-only memory (EEPROM) on the device side contains the parameters of each device connected to the BIU.

The intelligence of the BIUs eliminates the need for a central controller. Each HYPERbus can accommodate up to 200 BIUs on a cable up to 400-feet long (maximum length a function of number of taps and type of cable). A BIU can connect up to 16 devices and handle up to 64 virtual circuits. BIUs plug into an outlet, which facilitates ease of relocation of the BIU and its associated equipment by the user, eliminating the need to rewire the network. A BIU buffer receives data from attached devices and transmits it over the coaxial cable in high-speed bursts. The receiving BIU buffers data received from the bus and passes it to the designated receiving device.

Data is transmitted onto the bus, one frame at a time. Each frame consists of a 16-byte envelope and 1 to 4096 bytes of data. Frame generation, its transmission, and its retransmission in case of error are transparent to the user. The data stream from the device attached to the BIU is enclosed in the envelope in the frame by the transmitting BIU. The receiving BIU removes the envelope from the frame and delivers only the data stream to the receiving digital equipment.

Users can access the HYPERbus system in 1 of 3 ways: direct dialing; emulating an 801 auto-call unit; or default dialing either at the BIU or through the optional Bus Service Center (BSC). The BSC can perform a variety of system monitoring, directory, and diagnostic functions. The addressing scheme is hierarchical. Dialing across the network is transparent to data protocols.

BIUs are available in 7 categories, according to application: B100 Series to connect RS-232C asynchronous or synchronous devices or host ports to HYPERbus; B200 Series attach RS-232C equipment via modems to HYPERbus and provide dial-in/-out facilities through the public networks. B300 Series to connect IBM 3270-compatible devices; B400 Series to connect minicomputers through parallel interfaces; B700 Series to connect HYPERchannel to backbone HYPERbus; and B800/B900 Series to link HYPERbus segments directly (B800) or through communication facilities at up to 1.544M bps. BIUs have multiple ports. One BIU model supports up to 16 ports; B300 BIUs are limited to 8 ports.

NSC HYPERbus Baseband Local Area Network

One or more optional Bus Service Centers (BSCs) can be included in a HYPERbus system. The BSC provides 4 major categories of services: directory services, system network monitoring, journaling, and diagnostics. BSCs implement these services can be spread throughout a HYPERbus installation. For example, with 4 buildings interconnected through HYPERbus segments, a BSC monitor could be placed in each building and 1 BSC could gather summary data from the other 3. Maintenance modules can be located wherever they are needed. Although a BSC is optional, NSC recommends it for networks of 100 or more terminals.

■ SOFTWARE

□ NETEX—Network Executive

When minicomputers within the HYPERbus network are interconnected to the HYPERchannel network (via B400 and B700 BIUs and an A400 HYPERchannel adapter), the NETEX software of HYPERchannel is utilized. NETEX not only logically links the 2 systems, but permits the minicomputers on the HYPERbus network to directly access the mainframe channels and associated equipment on HYPERchannel. NETEX assumes responsibility for delivery of data to its destination once it accepts data. It handles flow control, error recovery, and special conditions associated with satellite transmission. NETEX allows applications on the same host to share HYPERchannel as well as to communicate with each other.

A version of NETEX, which is coresident with the operating system of each minicomputer, allows minicomputer-to-minicomputer communication over HYPERbus. NETEX software provides for task-to-task communications as well as bulk file transfers.

■ HARDWARE

□ Terms & Support

Terms • NSC hardware is available for purchase or lease including a special 90-day lease arrangement; both purchase and lease prices include NSC jack/tap verification and BIU installation; network configuration is normally a joint NSC/customer responsibility; building wiring is customer responsibility with NSC providing electrical verification at no charge • the final network installation step includes installing each BIU in its designated position, profiling each BIU for proper operation with its attached device, connecting the device, and verifying proper network operation.

Support • most devices carry a basic monthly maintenance fee for support; static devices such as B110 wall outlets carry a time-and-materials charge for maintenance.

□ HYPERbus Basic Components

The HYPERbus system components are Bus Interface Units (BIU), BIU Dial Pad Units (DPU), Bus Jack Unit (BJU), coaxial cable Bus Tap Unit (BTU), Coaxial Cable, Bus Tap to Bus Jack Coax, Bus Jack to BIU Coax, and Dial Pad Cable. See Figure 2. A Bus Service Center (BSC) is optional.

Bus Interface Units

Bus Interface Units (BIUs) interface single or multiple (up to 16) devices to HYPERbus, and differ according to the devices connected to them. The BIU includes 2 microprocessors which share memory.

One microprocessor provides the interface to the device and the other provides the interface to the HYPERbus cable. The shared memory provides the data buffers for passing data between the device and the HYPERbus network.

The BIU implements the CSMA/CA protocol for bus access, generates the frame for data transmission, strips off the frame for data reception, checks the message for errors, handles retransmission (up to 16 times) if message is in error, delays transmission until its next turn if destination BIU is unable to receive, and passes data between the attached device and BIU memory. The BIU also stores the profile/characteristics of the attached device.

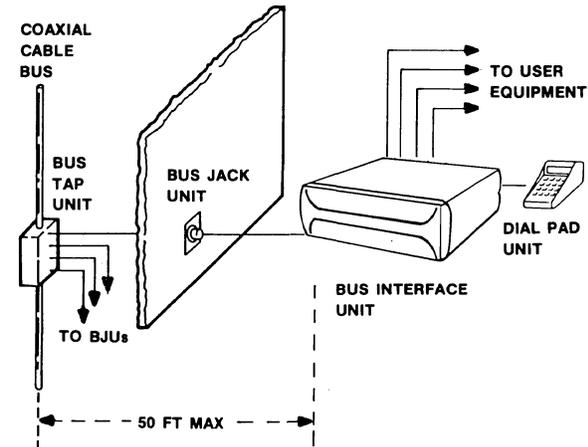


Figure 2 • HYPERbus component interconnections.

Each BIU has a set of 4 hexadecimal switches; 2 switches define its unique unit number on HYPERbus. The other switches define whether the BIU is part of a chain of equivalent BIUs for attachment to ports on a host computer, the BIU's position in the chain, or other parameters.

The BIU contains electrically erasable PROM (EEPROM) to store profile information. Profile parameters are entered into the EEPROM at initial installation from the BP10 Dial Pad or from a Bus Service Center. Once initialized, a profile can be permanently changed only through a port operating in Privileged mode, providing the operator enters a security code.

Selected profile parameters can be temporarily altered on a session-by-session basis. Profile parameters are divided into select functions, such as enter Privileged mode, initial EEPROM, and change password, network, connection parameters and device parameters.

Addressing is established through a BIU's unit number, set in hexadecimal switches. The address is further defined by a device's port number on the BIU. A station on the network can address a unit through direct dialing, logical dialing using a Bus Service Center, or rotary dialing. With rotary dialing, equivalent BIUs are identified by 1 address and the port number used is "00." This allows multiple BIUs to implement multiple ports into a common computer resource, and a request for access to the system connects to the first available BIU port. This is a specific internal parameter used only for this purpose, (see Figure 3). The Bus Service Center can optionally be dialed. Then various services can be accessed: short dialing, logical dialing to specified destination, logical dialing to system service, or specialized services.

B1XX Series Bus Interface Units • consist of B11X, B12X, and B153 models • emulate modems and accommodate large range of RS-232C-interfaced devices and protocols; provide for direct user dialing of network connection through a Dial Pad connected to the BIU and associated with the attached device, or through an RS-366 Auto-call interface if BIU is attached to computer • B11X and B12X BIUs support RS-232C-interfaced asynchronous devices and B153 BIU supports RS-232C-interfaced synchronous devices.

B113 RS-232C Async Term BIU (4 Ports) • provides 4 asynchronous RS-232C Data Terminal Equipment (DTE) ports to HYPERbus; supports terminal speeds up to 9600 bps; the terminals' keyboard and screen used for dialing within HYPERbus:

\$93/\$83/\$62 mo	\$1,950 prch	\$17 maint
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B114 RS-232C Async Term BIU (8 Ports) • same as B113 except provides 8 DTE ports:

136/122/92	2,860	25
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NSC HYPERbus Baseband Local Area Network

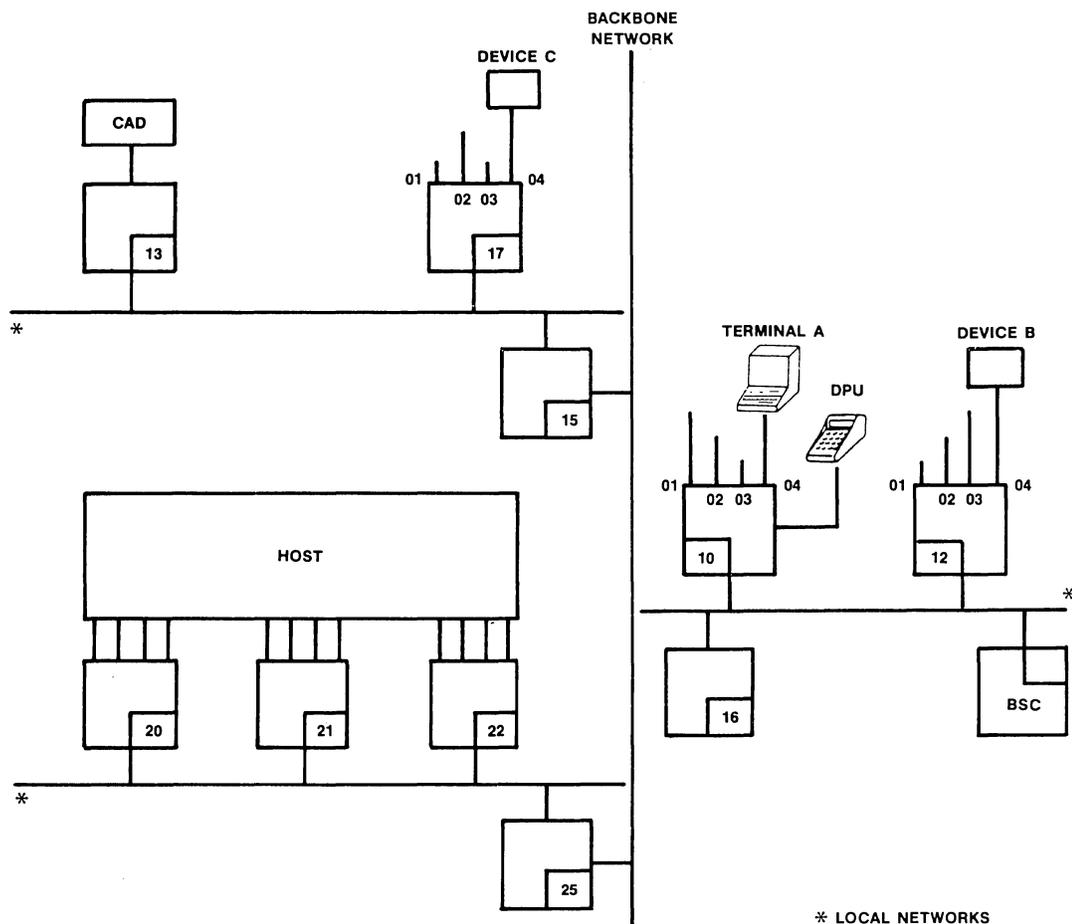


Figure 3 • HYPERbus addressing for dialing.

B116 RS-232C Async Term BIU (16 Ports) • same as B113 except provides 16 DTE ports:

222/199/150	4,680	41
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B123 RS-232C Async Term BIU (4 Ports) • supports 4 asynchronous RS-232C DTEs and dialing within HYPERbus from terminal's keyboard and screen • port data rate to 19.2K bps:

143/128/96	3,000	17
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B124 RS-232C Async Term BIU (8 Ports) • supports 8 asynchronous RS-232C DTEs and dialing within HYPERbus from terminal's keyboard • port data rate to 19.2K bps:

209/187/141	4,400	25
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B126 RS-232C Async Term BIU (16 Ports) • supports 16 asynchronous RS-232C DTEs and dialing within HYPERbus from terminal's keyboard and screen • port data rate to 19.2K bps:

342/306/230	7,200	41
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B153 RS-232C Sync Term BIU (4 Ports) • supports 4 RS-232C DTEs and 4 BP10 Dial Pad Units, 1 per DTE:

200/179/134	4,200	24
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B200 Series Bus Interface Units (BIUs) • B200 Series, unlike B100 Series, attach to RS-232C devices through modems; B20X models support RS-232C interfaced asynchronous devices and B25X models support RS-232C interfaced synchronous devices; both series of models provide dial-in/dial-out support for devices connected to HYPERbus network.

B203 RS-232C Async Comm BIU (4 Ports) • supports 4 asynchronous RS-232C DCEs • accommodates modems connected to dedicated or switched (DDD) lines; accommodates auto-answer modems • full-duplex port; data rate to 9600 bps:

195/174/131	4,100	24
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B253 RS-232C Sync Comm BIU (4 Ports) • supports 4 synchronous RS-232C DCEs • accommodates modems connected to dedicated or switched (DDD) lines; accommodates auto-answer modems • full-duplex port; data rate to 9600 bps:

209/187/141	4,400	25
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B3XX Series Bus Interface Units (BIUs) • interface IBM 3270 terminals and controllers to HYPERbus network; B300 models appear as controllers to 3270 terminals and B350 models appear as terminals to IBM 3274 controllers; provides dial-in switching between terminals and controllers • support IBM 3278, 3279 terminals and 3268/3287 printers (including color).

B323 IBM 32XX Device BIU (4 Ports) • supports 4 IBM 3278 terminals or 3287 printers; dialing from terminal's keyboard and

MO: monthly charge; first figure is 90-day rental, second figure is 1-year lease, and third figure is 3-year lease. PRCH: purchase price. MAINT: monthly maintenance charge. T/M: charge by time and materials. NA: not available/applicable. Prices current as of March 1985.

NSC HYPERbus Baseband Local Area Network

screen:

189/169/127 3,980 21

B324 IBM 32XX Device BIU (8 Ports) • supports 8 IBM 3278 terminals or 3278 printers; dialing is from terminal's keyboard and screen:

251/224/169 5,280 30

B333 IBM 32XX Device BIU (4 Ports) • supports 4 IBM 3278/3279 color terminals or 3287 color printers; dialing from terminal's keyboard and screen:

NA/NA/NA NA NA

B334 IBM 32XX Device BIU (8 Ports) • same as B333 except with 8 ports:

NA/NA/NA NA NA

B350 IBM 3274 Controller BIU (4 Ports) • supports 4 IBM 3274 controller terminal lines:

214/191/144 4,500 26

B351 IBM 3274 Controller BIU (8 Ports) • supports 8 IBM 3274 controller terminal lines:

271/242/182 5,700 32

B400 Minicomputer BIU • interfaces minicomputer to HYPERbus through Direct Memory Access (DMA) port • connects to 16-bit parallel ready/resume interface available on wide range of minicomputers • supports NSC's PIXX Process Interface Expansion Options • data rates to 10Mbps and 64 virtual circuits; also supports HYPERchannel network message format and A400 HYPERchannel adapter commands at user interface:

285/255/192 6,000 34

B403 Minicomputer BIU (4 Ports) • same as B400 except provides 4 ports:

495/408/307 9,600 54

B700 HYPERchannel Access BIU • interfaces HYPERbus to HYPERchannel system through A400 Network Adapter:

292/261/197 6,150 35

B800 Direct Bus Link BIU • provides 2 HYPERbus connections to link directly to 2 HYPERbus coaxial cable systems • maximum number of circuits is 64.

B800B3 Direct Bus Link • with 64K-byte memory:

238/213/160 5,000 27

B800B5 Direct Bus Link • with 192K-byte memory:

333/298/224 7,000 37

B91X Communications Link BIU • provides 2 HYPERbus connections to 2 separate HYPERbus systems through standard communication facilities • full-duplex data rates to 1.5M bps • can be configured with various electrical interfaces: RS-232C, RS-449, M188/422, Bell 306/V.35, and NSC LIT series modems (AT&T 306 type interface).

B910B3 AT&T 306/V.35 Interface • with 64K-byte memory:

311/278/210 6,550 35

B910B5 AT&T 306 V.35 Interface • with 192K-byte memory:

406/363/274 8,550 46

B911B3 RS-449 Interface • with 64K-byte memory:

311/278/210 6,550 35

B911B5 RS-449 Interface • with 192K-byte memory:

406/363/274 8,550 46

B912B3 RS-232 Interface • with 64K-byte memory:

311/278/210 6,550 35

B912B5 RS-232 Interface • with 192K-byte memory:

406/363/274 8,550 46

B914B3 Mil-188/422 Interface • with 64K-byte memory; available July 1984:

311/278/210 6,550 35

B914B5 Mil-188/422 Interface • with 192K-byte memory; available July 1984:

406/363/274 8,550 46

BM92 Memory Upgrade • field upgrade for B900; increases memory from 64K bytes to 192K bytes:

119/106/80 2,500 13

CN123 Converts B113 BIU to B123 BIU • field installable; one-time installation charge of \$200 for both purchased and leased BIUs:

50/45/34 1,050 NA

CN124 Converts B114 BIU to B124 BIU • field installable; one-time installation charge applies to both leased and purchased systems:

73/65/49 1,540 NA

CN126 Converts B116 BIU to B126 BIU • field installable; one-time installation charge applies to both leased and purchased systems:

120/107/81 2,520 NA

Bus Service Center (BSC)

The BSC is an optional network control center for HYPERbus. It operates as a system resource to provide special directory and administrative services to the HYPERbus. It offers connect level and system level user interaction. The connect level allows the user to access network resources and to alter certain parameters on the BIU port through a particular session. The system level supports all connect level functions as well as connecting, disconnecting, and performing operations on any port in the system. The BSC offers the user a network command processor for network control.

The BSC performs 4 basic system functions. It provides a journal of BIU information frames and gathers statistics on network traffic. It supervises the networks and provides security through limiting access to network resources according to the BIU control parameters. It enhances maintenance access to individual BIU operations. It provides directory services such as dialing a logical destination using translation tables stored in BSC; establishes third-party connections; and assists in dialing or verifies connections.

The BSC complements the intelligence of the BIUs. Multiple BSCs can be placed on a HYPERbus system. The BSC interfaces to HYPERbus through a standard BTU and BIU and a specially programmed BIU.

BSC1A Bus Service Center • optional network control center for HYPERbus • provides directory, monitoring, and maintenance services throughout HYPERbus network • includes superbrain minicomputer, BIU, disk drive, printer, and associated software packages to provide directory, monitoring, and maintenance services:

\$1,220/\$1,091/\$822 mo \$25,675 prch \$147 maint

Other HYPERbus Components

BP10 Dial Pad Unit • enables users to address any BIU in HYPERbus system from standard 12-key telephone pad; includes 4 function keys, and 16-digit alphanumeric readout:

\$5/\$4/\$3 mo \$95 prch T/M maint

BJ10 Bus Jack Unit (Wall Outlet) • standard outlet for connection of a BIU to coaxial cable bus through drop cable to bus tap unit (BT40); contains selectors to set parameters at installation time to reflect physical location on the HYPERbus and its position in system contention timing scheme:

NA/NA/NA 50 T/M

BT40 Coax Cable Bus Tap—Quad • connects up to 4 BJ10 Bus Jack Units to HYPERbus coaxial cable; provides piercing tap with impedance buffering electronics to decouple power losses; power drawn from attached BIU:

NA/NA/NA 275 T/M

BJT1 Combined Jack/Tap—Quad • provides tap connection to HYPERbus for 4 user connections through BIUs; includes piercing tap with impedance buffering to decouple power losses, 4 sets of physical location parameters for contention timing scheme; power drawn from an attached BIU:

24/21/16 495 3

NSC HYPERbus

Baseband Local Area Network

BB10 PVC Trunk Coax (HYPERbus) • PVC coaxial cable for use with HYPERbus • per foot:

NA/NA/NA	2	NA
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BB20 PFA/FEP Trunk Coax (HYPERbus) • PFA/FEP Teflon-coated coaxial cable for use with HYPERbus where bus is installed in return air plenums • per foot:

NA/NA/NA	5	NA
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BEXX Dial Pad Cables • multiconductor cable for connecting DP10 Dial Pad to a BIU (1 required for each DP10); includes quick-connect connectors.

BE10 • 10-foot Dial Pad Cable:

1/1/1	9	NA
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BE25 • 25-foot Dial Pad Cable:

1/1/1	16	NA
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BE50 • 50-foot Dial Pad Cable:

1/1/1	25	NA
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BFXX Jack Drop Cables • twin subminiature coaxial cable with connectors; connects a single bus jack (BJ10 wall outlet) to a bus tap (BT40) • can be ordered in Teflon or PVC.

BF10 • 10-foot Jack Drop Cable:

NA/NA/NA	47	NA
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BF20 • 20-foot Jack Drop Cable:

NA/NA/NA	76	NA
----------	----	----

BF30 • 30-foot Jack Drop Cable:

NA/NA/NA	105	NA
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BF40 • 40-foot Jack Drop Cable:

NA/NA/NA	134	NA
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BGXX BIU Drop Cables • connect BIUs to BJ10 Wall Jack or combined Jack Tap.

BG10 • 10-foot BIU Drop Cable:

2/2/2	47	NA
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BG20 • 20-foot BIU Drop Cable:

4/3/2	76	NA
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BG30 • 30-foot BIU Drop Cable:

5/4/3	105	NA
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BG40 • 40-foot BIU Drop Cable:

6/6/4	134	NA
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BG50 • 50-foot BIU Drop Cable:

8/7/5	163	NA
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□ Specification

HYPERbus is a packet-switched network, compatible with Network Systems' 50M-bps baseband HYPERchannel network. Both use a similar CSMA/CA access scheme and similar packet formats. HYPERbus provides ALERT, NORMAL, and BACKGROUND message priorities for traffic over the bus. Priority is established for each port through its Dial Pad Unit, auto-call unit, or from the optional Bus Service Center when it is included in the configuration.

HYPERbus systems use a hierarchical bus structure. At its simplest, HYPERbus includes a local area network that interconnects devices through up to 200 BIUs on a cable up to 4,080-feet long. The local area network can be extended to interconnect multiple HYPERbus segments through a backbone bus and link BIUs. The system can be extended farther by adding more HYPERbus segments, more link BIUs, and multiple backbone buses. In geographically extended environments, multiple HYPERbus segments can be interconnected through link BIUs and a data communication link between the backbone buses that interconnect multiple HYPERbus segments. Multiple data communication links interconnect HYPERbus segments located at multiple remote sites.

HYPERbus systems can also be configured to interconnect with HYPERchannel networks through a link BIU. This allows

terminals and minicomputers on HYPERbus to access files and applications on mainframes connected to HYPERchannel.

Packet Format

Data is transmitted throughout the HYPERbus network through Bus Interface Units (BIUs), in packets to and from minicomputers or between minicomputers. The BIU controls the transmission. There are typically 4 transmissions associated with a single message transmitted over HYPERbus. The source BIU sends a frame interrogating the destination BIU about available buffer capacity to receive a message. The destination BIU replies with an ACK or NAK acknowledgement in response to the interrogation. An ACK is a positive acknowledgement; its receipt by the source BIU triggers the transmission of the message frame. A NAK triggers the release of the bus and restarts the timer, but the message is retained. Upon receipt of a frame of the correct length and CRC characters, the destination BIU returns an ACK. The origination BIU releases the bus, (the carrier is terminated) and the controlled time sequence passes control to the next BIU with data to transmit.

If the destination BIU cannot receive the message from the source BIU because it lacks available buffer space or for some other reason, it sends a NAK to the source BIU. The source BIU releases HYPERbus but retains the message in its buffer so it can attempt to transmit it again when the BIU receives control of the bus. The number of times a BIU attempts to deliver a message before it notifies the originator or Bus Service Center is a system parameter.

If the destination BIU is malfunctioning or is off-line and returns neither an ACK or NAK, the origination BIU will retry up to 16 times before notifying the user or the Bus Service Center.

If a destination BIU receives a message in error, it sends a NAK frame back to the source BIU with an error code defining the type of error. The source BIU retransmits the message up to 64 times before it notifies the user or the Bus Service Center of an unsuccessful transmission.

Format • each frame includes a 16-byte envelope and 1-byte to 4K-byte message • frame includes: 1-byte frame character, 1-byte protocol function code, 2-byte origination address (1-byte physical address and 1-byte logical address), 2-byte destination address (1-byte physical address and 1-byte logical address), 1-byte message priority (ALERT, NORMAL, BACKGROUND), 2-byte length-of-frame byte count, 1-byte to 4K-byte message, and 2-byte CRC • other formats are used for higher level protocols and control message sessions using the HYPERbus network command processor.

Transmission Characteristics

Channel Encoding • uses a modified form of Manchester Encoding, designated as Modified Frequency Modulation (MFM).

Data Rate • 10M bps.

Control Procedures

HYPERbus utilizes a Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) scheme, the same as the one used with HYPERchannel. Its implementation makes it similar to token passing, except a virtual token is used. Collisions are avoided because control is passed from station to station using a timer and allocating a time slot to each station on the bus. During its time slot, a station can take control provided no station preceding it in the time sequence captures control. Thus, unlike CSMA/CD, HYPERbus eliminates collisions and back-offs; access to the bus is predictive.

The contention resolution scheme avoids collisions on the bus. Calibration switches on each bus jack unit define the attached BIU's position in the contention resolution scheme, thus BIU's can be moved around fully without changing the switch settings.

The contention resolution scheme gives each BIU a unique time slot during which it can initiate a transmission of up to 4096 data bytes in length. After transmission, a BIU cannot transmit again until its next time slot comes around. HYPERbus supports message transmission at 3 priority levels: Alert, Normal, and Background. This scheme ensures that high priority traffic is not shut out by low

NSC HYPERbus Baseband Local Area Network

priority traffic. The priority is set individually for each port in the BIU's firmware via the user dial pad or the BSC.

Once a station captures the bus, it retains control until it has transmitted at least 4 frames: an inquiry frame asking the destination if it is able to receive a message, an "ACK" or "NAK" response frame to the inquiry, the message frame, and the ACK or NAK response frame to the message frame.

Transmission Medium

The transmission of the signals through the network's Bus Interface Units (BIUs), Bus Jack Units (BJUs), Bus Tap Units (BTUs), and the bus coaxial cable is conducted in 10M-bps bursts. The bus coaxial cable is coated with either polyvinyl chloride (PVC) or Teflon. Signal gain and loss is measured in decibels (dB). HYPERbus is designed as a 20 dB system which means the signal loss for transmission between any 2 BIUs on the system cannot exceed 20 dB. The loss is 0.0028 dB per foot on the coaxial cable, 0.088 dB for each tap pass and a fixed 5.216 dB for the sum of send tap, receive tap, and send/receive bus drop cables.

The length of the interconnecting bus can be extended to remote areas for a small number of taps with a cable that has less than 0.0028 dB per foot loss. See Figure 4.

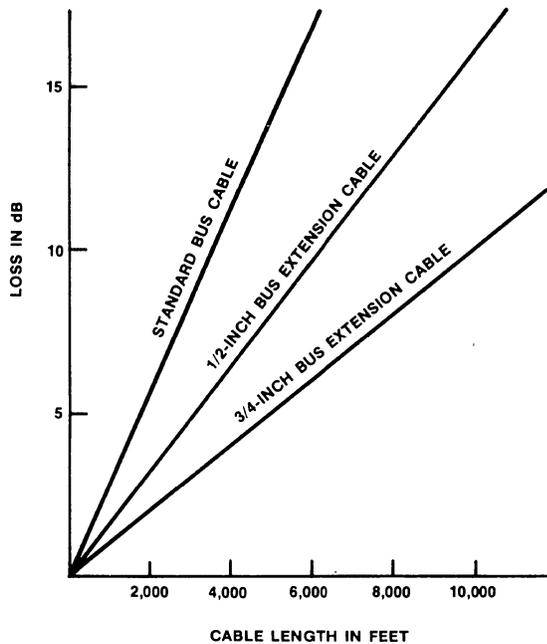


Figure 4 • comparative loss in dB for different cables.

A HYPERbus configuration can range from a 4,080-foot cable with 2 taps to a 3,100-foot cable with 100 taps. A tap can be used to connect up to 4 BIUs to HYPERbus and a single HYPERbus segment is limited to 200 BIUs. Thus, a typical configuration is likely to range from 10 to 32 taps with a cable length of 1,000 to 4,000 feet, (see Figure 5).

The combined length of the drop cable from the Bus Tap Unit to the Bus Jack Unit and from the Bus Jack Unit to the Bus Interface Unit is limited to a maximum of 50 feet.

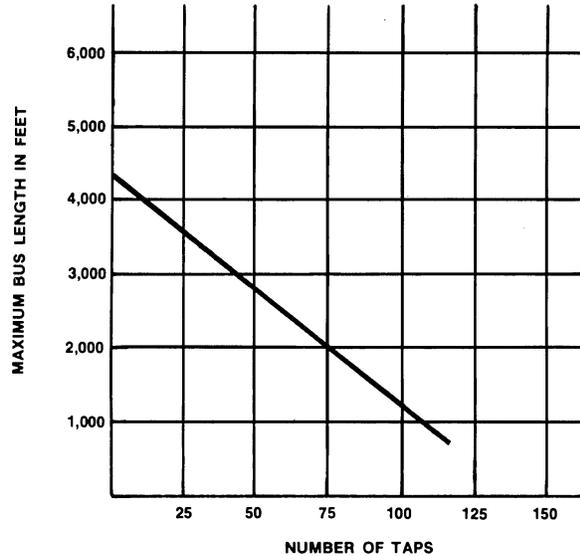


Figure 5 • maximum cable length as function of number of cable taps.

In a typical installation, the coaxial cable is generally run in a false ceiling, cable raceways, and elevator shafts.

Each Bus Tap Unit provides a means of tapping into the bus for up to 4 drop coaxial cables to connect Bus Jack Units. This unit consists of a piercing type tap and impedance buffering electronics to decouple power losses. Each BTU connects to a Bus Jack Unit by means of 2 subminiature coaxial cables.

The Bus Jack Unit is a wall-mounted outlet that interconnects a BIU to HYPERbus through a BTU. A set of selectors in the BIU defines the physical location along the bus of the associated taps and the position of the BIU in the contention timing scheme. An additional control wire contains the 8-bit contention selection. The functions of both a BTU and 4 BJUs are available in 1 composite unit (a BIT1).

Use

HYPERbus is a multidrop, coaxial cable system with speeds up to 10M bps, that extends high-performance digital networking to the users of RS-232C terminals, IBM 3270 terminals, CAD/CAM systems, mini-micro subsystems, personal computers, and process control equipment. The minicomputers that are presently supported by HYPERbus are: DEC Unibus, Massbus, LSI bus; Data General MODCOMP; Perkin-Elmer; Hewlett-Packard 3000; Honeywell Level 6; Prime; Tandem; AT&T 313B20; SEL 32; STRATUS; and all minicomputers using the Multibus architecture. In addition to its utility as a standalone local area network, it is designed to operate with backbone bus segments that interconnect multiple local HYPERbus networks with HYPERchannel and with remote HYPERbus segments.

HYPERbus is primarily used as a standalone network interconnecting terminals, computers, printers, and personal computers. It is also used to interconnect networks of IBM 3270 Display/Printer Terminals (3278/3279/3268/3287) with IBM 3274/3276 controllers. It can also be integrated with the IBM Cabling system.

• END

NSC HYPERchannel

High-Speed Baseband Local Area Network

■ PROFILE

Architecture • NSC HYPERchannel.

Type • multipoint (multidrop) baseband local networking bus interconnects processors and peripherals via adapters for resource sharing • uses CSMA/CA (collision avoidance) access scheme similar to HYPERbus.

Transmission Speed • up to 50M bps on local network; up to 44.7M bps over T3 AT&T Telephone links.

Cable Length • 1 mile on local coaxial cable; repeater extends length to 3 miles; fiber optic cable will extend length farther.

Applications • interconnection of multiple vendors' mainframe and minicomputer CPUs and peripherals with high-performance communication requirements • see Figure 1.

Configuration • up to 256 devices can be addressed on local cable; typical configuration is 1,000-foot trunk with 16 drops • can be extended with high-speed terrestrial and satellite links.

Interface • NSC AXXX adapters.

Gateways • through Link Adapters to high-speed terrestrial carrier facilities such as AT&T T1/T2/T3 service, microwave, fiber optic cable, DDS service, and satellite communication links.

Support of Foreign Devices • hosts: AT&T 3B20S; Amdahl

V7/V8; Apollo Multibus; CDC 6000/7600; CY70/170/176; CDC 1700; Cray/Cray 1; Sperry 1100/494/418III; Burroughs B 700/B 800 Series; Computervision; Calma; Honeywell L66/L68; IBM S/360/370/303X or IBM S/370-compatible systems; Digital Equipment UNIBUS/MASBUS/LSI-Bus systems; Data General I/O bus systems; MODCOMP Modular Bus system; Perkin-Elmer I/O Bus systems; Tandem I/O controller; Harris; Gould SEL 32; CII Honeywell Bull L64; Siemens 6; HP 1000; HP 3000; and Prime 50 for data communication • devices: all that connect to IBM Block Multiplexer channel, Cray and CDC disk controller for CDC 819 disk.

Communications Management • firmware in link adapters implement protocols comparable to the 2 lowest-level protocols (Physical and Data Link layers) of the OSI (Open Systems Interconnection) model of the ISO (International Standards Organization): Physical and Data Link levels • NETEX software running in host system implements protocols comparable to the next 3 levels of the OSI model: Network, Transport, and Session layers • NETEX (for LAN) is similar to IBM's VTAM on IBM mainframes, NETEX coresides in mainframe with VTAM.

Support Software • makes HYPERchannel transparent to host operating system; requires application-level programming calls to utility programs or NETEX services • NETEX provides host-to-host communication; HYPERchannel support includes host drivers for CPU-to-CPU communication, device drivers for CPU-to-device communication, bulk file transfers, and network managers for network control.

First Delivery • 1977.

Systems Delivered • over 3,000 adapters at 350 sites; about 10 with satellite links and about 50 with microwave links.

Comparable Systems • none quite comparable because NSC supplies software in hosts to drive systems connected to HYPERchannel in multivendor environment • also, channel data rate is much higher than for most other local area networks such as Ethernet: 50M bps for HYPERchannel versus 10M bps for Ethernet.

Vendor • Network Systems Corporation; 7600 Boone Avenue North, Minneapolis, MN 55428 • 612-425-2202.

Distribution • through 35 NSC sales offices in United States, 3 in Canada; distributors in Australia, South Africa, and Italy; and 3 subsidiaries in France, West Germany, and United Kingdom.

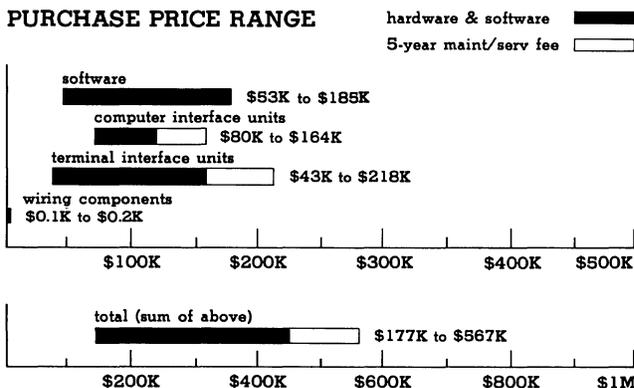
■ ANALYSIS

HYPERchannel is the only 50M-bps high-performance baseband local area network (LAN) on the market today. Most other LANs are limited to the 10M-bps range and some are designed for the vendor's own equipment, precluding multivendor support. An increasing number of LANs, however, are generic and do support multiple vendors.

NSC supports HYPERchannel with both hardware and software for specific computer systems. The user programs the application using HYPERchannel by calling standard utilities, drivers, and services provided by NSC. This approach means that multivendor support is limited to specific hosts. Physical connections are provided for many more systems than the software supports. With the NETEX software, NSC is using the OSI model for its layered software organization. This approach makes sense because the OSI model was developed to allow interconnection of multiple vendors' computers.

The Link Adapter, first announced in 1979, allows HYPERchannel to interface to high-speed global communication facilities: AT&T T1 (1.544M-bps), T2 (6.3M-bps), and T3 (44.7M-bps) links and 6M

PURCHASE PRICE RANGE



NSC HYPERCHANNEL PURCHASE PRICING bar graph illustrates price ranges for small to large systems with solid bars reflecting software/hardware purchase pricing and open bars reflecting 5-year service/maintenance fees associated with large system • **SMALL SYSTEM** includes all basic components to interface 100 terminals and 2 computer systems to HYPERchannel all interconnecting units and cables, software and 5-year maintenance; includes A222 Processor Adapter for IBM mainframe, A400 General-Purpose Minicomputer Adapter with P111 DEC MASSBUS interface, A510 Device Adapter that can attach 4 3274 Terminal controllers to support up to 128 terminals, 2 AC-1 adapter cabinets, H211 MVS/BFX Utility, and H210 NETEX Executive on IBM mainframe running MVS, and H261 BFX/VMS and H260 NETEX Executive on VAX-11 running VMS • **LARGE SYSTEM** includes all basic components and software to connect 500 terminals and 4 computers to HYPERchannel; includes 2 A222 Processor Adapters for IBM mainframes, 1 A400 General-Purpose Minicomputer Adapter with 2 P111 DEC MASSBUS interfaces, 4 A510 Device Adapters that can interface 16 3274 terminal controllers to support 512 terminals, 4 AC-1 Adapter cabinets, 2 H211 MV/BFX Utilities, and 2 H210 NETEX Executives for IBM MVS mainframes, and 2 H261 BFX/VMX Utilities and 2 H250 NETEX Executives for VAX-11 computers running under VMS • assumes 100-foot cable on small system and 300-foot cable on large system and 20-foot drop cables • configurations also require DR70 Massbus Adapters for VAX-11s.

NSC HYPERchannel

High-Speed Baseband Local Area Network

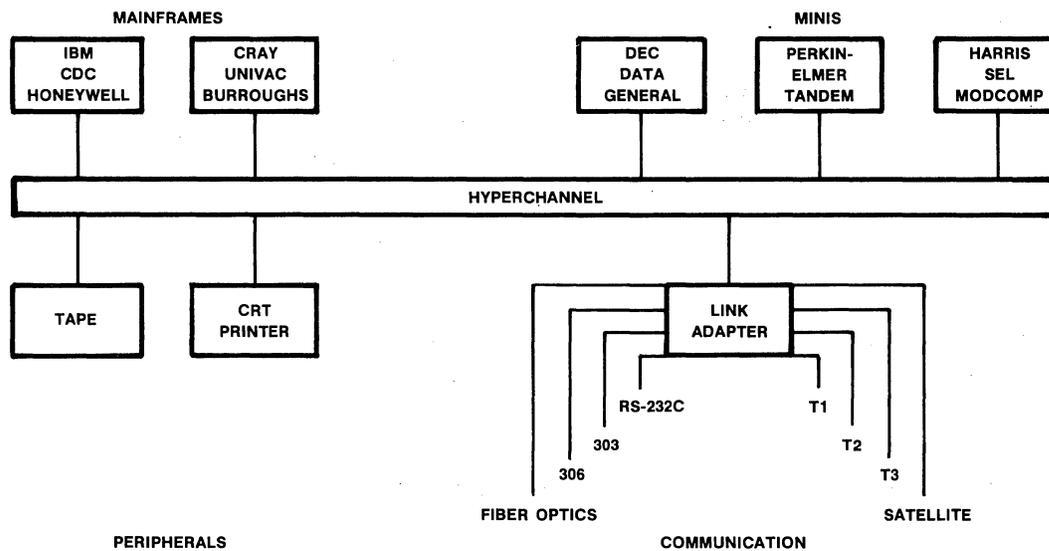


Figure 1 • HYPERchannel multivendor mainframe and minicomputer configuration.

bps over microwave. The satellite link adapter extends global communication even further with data rates up to 44.7M bps. HYPERchannel can also be extended with fiber optic cable.

NSC also sells HYPERbus, which is similar to HYPERchannel, except it was developed to interconnect workstations, terminals, printers, and other devices used in the automated office environment. The HYPERbus data rate is 10M bps.

All adapters can support 4 trunks that operate independently. Multiple trunks can be used to extend HYPERchannel to almost any desired configuration. HYPERchannel can also be used with HYPERbus to provide a total LAN environment.

Strengths

NSC has been delivering HYPERchannel products for 7 years. The company has found a niche in the communication marketplace and developed it with a high-performance product. Competition will undoubtedly develop when broadband LANs become more prevalent, but today, NSC's product is unique.

NSC has expanded down into the automated office with its HYPERbus.

NSC is continually developing Adapters and NETEX software to support new computer systems. Currently, about 30 NETEX packages are under development.

The HYPERchannel is very flexible and versatile, supporting redundant systems either for reliability for increasing throughput, or for isolating sensitive devices or data. It also supports microwave and satellite links to remote sites.

The ECL 10000 hardware used in the HYPERchannel adapters can actually operate at a 100M-bps data rate. Thus, the current data rate does not push the technology. Rumors are that NSC is working on a higher data rate LAN called Datapipe to be used primarily for interconnecting LANs or supercomputers.

For the past few years, NSC revenues have been growing at a 60 percent rate. It appears the company's products were initially ahead of the market. Now, the market is finally catching up to HYPERchannel, and NSC is becoming very successful.

Limitations

The LAN market is still in its infancy, and could take many directions before it matures. NSC specialized in high-performance LANs until it announced HYPERbus, which is offered to augment HYPERchannel in the low-performance, office

automation end of the market. This is a relatively new area for NSC, and competition is much more intense. NSC is very much at home, however, in the multivendor environment and knows how to build networks and make them work. HYPERbus is selling very well.

NETWORK SUMMARY

Network Systems, founded in 1974, delivered the first HYPERchannel adapter in 1977. Since then, NSC has continued to add adapters for different vendors' processors and to deliver software to support HYPERchannel. The NETEX software has extended support further, making HYPERchannel applications relatively easy to develop. The Link Adapters support microwave and satellite links, allowing remote HYPERchannel networks to communicate with one another.

Each adapter supports 4 trunks or HYPERchannels that can be used to increase performance or to provide redundant channels for reliability. Some users may also wish to isolate systems that handle sensitive data. Asymmetrical trunks can be configured to prevent access to sensitive data. Systems residing on the same channel can also be protected from each other by the access code logic. As a practical matter, the performance of HYPERchannel is high enough for most users; only a few sites use multiple channels to increase reliability.

Generally, HYPERchannel networks are established as turnkey systems. The typical purchase price of a HYPERchannel adapter is about \$40,000 per unit. The interface boards range from \$2,000 to \$3,500. The NETEX Host-to-Host communication software license fee is about \$1,400 initially plus about \$500 per month.

SOFTWARE

Terms & Support

Terms • software is available under one of two license fee arrangements • the first is an initial fee plus a monthly fee; the license fee includes new release updates, fixes, and central service • the second is a paid-up license (PUL) plus a monthly maintenance fee for the first license only; subsequent licenses require no maintenance fee; maintenance includes updates and central service • multiple software packages are available under the following discount schedule: single system, full price; 2 to 4 systems, 25 percent discount; 5 to 8 systems, 50 percent discount; and 9 or more systems, 75 percent discount.

NSC HYPERchannel High-Speed Baseband Local Area Network

Support • from central service site, available on 24-hour basis; user generally diagnoses problem, perhaps with help from local hardware service personnel, and calls central service for a fix.

□ NETEX—Network Executive

NETEX operates as a network executive. Logically, it performs the same kind of functions for HYPERchannel that VTAM in an IBM mainframe performs for a data communication network. A version of NETEX (depending on the operating system) and VTAM (or other communication manager) coreside in the IBM (or other vendor) mainframe and each complements the other.

NETEX logically links (establishes a session between) systems that are intercommunicating. It assumes responsibility for delivery of data to its destination once it accepts the data for transmission. It handles flow control, error recovery, and special conditions (such as satellite) associated with link transmissions. NETEX allows applications in a host to share HYPERchannel as well as to intercommunicate.

NETEX allows 2 application programs residing in separate hosts on HYPERchannel to intercommunicate independently of the network configuration and other programs running. NETEX supports file transfers, job transfers, and transaction processing in single- or multivendor environments. NETEX is initialized as a subsystem along with other subsystems such as IMS, JES2, or VTAM.

NETEX on a system receives all requests for services and prepares them for transmission on the HYPERchannel network through the local network adapter. The message can travel over a local cable network or through a link or satellite adapter to a remote site; in either case the message must travel through the local adapter to the NETEX software in the second system which fulfills the service request.

NETEX conforms to the ISO Open Systems Interconnection (OSI) reference model for the SESSION and TRANSPORT levels. Application interfaces allow addressing other applications by symbolic names or directly by a physical address. Selected users can interface to the HYPERchannel network at the message level.

NETEX supports full-duplex operation, and multiple application programs can access the system simultaneously. Various NETEX products support NSC software, such as Bulk File Transfer (BFX),

as well as user-written programs in assembler and higher-level languages on the host systems. Figure 2 illustrates an IBM MVS NETEX/HYPERchannel configuration.

Software Modules

Modules are provided for CPU-to-CPU communication, for bulk transfer of data files, for transaction processing, and for collection of real-time data from minicomputers. Modules for CPU-to-device communication support remote location of peripherals.

Network Systems supplies 5 types of software modules: CPU-to-CPU Communication I/O Driver Utilities, NETEX Communication Packages, BFX Application Utility, CPU-to-Device Communication Drivers, and Network Managers. Applications for network software include file transfers, job and job output transfers, remote job entry, and transaction processing.

CPU-to-CPU Communication I/O Driver Utilities • provide a very basic level of communication between hosts on a network; maintained within each host's operating system • facilitate all I/O and addressing functions between the attached processors and the HYPERchannel network • requires NSC Adapter on each CPU.

NETEX Communication Packages • operate as a NETWORK EXECutive providing a universal access method for multivendor CPUs • implement SESSION and TRANSPORT levels of the ISO OSI model for system interconnection • requires NSC adapter on each CPU • provides facilities for high-speed task-to-task communication using HYPERchannel equipment between 2 systems running NETEX.

Bulk File Transfer (BFX) Application Utility • allows users to move large files between homogeneous or heterogeneous CPU models • handles all communication between different mainframes including file conversions • includes a batch utility called Transfer Initiate in source processor to define file for I/O transfer, control statements, and batch job to be executed on destination processor; a Transmit Responder in the destination processor that communicates with initiating processor and passes job on to the Job Submitter in the destination processor • Job Submitter enters the job in the batch job queue of the destination processor; when job is executed it connects back to the Transfer Initiator and transfers the file • can be used for RJE facility, on-/off-site file backup, database distribution, and real-time file

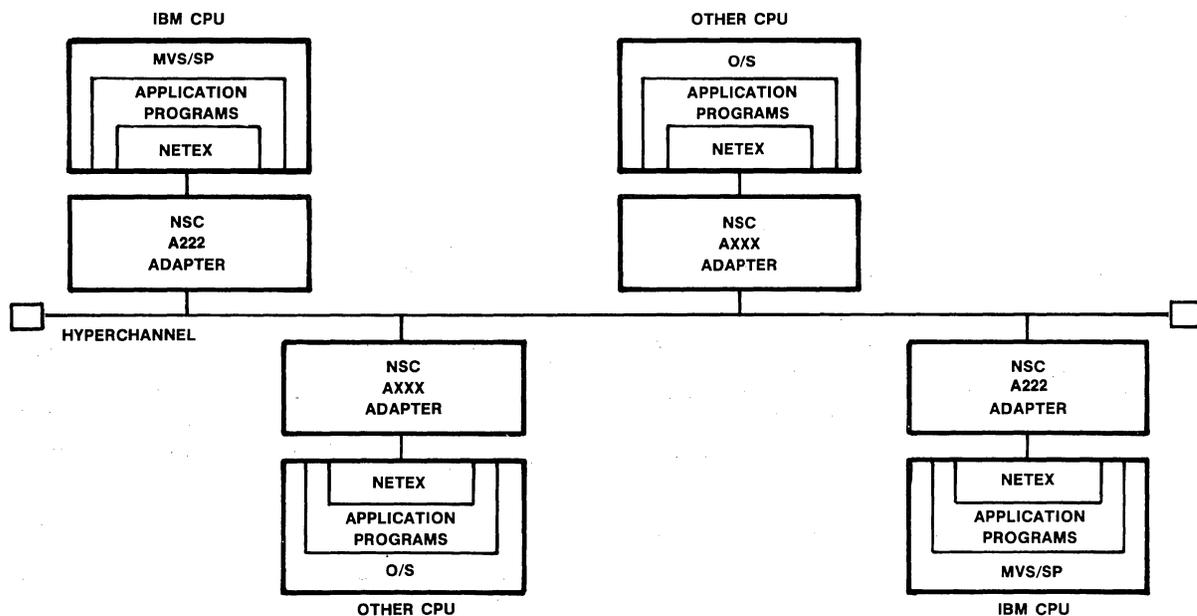


Figure 2 • H210 IBM MVS NETEX/HYPERchannel configuration.

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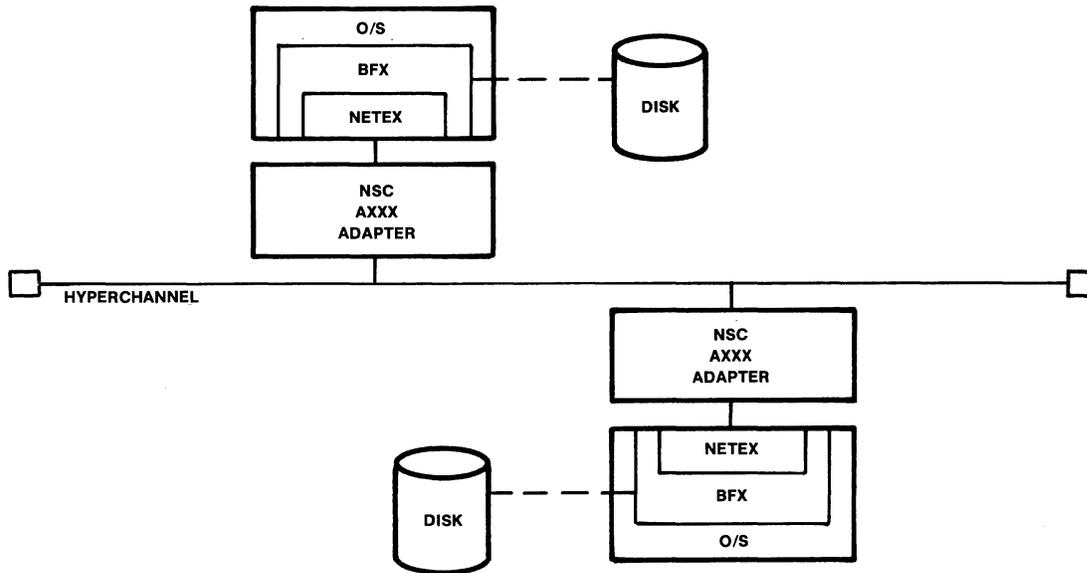


Figure 3 • BFX/NETEX/HYPERchannel configuration.

transfer • requires NSC adapter on each CPU and NETEX software; see Figure 3.

CPU-to-Device Communication Drivers • transparent to user software; allows remote devices to operate as if they were locally attached to CPU; intercepts user I/O requests, converts them into network messages, and puts them on HYPERchannel • requires NSC Device Adapter to pick up message and perform I/O function on attached device • can coreside with NETEX software on CPU • allows remote attachment of many terminals, establishment of tape and printer pools, and remote location of graphics devices • requires NSC processor adapter and NSC device adapter.

Network Manager • provides users with ability to manage their networks; provides network statistics and usage information from hardware, network hardware status monitoring, NETEX software status monitoring, and marginal error reporting; also automatically scans entire configuration periodically and reports problems that occur • requires NETEX communications software to operate.

IBM Host-to-Host Communication • supports various communication modules that run on IBM S/370-compatible host.

H015 Software I/O Driver • runs under IBM MVS, providing system users with facilities to access unit record, tape, and/or display devices over long distances using HYPERchannel equipment; CPU runs under MVS/SP 1.3 or MVS/XA:

\$1,000	\$400 mo	\$14,400 OTC
\$425 maint		

H085 Software I/O Driver • runs under IBM VM, providing system users with facilities to access unit record, tape, and/or display devices over long distances using HYPERchannel facilities; CPU runs under VM/SP:

1,000	400	14,400
425		

H210 IBM NETEX/MVS • executive runs under IBM MVS:

1,400	560	20,160 PUL
595		

H211 IBM BFX/MVS • bulk file transfer utility:

600	240	8,640
255		

H218 IBM/MVS Network Manager • requires NETEX/MVS to

operate:

300	120	4,320
130		

H280 IBM NETEX/VM • executive runs under VM:

1,400	560	20,160
595		

H281 IBM BFX/VM • bulk file transfer utility runs under VM:

600	240	8,640
255		

H288 IBM/VM Network Manager • requires NETEX/VM to operate:

300	120	4,320
130		

DEC Host-to-Host Communication • supports NETEX Network Executive and BFX Utility that run on the DEC PDP-11 under RSX-11 or under VMS on VAX-11.

H250 DEC NETEX/RSX • executive runs under RSX-11/M on PDP-11:

800	320	11,520
340		

H251 DEC BFX/RSX • bulk file transfer utility runs under RSX-11/M; requires NETEX/RSX:

300	120	4,320
130		

H260 DEC NETEX/VMS • executive runs under VAX/VMS on VAX-11:

1,200	480	17,280
510		

H261 DEC BFX/VMS • bulk file transfer utility runs under VAX/VMS; requires NETEX/VMS:

500	200	7,200
215		

INITL: initial license fee. MO: monthly license fee after initial payment. PUL: paid-up license. SERV: central service charged for first copy of the software package only; no charge is made for subsequent copies. Prices effective as of August 1984.

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Sperry Host-to-Host Communication • supports NETEX Network Executive and BFX utility running under OS on 1100 systems.

H300 Sperry NETEX/1100 • executive runs under OS 1100:

1,400	560	20,160
		595

H301 Sperry BFX/1100 • bulk file transfer utility runs under OS 1100; requires Sperry NETEX/1100:

600	240	8,640
		255

Honeywell Host-to-Host Communication • supports NETEX Network Executive and BFX utility on Honeywell Level 66 and DPS 66 systems running under GCOS-3.

H290 HIS NETEX/GCOS-3 • executive runs under GCOS-3:

1,400	560	20,160
		595

H291 • bulk file transfer utility runs under GCOS-3; requires HIS NETEX/GCOS-3:

600	240	8,640
		255

CDC Host-to-Host Communication • supports NETEX Network Executive and BFX utility under NOS and NOS-BE on CDC 6000/Cyber 70/170/700 Series.

H220 CDC NETEX/NOS • executive runs under NOS:

1,400	560	20,160
		595

H221 CDC BFX/NOS • bulk file transfer utility runs under NOS; requires CDC NETEX/NOS:

600	240	NA
		NA

H230 CDC NETEX/NOS-BE • executive runs under NOS/BE:

1,400	560	20,160
		595

H231 CDC BFX/NOS-BE • bulk file transfer utility runs under NOS/BE; requires CDC NETEX/NOS-BE:

600	240	8,640
		255

Tandem Host-to-Host Communication • supports NETEX Network Executive and BFX utility that run under the Guardian operating system on Tandem NonStop system.

H361 Tandem BFX/Guardian • bulk file transfer utility that runs under Guardian; requires Tandem NETEX/Guardian:

500	200	7,200
		215

H365 Tandem NETEX/Guardian • executive runs under Guardian Release A05 or above:

1,200	480	17,280
		510

Gould SEL Host-to-Host Communication • supports NETEX Network Executive and BFX utility that run under the MPX-32 operating system on Gould SEL computers.

H401 SEL BFX/MPX 32 • bulk file transfer utility runs under MPX-32; requires SEL NETEX/MPX-32:

500	200	7,200
		215

H405 SEL NETEX/MPX-32 • executive runs under MPX-32:

1,200	480	17,280
		510

APOLLO Host-to-Host Communication • supports NETEX Network Executive and BFX utility running on APOLLO computer under AEGIS operating system.

H511 APOLLO BFX/AEGIS • bulk file transfer utility runs under APOLLO AEGIS operating system; requires APOLLO

NETEX/AEGIS:

500	200	7,200
		215

H515 APOLLO NETEX/AEGIS • executive runs under APOLLO AEGIS:

1,200	480	17,280
		510

■ HARDWARE

Terms & Support

Terms • all systems are available under 90-day rental; 1-year, 2-year, or 3-year leases or purchase contracts; prices include installation • most systems are turnkey systems with NSC supplying all the network hardware and software • volume discount schedule: for systems with 20 or more adapters in any combination, 5% off all hardware in contract • for purchase conversion of leased equipment, 30% of lease payments during first year can be applied to purchase price, 40% in second year, and 50% in third year.

Support • NSC provides maintenance support ranging from per-call basis with price determined by time and materials; to on-call maintenance for 5 days a week, 9 hours a day; to on-site, 24-hour service • standard on-call maintenance is shown in report.

Adapters

Adapters contain trunk interface boards, registers with associated control and data buffers, a microprocessor with maintenance console, and the interface to the device using the channel. Several adapters are available to interface specific vendor's CPUs and peripherals to HYPERchannel. A Link Adapter and a Satellite Link Adapter connect HYPERchannel to remote sites through high-speed common carrier facilities.

Trunk Interface Board • accommodates a maximum of 4 trunks on a single adapter; contains the transmitting and receiving electronics and the logic to manage the transmission "envelope" of network addresses, access code, and checkwords; each trunk operates independently of the other 3 • trunks can be extended to communicate with remote sites through Link Adapters or Link Satellite Adapters.

Control Buffer • 1K bytes; stores stacking control information.

Data Buffer • 4K or 8K bytes; stores received data or data to be transmitted; supports an aggregate 100M-bps data rate: 50M bps for transmission over the HYPERchannel and 50M bps to/from the attached device using the channel • online character conversion logic is included on some adapter models.

Microprocessor • cycle time is 320 nanoseconds; executable program is stored in a 4K-byte ROM; uses 16 immediate and 256 extension 8-bit registers; extension registers used to access the buffer and control logic and the equipment interface, and to control the direct memory access (DMA) data block transfers between the adapter and the device using the channel.

Maintenance Console • separate portable physical package that plugs into an adapter for diagnostic testing • includes logic/memory board with 4K-byte RAM, direct interface to control panel, and 4 RS-232 interfaces: 1 attaches to diskette drive, other 3 can connect to other devices such as a display terminal • runs diagnostic routines to isolate failures in the adapter, equipment attached to adapter, other adapters in network, and network • can drive printer and terminal display/keyboard.

Device Interface • specific to the device using the channel; contains electrical and physical interface, assembly/disassembly logic, holding registers, and hardware ready/resume logic; adapters contain a number of features that are used for specific applications.

Access Code Logic • uses the 4-bit physical access code to compare with the access code received with a frame: a "0" in the physical access code is interpreted as a "don't care" character and allows the adapter to accept any character in that position; if

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the physical access code contains no 0s, adapter accepts access only if the received frame access code equals the physical access code • facility allows sharing of some devices (such as disk) and not others (such as magnetic tape) by selecting appropriate access codes.

Adapter Network Address • selected by 2 HEX thumbwheel switches on each adapter; a data trunk on an adapter referenced according to the physical location of its interface board in the adapter cabinet.

Assembly/Disassembly (A/D) • logic performs format conversion under program control; can receive data in one format and transmit it in another.

Code Conversion • converts between code formats under host CPU selection; e.g., 7-bit ASCII to 8-bit EBCDIC, or from one code format to a number of other code formats.

Message Loopback • a diagnostic procedure that returns the message received by the adapter to the transmitting adapter to verify integrity.

Statistics Gathering • feature accesses statistical information stored in hardware and firmware registers relating to the activity and use of the trunk for performance monitoring.

HYPERchannel Adapters

Processor adapters function as buffered communication controllers to transmit messages between interfaced computer systems. The adapter interfaces the processor's data channel to HYPERchannel. Device adapters such as the A320 or A327 include the device controller as well as the interface between the data channel and HYPERchannel.

A110 CDC 6000/Cyber 70/170 Adapter • interfaces one data channel:

\$1,826/\$1,634/\$1,230 mo	\$38,440 prch	\$230 maint
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A120 CDC 7600/Cyber 76 Adapter • interfaces 2 data channels:

1,826/1,634/1,230	38,440	230
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A130 CRAY-1 Adapter • interfaces 1 medium-speed data channel pair (in and out):

1,826/1,634/1,230	38,440	230
-------------------	--------	-----

A140 Sperry 1100 Adapter • word channel interface for 1 ISI data channel:

1,826/1,634/1,230	38,440	230
-------------------	--------	-----

A142 Sperry 1100 Adapter • interfaces a Sperry 1100/80 block multiplexer channel; not for use on Sperry FIPS channel:

1,877/1,679/1,264	39,515	230
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A150 Burroughs Processor • HTC 1A interface for Burroughs 5800, 6800, and 7700 systems:

1,826/1,634/1,230	38,440	230
-------------------	--------	-----

A152 Burroughs Adapter • interfaces Burroughs B 700 Host Transfer Control (HTC1A) channel on Burroughs 3700, 3800, and 4800 systems:

1,826/1,634/1,422	38,440	230
-------------------	--------	-----

A160 Honeywell Processor Level 66/68 • interfaces special PSIA channel on Level 66 or 68 IOM:

1,826/1,634/1,230	38,440	230
-------------------	--------	-----

A161 Honeywell Adapter • interfaces a PSIA HYPERchannel attachment feature on Level 66/68 DPS or DPS 88 model processors; customer must supply PSIA HYPERchannel attachment feature:

1,826/1,634/1,230	38,440	230
-------------------	--------	-----

A220 IBM 360/370 Adapter • interfaces an IBM 360/370 Selector or Block Multiplexer Channel; also applies to 303X and 43XX Series:

1,877/1,679/1,264	39,515	230
-------------------	--------	-----

A222 IBM 370/30XX/43XX Adapter • interfaces block multiplexer channel; code conversion option applies:

1,877/1,679/1,264	39,515	230
-------------------	--------	-----

A320 CDC Disk Control Adapter • interfaces 4 D300 HCDD disk units; disk format is 512 64-bit words per sector; contained in 2 packages:

3,504/3,135/2,360	73,760	463
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A327 CDC Disk Control Adapter • interfaces 4 D300 HCDD units; 2 switch-selectable disk formats • 20 sectors per track with 512 60-bit words per sector or 18 sectors per track with 512 64-bit words per sector; contained in 2 packages:

3,504/3,135/2,360	73,760	463
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A400 General-Purpose Mini-Computer Adapter • supports the following options: provides up to 4 standard interfaces to 16-bit I/O structure of minicomputers; PI 10/11/12/13/14/15/20/30/40; options not included:

1,850/1,655/1,441	38,940	230
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A450 Harris Processor Adapter • interfaces 1 Model 800 BBC, Model 100/500 UBC, or Model 4/7 CBC:

1,826/1,634/1,230	38,440	230
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A470 SEL 32 Processor Adapter • interfaces 1 SEL 9131, 9132, or 73-9132 high-speed data interface:

1,826/1,634/1,230	38,440	230
-------------------	--------	-----

A490 CDC 1700 Processor Adapter • interfaces 1 CDC 1706 buffered data channel; can be expanded to 2 interfaces with PI90 option:

1,914/1,713/1,289	40,295	230
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A510 IBM Controller Adapter • IBM 360/370 block multiplexer channel interface for variety of devices: card readers/punches, serial tape drives, document readers, and CRTs:

1,877/1,679/1,264	39,515	230
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A512 IBM Controller Adapter • IBM 370/30XX/43XX block multiplexer channel interface for high-speed devices only, such as printer subsystems; AM65 option required for 3800 and multiple printer support:

1,877/1,679/1,264	39,515	230
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A901 Basic Network Adapter • without specific device interface logic; provides buffer, control logic, and microprocessor:

1,578/1,412/1,063	33,215	190
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Link Adapter

Two types of link adapters have been developed: terrestrial and satellite. A terrestrial link adapter maintains flow control and retransmits data if an error occurs over the terrestrial communication link. The satellite adapter implements a special protocol for communication to compensate for the long delays associated with satellite transmission. Two Link Adapters are associated with a communication link: one at each end.

The Link Adapter intercepts network messages on HYPERchannel that are addressed for transmission over the communication link to its corresponding Link Adapter at the other end. The receiving adapter transmits the message over the remote trunk to the addressed device.

A710 Link Adapter • provides 2 independent interface ports selectable under program control; supports data rates up to 44.7M bps • available interfaces include RS-232C, AT&T 303 or 306 modems, KG34 military interface, and NSC LIT Series Modems:

\$1,942/\$1,737/\$1,308 mo	\$40,817 prch	\$264 maint
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A711 Adapter • same as A710 except available interface limited to X.24-VII or J64; applicable cable option is T10E:

1,942/1,737/1,308	40,875	264
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MO: first figure is monthly fee for a 90-day rental plan, second and third figures are monthly fees under 1-year and 3-year leases, respectively. PRCH: purchase price. MAINT: monthly maintenance. NA: not available/applicable OTC: one time charge. T&M: time and materials. Prices effective as of August 1984.

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Satellite Link Adapter • uses a special protocol; handling of errors is application-dependent • uses an extended message format that essentially performs 2 operations: one for the LAN parameters to direct the adapter transmitting the message; the other directs the receiving satellite link and the disposition of the message • supports 6.7M-bps data rate.

S720 Satellite Link Adapter • extends HYPERchannel to remote sites for CPU-to-CPU and CPU-to-device communication • RS-449, AT&T 306, V.35, KG34, KG81, or NSC LIT Series interfaces for data rates up to 6.3M bps • supports data rates up to 6.3M bps • includes Transmit and Receive units:

4,090/3,659/2,755	86,100	517
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S725 Full-Duplex Link Adapter • interfaces local network to remote HYPERchannel network using full-duplex communication medias at speeds up to 2M bps; for terrestrial or satellite application • modem interfaces are NSCLIT/VIT, V.35, RS-449, and KG34/81; T10X cable not included:

2,375/2,125/1,600	50,000	430
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HYPERchannel Adapter Options

AM65 Adapter Memory Increment Expansion • provides 32K bits of data buffering for HYPERchannel network adapters; field retrofit by NSC and replaced memory board becomes property of NSC:

\$304/\$272/\$205 mo	\$6,395 prch	\$40 maint
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ARXX Auto Resync Options • detects loss of modem synchronization and automatically issues signal to cause resynchronization; applies to KG34/81 equipment; field installable.

AR71 • for A710 Links:

86/77/58	1,800	10
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AR72 • for S720 Links; 2 are required for full S720 configuration flexibility:

86/77/58	1,800	10
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AR73 • for A711 Links:

86/77/58	1,800	10
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AT5X Adapter Trunk Interface Expansion • provides additional network trunk interface to HYPERchannel Network Adapters; has independent reject response on Adapter Busy or Reserved; field installable.

AT50 Trunk Interface • 50M bps:

223/200/151	4,705	30
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AT51 Trunk Interface • 50M bps; for A710 Adapter only:

223/200/151	4,705	30
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CC10 Code Conversion • provides capability to convert from one character set to another dynamically; consists of 1024-byte RAM • option applies to A110, A120, A140, A150, A160, A222, and A450 Adapters only:

153/137/103	3,225	17
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PIXX Processor Interface Expansion Option • provides expansion of additional interfaces from network adapter to the attached processors; an adapter can be expanded to a total of 4 processor interfaces of any mix • option applies to the A400 Adapter.

PI10 UNIBUS Processor Interface Expansion • provides adapter interface logic for a DEC DR11B general-purpose DMA interface; requires DR11B; includes 10-foot ribbon cable; PI17-X extension cable optional:

22/20/15	465	16
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PI11 MASSBUS Processor Interface Expansion • provides adapter interface logic to DEC DR70 MASSBUS interface; requires DR70 • includes 10-foot ribbon cable; PI17-2 extension cable optional:

68/62/46	1,442	16
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PI12 LSI-11 Processor Interface Expansion • provides adapter interface logic to DEC DRV11B interface; requires DRV11B board in LSI-11 • includes 10-foot ribbon cable; PI17-X extension

cables optional:

47/42/32	990	16
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PI13 DEC UNIBUS Interface • interfaces DEC UNIBUS to NSC A400 Adapter; direct replacement for NSC PI10/DEC DR11-B Interface; plugs directly into UNIBUS backplane • includes cables; PI17-X extension cable optional:

139/125/94	2,930	20
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PI14 DEC UNIBUS Interface • same as PI13 except provides an electrical isolated connection:

230/206/156	4,855	28
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PI15 DEC MASSBUS Processor Interface • same as PI11 MASSBUS Interface but provides electrical isolated connection:

165/148/111	3,477	22
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PI16 Ket Processor Interface Expansion • provides adapter interface to a ket processor through a customer-supplied Able Computer Technology (ACT) general-purpose I/O bus interface board (DR11B equivalent) • PI17-X extension cable optional:

76/68/52	1,600	16
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PI17-2 16-Bit Parallel Interface Expansion • 2 20-foot extension cables for connection of PIXX interface options or 16-bit parallel vendor interfaces to NSC A400 Adapter • applicable vendors include AT&T 3B20, APOLLO, Hewlett-Packard HPIB, and Prime processors:

33/29/22	688	T&M
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PI17-5 16-Bit Parallel Interface Expansion • same as PI17-2 except 50-foot extension cables; does not apply to PI11 and PI15:

44/39/29	922	T&M
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PI20 Data General Processor Interface Board Expansion • provides adapter interface logic plus adapter to I/O bus logic; occupies a board slot in the computer chassis • includes 10-foot ribbon cable:

149/134/101	3,140	20
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PI30 Modcomp Processor Interface Expansion • provides adapter interface logic plus adapter to modular bus logic; occupies a board slot in a peripheral controller • includes 10-foot ribbon cable; PI17-X extension cables apply:

149/134/101	3,140	20
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PI32 SEL Processor Bus Interface Expansion • provides an interface between a SEL processor and an A400 Adapter port; plugs into standard SEL 9131, 9132, or 73-9132 High-Speed Data interface in SEL Chassis • includes 10-foot ribbon cable • does not apply to A470 Adapter; PI17-X extension cables apply:

144/129/98	3,040	22
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PI40 Perkin-Elmer Processor Interface Adapter • provides adapter interface logic plus adapter to I/O bus logic; occupies a board in the computer chassis • includes 10-foot ribbon cable; PI17-X cable option available:

149/134/101	3,140	20
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PI90 CDC 1700 Processor Interface Expansion • provides adapter interface logic to CDC 1706 buffered data channel; option applies to A490 Adapter only • 10-foot ribbon cable included; PI17-X cable options apply:

149/134/101	3,140	20
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Modem Interface Cables • used to interface modems to adapters.

T10A • interfaces AT&T 306-type modem or NSC LIT-1 Series modem to a Link Adapter; 50 feet long:

NA/NA/NA	350	NA
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T10B • interfaces B 303-type modem to a Link Adapter; 50 feet long:

NA/NA/NA	350	NA
----------	-----	----

T10C • interfaces RS-232C-type modem to Link Adapter; 50 feet long:

NA/NA/NA	550	NA
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T10D • interfaces KG34-type device to Link Adapter; 10 feet long:

NA/NA/NA	400	NA
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T10E • interfaces X24.VII or J64-type modems to A711 adapter; 15 meters long:

NA/NA/NA	350	NA
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T10F • provides integrated plug and terminal strip for connection KG81 cable to A710, A711, or S720 links; 1,500 feet maximum length:

NA/NA/NA	300	NA
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T10G • interfaces RS-449 modems to S720 Adapters; 50 feet long:

NA/NA/NA	NA	NA
----------	----	----

T10H • interfaces V.35 or NSC LIT-X Series modems to A710 Adapters; 50 feet long:

NA/NA/NA	350	NA
----------	-----	----

T10J • interfaces AT&T 306-type for NSC LIT-1 Series modems to S720 Adapters; 50 feet long:

NA/NA/NA	350	NA
----------	-----	----

T10K • interfaces V.35 or NSC LIT-X Series modems to S720 Adapters; 50 feet long:

NA/NA/NA	350	NA
----------	-----	----

HYPERchannel Support Equipment

Network Systems uses 75-ohm standard TV cable except specifications are rigidly controlled. For example, variation of 75-ohm cable is held within +2%. Network Systems uses 75-ohm connectors for joining sections of cables together.

Five types of cable are offered as standard products, depending on the number of connections needed for a given length. Up to 16 adapters can attach to 1,018 feet of the least expensive cable. Up to 16 adapters can connect to 3,476 feet of the most expensive cable. Other cable, including armored cable, is available for special environments such as suspended from outdoor poles in harsh weather. These cables require individual price quotations. Different kinds of cable can be mixed on the same network.

Network Systems uses no junction boxes. The cables are looped through the adapter. The connection is made inside the adapter using a patented tap.

Cable

T50A • 0.27-inch cable; allows 16 attachments on 1,018-foot length • \$0.80 per foot.

T50B • allows 16 attachments on 1,527-foot length • \$2.05 per foot.

T50C • allows 16 attachments on 2,112-foot length • \$2.50 per foot.

T50D • allows 16 attachments on 3,079-foot length • \$3.15 per foot.

T50E • 1.1-inch cable; allows 16 attachments on 3,476-foot length • \$4.55 per foot.

Other Components

AC-1 Adapter Cabinet • 220V/60 Hz; can house up to 3 standard adapters; includes blower assembly and power distribution:

\$179/\$160/\$120 mo	\$3,760 prch	\$15 maint
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AC-2 Adapter Cabinet • 230V/50 Hz; otherwise same as AC-1; required for international installations:

232/208/156	4,890	19
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ATR1 HYPERchannel A Series Trunk Repeater • provides a 50M-bps bidirectional repeater; self-contained power supply and power cord included • maximum 1 per trunk, 2 allowed if no adapters attached to middle segment:

371/332/250	7,800	42
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LIT-1A Link Interface Modem • interfaces Link Adapter to a DS-1 (T1 at 1.544M bps) standard communication interface; includes 500 feet of shielded cable; DS end connector not included:

290/259/195	6,100	36
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LIT-2A Link Interface Modem • interfaces Link Adapter to a DS-2 (T2 at 6.312M bps) standard communication interface; includes 1,000 feet of shielded cable; DS end connector not included:

323/289/218	6,800	41
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LIT-3A Link Interface Modem • interfaces a Link Adapter to a DS-3 (T3 at 44.736M bps) standard communication interface; includes 2 500-foot NSC Type 50A coaxial cables:

323/289/218	6,800	41
-------------	-------	----

VME-1 Variable Modem Emulator • interfaces 2 NSC link units in back-to-back configuration (V.35/306); selectable speeds are 44.7M/22.3M/11.2M/5.6M/1.4M/699K/233K/58.3K bps • does not include 2 T10A modem cables:

323/289/218	6,800	41
-------------	-------	----

NMC3 Network Maintenance Console • used primarily by NSC Service Center although customers with large networks can buy it • portable hardware maintenance and microcode modification facility for testing Network Adapters; includes console, keyboard, LED display, CRT, and floppy disk; also includes tester board (for service engineer) with 4K 16-bit words of read/write memory; includes all interconnecting cables:

1,115/998/751	23,475	133
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RM03 Remote Maintenance Option • for NMC3 tester; allows 2 NMC3 units with RM03 options to operate in parallel over standard telephone facilities; includes intelligent auto-dial and auto-answer modem and cables:

81/72/54	1,700	19
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■ SPECIFICATION

HYPERchannel is designed for data transmission only. It implements a complete data transmission protocol for local area networks. All communication is conducted between 2 adapters connected to a trunk/cable.

Packet Format

Data is transmitted around the network in packets from source adapter to destination adapter. The channel is not released until the source receives an acknowledgement from the destination for receipt of data. Packet size is variable to accommodate an unlimited number of data bytes. Each packet consists of a 14-byte Frame Header and a 9 plus n-byte Data Field, where n bytes represent data. The Frame Header contains 8 fields including sync, frame code, access code, source address, destination address, function/status, length count, and header checkword. Each field is defined as follows.

Sync • synchronizes destination adapter detection circuit with transmission; 3-byte minimum consisting of alternate "1"s and "0"s.

Frame Code • indicates start of frame; 1 byte; hex 99 for transmit; hex 96 for receive.

Access Code • provides access to specific link adapter; prevents unauthorized access to link-attached device; 2-byte code yields 4 hex characters; formed by combining access code received from message with code selected by adapter access code switches • access code also included in message acknowledgement Response Frame transmitted to originating adapter.

TO • single-byte address of destination adapter; address of source adapter when used in Response Frame of message acknowledgement • address established by adapter unit number switches.

FROM • single-byte address of source adapter; address of destination adapter when used in Response Frame of message acknowledgement • address established by adapter unit number switches.

Function/Response • 2-byte field specifies trunk function code for Data Frame and provides status bits in Response Frame • functions include reserve, copy registers and return in data field of response frame, load registers, test-and-set or test-and-clear flag bits, return data from control or data buffers in response frame, and load data from this frame into the receiver's control or

NSC HYPERchannel

High-Speed Baseband Local Area Network

data buffers • response status bits include reject (receiving adapter unable to accept data frame), busy, reserved by another adapter or a device, last function not executed, illegal function, checkword error, sequence bit, and unit number of the adapter that has already reserved the destination adapter.

Length Count • number of bytes transmitted in Data Field.

Header Checkword • error-checking technique for transmission integrity • 2 bytes generated in a cyclic generator in trunk interface logic; destination adapter generates checkword as it receives frame and compares it to the header checkword for integrity.

The Data Field consists of 3 subfields including Data, Data Checkword, and Sync.

Data • 0 to n bytes; contains data to be transferred.

Data Checkword • 2 bytes used to detect errors in the data field of the transmission frame • generated in cyclic generator in trunk interface logic and transmitted to destination adapter, which compares it to an independently generated checkword generated as data is received.

Sync • 7 bytes of alternate 0s and 1s to pad the end of transmission.

Transmission Characteristics

Transmission of data occurs in 3 stages: (1) from device using the channel to the buffer in the source adapter, (2) from the sending adapter's buffer to the receiving adapter's buffer, and (3) from the receiving adapter's buffer to its attached device that is using the data. All 3 stages operate simultaneously. For long data streams, the buffer area is divided into 2 buffers that alternate; while one is receiving data the other is transmitting data.

Once data is transmitted, the source adapter does not release the channel until an acknowledgement Response Frame is received from the destination adapter.

Channel Encoding • phase inversion technique similar to Manchester coding.

Data Rate • 50M bps for HYPERchannel; up to 44.7M bps for link adapter; 6.3M bps for satellite link adapter.

Carrier • signaled by transitions on the cable.

Control Procedures

Control Procedures follow the Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) scheme to control access to the channel by the 256 adapters that can be connected to the cable. A single adapter can transmit data at one time over a trunk, but each adapter can connect to a maximum of 4 trunks to increase throughput, or to provide redundant fail/safe communication. Each trunk connects to a separate adapter. Multiple trunks allow a data frame to be transmitted on a trunk while a response frame to a previous data transmission is transmitted on another trunk. Multiple trunks also support asymmetrical configurations. These are used to implement LANs that isolate some devices from others to provide a secure environment for sensitive data. Once an adapter begins transmitting on a trunk, it maintains control of it until the response frame is returned.

The HYPERchannel CSMA/CA access scheme implementation is similar but not identical with the HYPERbus implementation. One main difference is that HYPERbus avoids all collisions while HYPERchannel can have a single collision at the beginning of a transmission.

HYPERchannel is also different from HYPERbus in that HYPERchannel provides only 1 priority level of traffic; HYPERbus provides 3 priority levels.

Before transmitting data, an adapter senses ("listens to") the trunk for traffic to determine if it is busy. If the trunk is busy, the interface hardware does not transmit data. When it senses that the trunk is not busy, the interface hardware waits a Fixed Delay Time the same for all adapters, plus a variable "N" Delay based on the adapter's distance from Adapter "0." The adapter's address has

no effect on the N Delay. The Fixed Delay equals the product of 4 nanoseconds times the trunk length in feet. For example, a 1,000-foot trunk requires a 4-microsecond Fixed Delay. The N Delay equals the product of 4 nanoseconds and the distance between adapter N and adapter N-1 in feet. Adapter "0" has a "0" N Delay. If the distance between adapter 0 and adapter 1 is 100 feet, then adapter 1 has a 0.4-microsecond N Delay.

Once the Total Delay time has elapsed, the channel is in a "free-for-all" state, and any adapter can capture control of the channel and begin transmitting. If 2 or more adapters begin transmitting concurrently, the messages collide. Adapters listen for collisions, and when one occurs, the transmitting adapters back off and all adapters reset their timers.

Each adapter's timer is calibrated to give it a unique time slot during which it can gain control of the channel. This arrangement produces a logical ring of the adapters connected to the channel, and the timer calibrations produce a logical token-passing scheme.

The logical position of an adapter on the bus bears no relationship to its physical location on the bus. The logical position depends on the calibration of adapter's timer, thus an adapter can be physically moved from one position to another on the bus without effecting its logical position. Conversely, changing a timer's calibration changes the adapter's logical position without changing its physical position.

The reason HYPERchannel does not reset timers after each transmission and pass a "logical token" to avoid all collisions is to improve bus throughput. Collisions are so infrequent, backing off consumes less time than required to reset the timers and pass the token around the complete logical ring before each transmission.

So far, the scheme does not prevent an adapter with control of the bus from monopolizing the channel and locking out transmissions from other adapters. To prevent channel lock-out, the channel can operate in Wait Mode, which sets a wait flag after an adapter completes a transmission. The adapter cannot begin another transmission until the wait flag is reset. The time interval between setting and resetting the wait flag is long enough to allow any adapter waiting to transmit a message to capture control of the bus. If no other adapter does take control of the bus, the busy adapter can continue to control the bus and transmit another message.

Transmission Medium

HYPERchannel uses a standard single multidrop 75-ohm coaxial cable terminated at each end. It interconnects intelligent adapters that interface to computers, devices, and global data links. The cable has no active elements. It can, however, support 2 repeaters (if no adapters are connected to the segment between repeaters) to extend cable length to 3 miles. It operates as a passive trunk over which data flows at a rate of 50M bps. The intelligent adapters provide the common trunk interface, control and data buffering, microcomputers, and device interface. Adapters attach to the cable through multidrop connections, equivalent to coaxial T-connectors. Data is transmitted at baseband frequencies and is phase-encoded with self clocking.

ATR-1 Trunk Repeater • allows extension of trunk cable from 1 to 3 miles:

NA/NA/NA mo	\$7,800 prch	NA maint
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Use

HYPERchannel is designed for a single- or multivendor environment. Remote LANs can communicate with one another over terrestrial and satellite communication links.

Applications include centralized databases with dispersed processors having access to it for running database applications as well as entering data into it. Distributed processing can be run on small scale computers, but central hosts can have access to the smaller system to access data, files, and results of jobs run. The high-speed interface allows hosts to operate with real-time data.

• END

On-Line Software International (OSI) InterTest CICS/VS Testing Tool

■ PROFILE

Function • IBM CICS/VS testing and debugging tool.

Computers/Operating Systems Supported • IBM System/370, 3000, 4300, and compatible computers; any IBM operating system that supports CICS.

Current Version • 2.4.0.

Installations • approximately 1,500.

Comparable Products • Gary Bergman Associates ADS.

Vendor • On-Line Software International; Fort Lee Executive Park, Two Executive Drive, Fort Lee, NJ 07024 • 201-592-0009 • outside NJ 800-526-0272 • no Canadian distributors.

GSA Schedule • yes.

■ ANALYSIS

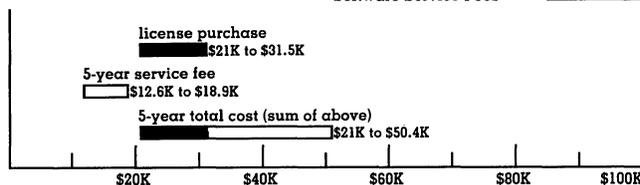
InterTest is an online, interactive testing and debugging tool for IBM CICS/VS environments. Its purpose is to help programmers reduce the time required to test and debug application programs and to reduce the implementation time required to bring up communications-oriented systems. InterTest provides monitoring and control functions for selected CICS/VS programs to prevent catastrophic errors from bringing the system down during test and/or production sessions. InterTest commands contain many parameterized options that can be entered directly or via menu screens by less sophisticated users. These characteristics provide maximum flexibility in a testing mode. OSI's extensive use of breakpoint and control technology throughout InterTest is ideally suited to a multiterminal, multitasking, and multithreaded environment.

□ Strengths

Because of the complexity of CICS/VS and all its many options and facilities, normal testing sessions entail very time-consuming analyses of dumps, traces, and system tables. Installing InterTest between the CICS/VS program and the application program allows users to dynamically view all pertinent system and program areas on a CRT screen and permits programmers to manipulate the analysis information on demand. The results are greater productivity in test operations and the development of keener diagnostic skills. Being able to view system performance on a real-time basis goes a long way toward faster implementation of all phases of a CICS/VS application system.

PURCHASE PRICE RANGE

Software License Purchase
Software Service Fees



ON-LINE SOFTWARE INTERNATIONAL INTERTEST PRICING • solid bar shows typical minimum/maximum configuration price range; open bar shows corresponding service-fee range for 5-year period, but the fees are computed for 4 years (48 months) because first-year service is included in license purchase price • **MINIMUM CONFIGURATION** is a DOS/VS single-site, single-CPU license • **MAXIMUM CONFIGURATION** is an OS/VS location use license.

The InterTest menus and command language are straightforward and "rich" in options. The ability to use source-level debugging commands enhances InterTest's productivity factor. InterTest also enforces CICS/VS standards, which in turn ensures that no application program will cause a storage violation, abend, or harm CICS. Productivity, in the sense of test program delivery and reduction of abnormal termination conditions, is certainly one of the key benefits afforded by this testing tool. The ability to test new applications while running production programs without fear of bringing the system down is another plus factor.

Continuing with its ongoing enhancement policy, On-Line Software's latest release of InterTest now offers full MRO support for multiregion operation, new menu screens to aid the inexperienced user, comprehensive PF key support for improved flow between InterTest screens, CORE support for MVS/XA 31-bit mode addressing (full MVS/XA support is scheduled for the 3rd quarter 1985), new breakpoint displays with improved debugging information for COBOL and PL/I users, full symbolic PL/I support, an expanded online HELP facility, and a new user's guide that includes a sample test session to assist new InterTest users learn the product.

□ Limitations

InterTest's option-rich command language has undoubtedly contributed to its flexibility and acceptance as one of the leading packages of its type. However, it has also been the cause of many complaints from new or novice users concerned about the degree of difficulty encountered when using the product.

As we had indicated in our last report, OSI has recognized and addressed the complexity problem by incorporating user-friendly command builder menu screens, a new HELP facility, and completely rewritten user documentation. In this latest release, OSI has continued to make InterTest the most user-friendly debugging tool presently available today. The ease of use improvements in the current InterTest release are for both the sophisticated and the inexperienced programmer. These improvements include integrated facilities accessible via PF key support, better menus, a better Help facility that provides both standalone and interactive documentation directly from any other InterTest facility, new breakpoint screens designed for the COBOL and the PL/I programmer, and an interactive demonstration program with a sample test session. This guides a new user through a typical debugging session, keystroke, and teaches him how to use the product. Now new InterTest users, or relatively unsophisticated COBOL and PL/I command-level programmers, can limit themselves to the menu facilities thereby eliminating most of the difficulties encountered when attempting to use the total capabilities of the system or attempting to learn InterTest syntax.

This system dichotomy has been well received and should enable novice users to attain a degree of proficiency while, at the same time, retaining the more sophisticated options for the advanced user.

Analysis is not an advertised nor provided feature of the system, but it is one that might be expected from a system of this type to at least permit users to separate program errors from possible CICS faults. Certain application programs on the market use nonstandard CICS conventions for performance and internal reasons that may cause InterTest to produce a breakpoint. However, this is usually not a problem since InterTest has a variety of features that can handle the nonstandard conventions. OSI is currently working with major vendors of such application programs and has already announced full InterTest support for users of HOGAN System Software and UFO.

On-Line Software International (OSI) InterTest CICS/VS Testing Tool

■ OVERVIEW

□ Terms & Support

Terms • can be acquired either for use at a single location or for use on a single CPU; available on a permanent license basis, with a lease/license agreement with 3 payout schedules, or on a 30-day cancellable rental plan with a monthly or 12-month payment term; additional copies, either for additional CPUs or for another computer center belonging to the same company, can be acquired at 1.25 times the CPU license fee; discounts apply only to prevailing license fees and are not applicable to rental plans; the amount paid for a permanent license or equity accumulated under a monthly lease will be credited towards the location use license; a CPU-use monthly rental plan can be replaced with a location-use monthly rental plan at prevailing rates.

Support • 2 types of in-house training programs are offered: a 1-day familiarization course costs \$2,000 plus expenses; a full 4-day CICS course concentrates on teaching CICS/VS debugging techniques and how to apply them with InterTest; for 1 to 12 students the cost is \$7,700; for 13 or more students the charge is \$500 extra for each student beyond 12 • maintenance and enhancement are free for the first year; thereafter, ongoing annual maintenance is 15% of the prevailing license fee; multicopy and multiproduct discounts available; no-obligation 30-day trial is provided; acquisition includes one full set of manuals and 10 copies of the InterTest User's Guide; all manuals except the User's Guide can be duplicated from the distribution tape; User's Guides can be purchased for from \$5.00 to \$7.50 apiece, depending on quantity.

□ Product Definition

InterTest is a test and debugging software product designed to improve productivity in the development and implementation of CICS/VS application programs written in either COBOL, PL/1, or IBM assembler language source code. It consists of 5 basic modules: a monitoring module, a monitoring command service module, an inquiry module, a main storage debugging module, and a file and auxiliary storage debugging module. The InterTest monitor sits between the CICS/VS program product and the application program(s) being monitored. It controls the interaction of CICS/VS and the programs to prevent errors from damaging the online operations of the test and production system. Interactive debugging is facilitated through the use of breakpoint settings. All diagnoses and displays are directed to either the terminal controlling the command language or to a designated terminal on the system.

InterTest • DOS/VS, single CPU:

\$21,000 lcns	\$1,370/\$1,260 mo	\$3,150 serv
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InterTest • DOS/VS, location use:

26,250	1,715/1,575	3,938
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InterTest • DOS/VS, 4331 or equivalent:

12,600	825/755	1,890
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InterTest • OS/VS, single CPU:

25,200	1,645/1,510	3,780
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InterTest • OS/VS, location use:

31,500	2,055/1,890	4,725
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■ FUNCTIONAL FACILITIES

□ Host Computers & Operating Systems

InterTest runs on any IBM or compatible mainframe computer capable of running CICS/DOS/VS or CICS/OS/VS.

□ Minimum Operational Configurations

The 5 modules that make up the basic InterTest system reside in the CICS dynamic memory area. They range in size from 6K bytes to a maximum of 10K bytes each and are swapped in and out as needed so that no more than 1 module need be resident at any given time. Load tables are defined by the user and are variable in size.

■ USER INTERFACES

□ Languages Supported

The InterTest SYMBOLIC feature supports setting breakpoints by COBOL paragraph names and statement numbers, by PL/1 procedure names and statement numbers, and by ASSEMBLER labels. It also allows viewing of program data by field name for all 3 languages. In addition, source code is available on the breakpoints display for COBOL and PL/1 with full source code viewing available via the LIST utility for COBOL and the PLIS utility for PL/1.

□ CICS Test/Debug Facilities

Monitoring Facilities

The monitoring command service module is the interface between the user terminal and the monitor. It accepts monitoring, breakpoint, and disposition commands and passes the requests on to the monitor. The monitor logically resides between the CICS/VS program product and the user application program. InterTest commands can be entered through the menu screen or directly. Command entry/execution is supported by a HELP facility. All operations are interactive and are based on existing system terminals. Two tables are created when the monitoring function is initialized. The tables identify the programs, terminals, and/or transactions that will be monitored. The size and contents of the tables are set at initialization time but are dynamically increased as system user requires. The main purpose of the monitoring function is to make certain that catastrophies in the CICS/VS environment will not cause the system to go down, to pass incorrect information, or to branch out of the program boundaries. The monitor interrupts a task whenever an error is detected. Any task execution can be suspended until the error is corrected via the breakpoint debugging facilities. If no breakpoint display is wanted, as in the production environment, the monitor automatically terminates the task in an orderly manner, produces a dump, and sends a message to the terminal. Error codes identify the cause of any abnormal termination.

The full MRO environment is supported by Release 2.4 of InterTest. Function Shipping, Asynchronous Processing, and Transaction Routing are supported for transactions, terminals, and other resources defined on both local and remote CICS regions. Distributed Processing is also supported.

Optional Monitoring Facilities

The Bypass option lets the user remove storage protection constraints for whole programs, selected sections of programs, or specified transactions without compromising the safeguarding actions of the monitor. The user can remove storage protection temporarily for a particular instruction, for the CSA (Common System Area), and for the CWA (Common Work Area).

The Replace Feature allows a program to use a different resource other than those coded in the program. For example, a user might wish to use test files rather than production files when executing a program and allow other users of the same module to run in normal fashion. InterTest allows File Names, Program Names, Transient Data Destinations, and Temporary Storage Identifications to be changed dynamically.

The No Update option allows testing a program while "making it pretend" that it is updating, adding or deleting records in a dataset that must not be changed. This feature is particularly useful when debugging programs in a production environment.

The Maximum CICS Request Facility allow setting a limit on the total number of CICS requests that a program issues before receiving an automatic breakpoint. This is especially useful for debugging programs that contain a CICS request in a loop and

LCNS: one-time license fee. MO: first figure is monthly charge for a 36-month lease plan; second figure is monthly charge for a 30-day cancellable rental. SERV: annual charge for service; applies after first year for all license/lease arrangements. Prices are effective as of March 1, 1985.

On-Line Software International (OSI) InterTest CICS/VS Testing Tool

therefore will not time out. The Maximum CICS Storage Acquired facility limits the amount of storage a program can acquire before obtaining an automatic breakpoint.

Many other options are available for independently supplied or complex CICS applications that violate traditional CICS programming standards.

Breakpoint Facilities

InterTest supports automatic breakpoints, conditional or specific breakpoint settings, and a series of options that govern breakpoint action. The automatic breakpoint display is produced when an error is detected by the monitor during execution of the application program. The program comes to a halt, and the user has time to analyze the problem and possibly correct it by using the main storage and file debugging commands. After determining what action is needed, the user can either continue or terminate the task. Conditional breakpoints allow execution to be suspended whenever a certain condition occurs (for example, when the value of a program variable changes). Specific breakpoints allow the user to look at work areas and records at intermediate points in the processing cycle. These breakpoints are specified in the monitor command. Breakpoints can be designated by COBOL statement number or paragraph name, by PL/1 statement number or procedure name, by assembler label, by displacement from the start of the program, or by addresses for programs that are CICS resident. Options available through the use of the breakpoint display facility include: program backward trace, single-step operations through the program logic in sequential order, and the ability to walk through the logic of a task where the user can reposition a breakpoint location and produce a snapshot of a particular area. With the breakpoint option, the user can alter the restarting point for execution after a breakpoint stop has occurred.

Display Facilities

There are 3 types of display capabilities: source code display, main storage display and modification, and file storage display and modification. The user's current source code is displayed at every breakpoint. This procedure eliminates the need to wait for printed listings. The current COBOL, PL/1, or assembler instruction is highlighted. The full source code listing and compiler output are available on demand through a separate InterTest transaction. Any program-related data can be inspected and modified by name. Displays can also be identified by absolute address, symbolic address, or keyword. The memory display presents 16 bytes of information per line on 17 lines of an IBM 3270 CRT screen. The display is in both hexadecimal and character formats.

The display function permits scanning all InterTest tables and buffers, CICS control tables, and programs and data in main storage. The modification capabilities allow the user to move data in main storage. Up to 256 bytes of data can be manipulated in a single command. User storage and Terminal I/O Areas (TIOAs) can be acquired through the use of the system GETMAIN command. InterTest can be used to convert data from decimal display to hexadecimal and back for calculation purposes.

A unique feature of InterTest allows COBOL programmers to modify storage without having to know the internal data formats, hex values, or storage representations. A simple "COBOL like" command permits moving data into a field by entering its name into the "TO" field (the receiving field) and either specifying the name of the sending field or a literal in the "FROM" field. Any of the following COBOL keywords can be used as a literal in the "FROM" field: ZERO (S), SPACE (S), HIGH-VALUE (S), LOW-VALUE (S), AND QUOTE (S). For example, to fill the field TASK-NUMBER with

low values (binary zeros) the command would be CORE = MOVE LOW-VALUES TO TASK-NUMBER.

File display and modification transactions are written as generalized CICS/VS application programs. ALL FILE transaction keywords are converted into CICS/VS Macro Level requests and are passed to the CICS software. Some of the file handling options include: browsing, adding records, deleting records, updating files, logging, and password generation. All standard IBM file structures are supported, including ISAM, BDAM, VSAM, DL/I segments, Transient Data, and Temporary Storage.

InterTest provides several levels of security controls for the CORE and FILE transactions. FILE requests can never overrule previously defined security decisions.

Testing Facilities

Testing with InterTest can be conducted in a multithread environment. When a breakpoint is reached, the terminal originating the breakpoint can be disconnected from its task and is available to input commands relating to any other task in the system. Using task identifiers with each command, the programmer can proceed with testing by moving from one breakpoint to another with only 1 terminal. If desired, breakpoint displays can be directed to another terminal. In all cases, a unique breakpoint identifier is associated with each display. Although not recommended for medium-to-high volume production environments, InterTest does allow the user to establish a system-wide monitoring environment, which is useful when testing for an elusive bug in the CICS/VS system, but the overhead demands are extremely high in this mode of testing.

■ USER REFERENCES

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

- Steven W. Jost
Systems Analyst
Deere & Company
Financial Services Systems
Financial Services Building
34th & 80th Streets
Moline, IL 61265
Tel: 309-752-5132
- John R. Thomas
Manager, Database & Systems Technology
Babcock & Wilcox T.P.G.
P.O. Box 401
Beaver Falls, PA 15010
Tel: 412-846-0100
- Ron Czarnecki
Manager Technical Support
Bullock's
800 S. Hope Street
Los Angeles, CA 90017
Tel: 213-612-5011
- Mr. Neill Stewart
Systems Programmer
Central Service Association
P.O. Box 348/340 Court Street
Tupelo, MS 38801
Tel: 601-842-5692

● END

Pansophic Systems, Inc O-W-L

Online Program Development System

■ PROFILE

Function • source program maintenance and development tool; primarily for online operations but includes full batch support.

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

Networks & Protocols • SNA; BSC, SDLC.

Languages Supported • any system-acceptable high-level programming language; O-W-L Procedure Language (proprietary).

Communications Interfaces • IBM CICS/VS (both OS and DOS systems); self-contained monitor.

TP & File Access Methods • all standard IBM communications access methods; standalone versions support VTAM (DOS and OS); SAM, ISAM, VSAM, and all other standard IBM file access methods.

Terminals • 3270-compatible plus any other terminal supported by CICS/VS.

Special Features • Conversational Procedure Language and System Programmer Tool Online (STOL).

Logging/Accounting • Dynamic Recall history file archiving; CICS statistics via the INFO command.

Failure/Recovery • backup/restore utility program.

Current Version • 8.1.

Installations • approximately 570.

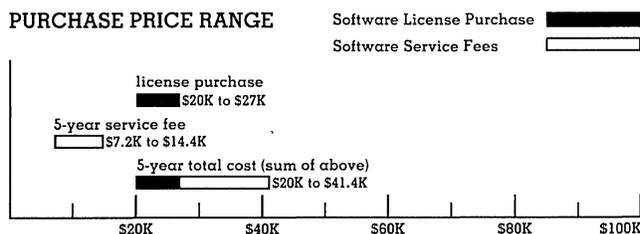
Comparable Products • IBM ICCF, IBM TSO/SPF, ADR VOLLIE (DOS), OBS WYLBUR, and ADR ROSCOE (OS).

Vendor • Pansophic Systems, Inc; 709 Enterprise Drive, Oak Brook, IL 60521 • 312-986-6000.

Canada • Pansophic Systems of Canada, Ltd; 165 Dundas Street West, Suite 902, Mississauga, ON L5B 2N6 • 416-272-0780.

■ ANALYSIS

Like many of its competitors, O-W-L originated during the height of the batch processing era. However, unlike its competitors, O-W-L has been redesigned over the years, not merely to operate in an online environment, but to take full advantage of the system's online capabilities. The result is an Online Without Limits



PANSOPHIC SYSTEMS O-W-L 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 O-W-L for an IBM DOS/VS(E) system • **MAXIMUM CONFIGURATION** is O-W-L for an OS/VS system • inasmuch as all options are included in the original base price, there are no extra costs incurred.

(O-W-L) system designed in such a way that operating system and hardware configuration changes have little or no effect on O-W-L ability to support any new environment; O-W-L can grow, theoretically, "without limits."

The design of O-W-L does not limit it to a source program maintenance system. It also can generate and maintain JCL, store and maintain program libraries, enhance online program development time, and provide users with more timely test and debugging sessions. The ability to submit a job for execution, view any errors, correct the errors, and resubmit the job within a matter of minutes instead of hours now becomes a reality. The key to effective program maintenance is a tight security system. O-W-L contains numerous security options and facilities that can be adapted to almost any degree required by the installing installation. O-W-L can be installed with the IBM CICS/VS communications monitor or it can be acquired standalone with its own TP drivers. O-W-L can readily be coupled with Pansophic's PANVALET and PAN-EXEC to form a complement of online productivity and library control systems.

□ Strengths

The major strength of the O-W-L product is its ability to provide users with an effective and efficient online program development tool. Its ability to manipulate programs and/or segments of programs in either a test or debugging environment with very little loss of turn-around time enables users to realize much more production time from the installed system. Terminal orientation is another big plus factor provided in O-W-L. With all the integrity options built into the system, a given user does not have to worry that another terminal user will access a data file not authorized to that user. The O-W-L Database file is one physical entity, which means that file maintenance and backup/restore operations take much less time and are easier to perform. There is also a reduction in the amount of free space required for the test operation.

The O-W-L Procedure Language allows users to tailor the production JCL needed for a specific task and then submit the total "deck" to compilation, assembly, test, or production. The Conversational Procedures option is designed to help nonprogrammers and novice programmers to develop complete interactive sessions with a "fill-in-the-blanks" operation. The degree of assistance provided automatically by the system depends on what the system "feels" the user needs. Also, users do not need to know the command structure or the parameters associated with each command. The help aids can display the make-up of any command in the system.

The toggle switch facility is another programmer production enhancement feature. This capability allows users to develop a split screen that effectively operates as 2 separate screens. No relationship is required between the contents of each display.

□ Limitations

A major O-W-L shortcoming is that it doesn't offer as many facilities as comparable products for the same price tag. For example, there is no facility designed explicitly for syntax checking of application code. Also, there are no features that specifically address data entry and validation operations, although users can achieve these results by judicious concatenation of existing O-W-L facilities. Other minor limitations of a similar nature attest to the aging of the product, and might suggest that perhaps a rejuvenation project should be launched.

As we all know, there is always a trade-off between speed and complexity. This is the case with O-W-L. Admittedly, since the O-W-L database file is one physical entity (data set), maintenance and backup/restore operations are faster and more convenient to

Pansophic Systems, Inc O-W-L Online Program Development System

perform. However, the very benefits derived from the single-entity concept only serve to emphasize the increased criticality of security and integrity considerations when operating in such an environment. A significant amount of manual administrative emphasis is required to establish controls associated with access authorization structures, backup/restore functions, archiving, off-site storage/rotation cycles, disaster recovery procedures, etc. In other words, users must be extremely aware of the fact that "all their eggs are in one data set."

Before any data can be stored in the O-W-L database, the user must predefine how it is to be handled by the system for internal formatting. These format options are defined by the administrator at installation time, and in some cases, once established, can never be changed. Therefore, it becomes intuitively obvious that careful planning must precede the initial format definitions.

■ OVERVIEW

Terms & Support

Terms • available on a permanent license basis or on a 24-, 36-, 48-, or 60-month lease; time payment plans are available.

Support • first year of support free with license purchase; thereafter, maintenance is available at an annual rate of 12% of the then-current license fee; maintenance is included in the lease plan charges; training is free during installation.

Component Summary

The O-W-L system is basically a total operating environment that consists of a procedural language, a command repertoire, and a variety of utility-type programs to manipulate the data in the libraries and databases. It can be interfaced with IBM's CICS/VS or can be acquired with its own TP drivers. Only 2 options, which are included with the system, are available to the O-W-L user: the Conversational Procedure Language and the System Programmer Tool Online (STOL). Conversational PROCs (as they are called by the vendor) allow users to develop a question and answer mode of operation that will permit simplified use of O-W-L capabilities. The STOL option was released for general use in the second quarter of 1982. This system programmer's tool provides 11 distinct utility programs that enhance system maintenance and make the system programmer's job easier.

Host Computers & Operating Systems

O-W-L can be installed on any IBM System/370, 3000, 4300, or compatible computer capable of running under DOS/VS(E), VS/1, or MVS. A standalone version of O-W-L is available for both DOS/VS and OS/VS users, but a version that runs under CICS/VS Release 1.5 or above is also available.

Minimum Operating Requirements

O-W-L operates as an application in the operating system environment. When it is operating, it requires approximately 84K bytes of real memory. O-W-L requires a disk device for its databases. Any device supported by the operating system is supported under O-W-L. For terminal operations, 3270-type devices are supported by the standalone version, and any terminal supported under an associated TP monitor can also be handled under O-W-L.

■ ONLINE PROGRAM DEVELOPMENT

The O-W-L Nucleus

The O-W-L Database constitutes the heart of the operations performed by the development tool. It is a single physical file that is logically divided into 3 distinct operational components: the ODB (Online Data Base), the PDB (Public Data Base), and the Control Area. The entire operation of the system revolves around these elements. The ODB is the storage and maintenance area for on-line operations. Whole programs or segments of programs can be stored on this file in compressed mode. Each group of related data stored in the ODB is called a "scratchpad." The PDB is made up of elements called "members." A member is any group of related data made up of 80-column card images. The PDB is normally used to store production programs and JCL. The mem-

bers are also stored in compressed mode, which permits users to store data in about 20% of the storage space normally associated with the operating system library structure. All O-W-L control information is stored in the Control Area. Some of the more important information maintained in this area includes security profiles and default values.

Users must predefine Format Types at installation time to use the O-W-L Databases. The Format Types define the rules for each individual member or scratchpad. The Types are normally the responsibility of the Data Base Administrator (DBA). ODB Format Types deal with the access and viewing parameters of the scratchpad while it resides within the ODB portion of the database. The information available in the Format Type includes length of statements in the scratchpad, position of the display screen, symbol to be used as the logical tab character, the number of lines used for paging, the value for nonkeyed characters in a new record, the location of the tab settings, and the programming language used in the scratchpad. None of this information is stored with the scratchpad, so it is temporary. On the other hand, the PDB Format Type information is stored in the member being described and becomes permanent for the life of that member. The type of information stored in the PDB Type record includes: the location and length of sequence numbers; the sequence number increment factor; "yes/no" declarations relating to storage of sequence numbers, compression of sequence numbers, authorization to resequence sequence numbers; and the number of revision levels to be retained for Dynamic Recall. Since ODB Type Information is not stored with the member and is therefore temporary in nature, it can be varied by modification of the current TYPE definitions. On the other hand, PDB Type Information is stored within the member and cannot be changed by any temporary modification or deletion of the current TYPE definitions.

O-W-L is a command-structure system. It provides users with a full and comprehensive set of editing and viewing commands. O-W-L users can perform extensive arithmetic operations in both fixed and floating-point modes. The full range of comparison operators (e.g., EQ, NE, GT . . .) and Boolean operators (AND/OR) is also available for use in structuring programs. O-W-L can interact with any spooler system that can function with the host operating system. Users of Pansophic's PANVALET library maintenance system can interface with O-W-L through transparent commands.

O-W-L • DOS/VS(E)-CICS or independent:

\$20,000 lcns	\$1,300/\$900 mo	\$2,800 serv
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O-W-L • OS/VS-CICS or independent:

27,000	1,700/1,200	3,600
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Functional Facilities

Many of the O-W-L operational elements can be viewed as independent modules, although they function as an integrated unit. Some selected functions are O-W-L PROCs (Procedure Language), the security facilities, the Inclusion command, sequence number handling, the Dynamic Recall facility, job submission subsystem, bracketing and pointing operations, the toggle switch feature, logical tabbing operations, the advanced prompting enhancement, generic processing, the User Profile feature, and command stacking.

O-W-L PROCs

The O-W-L PROCs language consists of a set of macro-type statements that can be invoked by the RUN command. The PROC processor can be used to generate tailored 80-character card images, which can then be stored in a scratchpad, executed as a command stack, or submitted to the operating system for execution. The card images can also be stored in the PDB if the PROC must be available to other system users. Two types of statements

LCNS: license purchase price includes first year of maintenance. MO: first figure is monthly charge for 2-year lease; second figure is monthly charge for 5-year lease. SERV: ongoing annual maintenance charge based on 12% of the then-current license purchase price. Prices effective as of January 1985.

Pansophic Systems, Inc O-W-L Online Program Development System

are used with O-W-L PROCs: a Procedural statement and a Data statement. The Procedural statement is actually a command to the O-W-L PROC processor; a Data statement is a card image that is generated as a result of processing by the processor.

Some examples of Procedural statements are: Declarative statements, which identify the beginning and end of an O-W-L PROC, provide comments, limit loops, and identify data to be included in the output; the Data Manipulation statements, which create and manipulate fields within an O-W-L PROC and define, initialize, and alter variables and parameters; Terminal I/O statements, which write and read information from a display terminal and establish conversation interaction if desired; and Logic Control statements, which allow users to control the flow of logic (e.g., DO, IF, GOTO, etc) during the execution of the procedure.

There are 2 types of Data statements: Processed Data and Included Data. A Processed Data statement is any statement in the O-W-L PROC that does not qualify as a Procedural statement. Processed Data statements are scanned by a Substitution Processor and can be modified by an insert. An Included Data statement is any statement included by an O-W-L PROC but not residing within the PROC itself. Included Data statements are never processed by the Substitution Processor and are always generated without modification.

The PROC processor communicates with the user and the system through FIELDS. There are 3 types of FIELDS: PARMs, VARIABLES, and SYSTEM. The PARMs type allows users to pass parameters by entering them as keywords with the RUN command. The VARIABLES type is defined dynamically when encountered by a SET command. Eleven SYSTEM fields deal with date, time, and terminal ID controls. The Substitution Process replaces a reference to a PARM, VARIABLES, or SYSTEM field with the current content of the field. The statement can be temporarily expanded or contracted. Selected data statements and Include statements can be passed to 1 of 3 output media: the system spooler input reader, the command stack belonging to the involved terminal user, or to an ODB scratchpad.

Security • ODB security is based on password and User-ID directory entries; the directory entry is assigned to a particular ID and identifies the user to the system; the entry information contains name, management level, and allowable commands • a scratchpad directory contains 1 record of information for each scratchpad belonging to an individual User-ID; the information consists of padname, record size and data, and time of last access • a PROFILE for each scratchpad can be defined as either PRIVATE or PUBLIC; PRIVATE means that only the creator can access and modify the scratchpad; PUBLIC means that anyone can access the scratchpad, but only the creator can modify it • PDB security is provided through a master password facility and a keyword designation; a security key can be assigned to an individual member through an OWNER keyword; group security is handled through read and/or write password protection schemes; up to 5 status codes can be designated for access protection; a master password technique is used for global operations such as library backup; a master password can override all other security measures • security passwords are internally scrambled to prevent determination by file dump; they can be changed as often as desired or required.

Inclusion Facility • stores commonly used portions of programs as individual ODB scratchpads or PDB members; provides automatic "inclusion" of these segments in an ODB (or another PDB member) upon request; in ODB inclusion, 1 scratchpad can be included in another scratchpad; the ODB supports only 1 level of inclusion; for a PDB inclusion in the ODB operation, the commonly used segments of programs are stored as individual PDB members and can be further included into an ODB scratchpad; the ODB supports 3 levels of PDB nested INCLUDES; the PDB supports an unlimited number of nested INCLUDES • the SUBMIT command reads and resolves the INCLUDE Statement; it replaces the statement parameter with the named scratchpad, member, or portion of member; the resulting program (or portion of a program) is then placed in the input reader queue for batch execution.

Sequence Numbering • there are 3 sequence number handling options: stored sequence numbers (not supported in the ODB),

variable sequence numbers, and external (ghost) sequence numbers; stored sequence numbers occupy specified columnar positions of each statement; they are resequenced at the user's option; they are not generated or resequenced automatically by O-W-L • variable sequence numbers are never stored within the statements; they are generated and resequenced automatically by O-W-L and are placed into specified columnar positions of each statement whenever a member is extracted and written to an output file • external sequence numbers are never stored or placed in a statement; they are printed (as ghost numbers) alongside the statements they represent on the output reports; these numbers reflect the relative position of the statement from the beginning of the member; ghost numbers are not normally visible on the screen display field but can be brought into view by shifting the image; when variable sequence numbers are used, the ghost numbers are identical to the variable sequence numbers displayed with the statements.

Dynamic Recall • provides an automatic record and audit trail of maintenance activity to a member; multiple revision levels are captured for historical purposes; internal facility can recall the complete history of a member on demand; recall feature can show all maintenance activity that has been done to a program on prior revisions; provides for complete reconstruction of a prior revision, reverses improperly applied changes made to a revision, can create new programs from prior revisions, and can display a history of past changes to a member showing the actual statements added and deleted at each revision.

Job Submission • provides the ability to submit one or more scratchpads into a different partition for asynchronous batch processing; submission is normally for compilations, assemblies, testing, or production execution of programs; the O-W-L PROCs can be used with Job Submission to cause JCL or any card images to be generated and tailored for a specific task; the SUBMIT command is used to submit self-contained jobs to the internal reader for execution.

Bracketing & Pointing • method for manipulating statements while bypassing sequence numbers; bracketing identifies a statement or range of statements by using Field Mark Key identifiers within statement(s); pointing identifies a single statement or a location on the screen through the use of the cursor; statements can be bracketed and deleted from the scratchpad; statements can be bracketed and moved or copied to the pointing cursor location.

Toggle Switch Command • enables users to view and/or work with 2 distinct screens at the same time; operates in either Dual-Screen Mode or Full-Screen Mode; Dual-Screen Mode divides the display screen in half; the display for the first command is placed in the upper half of the screen, and the display for the second command is placed in the lower half; a toggle switch technique determines which display is affected by keyboard entries • Full-Screen Mode displays a full screen of each portion of data; the toggle switch enables users to switch back and forth between 2 displays; allows users to work with 2 parts of the same scratchpad, a scratchpad and a listing, 2 distinct scratchpads, or 2 distinct listings.

Logical Tabbing • allows users to enter statements as a contiguous string of characters and have them positioned to specific columns within the statement; all tab positions are predefined during installation for each Format Type; tab stops are indicated by the letter "V" on the screen ruler; O-W-L uses the logical NOT indicator as the default logical tab character; whenever this symbol is encountered, the characters that follow are advanced to the next physical tab position.

Advanced Prompting • System Prompting is initiated whenever the system determines that an error is severe enough to indicate that the user requires more information to complete activity; User Prompting is available when requested by a user within a primary command, such as VIEW or EDIT, which contains many subcommands that need to be identified.

Generic Processing • available for commands that allow generically masked operands to be specified; this feature allows multiple members to be processed within a generic grouping with just a single command structure; a generic masking on an operand is denoted by the presence of an asterisk (*) to the right of the oper-

Pansophic Systems, Inc O-W-L Online Program Development System

and in the syntax block of the command; any character can be masked out.

User Profile Facility • extends the User-ID command to provide a screen display of all command and access privileges available to a user; permits the DBA or higher-level manager to allow or disallow specific privileges through the keyboard entry command statement.

Command Stacking • allows users to concatenate (or stack) commands for subsequent execution; stacking can be done through the input command line at any time; it can also be done by entering commands into an O-W-L PROC and executing the RUN command.

Conversational Procedures (PROCs)

This option allows users to write specialized O-W-L PROCs that can establish a question and answer session with the system. It provides interactive conversation and the ability to respond to predesigned inquiry panels. Together with the arithmetic and logic operations provided with the system, users can standardize production JCL, enhance job scheduling and job submission from terminals, provide instructional screens for non-programming personnel, and establish validity check criteria for job submissions. Conversational PROCs can be written to dynamically generate tailored sets of commands for repetitive tasks. By using the prompting technique inherent in Conversational PROCs, users need not be familiar with specific command parameters.

System Programmer Tool Online (STOL)

STOL consists of a series of 11 online utility programs designed to support and assist the system programmer in maintaining the O-W-L system. Some of these routines include: a facility to change the VTOC (Volume Table Of Contents), a new MAP command for 3270-type screen mapping, and the ability to view and alter any DOS/VSE priority, to view and expand the channel queue, and to list all I/O functions, etc.

■ USER INTERFACES

Batch Processing Mode

O-W-L provides users with a series of batch operation facilities. Many of the commands utilized in the online system are also available to the batch processor. Several special utility programs can only be executed in batch mode. The CRT utility is used by the system to initially format and create a new O-W-L database file. The UNL program unlocks an O-W-L Database that has been locked because of a hardware or software malfunction.

Three special utility programs are designed to help management control the O-W-L system. The MNG program provides facilities to maintain all secondary libraries, where off-line storage of less

frequently used programs is maintained, and provides directory reporting and historical maintenance reporting capabilities. The DIR program produces a condensed directory report or a cross reference of INCLUDE usage within the PDB. The BKP utility provides complete backup and restore facilities for the O-W-L Database.

Finally, the PRG program provides programmers with full batch updating and reporting facilities for members in the PDB.

■ USER REFERENCE LIST

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

- Mr. Greg Terrill
Programming Manager
Industrial Risk Insurers
85 Woodland Street
Hartford, CT 06102
Tel: 203-525-2601
- Mr. Lee Allen
Vice President
First Buckeye Bank
99 Park Avenue East
Mansfield, OH 44902
Tel: 419-522-2211
- Mr. Bob Walker
Computer Operations Administrator
Grange Mutual Life Insurance
650 South Front Street
Columbus, OH 43216
Tel: 614-445-2735
- Mr. Ernest R. Fulanetto
Assistant Vice President
Bell Federal Savings
79 West Monroe Street
Chicago, IL 60603
Tel: 312-346-1000
- Mr. Charlie Jones
Programming Manager
Data Processing
Random House
400 Hahn Road
Westminster, MD 21157
Tel: 301-848-1900

• END

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

■ PROFILE

Function • bit-interleaved time-division multiplexer (DCX725) • statistical multiplexers and network concentrators.

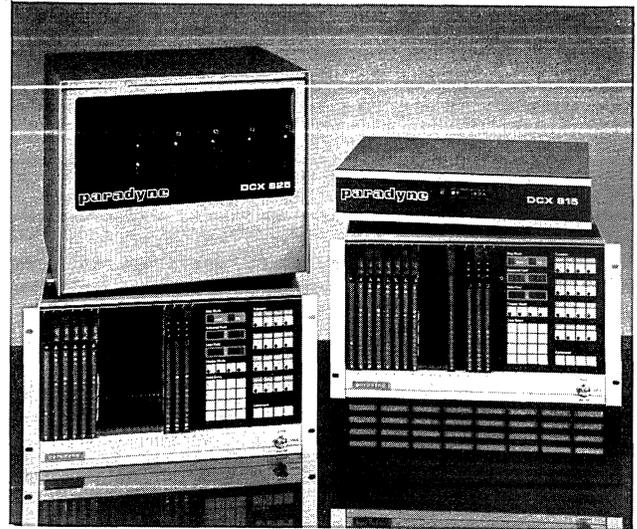
Communications/Networks • DCX725 TDM supports up to 4 synchronous channels; statistical models DCX815/DCX861 up to 8 asynchronous/BSC channels; DCX825/DCX871 up to 32 asynchronous/BSC channels; DCX840/DCX850 up to 240 asynchronous/BSC channels • channel rates up to 9600 bps • maximum aggregate channel rate of 38.4K bps (DCX725, DCX815/DCX861); 76.8K bps (DCX825); 576K bps (DCX840/DCX850) • DCX725/DCX815/DCX861/DCX825 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 Level II link protocol, all statistical models.

First Delivery • 1982.

Systems Delivered • unknown.

Comparable Systems • principal competition for DCX725 from Micom Micro 700 • for DCX815/DCX861 from DCA 105/110; Gandalf PIN 9106; Infotron Supermux 480; Micom Micro 800/2; Racal-Milgo Omnimux; and Timeplex M4A/M8C • for DCX825/DCX871 from Codex 6005/6010; DCA 120; DCC CM9100; Gandalf PIN9103; Infotron Supermux 680; Micom Micro 800/2; Racal-Milgo Omnimux 320; and Timeplex Multiplexer M24C/M48C • for DCX840/DCX850 from Codex 6030/6040/6050; Infotron 790/792NC and 990/992NP.

Vendor • Paradyne Corporation; 8550 Ulmerton Road, Largo, FL 33540 • 813-530-2000.



Canadian Headquarters • Paradyne Canada Limited; 200 Consumers Road, Suite 504, Willowdale, ON M2J 4R4 • 416-494-0453.

Distribution • nationwide via local sales offices and worldwide via direct sales or distributors • Canada via Paradyne Canada Ltd • Great Britain via Paradyne U.K. Ltd • Germany via Paradyne GmbH • Europe, Asia, Central and South America via Paradyne distributors.

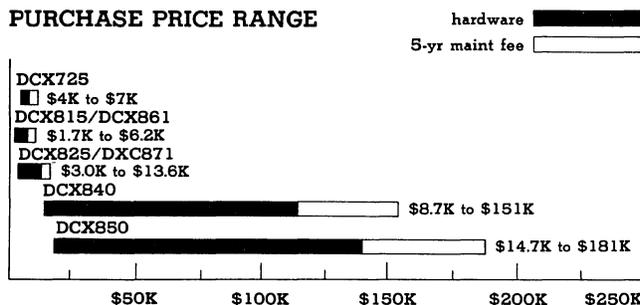
GSA Schedule • listed.

■ ANALYSIS

The incorporation of the DCX Network Supervisory Controller (NSC) into the existing DCX product line reinforces Paradyne's network strategy. Most notably, this latest DCX addition enhances overall network operating flexibility and ease of operation, 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. Simplified supervisory control is an asset to users with sophisticated networks that require frequent operating parameter alterations.

In addition, Paradyne is now offering 2 extra-cost options for high-end models DCX840 and DCX850 that dramatically increase their flexibility by allowing users to integrate several protocols in a common network. The DCX BlueGate option provides integral async to 3270 bisync protocol conversion. The DCX XGate option provides an integral async PAD (Packet Assembler Disassembler) for accessing public or private data (packet switch) networks (PDNs). Both options fit into a card slot of the DCX840/850 chassis and can be distributed throughout a network or mixed in the same chassis. Up to 13 BlueGates can be installed in a DCX840/850 with a maximum of 32 virtual channels per card. Up to 13 XGates can be installed in a DCX840/850 with a maximum of 64 virtual channels per card.

PURCHASE PRICE RANGE



PARADYNE DCX SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations (solid bars), and for associated 5-year maintenance fee (open bars) • DCX725 small or large configuration consists of 4-channel sync mux • DCX815/DCX861 small configuration consists of 4-channel async mux; large of 8-channel async mux with integral 9600-bps modem • DCX825/DCX871 small configuration consists of 4-channel async mux; large of 32-channel async mux with integral 9600-bps modem • DCX840 small configuration consists of card frame with 4 async channels, 16K-byte buffer, and single 19.2K-bps composite link; large of 5 card frames with 192 async channels, 1024K-byte buffer, and 12 56K-bps composite links • DCX850 small configuration consists of card frame with 4 async channels, 16K-byte buffer, switching module, and single 19.2K-bps composite link; large of 5 card frames with 192 async channels, 1024K-byte buffer, multinode switching module, 12 56K-bps composite links, and DCX/NSC Supervisory Controller.

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

Over the past year, Paradyne has sliced 2-year/3-year lease maintenance pricing from 6 to 54 percent on selected models and options. Furthermore, the IBM BSC option for the high-end DCX850 now carries a purchase price tag of \$1,200.

The DCX Series of statistical and time-division multiplexers were originally designed and manufactured by Computer and Systems Engineering Ltd (CASE) of Great Britain, a data communication firm that licenses DCX products to 2 American companies: Rixon Incorporated of Silver Spring, MD, and Paradyne Corporation of Ulmerton, FL. Although DCX offerings from both U.S. companies are conceptually alike at this time, some models are packaged differently (notably the DCX825) while other models may be missing from one vendor's lineup altogether (Paradyne does not market the DCX836). Each U.S. firm has the option to change or enhance any of the DCX multiplexers to its own specifications. Rixon enjoyed exclusive rights to DCX multiplexers for a number of years before CASE licensed the line to Paradyne. Paradyne manufactures most DCX models/parts at its own facilities in the United States.

The Paradyne DCX family consists of 6 models of statistical multiplexers that focus on small-, medium-, and large-scale asynchronous/BSC network requirements, and 1 time-division multiplexer to support minimal synchronous requirements. The statistical models are transmission compatible and can all be used in the same network, whereas the TDM (DCX725) is meant to provide synchronous channels for the other models in a tandemly configured, bandsplitting role, although it can be used in a standalone point-to-point configuration as well. The DCX825, a mid-range DCX model, is alone among the series in its ability to accommodate a card-version of the DCX725, and is also the only model to accommodate onward linking. 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 DCX861 and DCX871 are variants of the DCX815 and DCX825, respectively, that incorporate an integral 9600-bps, CCITT V.29-compatible modem; both units are functionally identical to the original units without the modems, and include the same specification and capacities. The DCX840 and DCX850 are multinode, multilink models which are also functionally similar except for the 850's ability to perform dynamic channel switching. All DCX multiplexers are designed for point-to-point communication.

Paradyne statistical multiplexers range from the entry-level DCX815 with 4 or 8 channels, through the 32-channel DCX825, to the top-end 240-channel DCX840/DCX850. The DCX850 can address 63 DCX850 nodes at 240 ports-per-node, as well as other nodes composed of other model DCX multiplexers. The DCX family of statistical multiplexers is upward and downward compatible to benefit operating flexibility as well as future growth requirements.

The DCX815 is a packaged multiplexer designed to satisfy the need 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 is standard; automatic speed detection is standard and echoplex is available.

The DCX825 is essentially a package of up to 4 DCX815s in a single unit. The unit accommodates DCX815 asynchronous/synchronous quad-channel adapters that have been altered for vertical mounting. A synchronous quad-channel bandsplitter is 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 3 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 Paradyne 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, a Paradyne board equivalent of its T-96 is rated at 9600 bps.

The DCX840 and 850 address medium-to-large-scale network requirements for asynchronous/synchronous communication support. They are extremely flexible, large-capacity units that can be configured to meet immediate needs as well as those for future expansion. DCX840 and DCX850 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 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 user 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 DCX840 and DCX850 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. Central control is distributed among quad-channel adapters and composite link modules, which minimizes the cost for central control.

Additional enhancements to the DCX line include larger node support and a short-form address scheme for the DCX840/850 along with a new approach to supporting BSC synchronous channels by emulating an IBM 3270 controller. The synchronous BSC emulation mode reduces overhead and polling delays for 3270 users and also cuts IBM equipment costs.

□ Strengths

The principal advantage of the Paradyne 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

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

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. Newer wideband and X.25 link modules enhance their utility in high-traffic environments. 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.

Centralized network control is a significant user benefit that consolidates performance and diagnostic information for review at 1 location. The user can observe performance statistics at both local and remote units, conduct diagnostic tests to detect failures, and evaluate existing operating parameters for alteration when necessary. The concentration of event logs and configuration maps to 1 site for storage and printing not only facilitates operating convenience but reduces additional equipment costs.

Network flexibility is further enhanced by the addition of X.25 and BSC gateway options for DCX850 multiplexers. DCX XGate is an easily installed single-card interface that enables the user to access a packet network such as Telenet, Tymnet, and Uninet. Also a single-card interface, DCX BlueGate provides asynchronous to 3270 bisynchronous protocol conversion integrally to DCX multiplexers. In addition to XGate and BlueGate, Paradyne also supports protocol options for prominent minicomputers. Users of Wang, Hewlett-Packard, and Tandem computers will appreciate the inclusion of these no-cost items for handling different vendor's flow control idiosyncracies.

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 high level of operating flexibility provided by the DCX850 makes it a strong candidate for large networks. Users that need this kind of operating flexibility with the configuration and expansion flexibility of the DCX850 should consider it as a possible solution to their network problems.

□ Limitations

Although Paradyne significantly improved throughput performance for the DCX Series by increasing the maximum 4-channel aggregate data rate to 38.4K bps (9600 bps per channel), some limitations still exist for low-end 4- to 32-channel models which share logic among channel-card pairs. The 38.4K-bps aggregate rate **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 in a DCX825 master/expander card combination are restricted to the 38.4K-bps aggregate rate (4800 bps per channel). The same limitation applies to the 2-channel BSC option when coupled with asynchronous channels; 38.4K bps is still the maximum aggregate rate. No such limitation exists for DCX840/850 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 synchronous channel option for the DCX825 is a bandsplitter with dedicated bandwidth that varies according to channel priority assignments. The 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. According to the vendor, Paradyne split-stream (TDM multiplexed) modems perform better than this option.

The Onward Linking option benefits users with multiplexers geographically scattered with respect to the remote multiplexer that incorporates this option, by significantly 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.

Data compression techniques that reduce data loads by encoding repeated characters or common bit sequences are not provided for 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. However, any DCX multiplexer, including the DCX815 and DCX825, can be downline loaded from another multiplexer in a large network.

■ HARDWARE

□ Terms & Support

Terms • available on purchase or for lease under 2-, 3-, or 5-year agreement; maintenance not included in lease price, but available for both lease and purchase contracts • lease/purchase credit handled on a contract basis • 90-day warranty on purchased units • quantity discounts available for purchased or leased units.

Support • installed by Paradyne or by user; installation charge varies by model and configuration, ranging from \$150 to \$275 • maintenance available under contracts for leased or purchased equipment, by on-call service, or via factory repair • contract maintenance performed during Principal Period of Maintenance (PPM) 8:00 AM to 5:00 PM, Monday through Friday except holidays; a fee of \$125 per hour, plus travel expenses, is charged for maintenance outside the PPM • on-call service charges include \$100 per hour labor, or \$125 per hour outside the PPM, plus travel expenses • on-call service and maintenance outside the PPM require a 2-hour minimum charge • factory service available for purchased equipment only; repair or replacement at no cost for equipment under warranty; turnaround typically within 30 days; \$100 charge for expedited service provides turnaround within 5 working days • service provided through

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

over 100 service centers and field service offices located in major cities nationwide • consulting service provided with charges for labor, travel, and overnight expenses; consulting labor charge at \$125 per hour, or \$175 per hour outside the PPM, with a required 4-hour minimum.

□ Overview

The 6 models of DCX family multiplexers are designed for point-to-point and multinode network configurations. The models are available with 4 synchronous TDM-multiplexed and 4 to 240 asynchronous statistically multiplexed channels in 4-channel increments; upper-end models can support networks containing dozens of nodes and up to 3,000 asynchronous terminals. In addition, statistical models will support 2 IBM BSC channels in place of 4 asynchronous channels at no extra cost. Statistical models of the DCX line are upward and downward compatible, and the 2 upper-end units share components. Composite link protocol is CCITT X.25 Level II for all models; error detection and correction are performed using CRC 16 and ARQ techniques (excepting the DCX725).

The DCX725 is a time-division multiplexer (TDM) or dynamic bandsplitter, with 4 fixed channels for synchronous input only. It is intended for use in conjunction with other DCX members, in tandem, to supplement asynchronous traffic over the same composite link. A remote DCX statistical multiplexer, for example, would feed into 1 of the DCX725 inputs with the remaining 3 inputs reserved for synchronous devices, such as printers or high-speed synchronous terminals. The DCX725 is also available as a card-mounted option for the DCX825/DCX871, occupying a single slot within that unit's card enclosure.

The DCX840 and DCX850 are both multilink models with 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 1 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.

Quad-channel asynchronous or dual-channel BSC adapters are standard for the entire family with data rates from 50 to 9600 bps; aggregate data rates cannot exceed 38.4K bps per each quad adapter or 9600 bps per each dual BSC 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 or optional rackmount unit • supports synchronous channels at selectable data rates to 9600 bps; dynamic bandwidth allocation provides 3 levels of channel priority • 19.2K-bps maximum aggregate channel rate • 1 composite link; synchronous rates to 19.2K bps • passes 3 full-duplex EIA control signals.

DCX815/DCX861 Configuration • 4- or 8-channel asynchronous 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 • supports optional BSC synchronous channels • 1 composite link; synchronous rates to 9600 bps • DCX861 contains integral 9600-bps CCITT V.29-compatible modem.

DCX825/DCX871 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 • DCX871 contains integral 9600-bps CCITT V.29-compatible modem.

DCX840 Configuration • rackmounted base and expansion units • expandable to 240 asynchronous channels maximum in 4-channel increments • supports asynchronous channels at rates

to 9600 bps; 1152K-bps maximum aggregate channel rate; dedicated channels only • supports optional BSC channels • 15 composite links maximum; synchronous rates to 72K bps each link • 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; 1152K-bps maximum aggregate channel rate • supports optional BSC channels • supports dedicated contention, and switched channels • 14 composite links maximum; synchronous rates to 72K bps each link.

□ DCX725 Synchronous Multiplexer

DCX725 Central Control

Central control module contains central logic, power supply, integral channel adapters, and composite link module • standard 4-channel unit:

\$235/\$225 mo	\$4,000 prch	\$50 maint
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2990-1 Rackmount Kit • accommodates single DCX725 in rackmount configuration:

NA/NA	35	NC
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DCX725 Diagnostic Tests

Isolates failures in local/remote channels or in the composite link through local/remote channel loopbacks and composite link loopback testing • standard feature included in package price:

NC/NC mo	NC prch	NC maint
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DCX725 Status Reporting

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

NC/NC mo	NC prch	NC maint
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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/NC mo	NC prch	NC maint
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Dynamic Channel Allocation • improves composite link utilization by automatically assigning only active data channels for transmission, at 3 switch-selectable channel priorities • priority 1 channels have dedicated bandwidth; priority 2 channels contend with other priority 2 channels and with priority 3 channels; priority 3 channels have permanent minimum bandwidth and contend with priority 2 channels for additional bandwidth • standard feature included in package price:

NC/NC	NC	NC
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DCX725 Composite Link

Central control packaged 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/NC mo	NC prch	NC maint
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MO: monthly 2-year/3-year lease charge; does not include maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for leased or purchased units. NA: not applicable/not available. NC: no-cost item. Prices are current as of March 1985.

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

□ DCX815/DCX861 Statistical Multiplexer

DCX815/DCX861 Central Control

Central control module available in 4- or 8-channel packaged configurations, expandable to maximum of 8 channels • contains power supply, central logic, 5.5K-byte RAM buffer, and composite link module • DCX861 packaged with integral 9600-bps CCITT V.29-compatible modem.

Model 2960 • multiplexer configuration packaged with 4 channels and composite link:

\$84/\$77 mo	\$1,690 prch	\$25 maint
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Model 2961 • multiplexer configuration packaged with 4 channels, composite link, and integral 9600-bps modem:

142/131	2,900	50
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Model 2960-1 • multiplexer configuration packaged with 8 channels and composite link:

120/110	2,180	25
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Model 2961-1 • multiplexer configuration packaged with 8 channels, composite link, and integral 9600-bps modem:

178/164	3,180	50
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2960-2 Channel Upgrade • plug-in board expands 4-channel Model 2960 to 8-channel Model 2960-1:

40/37	610	NC
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2961-2 Channel Upgrade • plug-in board expands 4-channel Model 2961 to 8-channel Model 2961-1:

40/37	610	NC
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2960-3 Mounting Kit • rackmount option for 4-/8-channel Models 2960 and 2960-1; mounts single unit in standard 19-inch cabinet:

NA/NA	55	NC
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2961-3 Mounting Kit • rackmount option for 4-/8-channel Models 2961 and 2961-1; mounts single unit in standard 19-inch cabinet:

NA/NA	55	NC
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DCX815/DCX861 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/NC mo	NC prch	NC maint
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Tandem Option • accommodates "T-Pause" flow control technique for Tandem computers • mutually exclusive with IBM BSC and Hewlett-Packard Block Mode options • included in package price:

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

NC/NC	NC	NC
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DCX815/DCX861 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 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:

NC/NC mo	NC prch	NC maint
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DCX815/DCX861 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:

NC/NC mo	NC prch	NC maint
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DCX815/DCX861 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 9 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/NC mo	NC prch	NC maint
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Auto-Speed 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	NC
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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	NC
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Hewlett-Packard Block-Mode Option • supports HP 3000 systems using ENQ/ACK block-mode protocol • included in package price:

NC/NC	NC	NC
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Echoplex Option • echos terminal data from remote multiplexer instead of from CPU, improving terminal response time • included in package price:

NC/NC	NC	NC
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Wang Option • accommodates Wang 2200 computer systems using 9-bit character codes for special function keys • included in package price:

NC/NC	NC	NC
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IBM BSC Option • supports 1 or 2 IBM 3270 or 2780/3780 BSC channels (basic models 2960 or 2961) or 1 or 2 IBM BSC channels and 4 asynchronous channels (expanded models 2960-1 and 2969-1) • 2 channels at 4800 bps each, or 1 channel at 9600 bps • factory selected or field upgraded • included in package price:

NC/NC	NC	NC
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DCX815/DCX861 Composite Link

Central control module packaged link • up to 9600 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.

DCX861 Integral 9600-bps Modem • 4- and 8-channel DCX861 units are packaged with a half-/full-duplex, synchronous, 9600-bps modem for operation over 4-wire dedicated Type 3002 lines • CCITT V.29 compatible, with manual fallback data rates at 7200/4800 bps • automatic adaptive equalization • 253-millisecond training time • included in DCX861 package price, Models 2961 and 2961-1:

NC/NC mo	NC prch	NC maint
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Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

□ DCX825/DCX871 Statistical Multiplexer

DCX825/DCX871 Central Control

Basic card frame with power supply and 4 horizontal dual-card slots; accommodates up to four 8-channel asynchronous adapters, composite link module (dedicated slot), optional 4-channel synchronous adapter, and from 1 to 4 synchronous bandsplitters (Onward Link Cards) • DCX871 includes an integral 9600-bps CCITT V.29-compatible modem in a dedicated slot • central control distributed among channel adapters and composite link card; channel adapters include master and expander cards, each containing 4 asynchronous channels and combined in pairs—1 pair to a slot—to a maximum of 32 channels • optional 4-channel synchronous adapter and Onward Link Cards each occupy 1 card slot and are mutually exclusive with 8 asynchronous channels.

Model 2970 Basic Chassis • desktop unit with power supply and 4 horizontal card slots:

\$68/\$63 mo	\$2,040 prch	\$50 maint
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Model 2971 Basic Chassis • desktop unit with power supply, integral 9600-bps modem, and 4 horizontal card slots:

124/114	4,000	50
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2970-1 Mounting Kit • rackmount option for DCX825; mounts single unit in standard 19-inch cabinet:

NA/NA	55	NC
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2971-1 Mounting Kit • rackmount option for DCX871; mounts single unit in standard 19-inch cabinet:

NA/NA	55	NC
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Downline Load • automatically downline loads channel configuration parameters from master to slave unit • standard feature included in package price:

NC/NC	NC	NC
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DCX825/DCX871 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.

Tandem Option • accommodates "T-Pause" flow control technique for Tandem computers • mutually exclusive with IBM BSC and Hewlett-Packard Block Mode options • included in package price:

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

NC/NC	NC	NC
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DCX825/DCX871 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/NC mo	NC prch	NC maint
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DCX825/DCX871 Status Reporting

Master Card • 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/NC mo	NC prch	NC maint
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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	NC
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DCX825/DCX871 Channels

Master and Expander Cards 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 9600 bps per each 4 channels, maximum aggregate input rate of 153.6K bps (38.4K bps per Master/Expander Card combination) • 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.

Master Card • contains central logic, 4K-byte buffer, and 4 asynchronous channels; supports Expander Card:

\$56/\$51 mo	\$900 prch	NC maint
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Expander Card • 4-channel asynchronous channel adapter; requires Master Card:

40/37	570	NC
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Hewlett-Packard Block-Mode Option • supports HP 3000 systems using ENQ/ACK block-mode protocol • included in package price:

NC/NC	NC	NC
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Echoplex Option • echos terminal data from remote multiplexer instead of from CPU, improving terminal response time • included in package price:

NC/NC	NC	NC
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Wang Option • accommodates Wang 2200 computer systems using 9-bit character codes for special function keys • included in package price:

NC/NC	NC	NC
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IBM BSC Option • supports 1 or 2 IBM 3270 or 2780/3780 BSC channels on the Master Card; replaces 4 asynchronous channels • 2 channels at 4800 bps each, or 1 channel at 9600 bps • Master Card can still support 4-channel asynchronous Expander Card • factory selected or field upgradable • included in package price:

NC/NC	NC	NC
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Sync Port Card • synchronous bandsplitter with 4 synchronous (transparent) channels • combines channels with composite stream from multiplexer • 3 levels of priority, switch selectable; priority 1 channels have dedicated bandwidth; priority 2 channels contend with other priority 2 channels and with priority 3 channels; priority 3 channels have permanent minimum bandwidth and contend with priority 2 channels for additional bandwidth • requires 2 slots in card frame:

112/103	3,000	NC
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Auto-Speed • 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	NC
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Unbalanced Baud Rate (Split Channel Speed) Option • supports terminals operating at different receive/transmit data rates • receive data rate switch selectable on local DCX825/DCX871; transmit data rate determined at remote DCX825 •

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, 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 central control unit:

NC/NC	NC	NC
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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:

NC/NC mo	NC prch	NC maint
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Merge Card (Composite Link Module) • contains microprocessor logic for combining up to 32 asynchronous channels into 1 composite link • occupies dedicated slot inside DCX825/DCX871 Basic Chassis:

60/55	800	NC
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Onward-Link Card • combines composite link data stream from local or remote multiplexer with composite data stream of local DCX825/DCX871 • functions as bandsplitter • 3 maximum Onward-Link modules per DCX825/DCX871 • 32 channels maximum among all sites linked by Onward-Link Cards; 8 channels per site; 9600-bps maximum link rate • requires slot in card frame:

73/67	1,750	NC
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DCX871 Integral 9600-bps Modem • DCX871 packaged with half-/full-duplex, synchronous, 9600-bps modem for operation over 4-wire dedicated Type 3002 lines • CCITT V.29 compatible, with manual fallback data rates at 7200/4800 bps • automatic adaptive equalization • 253-millisecond training time • included in DCX871 basic frame price:

NC/NC	NC	NC
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□ DCX840 & DCX850 Statistical Multiplexers

DCX840/DCX850 Central Control

The DCX840 and DCX850 are configured identically, except that the DCX850 sacrifices 1 composite link (up to 14 compared to the DCX840's 15 composite links) to contain channel switching logic; the DCX850 can additionally assign network supervisory status to any network display terminal • DCX840/DCX850 system includes a basic card frame with power supply and 16 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 192 channels with full buffer complement (256K to 1024K bytes of RAM maximum, depending on which buffer module used); required buffer module occupies slot in card frame; up to 3 additional buffer modules per card frame, 1 per slot, each displaces one 4-channel adapter in a full configuration • additional card frames, cascaded in desk-high or standard equipment cabinet, each require connector card with corresponding bus extension card in master card frame.

DCX840/DCX850 Basic Chassis • rackmount unit includes power supply, STC card and MTP, and 16 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:

\$287/\$264 mo	\$5,600 prch	\$150 maint
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DCX840/DCX850 Expansion Kit • rackmount card frame includes power supply and 16 vertical card slots; provides ribbon cable and interface modules for control path between basic chassis and expansion chassis:

232/213	4,100	100
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Buffer Card • 16K-byte 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/DCX850 requires up to 4 cards per card frame, depending on channel capacity and data speeds:

46/42	1,100	NC
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Expanded Buffer Card • 64K-byte dynamic buffer memory • replacement for 16K-byte buffer card; may be required for BSC channels or async/BSC mix:

53/49	1,800	NC
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System Test & Configuration/Mapping Test Panel (STC/MTP) Card • 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 AT&T 212- or 1031-compatible modem attached to an interface on the STC module • 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 DCX840s 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 • pricing included in DCX840/DCX850 Basic Chassis:

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

NC/NC	NC	NC
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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/NC mo	NC prch	NC maint
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Tandem Option • accommodates "T-Pause" flow control technique for Tandem computers • mutually exclusive with IBM BSC and Hewlett-Packard Block-Mode options • included in package price:

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

NC/NC	NC	NC
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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

Paradyne DCX Series Multiplexers

Models DCX725, DCX815/DCX861, DCX825/DCX871, DCX840 & DCX850

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 with active channels • standard feature:

NC/NC mo	NC prch	NC maint
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DCX840/DCX850 Status Reporting

Low-Speed Channel Card • 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 Cards indicates memory error; parity error; and buffer overflow.

High-Speed Channel Card • 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.

Network Control & Management

Extensive network control and management is conducted through the DCX Network Supervisory Controller (NSC). DCX/NSC components include a CRT, controller, printer, and RS-232C interface unit • connects to a DCX850 in a network configuration via a 9600-bps composite link • user can define, validate, and establish operating parameters for any port or composite link within a multinode network • assimilates DCX850 supervisory functions including the event log, monitor card, and DCX840 mapping and test panel into 1 control unit • configuration maps depicting condition of each network node can be stored by DCX/NSC for review and alteration • revised configuration maps can be established at 1 central site and downline loaded to a specific network node • menu-driven display presents options for concentrated event log storage and printing, network configuration backup and restore capabilities, and event data archival • real-time event data along with condensed alarm and connection data can be displayed on the CRT, printed, or stored on IBM PC-compatible diskettes • monitoring and diagnostic functions are executed at DCX850 multiplexer being monitored • diagnostics can be run on remote nodes without interrupting network activity:

\$1,000/\$750 mo	\$18,000 prch	\$100 maint
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DCX840/DCX850 Channels

Low-Speed Channel Card • 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 38.4K bps per each 4-channel adapter, maximum aggregate input rate of 576K 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 card pricing:

\$44/\$40 mo	\$750 prch	NC maint
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Auto-Speed • 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 card:

NC/NC	NC	NC
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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 card:

NC/NC	NC	NC
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Hewlett-Packard Block-Mode Option • supports HP 3000 systems using ENQ/ACK block-mode protocol • included in package price:

NC/NC	NC	NC
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Echoplex Option • echos terminal data from remote multiplexer instead of from CPU, improving response time • included in package price:

NC/NC	NC	NC
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Wang Option • accommodates Wang 2200 computer systems using 9-bit character codes for special function keys • included in package price:

NC/NC	NC	NC
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IBM BSC Option • supports 1 or 2 IBM 3270 or 2780/3780 BSC channels on the Low-Speed Channel Card; mutually exclusive with asynchronous channels on the same card • 2 channels at 4800 bps each or 1 channel at 9600 bps • factory selected or field upgradable • extra-cost option:

55/51	1,200	NC
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Monitor Card • 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 hexadecimal format and highlighted • includes 15K-byte buffer • occupies single slot in Basic Chassis; displaces composite link module • extra-cost option:

111/102	3,300	NC
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DCX850 Channel Routing

Channel routing (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 module 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 UMPs or AMPs 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

Paradyne DCX Series Multiplexers

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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.

850 Single Node USO Card • provides terminal initiated channel switching, in combination with STC/MTP module • allows any network display terminal to serve as the 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:

\$258/\$237 mo	\$6,000 prch	\$25 maint
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850 Multinode USO Card • 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:

370/340	10,000	30
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DCX840/DCX850 Composite Link

Composite link(s) are contained in the High-Speed Composite Card, 58K-byte Composite Card, or X-Gate Card; each link controlled individually via microprocessor logic. DCX840 supports up to 15 composite links; DCX850 supports up to 14 composite links.

High-Speed Composite Card • combines up to 60 virtual circuits (low-speed channels) into single composite link • up to 19.2K-bps full-duplex synchronous rates with external clock source • switch-selectable data rates of 1200/2400/4800/7200/9600/19.2K bps full-duplex with internal clock source • CCITT X.25 Level II link protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • requires slot in Card Frame Assembly:

\$46/\$42 mo	\$1,200 prch	NC maint
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56K-Byte Composite Card • combines up to 128 virtual circuits (low-speed channels) into single composite link • up to 72K-bps full-duplex synchronous rates (56K bps typically used in U.S. networks), internal or external clock source • CCITT Level II link protocol • CRC 16 and ARQ error detection and correction •

RS-232C/CCITT V.24/V.28/V.35 electrical interface • requires slot in Card Frame Assembly:

56/52	2,600	NC
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BlueGate Composite Card • combines up to 32 virtual circuits (low-speed channels) into single composite link • up to 13 BlueGate cards can be installed in DCX840/850 multiplexer • up to 9600-bps full-duplex synchronous rates, internal, or external clock source • RS-232 D-type connector • EBCDIC character set support • point-to-point or multidrop applications • IBM 3271 or 3274 C-Type controller and 3277/3278 Model 2 terminal emulation:

375/345	8,000	NC
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XGate Composite Card • combines up to 64 virtual circuits (low-speed channels) into single composite link • up to 13 XGate cards can be installed in DCX840/850 multiplexer • up to 9600-bps full-duplex synchronous rates, internal, or external clock source • X.25 Level III link access protocol balanced (LAPB) • certified for use over Telenet, Tymnet public data networks and Paradyne 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 X.3, X.28, and X.29 supports switched and permanent virtual circuits; supports all 18 X.3 PAD parameters currently sanctioned by the CCITT • supports IBM BSC and other Paradyne-supported vendor-specific protocols • requires slot in Card Frame Assembly:

375/345	8,000	NC
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Satellite Optimization • integral buffer provides user-selectable satellite delay compensation for single- or double-hop satellite links • included in package price for DCX840/DCX850 models only:

NC/NC	NC	NC
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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:

NC/NC	NC	NC
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• END

Paradyne DCX-T1

T1 Voice/Data Multiplexer

■ PROFILE

Function • bit- or byte-interleaved TDM designed for T1 carrier facilities • point-to-point applications; downline loading of remote multiplexers • handles asynchronous/synchronous data and voice channels • composite link rate is 1.544M bps.

Communications/Networks • supports asynchronous data channels of 300 to 19.2K bps and synchronous channels from 56K to 448K bps; channel interfaces are RS-232C, CCITT V.35, MIL-Std-188-114, AT&T 301/303 • voice channels quantized via CVSD at 16K or 32K bps; 4-wire E&M signaling • single composite link (trunk) • point-to-point applications • cascaded channel multiplexers.

First Delivery • 1983.

Systems Delivered • undisclosed.

Comparable Systems • Amdahl Model 2211, Avanti-Ultra Mux, Bayly Omniplexer, Codex 6240, Coastcom D/I Mux, Datatel DCP 9100, DCA Netlink, General DataComm Megamux 1258, Infotron T Mux, and Timeplex Link/1.

Vendor • Paradyne Corporation; 8550 Ulmerton Road, P.O. Box 1347, Largo, FL 33540 • 813-530-2000.

Distribution • worldwide through direct sales and distribution.

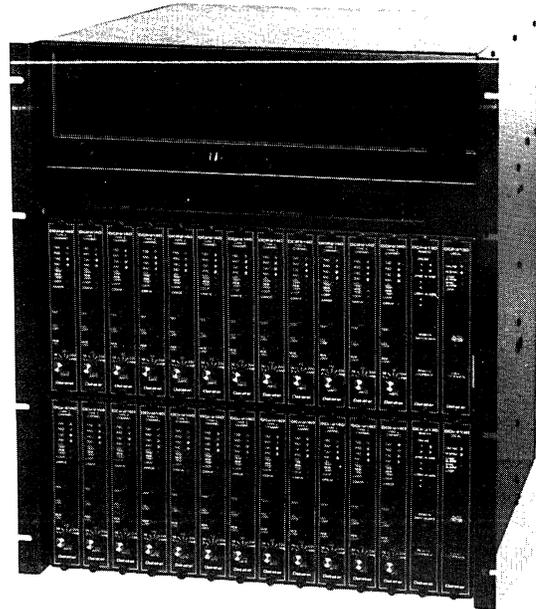
■ ANALYSIS

The Paradyne DCX-T1 is a specialized time-division multiplexer designed specifically to combine a wide range of asynchronous and synchronous data and voice channels on a single broadband link referred to as a T1 carrier. The multiplexer is OEMed from Datatel Corporation (which calls it the DCP9100); it is also sold by Infotron under the name T1 Mux.

The T1 carrier service has been used by the telephone company since the early 1960's 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 had to install their own microwave links. Users can now order the service under AT&T's ACCUNET T1.5 service or similar offerings from MCI, RCA, etc.

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 of the service is also superior. AT&T guarantees a point-to-point, full-duplex link with an error 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



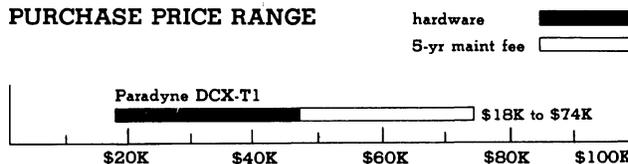
communication links (paths) such as may be the requirements of office automation. For example, such applications and digital voice transfers need at least 64K bps, mainframe-to-mainframe file transfers need at least 64K bps, and compressed video requires a minimum of 450K bps. A T1 multiplexer can accommodate these requirements.

The DCX-T1 first appeared last year and was a competent—but limited—product. For example, it could only handle synchronous data directly, with asynchronous inputs relegated to submultiplexers or the “clock in at 4 times the data rate” trick; it had no voice facility; it accommodated only 48 input channels; and it was strictly a hardware-configured box. Those drawbacks have now been eliminated, but others remain (see Limitations).

Another limitation of last year's product was that it was a totally hardware-configured system. Channel configurations and system tests, for example, had to be initiated via rotary switches and pushbuttons located on each card. This crippling limitation was eliminated with a newly designed model. An extremely advanced multiplexer that can be configured and controlled from a terminal supports the extended frame format (Fe) that will be mandatory for connection to the ACCUNET T1.5 service after January 1, 1985, and is frame compatible with AT&T D4 channel banks. The latter will be employed as part of AT&T's proposed Digital Access and Crossconnect Service (DACS) slated for release sometime next year. With DACS, T1 users will be able to specify and control the switching of any of the 24 64K-bps channels comprising a T1 link to any other T1 channel controlled by the DACS unit. This amounts to a form of **drop-and-insert** using AT&T facilities. For more information on DACS, (see Strengths).

Paradyne has also added an expansion nest with 24 channel slots and its own power supply and driver logic. Depending on the type of channel cards employed, the expansion nest adds between 24

PURCHASE PRICE RANGE



PARADYNE DCX-T1 PURCHASE PRICING bar graph covers price range between “small” and “large” configurations for hardware (solid bar) and associated 5-year maintenance fees (open bar) • **small** configuration consists of basic chassis with 10 Type 1 and 5 Type 2 data cards and 5 Type 4 voice cards; **large** configuration consists of basic unit with redundant control logic and power supplies, 24-channel slot expansion nest with power supply and control logic, 15 Type 1 and 15 Type 2 data cards and 10 Type 4 voice channel cards, and an alarm card • all prices single-quantity purchase.

Paradyne DCX-T1

T1 Voice/Data Multiplexer

to 48 channels, boosting the total channel-handling capacity of the DCX-T1 to 96. While the expansion chassis contains its own driver logic, it still relies on the base unit for message frame and T1 interface services.

The voice-channel card employs CVSD and provides two 32K-bps channels. We understand that a voice card employing adaptive differentiated pulse code modulation (ADPCM) will be available in 1985.

With the enhancements to the DCX-T1, Paradyne has positioned the product to be truly competitive with the likes of the Amdahl 2211, Avanti Ultra Max, Codex 6240, General DataComm Megamux Plus, DCA's Netlink, Scitic's BSPT 1, and Timeplex's Link/1. (Tellabs also has announced a similar product, but we've yet to see it.) These products are all software (terminal) configured and controlled, provide a voice facility, are equipped with extensive synchronous data handling facilities, and with the exception of DCA and Scitic, meet the DS1 framing format required for direct connection to the ACCUNET T1.5 service. Amdahl, Datatel, DCA, and General DataComm also offer deliverable asynchronous data cards.

As for futures, every vendor listed plus Coastcom and Bayly Engineering claim to have or are about to announce the extended frame format which becomes a must next year for connection to ACCUNET T1.5, and it's a safe bet that all will offer D4 framing in one form or another, matching Coastcom, Datatel, and Infotron. Infotron, however, is working on its own T1 product design, so it may not offer the same facilities in the future.

□ Strengths

The principal strengths of the DCX-T1 are its new "soft-configured," D4-compatible chassis, redundant control logic and power supplies, and sophisticated testing facilities.

The testing facilities are designed to pinpoint failures or degradation and are easy to use. Each channel has its own random test pattern generator which allows independent concurrent testing of 1 or more channels. The integral test data generator obviates the need for an external test-data source—generally an extra-cost test generator. The ability to isolate channel tests means that the user can perform an extended test on 1 or more channels without interfering with other channels.

The techniques for conducting loopback tests employs relays (as opposed to logic control). Loopback testing begins at the EIA side of the DTE and tests all components through to the EIA side of the DTE at the remote location. This loopback test procedure tests all components including the link driver. With some logic-controlled tests, that vital component is overlooked.

The control logic associated with the new chassis offers such advanced capabilities as terminal-controlled test and configuration, extended frame format (Fe), D4 frame compatibility, and channel expansion nests. Under terminal control, users employ a menu to configure channel operating parameters; perform tests and diagnostics on a per channel level and system load basis; display system statistics; view primary and secondary configurations; and display link parameters.

The architecture of the DCX-T1 is one of the simplest and most flexible in the industry. For example, the only difference between the basic chassis and expansion nest is the control logic. Thus, to upgrade the expansion nest, we need only swap its control logic driver cards for basic unit control logic. An added benefit of this swap is that it provides an **additional** separate T1 link facility at the user site.

The final DCX-T1 strength is its compatibility with AT&T D4 channel banks, a unit which will provide the switching services associated with AT&T's **Digital Access and Crossconnect System** (DACS) projected for 1985. DACS is a terminal-controlled system that allows the redistribution (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 channel terminations 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 64K bps wide and its DS1 format must consist of 24 8-bit words and 1 superframe bit for a total of 193 bits per frame. (A superframe is made up to 12 frames, and each superframe bit is time shared to identify both channel framing and signal framing.) A T1 multiplexer that does not employ 8-bit words and 64K bps channels, therefore, shouldn't be DACS compatible. The DCX-T1 does meet these specifications.

□ Limitations

While the DCX-T1 is a greatly improved product, it still does not offer a true drop-and-insert capability and does not efficiently use available channel bandwidth at low data rates. In parceling out slots within the available 1.544M-bps bandwidth, the DCX-T1 employs the following scheme: 56K-bps channels are assigned 1 time slot; 112-, 224-, or 448K-bps channels receive 2, 4, or 8 slots, respectively; 19.2K-bps channels and below are serviced 2 to a slot. What this means is that the smallest slot amounts to 2 9600-bps subslots. Any data rate lower than 9600 bps is still assigned that portion of the subslot regardless of its actual bandwidth requirement. For example, a 300-bps terminal wastes 9300 bps; 2 300-bps terminals waste 18,600 bps. It could be argued that such waste is trivial with 1.544M bps available. However, when considering that many users might want to interface digital voice (32K- to 64K-bps bandwidth), front-end processors (around 64K-bps bandwidth), and even video (at least 700K bps with current technology) such waste is a severe limitation. The Catch-22 to this situation for Paradyne is that if it alters its subslotting scheme, it is no longer DACS compatible. By not altering it, Paradyne stands to lose potential customers.

Drop-and-insert is useful in environments where many end points are involved that pick up and drop data. Organizations such as large banks and companies with large regional centers are typical candidates for this type of operating environment. Of the multiplexers on the market that actually work, only Bayly's Omnultiplexer and Coastcom's D/I Mux support this service.

The final major limitation is the DCX-T1 is restricted to a single link rate of 1.544M bps. While this is the data rate associated with T1 facilities within North America and Japan, it is not applicable to foreign countries that employ a link rate of 2.048M bps. Paradyne does not offer channel facilities needed for foreign T1 links either. For local networks, some users may find the 1.544M bps link rate too high. Paradyne could benefit and further increase its market opportunities by correcting this single speed limitation.

■ HARDWARE

□ Terms & Support

Terms • standard components and options are available for purchase or on a 2-, 3-, or 5-year lease; leased components include maintenance • lease prices were not available at this writing.

Support • installed by Paradyne at a cost of \$300, or by the user • maintenance available under contract for purchased units by on-call service.

□ Overview

The DCX-T1 is a bit- or byte-interleaved time-division multiplexer, designed primarily for point-to-point communications over AT&T's ACCUNET T1.5 services or facilities, such as those available from MCI, RCA, etc. It can also be interfaced to private microwave facilities, such as GE's GEMLINK. Cascaded multiplexers are supported and the unit can be configured as a multimode network. Drop-and-insert facilities are not currently available, but are under development.

The multiplexer offers channel cards that handle asynchronous

Paradyne DCX-T1

T1 Voice/Data Multiplexer

and synchronous data and voice. The latter employs Continuously Variable Slope Delta (CVSD) quantization and requires only 16K or 32K bps per channel. With the CVSD card, 2 voice channels can share a 64K-bps channel slot.

Data channel cards are either single- or dual-channel units. Type 1 is a single-channel card supporting synchronous data rates of 56K, 112K, 224K, and 448K bps. Type 2 is a dual-channel card handling synchronous data rates of 300 to 19,200 bps. The new asynchronous channel card is also a dual-channel unit supporting data rates of 300, 600, 1200, 2400, 4800, 7200, 9600, 14.4K, and 19.2K bps.

The basic equipment chassis provides 24 channel slots, and can be configured with redundant central control logic and power supplies. Channel configuration and system diagnostics are conducted from a supervisor ASCII terminal. System configuration and testing are under menu control and commands are in English for ease of use.

While the basic multiplexer chassis provides 24 data/voice channel slots, users can double this number via an expansion nest. This unit has its own power supply and driver logic cards, but is linked to the basic chassis for message framing and T1 link interfacing. Depending on whether single- or dual-channel data/voice cards are employed, a full-blown DCX-T1 can range from 48 to 96 data channels or 46 voice channels.

For those concerned with system integrity, Paradyne offers redundant power supplies and common logic for the DCX-T1 basic chassis and expansion nest. The common logic and power supplies operate as hot spares, and automatically take over if a primary component fails. The redundant power supply, incidentally, operates in tandem with the primary; this arrangement generally increases the life of both units dramatically.

☐ **DCX-T1 Multiplexer**

Central Control

2995 Central Control Unit • chassis, common logic, link module, power supply, and 24 channel-adapter card slots • accommodates up to 24 data-channel cards or 23 voice channel cards; voice/data cards can be intermixed • common logic requires 3 card slots and handles multiplexing/demultiplexing over single high-speed composite link; monitors local/remote logic functions; initiates local/remote system loopback operations; detects in-sync/out-of-sync condition; indicates logic alarms; permits manual or automatic switchover to redundant logic; stores channel configurations in RAM; downline loads configurations to remote unit • supports AT&T extended frame format (Fe), is AT&T D4 compatible, and provides supervisory terminal control • link speed is 1.544M bps:

\$5,200 prch \$160 maint

Expansion Nest • power supply, 2 control logic driver cards, and 24 channel card slots; includes cable for attaching to the 2995 chassis:

4,400 100

Backup Load-Sharing Power Supply • redundant power source for 2995 chassis and expansion nest • diode-coupled to primary power supply and operates in tandem with it; automatic switchover:

1,100 5

Redundant Control Logic • redundant central logic for central control unit plus control console port for ASCII terminal • occupies 3 card slots • link speed is 1.544M bps:

2,050 5

PRCH: purchase price for single-quantity units. MAINT: monthly maintenance fee. NA: not available. Prices are current as of November 1984.

Redundant Control Logic—Expansion Nest • redundant central logic for expansion nest • occupies 2 card slots:

826 5

Audible Alarm & Remote Backup Power Monitor • monitors remote-unit power supply for any variations in threshold voltages; provides visual/audible alarms if remote supply or supplies malfunction:

690 5

Channels

Paradyne supports asynchronous, synchronous, and voice channels, all of which can be intermixed in the basic chassis and expansion nest. Two types of synchronous data channel cards are offered: Type 1 is a single-channel card supporting input speeds of 56, 112, 224, and 448K bps; Type 2 is a dual-channel card which handles speeds of 300 to 19,200 bps. The equipment nest accommodates 24 channel cards in all. Type 1 and 2 cards can be intermixed in any combination up to the system limit of 48 channels. The asynchronous channel card, new this year, accommodates 2 data channels, and handles a data rate range from 300 to 19.2K bps. All data channel cards can be configured as DTE or DCE, which allows them to generate or receive clock signals.

The voice channel card employs CVSD and accommodates 2 separate voice channels. Data rates can be selected as 16K or 32K bps under the CVSD scheme. (The CVSD voice channel can also be used for data inputs interfaced via a modem. Top data rate is 2400 bps). Both voice cards are 4-wire units and employ E&M signaling. Up to **46** voice channels can be handled.

2995-300 Type 1 Channel Card • provides channel logic for single synchronous data channel • half-/full-duplex modes • data rates of 56/112/224/448K bps • plus or minus 8 bits of elastic storage • can be configured to interface with DTE or DCE equipment • LED indicators for transmit/receive data, transmit/receive clock, and local/remote test activities • CCITT V.35 interface standard:

\$450 prch \$5 maint

2995-400 Type 2 Channel Card • provides channel logic for 2 synchronous data channels • half-/full duplex modes • data rates of 300/600/1200/2400/4800/7200/9600/14,400/19,200 bps; independent data rates each channel • passes up to 4 full-duplex control signals (DTR, RTS, CTS, BO, DSR, CO, RT) • 128 bits of elastic storage per channel • can be configured to interface with either DTE or DCE equipment • LED indicators same as Type 1 card • RS-232C interface standard:

900 5

2995-500 Type 3 Channel Card • provides channel logic for 2 asynchronous data channels • half-/full-duplex modes • channel data rates of 300/600/1200/2400/4800/7200/9600/14400/19200 bps; channels can operate at different speeds • DTE/DCE interface • passes 4 control signals per channel • RS-232C interface:

NA NA

2995-600 Type 4 Voice Channel Card • provides channel logic for 2 voice inputs • CVSD quantization at 16K or 32K bps • 4-wire 600 ohm interface; E&M signaling:

1,090 5

Composite Link

DCX-T1 supports a single composite link at 1.544M bps only. No lower/higher speeds are available. The link between the multiplexer and communication facility is established through the common logic cards.

• END

Paradyne Microprocessor (MP) Series Modems

Models MP-48/208B, MP-14.4 & MP-16.0

■ PROFILE

Function • high-performance modems with network control capabilities for switched or dedicated facilities • AT&T-compatible modem for DDD network • high-speed, high-performance modems for dedicated facilities.

Communications/Networks • synchronous 4800-bps AT&T 208B compatibility for DDD network • synchronous 9600/12K/14.4K/16.0K-bps point-to-point and multichannel communications over conditioned 4-wire dedicated Type 3002 facility • auxiliary secondary channel • designed for use with Paradyne ANALYSIS 4000/5500/5530 Network Management System.

First Delivery • 1980 for MP-48/208B and MP-14.4 • 1981 for MP-16.0.

Units Delivered • 2,300 for MP-48/208B • 1,000 for MP-14.4 • 220 for MP-16.0.

Comparable Systems • AT&T-IS Dataphone II modems; Codex CS and 2600 Series; Ininet DMX and NEM Series; Racal-Milgo Omnimode Series.

Vendor • Paradyne Corporation; 8550 Ulmerton Road, Largo, FL 33540 • 813-530-2000.

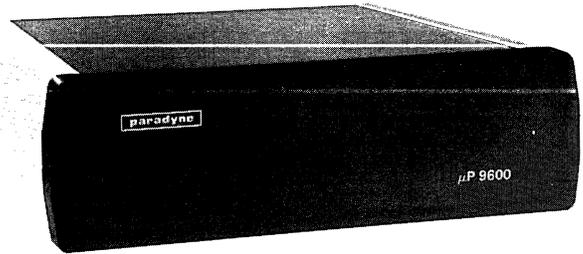
Canada • Paradyne Canada Limited; 200 Consumers Road, Suite 504, Willowdale, ON M2J 4R4 • 416-494-0453.

Distribution • nationwide via local sales offices and worldwide via direct sales or distributors • Great Britain via Paradyne U.K. Limited • Germany via Paradyne GmbH • Europe, Asia, Central and South America via Paradyne distributors.

GSA Schedule • listed.

■ ANALYSIS

Paradyne has superseded the MP Series with the more sophisticated VHS/MPX line of high-performance modems. MP models MP-48, MP-96, and MP-96RP have already been dropped in favor of their VHS/MPX successors. At the present time, the remaining modems, models MP-48/208B, MP-14.4, and MP-16.0, are still being actively manufactured and marketed.



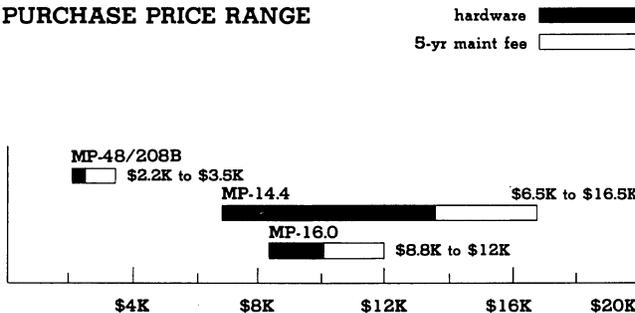
However, the impending demise of these residual offerings is inevitable. When compared with the newer, more versatile product alternatives, the existing MP modems are somewhat restricted with the exception of the MP-48/208B which is currently Paradyne's only AT&T compatible unit.

The recently extended VHS/MPX Series includes the MPX 2400, MPX 4800, MPX 9600, VHS 14.4K, VHS 16.8K, and VHS 19.2K bps modems. Paradyne has also added high-end models to its Challenger family of nondiagnostic modems (see report #970-P105-2400 for VHS/MPX and Challenger Series product details). All VHS/MPX modems can be controlled by Paradyne's ANALYSIS network control system. In addition, the ability to integrate 6-, 8-, or 16-channel TDM and statistical multiplexers with VHS modems further enhances their performance. While prices are approximately \$2,500 less than the comparable VHS model, the less flexible MP-14.4 only supports a 6-channel TDM multiplexer option. In contrast to the high-end VHS 16.8K model with ANALYSIS and 16-channel STDM option, the MP-16.0 modem cannot be configured with ANALYSIS network control and doesn't provide multipoint support. Although the basic Challenger 16.0K and the MP-16.0 are comparably priced, the Challenger modem is available in both a standalone and single-circuit card version. Circuit card versions of both Challenger 14.4K and 16.0K meet high-density requirements with nest mounting. Up to 13 Challenger 14.4 modem cards and up to 12 Challenger 16.0 modem cards can be stored in a single nest mount which considerably conserves data center floor space and is a decided advantage for users with sizeable networks and space constraints.

Like its VHS/MPX counterparts, the MP Series modems are microprocessor-based high-performance models, most of which are designed to operate over dedicated point-to-point and multipoint networks. Only one model, the MP-48/208B, is FCC-certified for the public switched network. Except for Model MP-16.0, the MP-48/208B and the MP-14.4 can be configured with Paradyne's ANALYSIS network control system via an extra-cost diagnostic (secondary) channel. Diagnostic and control commands are then forwarded to remote modems from a central-site operator console. The modems can operate independently of the network control environment, but diagnostics and remedial recovery procedures must be performed manually.

When equipped for network control, the modems immediately alert ANALYSIS users to degradation or failures so that remedial action can be taken, thus eliminating excessive downtime. The user can quickly pinpoint failures through modem-executed diagnostics that isolate failures at central or remote sites or in the

PURCHASE PRICE RANGE



PARADYNE MP SERIES PURCHASE PRICING bar graphs cover ranges between "small" and "large" configurations (solid bars), and for associated 5-year maintenance fee (open bars) • **MP-48/208B** small configuration consists of AT&T-compatible 4800-bps MP-48/208B modem; large of MP-48/208B modem with eye pattern generator • **MP-14.4** small configuration consists of 14.4K-bps MP-14.4 modem; large of MP-14.4 modem with 6-channel mux, ANALYSIS secondary channel, dual-dial auto-answer backup, voice adapter, and eye pattern generator • **MP-16.0** small configuration consists of 16K-bps modem; large of MP-16.0 with dual-dial auto-answer backup, voice adapter, and eye pattern generator.

Paradyne Microprocessor (MP) Series Modems

Models MP-48/208B, MP-14.4 & MP-16.0

line. Remedial recovery from modem or line failure is implemented through modem substitution or dial backup. Fallback data rates support the possible resumption of communications with tolerable error rates over degraded facilities.

Without ANALYSIS network control, user awareness to degradation or failure, and diagnostic testing is severely limited. Degradation or failure conditions alert the user through visual observance of front-panel indicator lamps, which indicate good, marginal, or poor signal quality. Diagnostic tests are performed through front-panel controls which establish loopback paths and generate a pseudo-random bit pattern for failure isolation.

The MP Series modems are high-speed synchronous modems for transmission at 4800 bps to 16K bps over a voiceband facility supporting both dedicated and switched communications applications. The MP-48/208B is end-to-end compatible with the AT&T 208B for use on the DDD network. It is FCC certified which means it does not require a coupler (Data Access Arrangement), and it trains in just 50 milliseconds. The MP-14.4 and MP-16.0 are both restricted to 4-wire dedicated point-to-point facilities. Paradyne recommends D1 line conditioning for maximum performance at 14.4K bps or 16.0K bps. Both models are actually the same modem: the MP-16.0 owes its higher performance to expanded signal bandwidth, which the MP-14.4 shares with a secondary channel when network control is implemented. The 2 models are equipped with 3 fallback data rates to compensate for line degradation; both are well-suited to high-volume traffic, and when equipped with a multiplexer, eliminate the cost of additional lines and modems to handle individual data streams.

Paradyne is a rapidly growing company with reliable communication products; MP Series modems have a mean-time-between-failure (MTBF) of not less than 30,000 hours, higher for some models. The series reflects the continued trend for network control among high-performance modems for dedicated networks. Network control eliminates excessive downtime which plagues most networks, sparing lost revenue and business, and boosting productivity.

□ Strengths

Chief among the advantages of the MP Series product line is support for network control to eliminate excessive downtime, remove the guesswork and finger-pointing from failure isolation, provide remedial recovery, and to keep the network manager well informed of network performance. Users that presently do not want the advantages of network control need not pay extra for the capability, but can upgrade their modems whenever the need arises.

High reliability, low error rate over unconditioned lines, and ease of maintenance are also important considerations. The estimated MTBF is in excess of 25,000 hours for the high-technology MP-14.4 and MP-16.0 modems, and 20,000 hours for the MP-48/208B. This equates to about 3 years of constant operation without a failure. And the modems are easy to maintain through very accessible circuit boards via the front panel, and a replaceable power supply module. The modems are expected to achieve a bit error rate of about 1 error in 10 million bits. However, D1 conditioning is recommended for optimum performance at 14.4K-bps or 16.0K-bps rates.

The MP-14.4 and MP-16.0 modems offer users the maximum performance currently available for dedicated voiceband transmission. The modems extend the data rate beyond the existing 9600-bps upper limit by 50 and 67 percent, respectively. The expanded transmission capacity benefits users in 2 ways. It handles rising communication traffic volume with company growth, and eliminates the cost of additional lines and modems via separate multiplexers and a single dedicated line. The standard MP-14.4 modem with a 2-channel multiplexer has been dropped from the line-up but a 6-channel integral multiplexer is available for the remaining MP-14.4 models that accommodate up to 6 data streams in any combination of 2400 bps to 14.4K bps.

Other advantages are application dependent. These include multiport communications, fast poll, alternate voice/data, auxiliary secondary channel, and modem sharing. Multiport support for the MP-14.4 eliminates unnecessary added cost for

extra modems and dedicated lines, or separate multiplexers and modems to support just a few devices. Typical applications are an installation with both interactive and RJE terminals, or a cluster of interactive terminals.

The alternate voice/data option (Model 2804 Voice Adapter) benefits 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 auxiliary secondary channel is an asset to users that need to control environmental conditions such as lighting, heating/air conditioning, or implement security measures at remote installations, or to those who want to eliminate the additional cost of a low-speed telegraph channel.

The modem sharing device benefits users with as many as 4 collocated terminals that do not need to communicate simultaneously. It eliminates the cost of additional modems and lines, or separate multiplexers and modems.

□ Limitations

Multiport support is not available for the MP-16.0, although a 6-channel multiplexer is available for the MP-14.4 at extra cost. The ability to configure both modems is severely limited without adequate multiport support.

Diagnostic support without ANALYSIS is restrained to local analog and digital loopback control. Remote analog and digital loopback is not provided, which means tests must be coordinated with attended remote sites. This is a severe limitation for unattended sites. This restriction is eliminated with Paradyne's ANALYSIS system.

■ HARDWARE

□ Terms & Support

Terms • available on purchase, or for lease under 2- or 3-year agreement; maintenance not included in lease price, but available for both lease and purchase contracts • lease/purchase credit handled on a contract basis • 90-day warranty on purchased units; special 2-year on-site maintenance guarantee for model MP-14.4 and MP-16.0 • quantity discounts available for purchased or leased units.

Support • installed by Paradyne or by user; installation charge, varies by model and configuration, ranging from \$150 to \$300 • maintenance available under contracts for leased or purchased equipment, by on-call service, or via factory repair • contract maintenance performed during Principal Period of Maintenance (PPM) 8:00 AM to 5:00 PM, Monday through Friday except holidays; a fee of \$125 per hour, plus travel expenses, is charged for maintenance outside the PPM • on-call service charges include \$100 per hour labor, or \$125 per hour outside the PPM, plus travel expenses • on-call service and maintenance outside the PPM require a 2-hour minimum charge • factory service available for purchased equipment only; repair or replacement at no cost for equipment under warranty; turnaround typically within 30 days; \$100 charge for expedited service provides turnaround within 5 working days • service provided through over 100 service centers and field service offices located in major cities nationwide • consulting service provided with charges for labor, travel, and overnight expenses; consulting labor charge at \$125 per hour, or \$175 per hour outside the PPM, with a required 4-hour minimum.

□ Overview/Packaged Modems

The 3 models of the Paradyne Microprocessor (MP) family are related primarily by state-of-the-art modem technology. Although intended for point-to-point and multipoint network configurations with Paradyne's remote diagnostics option, the MP line is not entirely compatible; Model MP-16.0 does not possess the capability to implement network control. The MP-48/208B is designed for AT&T compatibility on the public switched network, while the MP-16.0 is simply a very high-speed, point-to-point modem with limited remote diagnostics. The remaining models can be configured with optional diagnostics/microprocessor logic to operate as components of Paradyne ANALYSIS Network

Paradyne Microprocessor (MP) Series Modems

Models MP-48/208B, MP-14.4 & MP-16.0

Management System, and can execute commands entered at a central-site operator console. Network control commands and functions are transmitted between the central-site network control system and individual modems via a full-duplex, narrowband secondary channel supported under the optional diagnostics package. Functions supported and executed by modems with the network diagnostic option 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.

The modems also provide manual control for diagnostic functions that include local analog and digital loopback, and internal self-test via a pseudo-random bit pattern produced by an internal generator.

MP Series modems are available in standard versions configurable with different options, depending on the model. Options include rackmount configuration, network diagnostics, forward secondary channel for user applications, integral multiplexer, eye pattern generator, dial backup, spare-modem switch, and modem sharing.

Model MP-48/208B • standard 4800-bps fast-train AT&T 208B-compatible modem • supports eye pattern generator option:

\$75/\$65 mo	\$2,200 prch	\$20 maint
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Model MP-14.4 (2698-02) • 14,400-bps modem without options • supports ANALYSIS secondary channel, 6-channel multiplexer, dual-dial auto-answer backup, spare-modem hot-standby adapter, voice adapter, and eye pattern generator options:

261/228	8,500	25
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Model MP-14.4 (2698-04) • 14,400-bps modem with integral 6-channel multiplexer • supports ANALYSIS secondary channel, dual-dial auto-answer backup, spare-modem hot-standby adapter, voice adapter, and eye pattern generator options:

311/274	10,500	35
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Model MP-14.4 (2698-05) • 14,400-bps modem with integral ANALYSIS secondary channel • supports integral 6-channel multiplexer, dual-dial auto-answer backup, spare-modem hot-standby adapter, voice adapter, and eye pattern generator options:

290/251	10,350	35
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Model MP-14.4 (2698-06) • 14,400-bps modem with integral 6-channel multiplexer and integral ANALYSIS secondary channel • supports dual-dial auto-answer backup, spare-modem hot-standby adapter, voice adapter, and eye pattern generator options:

361/320	12,350	45
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Model MP-16.0 • standard 16,000-bps modem • supports dual-dial auto-answer backup, spare-modem hot-standby adapter, voice adapter, and eye pattern generator options:

230/200	8,800	28
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Model 4955 Rackmount Shelf • accommodates single modem on a rigid shelf within rack space • requires 5.25-inch mounting space • field installation by Paradyne requires \$50 installation charge:

NA/NA	60	NC
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□ Application

MP-48/208B • designed for operation over DDD network; 50-/150-millisecond RTS/CTS training time delay.

MP-14.4 & MP-16.0 • point-to-point communications over 4-wire dedicated Type 3002 voice channel • multipoint communication over point-to-point line (MP-14.4) • 253-millisecond RTS/CTS training time delay, with optional 6000-millisecond delay; D1 conditioning recommended for optimum performance at 14.4K/16.0K bps.

□ Operating Parameters

MP-48/208B • synchronous half-duplex at 4800 bps • DPSK modulation • automatic adaptive equalization.

MP-14.4 • synchronous half-/full-duplex; switch selectable at 14.4K/12K/9600 bps • QAM modulation • automatic adaptive equalization.

MP-16.0 • synchronous half-/full-duplex; switch selectable at 16.0K/14.4K/12K/9600 bps • QAM modulation • automatic adaptive equalization.

□ Channel Functions

Multipoint • MP-14.4 accommodates optional 6-channel buffered TDM multiplexer with any mix of synchronous data rates from 2400 bps to 14.4K bps • channels accommodate any mix of collocated terminal and tail circuits • Paradyne ANALYSIS Network Management Control.

Model 2616 6-Channel Multiplexer • PC board for installation within MP-14.4:

\$50/\$46 mo	\$2,000 prch	\$10 maint
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ANALYSIS Secondary Channel Remote Diagnostics • 110-bps full-duplex, FSK modulated channel • equips modem with network diagnostic and control functions when used in network with Paradyne ANALYSIS Network Management System • PC board module for installation within standalone modem.

RD-48 Diagnostic/Control Module • for MP-48/208B modem:

20/15	600	5
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RD-14.4 Diagnostic/Control Module • for MP-14.4 modem:

50/46	2,000	10
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ANALYSIS External Control • integral auxiliary channel for user-defined applications via the ANALYSIS Secondary Channel option • responds to central-site console • included in the ANALYSIS Secondary Channel price:

NC/NC	NC	NC
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Model 2803 Forward Secondary Channel • equips MP-48 modem with a 110-bps full-duplex, FSK modulated channel for user-defined applications • implemented with or without ANALYSIS secondary channel • PC board module for Model MP-48 only:

29/26	810	5
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Digital Interface • MP-48, MP-48/208B: EIA RS-232C/CCITT V.24 all ports • MP-14.4 and MP-16.0: EIA RS-232C/CCITT V.24/V.26 all ports • 25-pin electrical connector.

□ Control Functions

FCC Registered Modem • Model MP-48/208B is designed for the public DDD telephone network and is registered for direct connection under FCC Rules Part 68 • does not require a separate Data Access Arrangement (DAA) • standard feature included in modem pricing:

NC/NC mo	NC prch	NC maint
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Model 2804 Voice Adapter • standalone unit equips Paradyne and other manufacturer's modems with telephone handset for alternate voice/data communications over 4-wire dedicated lines:

12/12	450	5
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Model 2930 PRS-2B Modem Sharing Device • standalone unit allows up to 4 synchronous or asynchronous terminals to share modem channel port, one-at-a-time, speeds up to 19.2K bps • automatically scans the terminals and passes RTS to the modem when an active terminal is detected, locking out other terminals during transmission • terminal equipment can be manually removed from the scan sequence:

25/20	425	5
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Failure Recovery • provides immediate recovery from line or modem failures • switches modems at attended and unattended

MO: monthly 2-year/3-year lease charge; does not include maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for leased or purchased units. NC: no-cost item. NA: not applicable. Prices are current as of February 1985.

Paradyne Microprocessor (MP) Series Modems

Models MP-48/208B, MP-14.4 & MP-16.0

sites between 4-wire dedicated line and 2 dial-up lines to restore communications interrupted by line failure/degradation • switches data terminal equipment between faulty modem and hot-spare modem to restore communications interrupted by modem failure/degradation.

Model 4711 2-Call Auto-Answer • unit switches unattended or attended site modem between 4-wire dedicated and dual DDD lines • automatically answers calls on DDD lines • FCC-certified standalone unit • ANALYSIS Network Management System control:

35/32	550	NC
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Model 4700 Hot-Standby Adapter • standalone unit switches analog and digital connections between primary modem and hot-spare backup modem • ANALYSIS Network Management System control:

35/32	800	5
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Model 2403 CBS Coupler • standalone FCC registered, AT&T CBS-compatible Data Access Arrangement, manual dial-up unit for communications over DDD network • originate only • available for MP-48/208B modem only:

5/5	125	NC
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Model 2405 Switched Line Interface Module (SLIM) • standalone FCC-registered automatic dial-up unit for communications over DDD network • originate only • available for MP-48 modem only:

9/9	250	NC
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Diagnostic & Status Indicators

Comprehensive diagnostics isolate failures in local or remote

modems or dedicated line • manual or automatic control through ANALYSIS Network Management System 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 communication line:

NC/NC mo	NC prch	NC maint
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Test Pattern Generation • integral 511-bit pseudo-random generator/comparator for error testing in accordance with CCITT V.52:

NC/NC	NC	NC
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Model 2406 Eye Pattern Generator • optional PC board module allows hookup of external oscilloscope for display of analog line conditions • available for all MP modems:

5/5	150	NC
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Status Indicators • indicates power on; operating mode; EIA interface signal activity; test mode; and bit error bursts • ANALYSIS controlled signal/line quality indicators based on modem power, EIA interface signals, and analog parameters (received signal level, signal-to-noise level, and phase jitter) • circuit quality indicators measure user-defined bit error rate when line is down from traffic only; 2 test modes available: a short test of a specified number of 511-bit blocks, or an all-night simulated traffic test to all network drops.

• END

Paradyne VHS/MPX Series & Challenger Series Modems

Challenger 2400, 4800, 9600, 14.4K & 16.0K; MPX2400, MPX4800, MPX9600, VHS14.4K, VHS16.8K & VHS19.2K

■ PROFILE

Function • high-performance modems for dedicated facilities; optional network control support (VHS/MPX Series).

Communications/Networks • synchronous, with optional asynchronous-to-synchronous conversion, at 2400/4800/9600/14,400/16,000/16,800/19,200 bps; point-to-point or multipoint communication over unconditioned 4-wire dedicated Type 3002 facility; tail circuits supported via multipoint option • not compatible with AT&T modems • compatible with Paradyne MP and LSI Series modems in existing network • supports Paradyne ANALYSIS 5500/5530 network control and management systems (VHS/MPX Series).

First Delivery • September 1983 (Challenger 2400, 4800, 9600, and MPX2400, MPX4800, and MPX9600); March 1984 (Challenger 14.4K); November 1984 (Challenger 16.0K); March 1985 (VHS14.4K, VHS16.8K, and 19.2K).

Units Delivered • undisclosed.

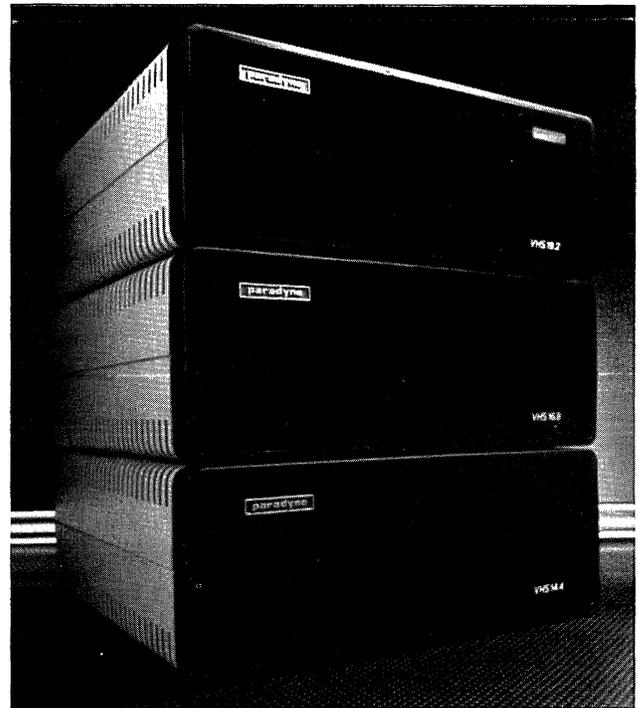
Comparable Systems • principal competition with AT&T Dataphone II modems; Codex CS Series; IBM 3860 Series; INFINET (Intel) NCM Series; NCR 7160 Series; Racal-Milgo CMS Series.

Vendor • Paradyne Corporation; 8550 Ulmerton Road, Largo, FL 33540 • 813-530-2000.

Distribution • nationwide through local sales offices and worldwide via direct sales or distributors • Canada via Paradyne Canada Limited; Willowdale, Ontario • Great Britain via Paradyne U.K. Limited; Windsor, Berkshire • Germany via Paradyne GmbH; West Germany • Japan via Paradyne Japan, KK; Tokyo • Caribbean via Paradyne Caribbean, Inc; Puerto Rico.

■ ANALYSIS

Paradyne has continued to diversify its line of modems by incorporating the high-speed VHS Series into its existing MPX product family. The extended VHS/MPX Series includes the MPX2400, MPX4800, MPX9600, VHS14.4K-bps, VHS16.8K-bps, and VHS19.2K-bps modems. The VHS/MPX Series support single and multilevel network architectures with multipoint and switched network tail circuits. Synchronous and asynchronous

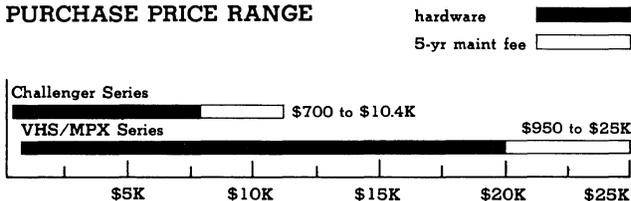


interfaces at modem and multiplexer levels accommodate both half- and full-duplex protocols. All VHS/MPX modems can be equipped with an extra-cost option to operate in conjunction with Paradyne's ANALYSIS System.

The Challenger family of nondiagnostic modems has also been enhanced by the addition of 2 high-end models. The Challenger Models 14.4K and 16.0K join the existing Challenger Series of 2400-, 4800-, and 9600-bps modems. Designed for users not requiring the comprehensive diagnostic functions supported by VHS/MPX modems, the Challenger family represents cost-effective product alternatives. The high-speed Challenger 14.4K-bps and 16.0K-bps modems are available as standalone units or as single-circuit cards that allow for high density nest mounting. Up to 13 Challenger 14.4K modem cards and up to 12 Challenger 16.0K modem cards can be stored in a single nest mount which conserves data center floor space. No provision exists for Paradyne's ANALYSIS network diagnostics; however, standard modem test features and a built-in eye pattern generator are included.

The VHS/MPX Series modems can be easily upgraded to support ANALYSIS 550, 5500, and 5530 network control and management systems. 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

PURCHASE PRICE RANGE



PARADYNE CHALLENGER SERIES & VHS/MPX 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) • Challenger Series pricing ranges from standard Challenger 2400 at low end to Challenger 16.0K with Two-Call Auto-Answer at high end • VHS/MPX Series pricing ranges from standard MPX2400 at low end to VHS19.2K with Diagnostic Control and 16-channel multiplexer at high end.

Paradyne VHS/MPX Series & Challenger Series Modems

Challenger 2400, 4800, 9600, 14.4K & 16.0K; MPX2400, MPX4800, MPX9600, VHS14.4K, VHS16.8K & VHS19.2K

can quickly pinpoint failures through modem-executed diagnostics that isolate failures to central- or remote-site modems or the line. Diagnostics are automatically executed in response to operator commands at the central-site ANALYSIS console.

Options are available for remedial recovery from modem or line failures through modem substitution or dial backup. Half-speed fallback data rates support the possible resumption of communication with tolerable error rates over degraded facilities.

In addition, VHS modems employ Paradyne's Projected Anisotropic Coding Structure (PACS) to insure transmission reliability over long-haul voice-grade circuits. A convolutional encoding/decoding scheme, PACS utilizes adaptive signal processing and error-correction algorithms to assist in the maintenance of data integrity and throughput.

□ Strengths

Paradyne's microprocessor-based high-performance modems are designed to suit a variety of user needs. The medium-to-high speed Challenger Series are cost-effective alternatives for users without extensive diagnostic control requirements. The modular plug-in design of the Challenger 14.4K and 16.0K models simplifies installation, upgrading and maintenance. Although available in both standalone and single-circuit card versions, the compact packaging of the 14.4K and 16.0K modem cards will appeal to users with space constraints. Up to 12 16.0K cards and up to 13 14.4K cards measuring 10.5x14 inches can be stored in a 19.25-inch card nest mount. Configuration flexibility is enhanced by the ability to intermix 14.4K and 16.0K cards in a single card nest. However, Paradyne has indicated that single-card versions of lower-speed Challenger models will not be added to the line up.

The VHS/MPX modems provide a comprehensive range of high-performance models. A primary benefit of the VHS/MPX Series is the advantage of network control. Network control and management functions aid in the elimination of excessive downtime. It puts the network manager in touch with the performance of the network and provides the tools for isolating failures that removes the guesswork from failure isolation. It also allows the manager to restore communication through temporary alternate paths until a failure is resolved.

Low price, high reliability, low error rate with a typical signal-to-noise ratio over unconditioned lines, low power consumption, and small compact packaging are other important considerations. The calculated MTBF is 38,000 hours, which means the modem should theoretically operate constantly for over 4 years without a failure. Operation over unconditioned lines saves the user considerable charges for conditioning. Power consumption is less than 25 watts, an important consideration at sites where many modems are installed. Compact size is also important to installations that contain many modems for space-saving considerations. And, of course, price is an important factor. These modems are reduced in price to as much as half the price of an equivalent MP Series modem.

Other advantages are application dependent and include multipoint support with tail circuits, asynchronous-to-synchronous data conversion, and digital network extension over analog lines. In addition, the ability to integrate 6-, 8-, or 16-channel multiplexers with VHX modems further extends performance capabilities. These options are an important consideration to users with these application requirements.

□ Limitations

There are a few limitations that should be considered by prospective users before placing an order, although not all users are affected. The user should be aware that diagnostic testing is limited to loopback tests with or without bit error rate testing using the modem's integral test pattern generator when the modems are used in a network without ANALYSIS network control. Also, user-established operating parameters cannot be downloaded to remote modems in a non-ANALYSIS network; operating parameters must be established at individual modems which could be a crippling inconvenience.

The modems do not provide redundancy, except through a separate hot-spare modem. Although the calculated MTBF is high, it doesn't mean failures can't occur, and they will; that's why Paradyne provides hot-spare switchover for critical operation. A fault-redundant modem would preclude the need for a hot spare with additional cabling at twice the price of a single modem.

CCITT compatibility is not provided with MPX9600 modems equipped with ANALYSIS network diagnostics. This limitation restrains the user requiring CCITT V.29 compatibility from using the modem in a network supported by the Paradyne ANALYSIS System.

At the present time, only the Challenger nondiagnostic 14.4K and 16.0K versions are available as single-circuit cards. For the remaining modems, rackmount installations are physically limited by the number of modems that can be accommodated in a single rack, and modem replacements or additions are physically inconvenient to the user. Only 2 modems fit adjacently in a rack, and are not designed for easy insertion into a card frame, as are many competitive products.

■ HARDWARE

□ Terms & Support

Terms • available for purchase or lease under a 2-, 3-, or 5-year lease agreement; maintenance is not included in lease price, but is available for both leased and purchased units • 90-day warranty on purchased units • lease/purchase credit handled on a contract basis • quantity discounts available for leased or purchased units.

Support • installed by Paradyne or by user; installation charge is \$150 for MPX2400 and MPX4800 models, and \$250 for MPX9600 models; installation charge reduced by 55 percent of total installation charge for multiple concurrent installations • maintenance available under separate contracts for leased or purchased equipment, by on-call service, or via factory repair • contract maintenance performed during Principal Period of Maintenance (PPM) 8:00 AM to 5:00 PM, Monday through Friday except holidays; a fee of \$125 per hour, plus travel expenses, is charged for maintenance outside the PPM • on-call service charges include \$100 per hour labor or \$125 per hour outside the PPM, plus travel expenses • on-call service and maintenance outside the PPM require a 2-hour minimum charge • factory service available for purchased equipment only; repair or replacement at no cost for equipment under warranty; turnaround typically within 30 days; \$100 charge for expedited service provides turnaround within 5 working days • service provided through over 100 service centers and field service offices located in major cities nationwide • consulting service provided with charges for labor, travel, and overnight expenses; consulting labor charge at \$125 per hour, or \$175 per hour outside the PPM, with a required 4-hour minimum.

□ Overview

The Challenger Series are cost-effective modems designed for point-to-point or multipoint operation over 4-wire dedicated Type 3002 voice channels. Based on bit-slice signal processing architecture, the Challenger Series feature auto-adaptive channel equalization at all speeds including 2400 bps. Options include 2-call dial backup, eye-pattern generator, and analog exterior interface. Challenger models 4800 and 9600 also feature an integral 4-channel multiplexer. The most recent additions to the Challenger family, Models 14.4K and 16.0K, are available in standalone or single circuit card versions.

The VHS/MPX family includes 6 models that are designed for point-to-point or multipoint network configurations with or without network control and management under Paradyne's ANALYSIS 5500/5300 series systems. Available in standalone or rackmount packages and rated at 2400, 4800, 9600, 14.4K, 16.8K, and 19.2K bps, the modems feature half-speed fallback, asynchronous-to-synchronous data conversion, multipoint operation, extensive diagnostics, and failure recovery through dial backup and hot-spare modem switching at central and remote sites.

Paradyne VHS/MPX Series & Challenger Series Modems

Challenger 2400, 4800, 9600, 14.4K & 16.0K; MPX2400, MPX4800, MPX9600,
VHS14.4K, VHS16.8K & VHS19.2K

The basic modem is contained on a single board which includes power supply, controls, indicators, and connectors. Rear-mounted connectors include a female RS-232C digital connector and an RJ11 modular jack for VF (analog) line connection. Rackmounted units mount side-by-side, 2 to a shelf.

Operating parameters can be established from the front panel through programmable controls (soft strapping) or they can be downline loaded from a central-site Paradyne ANALYSIS 5500 or 5530 system.

Fault isolation through diagnostic testing, conducted from the modem's front panel, include analog loopback, local and remote digital loopback, and separate transmit and receive bit error rate tests (BERT) using continuous spacing or marking or a 511-bit pseudo-random test pattern. Front panel LEDs visually indicate test results.

An optional Diagnostic Microcomputer Control (DMC) board conducts diagnostic tests and monitors network performance under control of commands issued by Paradyne's ANALYSIS 5500 or 5530 network control and management system. ANALYSIS constantly polls the DMC over an out-of-band, 110-bps (secondary) channel for status information received from the attached MPX modem; status (sensed operating parameters both analog and digital) are returned to ANALYSIS which alerts an operator to any abnormal conditions through visual and audible alarms.

The Asynchronous-to-Synchronous Converter (ASC) Option converts asynchronous data at the EIA RS-232C interface to a synchronous stream at the modem's clocked data rate. The ASC daughter board is attached to the basic modem board. A second daughter board is required for modems which include the multiport option for multiplexer ports B, C, and D, if async-to-sync conversion is needed for all ports; however, the feature can be activated on an individual port basis.

The Digital Data Network (DDN) option connects an MPX modem to a digital network for applications that require an analog extension, such as a local loop between customer and digital network. The DDN daughter board receives the master clock signal from the network's transmit clock (EIA interface pin 24) which synchronizes the data received from the network.

Packaged Modems

Standalone and rackmount packaging available for same price; rackmount units require extra-cost rackmount shelf, which accommodates 2 modems mounted side-by-side.

Challenger Series

Challenger Model 2400 • standard CCITT V.26-compatible, 2400-bps nondiagnostic, dedicated modem:

\$30/\$20 mo \$700 prch \$10 maint

Challenger Model 4800 • standard CCITT V.27-compatible, 4800-bps nondiagnostic, dedicated modem:

65/80 1,500 15

Challenger Model 9600 • standard CCITT V.29-compatible, 9600-bps nondiagnostic, dedicated modem:

110/80 2,300 20

Challenger Model 9600/Mux • standard CCITT V.29-compatible, 9600-bps nondiagnostic, dedicated modem with integral multiplexer; master or remote unit:

135/100 3,090 25

Challenger Model 14.4K • standard CCITT V.29-compatible, 14.4K-bps nondiagnostic, dedicated modem for point-to-point operation:

200/150 4,800 25

Challenger Model 16.0K • standard CCITT V.29-compatible 16.0K-bps, nondiagnostic, dedicated modem for point-to-point operation:

327/246 8,300 30

Challenger Model 14.4/16.0K Card Nest • modem card nest

for use with Challenger 14.4K-/16.0K-bps modem cards • 3 to 12 card capacity for 16.0K modem cards, 3 to 13 card capacity for 14.4K modem cards:

200/150 5,000 25

Challenger Model 14.4K Modem Card • standard CCITT V.29-compatible, 14.4K-bps nondiagnostic modem card for point-to-point operation; for use with Challenger 14.4K/16.0K card nest:

180/135 4,300 25

Challenger Model 16.0K Modem Card • standard CCITT V.29-compatible, 16.0K-bps nondiagnostic modem card for point-to-point operation; for use with Challenger 14.4K/16.0K card nest:

307/231 7,800 25

MPX Series

Model MPX2400 • standard CCITT V.26-compatible, 2400-bps dedicated modem without ANALYSIS diagnostic control (DMC):

\$35/\$25 mo \$950 prch \$10 maint

Model MPX2400/Diagnostic Control • standard 2400-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or older 4400 series systems:

54/40 1,450 15

Model MPX4800 • standard CCITT V.27-compatible, 4800-bps dedicated modem without ANALYSIS diagnostic control (DMC); master or remote unit:

65/50 2,000 20

Model MPX4800/Diagnostic Control • standard 4800-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for older 4400 series systems; master or remote unit:

85/65 2,600 25

Model MPX4800/Mux • standard CCITT V.27-compatible, 4800-bps dedicated modem with integral 4-channel multiplexer; master or remote unit:

85/65 2,600 25

Model MPX4800/Diagnostic Control/Mux • standard 4800-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for older 4400 series systems and with integral 4-channel multiplexer; master or remote unit:

105/80 3,200 25

Model MPX9600 • standard CCITT V.29-compatible, 9600-bps dedicated modem without ANALYSIS diagnostic control (DMC); master or remote unit:

120/90 3,400 25

Model MPX9600/Diagnostic Control • standard 9600-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems; master or remote unit:

145/105 4,000 25

Model MPX9600/Mux • standard CCITT V.29-compatible, 9600-bps dedicated modem with integral 4-channel multiplexer for multipoint operation; master or remote unit:

140/100 4,200 25

Model MPX9600/Diagnostic Control/Mux • standard 9600-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5300 or for point-to-point or multipoint operation on older 4400 series systems, and with integral 4-channel multiplexer for multipoint operation; master or remote unit:

160/120 4,800 25

MO: monthly 2-/3-year lease charge; does not include maintenance. PRCH: single-unit purchase price. MAINT: monthly maintenance charge for leased or purchased equipment. NC: no charge. NA: not available. Prices current as of December 1984.

Paradyne VHS/MPX Series & Challenger Series Modems

Challenger 2400, 4800, 9600, 14.4K & 16.0K; MPX2400, MPX4800, MPX9600, VHS14.4K, VHS16.8K & VHS19.2K

MPX Modem Rackmount Shelf • accommodates 2 MPX modems mounted side-by-side:

NA/NA	85	NC
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MPX Modem Rackmount/Blank Panel • for unused modem position of rackmount shelf:

NA/NA	10	NC
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VHS Series

Model VHS14.4K • standard CCITT V.24- and V.28-compatible, 14.4K-bps dedicated modem without ANALYSIS diagnostic control (DMC):

\$472/\$356 mo	\$10,200 prch	\$25 maint
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Model VHS14.4K/Diagnostic Control • standard CCITT V.24- and V.28-compatible, 14.4K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems; master or remote unit:

575/434	12,420	35
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Model VHS14.4K/Mux • standard CCITT V.24- and V.28-compatible, 14.4K-bps dedicated modem with integral 6-channel multiplexer; master or remote unit:

583/440	12,600	35
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Model VHS14.4K/Diagnostic Control/Mux • standard 14.4K-bps dedicated modem with diagnostic control (DMS) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems, and with integral 6-channel multiplexer for multipoint operation; master or remote unit:

686/517	14,820	45
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Model VHS14.4K/8CH Stat Mux • standard CCITT V.24- and V.28-compatible, 14.4K-bps dedicated modem with integral 8-channel statistical multiplexer; master or remote unit:

694/524	15,000	55
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Model VHS14.4K/16CH Stat Mux • standard CCITT V.24- and V.28-compatible, 14.4K-bps dedicated modem with integral 16-channel statistical multiplexer; master or remote unit:

805/607	17,400	75
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Model VHS14.4K/Diagnostic Control/8CH Stat Mux • standard 14.4K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 8-channel statistical multiplexer; master or remote unit:

733/553	15,800	65
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Model VHS14.4K/Diagnostic Control/16CH Stat Mux • standard 14.4K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 16-channel statistical multiplexer; master or remote unit:

844/637	18,240	85
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Model VHS16.8K • standard CCITT V.24- and V.28-compatible, 16.8K-bps dedicated modem without diagnostic control (DMC):

533/402	11,520	25
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Model VHS16.8K/Diagnostic Control • standard 16.8K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems; master or remote unit:

636/480	13,740	35
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Model VHS16.8K/Mux • standard CCITT V.24- and V.28-compatible, 16.8K-bps dedicated modem with integral 6-channel multiplexer; master or remote unit:

644/486	13,920	35
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Model VHS16.8K/Diagnostic Control/Mux • standard 16.8K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral

6-channel multiplexer; master or remote unit:

747/563	16,140	45
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Model VHS16.8K/8CH Stat Mux • standard CCITT V.24- and V.28-compatible, 16.8K-bps dedicated modem with integral 8-channel statistical multiplexer; master or remote unit:

755/570	16,320	55
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Model VHS16.8K/16CH Stat Mux • standard CCITT V.24- and V.28-compatible, 16.8K-bps dedicated modem with integral 16-channel statistical multiplexer; master or remote unit:

867/654	18,720	75
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Model VHS16.8K/Diagnostic Control/8CH Stat Mux • standard 16.8K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 8-channel statistical multiplexer; master or remote unit:

794/599	17,610	65
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Model VHS16.8K/Diagnostic Control/16CH Stat Mux • standard 16.8K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 16-channel statistical multiplexer; master or remote unit:

905/683	19,560	85
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Model VHS19.2K • standard CCITT V.24- and V.28-compatible, 19.2K-bps dedicated modem without ANALYSIS diagnostic control:

600/452	12,960	25
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Model VHS19.2K/Diagnostic Control • standard 19.2K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems; master or remote unit:

600/452	15,180	25
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Model VHS19.2K/Mux • standard CCITT V.24- and V.28-compatible, 19.2K-bps dedicated modem with integral 6-channel multiplexer; master or remote unit:

711/536	15,360	35
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Model VHS19.2K/Diagnostic Control/Mux • standard 19.2K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 6-channel statistical multiplexer; master or remote unit:

814/614	17,850	45
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Model VHS19.2K/8CH Stat Mux • standard CCITT V.24- and V.28-compatible, 19.2K-bps dedicated modem with integral 8-channel statistical multiplexer; master or remote unit:

822/620	17,760	55
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Model VHS19.2K/16CH Stat Mux • standard CCITT V.24- and V.28-compatible, 19.2K-bps dedicated modem with integral 16-channel statistical multiplexer; master or remote unit:

933/704	20,160	75
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Model VHS19.2K/Diagnostic Control/8CH Stat Mux • standard 19.2K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 8-channel statistical multiplexer; master or remote unit:

861/649	18,600	65
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Model VHS19.2K/Diagnostic Control/16CH Stat Mux • standard 19.2K-bps dedicated modem with diagnostic control (DMC) for ANALYSIS 5500/5530 or for point-to-point or multipoint operation on older 4400 series systems and with integral 16-channel statistical multiplexer; master or remote unit:

972/733	21,000	85
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□ Application

Point-to-point or multipoint communication over unconditioned 4-wire dedicated Type 3002 voice channel • Challenger 2400 training time delay selectable at 9/26/65/148 milliseconds •

Paradyne VHS/MPX Series & Challenger Series Modems

Challenger 2400, 4800, 9600, 14.4K & 16.0K; MPX2400, MPX4800, MPX9600, VHS14.4K, VHS16.8K & VHS19.2K

Challenger 4800 training time delay selectable at 25/50/709 milliseconds at 4800 bps; 33/67/943 milliseconds at 2400 bps • Challenger 9600 training time delay selectable at 20/253/726 milliseconds • Challenger 14.4K training time delay selectable at 253 milliseconds/2 seconds/6 seconds • Challenger 16.0K training time delay at 253 milliseconds/2 seconds/6 seconds • MPX2400 training time delay selectable at 9/26/65/148 milliseconds • MPX4800 training time delay selectable at 25/50/709 milliseconds at 4800 bps; 33/67/943 milliseconds at 2400 bps • MPX9600 training time selectable at 20/253 milliseconds • VHS modems support point-to-point communication over D1 conditioned 4-wire dedicated Type 3002 voice channel • training time delay is 253 milliseconds/2 seconds/6 seconds for Models VHS14.4K, VHS16.8K, and VHS19.2K.

□ Operating Parameters

Synchronous, full-duplex with selectable fallback data rates; optional asynchronous-to-synchronous converter accommodates asynchronous data at EIA electrical interface • Challenger 2400 rated at 2400 bps with half-speed fallback • Challenger 4800 rated at 4800 bps with half-speed fallback • Challenger 9600 rated at 9600 bps with fallback rates of 7200/4800 bps • Challenger 14.4K rated at 14.4K bps with fallback rates of 12000/9600 bps • Challenger 16.0K rated at 16.0K bps with fallback rates of 14400/12000/9600/8000/7200 bps • MPX2400 rated at 2400 bps with half-speed fallback • MPX4800 rated at 4800 bps with half-speed fallback • MPX9600 rated at 9600 bps with fallback rates of 7200/4800 bps • VHS14.4K rated at 14.4K bps with fallback rates of 12000/9600 bps • VHS16.8K rated at 16.8K bps with fallback rates of 14400/12000 bps • VHS19.2K rated at 19.2K bps with fallback rates of 16800/14400 bps • 4/8 phase DPSK modulation for Challenger 2400, MPX2400, Challenger 4800 and MPX4800, respectively; QAM modulation for Challenger 9600 and MPX9600.

□ Channel Functions

Multiport • Challenger 4800, Challenger 9600, MPX4800, and MPX9600 available with integral 4-channel buffered multiplexer • any mix of synchronous rates from 1200 bps to 4800 bps on Challenger 4800 and MPX4800; 1200 bps to 9600 bps on Challenger 9600 and MPX9600 • 6 selectable data rate port selections on Challenger 4800 and MPX4800, 10 selections on Challenger 9600 and MPX9600 • port data rate selections manually controlled via front-panel thumbwheel switch or automatically via ANALYSIS System for MPX modems equipped with DMC option; ANALYSIS preempts manual selection; zero setting nullifies multiplexer • included in package price of some models; upgrade price:

\$25/\$20 mo	\$800 prch	\$5 maint
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Secondary Channel • VHS/MPX option for separate Diagnostic Micro-Computer (DMC) board provides a narrow-band, 110-bps full-duplex channel FDM multiplexed with main high-speed data channel • provides control path for passing control, monitoring, and configuration parameters between central-site Paradyne ANALYSIS System and central-/remote-site modems • DMC board included in package price of some models; upgrade price:

20/15	600	5
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Asynchronous/Synchronous Converter (ASC) • option converts asynchronous data at the digital electrical interface to synchronous data stream (and the converse) • 1 and 4 ports can be selected on multiport models • supports data rates of 1200/2400/4800/7200/9600 bps • accommodates character lengths from 7 to 12 bits • 2 ASC boards required for all 4 ports of MPX modems with multiport option:

NA/NA	NA	NC
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Digital Network Interface • interfaces modem with digital data network for analog extension; transmit clock provided by digital network:

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

□ 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 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.

Model 4712 Two-Call Auto-Answer • unit switches unattended or attended-site modem between 4-wire dedicated line and 2 dial-up switched lines • automatically answers calls on dial-up lines • FCC-certified standalone unit:

\$45/\$42 mo	\$950 prch	\$5 maint
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Model 4700 Hot-Standby Adapter • standalone unit switches analog and digital connections between primary modem and hot-spare backup modem • ANALYSIS System control:

35/32	800	NC
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Master Modem Hot-Standby Adapter • switches analog and digital connections between primary central-site (master) modem and hot-spare backup modem • ANALYSIS System control:

NA/NA	NA	NC
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□ Diagnostics & Status Indicators

Comprehensive diagnostics isolate failures in local or remote modems or dedicated line • diagnostic tests manually conducted via front-panel controls or automatically via Paradyne ANALYSIS Network Control and Management System; DMC circuit board required for ANALYSIS control • ANALYSIS extends diagnostic testing to include analog parameter measurements that it compares with user-established thresholds for normal or alarm conditions; sensed analog parameters include receive signal level, phase jitter, phase hits, nonlinear distortion, dropouts, gain hits, signal-to-noise ratio, frequency offset, and impulse hits • modem displays visual indication of operating conditions (status); visual warning of deteriorating or abnormal conditions.

Loopback Tests • local analog loopback in accordance with CCITT V.54 loop 3; local digital loopback; remote digital loopback in accordance with CCITT V.54 loop 2 • standard feature:

NC/NC mo	NC prch	NC maint
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Transmit/Receive Test • conducts bit error rate test (BERT) on transmitted and received data in conjunction with loopback using continuous space or mark or 511-bit pseudo-random test pattern • individually tests each part of multiport modem without interfering with other ports • standard feature:

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

5/5	150	NC
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Status Indicators • indicates power on; operating mode; EIA interface signal activity; test mode; and bit error bursts.

• END

Paradyne ANALYSIS Systems

ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

■ PROFILE

Function • network control system (ANALYSIS 550/5500) and network control and management reporting system (ANALYSIS 5530).

Communications/Networks • ANALYSIS 550 supports up to 10 dedicated Type 3002 voice-grade lines; ANALYSIS 5500 supports up to 150 4-wire dedicated Type 3002 voice-grade lines in 10-line increments; ANALYSIS 5530 supports up to 900 4-wire dedicated Type 3002 voice-grade lines in 10-line increments • accommodates up to 6 line segments per secondary channel (up to 4 line segments only, ANALYSIS 550) • ANALYSIS 550 addresses up to 512 drops (modem addresses maximum, 256 drops per line maximum; ANALYSIS 5500 addresses up to 2,000 drops (modem addresses) maximum, 256 drops per line maximum; ANALYSIS 5530 addresses 6,000 drops maximum, 256 drops per line maximum • accommodates Paradyne MPX Series modems equipped with optional network control • 110-bps secondary channel supports network control functions.

First Delivery • first ANALYSIS product delivered in 1978; first ANALYSIS 5500 system delivered October 1983.

Systems Delivered • unknown.

Comparable Systems • principal competition from AT&T Information Systems DATAPHONE II Service; General DataComm Netcon 6; IBM 3860 Series modems with NPDA software product; Infinet EMS-One/Series 90; Racal-Milgo CMS 185/1000/2000 systems.

Vendor • Paradyne Corporation; 8550 Ulmerton Road, Largo, FL 33541 • 813-530-2000.

Distribution • nationwide via local sales offices and worldwide via direct sales or distributors • Canada via Paradyne Canada Limited • Germany via Paradyne GmbH • Europe, Asia, Central and South America via Paradyne distributors.

■ ANALYSIS

Paradyne's ANALYSIS Series of network control and management systems is comprised of 3 basic models that

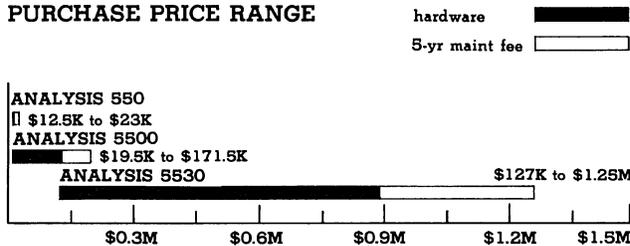


supervise dedicated data networks through continuous surveillance for line or component failure or degradation; through diagnostic testing to isolate failures; and through remedial recovery procedures to insure network integrity and eliminate excessive downtime. These modular, expandable models address the requirements of small- to large-scale data networks. Model 550 is a microprocessor-based unit supporting 10 lines; Model 5500 is a microprocessor-based unit which supports from 10 to 150 lines; Model 5530 is a minicomputer-based system supporting up to 900 lines, with database management capability.

The ANALYSIS 550/5500 Series replaces ANALYSIS 4400 (and older) network control systems. The 5500s are more modular and offer increased flexibility and expanded performance over their predecessors, and without associated line expansion limitations. In addition, the 550/5500 Series have been designed to monitor and control the new low-cost Paradyne MPX Series modems, which can monitor an expanded range of analog line parameters and support downline loading of modem strap settings.

With ANALYSIS, users increase their network control capacity by adding additional secondary channels, in groups of 10, as the need develops. Each secondary channel can supervise up to 4 line segments in "multitier" environments, defined as separate dedicated circuits arranged back-to-back in multiplexed and/or tail-circuit configurations; for ANALYSIS 5500 and 5530 systems,

PURCHASE PRICE RANGE



PARADYNE ANALYSIS SYSTEMS PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations (solid bars), and for associated 5-year period maintenance (open bars); pricing excludes the cost of diagnostic modems • ANALYSIS 550 small/large configuration consists of 10-line system with system printer and terminal • ANALYSIS 5500 small configuration consists of 10-line system with system printer and terminal; large of 150-line system with 5 operator terminals and 5 system printers • ANALYSIS 5530 small configuration consists of 50-line system with 2 system printers and 3 terminals; large of 900-line system with 8 operator terminals, 6 printers, 4 line printers, additional disk drives, and tape backup unit.

Paradyne ANALYSIS Systems

ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

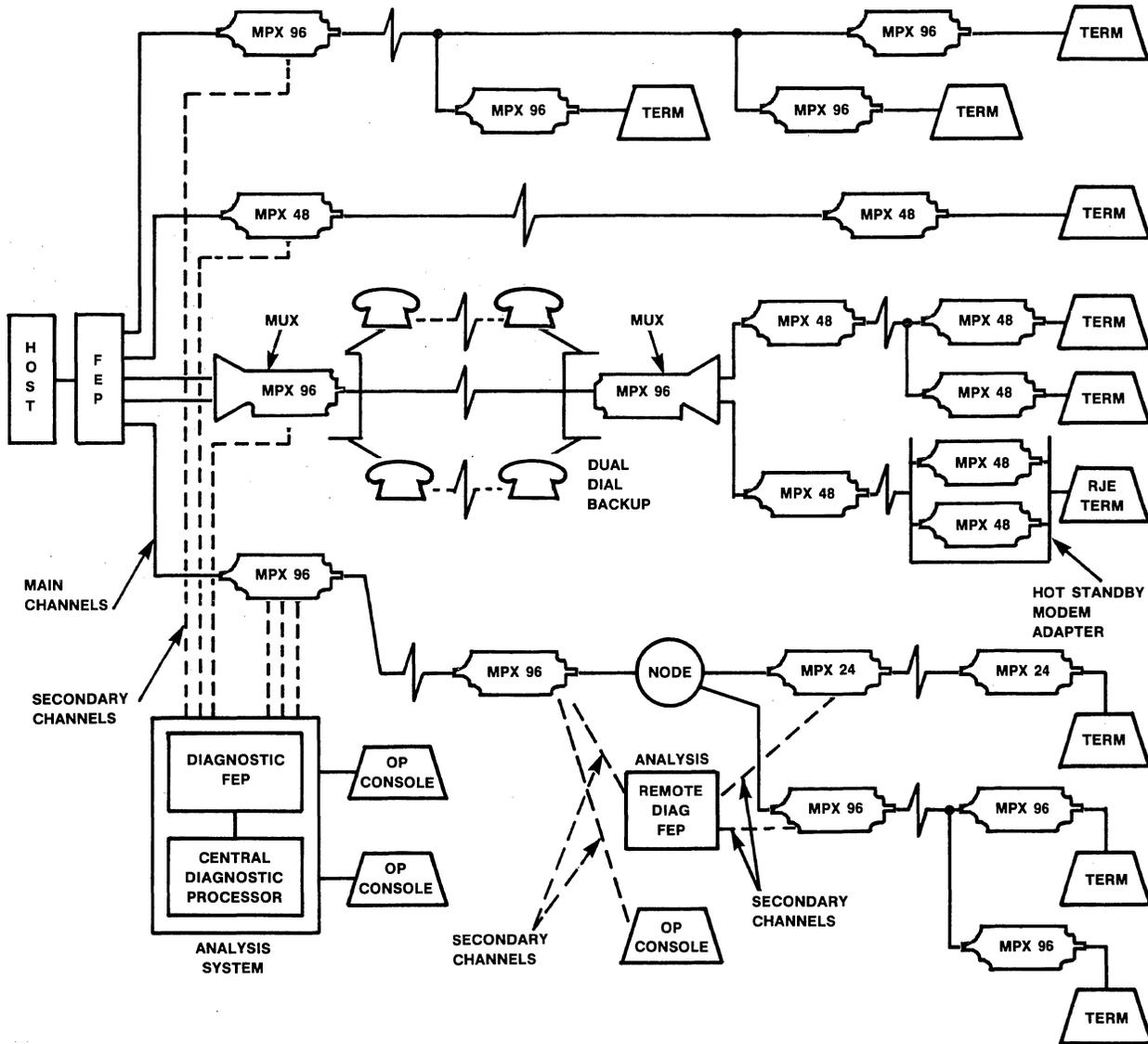


Figure 1 • Paradyne ANALYSIS System example configuration with Paradyne MPX Series modems.

up to 6 levels can be supported with remote diagnostic front-end processors. Multichannel modems support only 1 channel passing control information at one time, but users can duplicate the secondary channel for remote multiplexed tiers or tail circuits by employing an ANALYSIS hubbing device. Each modem drop on a line is polled by individual or multiple ANALYSIS communication processors, depending on the model, which monitor the modems for status and change-of-state conditions.

Strengths

The ANALYSIS Series is a modular system designed for small to very large networks. Users can expand from 10 to 900 lines—more than enough capacity for the majority of networks. Paradyne also designed the system to accommodate new features and options as they become available.

A powerful management reporting capability is standard for the

Model 5530. Utilizing what Paradyne claims is a relational DBMS, users can define and create a variety of administrative reports such as maintaining trouble tickets or managing inventory control. Both models in the family can also print routine status reports on various network components.

The out-of-band, secondary-channel approach used by ANALYSIS to monitor network performance is non-interfering with normal data communication activity. At least one other major network control system, IBM's NPDA software product with 3860 Series modems, employs an in-band approach that adds overhead to normal communication and can affect throughput.

ANALYSIS alarm thresholds are **user defined** for network modems, multidrop lines, or other network subsets. Individual sites or specific modem/line parameters can be **masked** from the monitoring process as well. ANALYSIS measurement of a comprehensive array of analog line/digital modem parameters is

Paradyne ANALYSIS Systems

ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

also a major advantage not afforded by most competitive network control systems. Another relatively unique feature is a pre-scheduled, unattended network test that can pinpoint failures during inactive network periods, allowing operators to implement remedial action before the problem(s) cause excessive downtime.

Downline loadable soft-strapping is a convenient feature provided only by ANALYSIS 550/5500 systems in conjunction with newer Paradyne MPX Series modems. From a central-site system console, network operators can configure individual modem strap settings at remote modems. This feature precludes the need to send experienced (and expensive) maintenance personnel to remote locations for modem configuration/reconfiguration tasks.

Paradyne is a leading communication equipment manufacturer with a reputation as an innovator and leader in modem technology. Furthermore, Paradyne products are dependable and known for their reliability. The company manufactures or markets nearly all components required for data networking and provides a nationwide field service force.

□ Limitations

In common with other secondary channel network control/management systems, ANALYSIS cannot be used over all-digital transmission facilities that do not support sideband circuits; i.e., AT&T's current DATAPHONE Digital Service or satellite facilities. Hybrid or wide-area network users can only employ ANALYSIS over that portion of their networks traversing dedicated voice-grade circuits; therefore, ANALYSIS represents only a partial solution to comprehensive network management in today's interconnected world.

There are several minor limitations that might make the ANALYSIS Series less attractive to some users. The more obvious omissions include the lack of an IBM 3600 loop system capability and the absence of a modem wraparound feature to accommodate non-Paradyne modems. One or both of these features are available on competitive network control systems from Codex, General DataComm, Intertel, and Racal-Milgo. Paradyne also does not provide a dial backup system for multipoint/multidrop circuits at this time.

The vendor has yet to adapt its DATALYZER network performance measurement system for use with the 5500 Series. Such systems, available in conjunction with network management products from Infinet and Racal-Milgo, provide line utilization and response-time data for spotting network bottlenecks and aiding network expansion. Paradyne expects a second-generation version of DATALYZER to be available in early 1985.

Users of Paradyne's earlier ANALYSIS 4400 system who need the support of the new 5500/5530 system must replace their existing system since there is no upgrade path to the 5500/5530.

■ SOFTWARE

□ Terms & Support

Terms • ANALYSIS Control Program, management reports software, and 5530 DBMS software all bundled with hardware • terms identical to hardware; listed under HARDWARE section.

Support • software support service is automatically included in monthly on-call maintenance charges and is identical to hardware; listed under HARDWARE section.

□ Operating System

ANALYSIS 550, 5500, and 5530 run under proprietary operating systems. The ANALYSIS 5530 supports proprietary database management (DBMS) software. All operating systems and systems software are bundled with hardware.

□ ANALYSIS 550, 5500 & 5530 Control Program

System Control

System control is performed by the operating system under the

direction of the console operator(s) through keyed commands; provides a system menu for selecting major command modes upon system initialization or when operator enters MASTER command • system executes commands and interacts with operator through displayed submenus, prompts, and alarm messages; program function-key selectable for various formats • all operator consoles operate independently; password protection ensures system integrity.

System Commands • create and modify entries in network/line configuration files • alter alarm thresholds of individual modems, including 9 EIA signal parameters and 10 analog parameters for Paradyne MPX Series modems • provides access to optional DATALYZER performance measurement system to initialize the file or display line configurations • set Paradyne MPX Series modem strap settings from an ANALYSIS operator terminal • can establish up to 64 strap settings per modem, a dozen of which are commonly used; can lock the front panel of MPX modems to avoid tampering.

Diagnostic Commands • conduct individual qualitative or quantitative tests or monitor routines for specific modems, interfaces, and analog circuits.

Monitor Commands • enable/disable automatic monitor mode (Autoscan), which monitors network modems for alarm conditions • adds/deletes lines and modem drops in/out of Autoscan • displays operating status of network modems.

Status Commands • display network configuration and status; alarm history; or analog line parameter trends • display status "snapshot" of dynamic modem interface status for 10 EIA interface leads of all modems in the system; results updated every 10 seconds • status will appear as either Normal or Alarm.

Remedial Commands • control switching primary data path between dedicated line and dial backup lines at specified device; hot-spare modem switching at specified device; and disables a streaming modem/terminal through inhibiting modem's RTS.

Database Management Commands • provides inventory and management reports, trouble ticketing, and general database management and maintenance for Model 5530 through the Network Administrator.

Network Surveillance

Network surveillance is performed continuously in the Autoscan mode during active communication periods without interfering with network activity. Digital and analog modem and line conditions for devices specified in a polling list are monitored for status changes according to user-specified threshold parameters. Network alarms are displayed on the system printer and logged to a disk file.

System Activity Files

Disk-resident system files store network activity information • files created, accessed, modified, and deleted through operator console(s) • File Management allows access to ANALYSIS files for initialization and line configuration; operator lists all network modems by line and drop number • an alarm threshold file contains user-established alarm threshold (limit) values for 9 EIA interface signal parameters and 10 analog (line) signal parameters for Paradyne MPX Series modems; older Paradyne modem alarm thresholds are not as extensive; EIA parameters include user-established timers and on/off values for TX clock active, TX data active, RX data active, Request-To-Send (RTS), Clear-To-Send (CTS), line signal detect (CD), Data Set Ready (DSR), and Data Terminal Ready (DTR); analog parameters include user-established thresholds for signal quality, received signal level, phase jitter, phase hits, non-linear distortion, dropouts, signal-to-noise ratio, gain hits, frequency offsets, and impulse hits; users can mask individual parameters or entire modems from the Autoscan monitor mode • displays alarm status in table form; alarms listed by line, drop, node, alarm type, number of errors, and time detected; for drops with multiple alarms, highest priority alarms (priority determined by Paradyne) are listed first.

Paradyne ANALYSIS Systems

ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

Diagnostic Tests

Diagnostic test procedures isolate and identify failures or degradation in network lines or components • specific tests executed at terminal operator command • most tests, including loopbacks and end-to-end/network tests, are disruptive of normal data communication over the primary data channel(s) • pre-scheduled, unattended testing automatically conducted (usually during inactive periods) in Network Test Function mode • all tests must be run sequentially.

RD Self-Test • performs diagnostic test of the Diagnostic processor residing in a remote modem.

RD NO-OP Test • routine assures proper operation of a Remote Diagnostic processor and assures continuity on the telemetry (secondary) channel.

Modem Self-Test • places modem into analog loopback; self-generated test pattern of all spaces transmitted for 3 seconds.

Transmission Test • provides end-to-end loopback testing between master and remote modems on point-to-point or multipoint lines • master and remote modems transmit 511-bit pseudo-random test patterns for comparison at the opposite end; number of test blocks is user-selected (maximum = 9999) • test results displayed for number of bit errors, number of blocks in error, and actual bit error rate for both transmit and receive paths • test can be repeated for each drop on a multipoint line.

Pin-Point Test • consists of 3 sequential tests on a master modem, remote modem, and analog circuit • Master Modem self-test places modem into analog loopback; self-generated test pattern of all marks • Remote Modem self-test identical to Master Modem test • Transmission Test sends 511-bit pseudo-random test pattern from master modem for comparison at remote modem, and vice-versa • pass/fail results displayed for both transmit and receive paths.

Loopback Test • provides local or remote analog or digital loopback testing for any modem in the network • tests transmitter, VF interface, data terminal, or network modem • data patterns of all marks or all spaces can be generated to simulate data activity.

Network Transmission Test • allows operator to perform a fixed-length end-to-end transmission test to and from each drop in the network and prints results • user-determined starting time allows unattended operation; test automatically executed on all lines in parallel • continuous test of 25 blocks transmitted to all network drops • indicates total bit errors, number of blocks in error, and actual bit error rate for both receive and transmit data paths.

Remedial Recovery

Remedial recovery procedures restore communication interrupted by line outages, line degradation, or modem failure until faulty condition is corrected • recovery procedures conducted by terminal operator through menu-selected commands.

Backup Dial Line Functions • 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-site switching equipment must be equipped with Auto-Answer feature.

Hot-Standby Modem Switcher Control • switches data terminal equipment and 4-wire dedicated line between faulty modem and hot-spare (backup) modem • can switch back to original modem following its repair • requires hot-standby switch installed at remote modem.

Master Modem Switcher Control • switches host equipment and 4-wire dedicated line between faulty central-site (master) modem and hot-spare (backup) modem • can switch back to original modem following its repair • requires Master Modem substitution switch.

Modem Fallback/Reconfiguration • switches modem data rate to fallback rate to compensate for line degradation (9600-bps

modems with mux option reconfigured via Mux Configuration Control).

Streaming Recovery • disables streaming terminal/modem by inhibiting RTS/CTS on EIA interface • does not automatically disable modem; requires operator intervention.

Management Reports

Both the ANALYSIS 5500 and 5530 support three Reporting Features that provide network status information in printed formats. The ANALYSIS 5530 also provides the Network Administrator, which includes DBMS software to assist network managers in the areas of system management and administration.

Reporting Features

This report generator provides detailed or summary reports on modem, alarm, or analog line parameter status. Reports are printed upon operator command; ANALYSIS 5530 can schedule report printing automatically according to user-defined time periods.

Turnover Log Report • consists of 2 printouts: the first lists a complete status report for each modem not in normal status; the second lists a system status summary.

Line Parameter Trending • allows system operator to plot a graph of any one of three modem parameters indicative of analog line performance trends • the three parameters are Received Signal Level; Signal-To-Noise Ratio; and Phase Jitter • selectable 24-hour or 30-day trend.

Network Configuration Report • printout lists all modems in the network by Line and Drop number • provides Alarm and Network Information including physical location and local telephone number.

ANALYSIS 5530 Network Administrator

The Network Administrator incorporates a query-by-example (QBE) relational database with screen customization and Operator Assist functions. All network information related to connectivity, equipment, vendors, network status, and historical data are automatically entered into the database. Network Administrator facilitates trouble ticket reporting and updating, and provides the ability to manage network inventory. It provides an easy and effective method for the user to handle administrative information, in a format conducive to alteration or replacement by user-created formats. Network configuration information can be accessed or sorted by operator-defined keys such as location, component, serial number, or other identifiers.

Screen customization provides a standard set of screen formats that can be tailored to specific user needs. Users can design formats unique to each application.

Operator Assist automates the preparation and tracking of trouble ticket reporting. During trouble ticket preparation, the terminal operator need only enter a unique data element (such as terminal I.D.), and the system will automatically fill in information such as location and vendor. Operator Assist also provides alerting and automatic escalation of trouble tickets entered into the system.

HARDWARE

Terms & Support

Terms • available for purchase or for lease under a 2-, 3-, or 5-year agreement; maintenance not included in lease price, but available for both lease and purchase contracts • lease/purchase credit is 50 percent of monthly lease paid out up to 80 percent of purchase price • 90-day warranty for leased or purchased units.

Support • installed by Paradyne; installation charge ranges from \$500 to over \$4,000, depending on the model • contract maintenance performed during Principal Period of Maintenance (PPM) 8:00 AM to 5:00 PM, Monday through Friday except holidays, labor and travel expenses not included • contract maintenance outside the PPM and other custom contracts available on a per-customer basis • service provided through

Paradyne ANALYSIS Systems

ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

over 100 service centers and field service offices located in major cities nationwide • consulting service provided with charges for labor, travel, and overnight expenses; consulting labor charge at \$125 per hour, or \$175 per hour outside the PPM, with a required 4-hour minimum.

□ Overview

The ANALYSIS series of network control and management systems consist of three models that supervise network performance through network surveillance, diagnostic testing, and remedial failure recovery. In addition, Models 5500 and 5530 can print network status information reports in convenient formats, and at the top of the line, the ANALYSIS 5530 includes an IBM Series/1 "backend processor" with relational DBMS software to create user-definable system management and administrative reports. The Model 550 is essentially a smaller version of the 5500 Series without data management or reporting capabilities.

Supervision is performed through a narrowband secondary channel attached to the primary communication channel; the network is continuously monitored for abnormal conditions according to user-defined alarm thresholds. Newer Paradyne MPX Series modems monitor an extensive array of analog and digital network parameters; ANALYSIS scans the modems and alerts network operator(s) to substandard or failed components by a visual alarm; a record of the alarm condition is logged on the system printer.

Diagnostic testing is performed by a terminal operator for specific lines or modems. Individually enacted tests such as modem circuitry tests, loopbacks, and line-level measurements can pinpoint line degradations or modem failures. Most diagnostic tests interfere with normal network communication; tests must be run sequentially. Additionally, ANALYSIS provides an unattended Network Transmission Test, which can be scheduled to conduct a performance test of all network drops and lines during inactive periods.

Remedial recovery initiated by the terminal operator(s) immediately restores communication interrupted by line outage/degradation or modem failure. An operator can switch to a hot-spare modem at a remote or central site to recover from modem failure; select a lower (fallback) data rate to compensate for line degradation; or switch a remote-site modem from dedicated line to dial backup to recover from a line outage.

A convenience feature afforded by the ANALYSIS 550/5500 Series is the ability to configure MPX Series modem straps centrally from the system console. ANALYSIS terminal operators can set up to 64 strap settings for each MPX modem in the network, deleting the requirement for experienced service personnel to configure modems in the field.

ANALYSIS 550 Configuration • central-site system consists of microprocessor-based controller unit, Winchester disk drive, diskette, printer, and operator terminal • supports up to 10 secondary channels • supports Paradyne MP, LSI, or MPX Series modems equipped with an optional ANALYSIS diagnostics card • each secondary channel supports up to 4 individual 4-wire dedicated Type 3002 lines in multiplexed, multipoint, or tail-circuit arrangements with a maximum of 256 modem drops per secondary channel.

ANALYSIS 5500 Configuration • central-site system consists of microprocessor-based controller unit, Winchester disk drive, operator terminal, and system printer; some models provide 10 peripheral ports for additional printers and terminals • supports up to 50, 100, or 150 secondary channels, depending on the model • supports Paradyne MPX Series modems equipped with an optional ANALYSIS diagnostics card • each secondary channel supports up to 6 individual 4-wire dedicated Type 3002 lines in multiplexed, multipoint, or tail-circuit arrangements with a maximum of 256 modem drops per secondary channel.

ANALYSIS 5530 Configuration • central-site system consists of a minicomputer with 1 to 3 rigid disk drives; 1 to 6 Diagnostic Front-End Processors (DFEPs); up to 20 operator terminals/system

printers/line printers; and an optional tape drive • each DFEP supports up to 150 secondary channels • supports Paradyne MPX Series modems equipped with an optional ANALYSIS diagnostics card • each secondary channel supports up to 6 individual 4-wire dedicated Type 3002 lines in multiplexed, multipoint, or tail-circuit arrangements with a maximum of 256 modem drops per secondary channel.

□ ANALYSIS 550, 5500 & 5530 Network Control Systems

ANALYSIS 550 Central-Site Control

Complete ANALYSIS 550 system consists of desktop controller containing microprocessor with 512K bytes of main memory, 1M-byte dual-sided diskette, and 26M-byte Winchester disk drive; 1920-character video display terminal with detached keyboard; 150-cps impact printer; and 1 to 10 secondary channels • each secondary channel port connects to a central-site Paradyne modem and shares the bandwidth of a voice-grade communication path with the modem's primary data channel; each secondary channel supports up to 4 individual 4-wire Type 3002 circuits in multiplexed or tail-circuit arrangements • links Paradyne MPX Series modems equipped with optional plug-in ANALYSIS secondary channel diagnostics card; 110-bps secondary channel • does not support modems from other vendors:

\$575/\$435 mo	\$12,500 prch	\$175 maint
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ANALYSIS 5500 Central-Site Control

ANALYSIS 5500 kernel systems consist of a desk-high standalone Controller cabinet, an operator terminal, and a system printer • Controller cabinet contains a microprocessor with 256K-byte main memory, a diskette drive, a Winchester disk drive, I/O panels, communication controller cards, card slots for secondary channels, power supply, and cooling fan • main memory expandable to 512K bytes; base Models -03 through -05 provide up to 10 peripheral ports supporting additional operator terminals and/or system printers • Controller cabinet creates secondary channels, performs modem polling, and receives network status and alarms from individual modems • each secondary channel port connects to a central-site Paradyne modem and shares the bandwidth of a voice-grade communication path with the modem's primary data channel; each secondary channel supports up to 6 individual 4-wire Type 3002 circuits in multiplexed or tail-circuit arrangements • links Paradyne MPX Series modems equipped with optional plug-in ANALYSIS secondary channel diagnostics card; 110-bps secondary channel • does not support modems from other vendors.

Model 5500-01 • ANALYSIS 5500 kernel system with 10M-byte Winchester disk drive and 10 ANALYSIS secondary channels; expandable to 50 secondary channels maximum • nonupgradeable:

\$900/\$700 mo	\$19,500 prch	\$150 maint
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Model 5500-02 • ANALYSIS 5500 kernel system with 40M-byte Winchester disk drive and 10 ANALYSIS secondary channels; expandable to 50 secondary channels maximum • upgradeable to Model 5500-04:

1,500/950	32,300	300
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Model 5500-03 • ANALYSIS 5500 kernel system with 10M-byte Winchester disk drive, 10 peripheral ports, and 20 ANALYSIS secondary channels; expandable to 100 secondary channels maximum • nonupgradeable:

1,650/1,100	38,000	400
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Model 5500-04 • ANALYSIS 5500 kernel system with 40M-byte Winchester disk drive, 10 peripheral ports, and 20

MO: single-unit monthly 2-year/3-year lease charge; does not include maintenance. PRCH: single-unit purchase price. MAINT: monthly maintenance charge for leased or purchased units. NC: no-cost item. NA: not applicable/available. Prices effective as of June 1984.

Paradyne ANALYSIS Systems

ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

ANALYSIS secondary channels; expandable to 100 secondary channels maximum • upgradeable to Model 5500-05:

1,950/1,350	45,000	500
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Model 5500-05 • ANALYSIS 5500 kernel system with 40M-byte Winchester disk drive, 10 peripheral ports, and 30 ANALYSIS secondary channels; expandable to 150 secondary channels maximum:

2,400/1,750	55,000	600
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ANALYSIS Port Expansion • provides 10 ANALYSIS secondary channels to expand Models -02 through -05 • PC card fits slots in Controller cabinet:

70/60	2,500	10
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Memory Expansion • 256K-byte memory expansion module; required on Models -03 through -05 when adding 3 or more operator terminals:

70/60	2,500	10
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ANALYSIS Operator Terminal • keyboard-display terminal with 12-inch CRT; typewriter-style keyboard, numeric keypad, and function keys • displays 1920 characters at 24 lines x 80 columns; features nondestructive cursor • functions as system control console; displays system menus, tables, and reports • single operator terminal included with 5500 kernel systems; additional operator terminals can be added to Models -03 to -05 at extra cost:

70/60	2,250	10
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ANALYSIS Printer • RO • 150-cps impact printer • 9x7 dot matrix • 132 columns • logs network alarms, provides hard copy of test results, and prints network configuration information • single printer included with 5500 kernel systems; additional printers can be added to Models -03 to -05 at extra cost:

120/110	4,000	20
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5500-02 to 5500-04 Upgrade • additional communication controller cards, I/O panels, and system logic required to accommodate additional secondary channels:

450/400	127,000	25
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5500-04 to 5500-05 Upgrade • additional communication controller cards, I/O panels, and system logic required to accommodate additional secondary channels:

450/400	100,000	15
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ANALYSIS 5530 Central-Site Control

Kernel systems consist of a minicomputer with 256K-byte main memory, 64M-byte rigid disk drive, and diskette drive; a Diagnostic Front-End Processor (DFEP) packaged with ANALYSIS secondary channels; a Peripheral Port Controller with 4 ports; an operator terminal; and a system printer • supports up to 20 peripheral ports for attaching additional operator terminals, system printers, and/or line printers • optionally supports up to 5 additional DFEPs, 2 additional rigid disk drives, and a tape drive • each additional DFEP packaged with 10 ANALYSIS secondary channels, supports up to 150 channels each; secondary channels added in 10-channel increments for a system maximum of 900 • each secondary channel port connects to a central-site Paradyne modem and shares the bandwidth of a voice-grade communication path with the modem's primary data channel; each secondary channel supports up to 6 individual 4-wire Type 3002 circuits in multiplexed or tail-circuit environments • links Paradyne MPX Series modems equipped with an optional plug-in ANALYSIS secondary channel diagnostics card; 110-bps secondary channel • **does not support modems from other vendors.**

Model 5530-01 • kernel system with single DFEP equipped with 50 secondary channels:

\$5,600/\$4,200 mo	\$127,300 prch	\$1,350 maint
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Model 5530-02 • kernel system with single DFEP equipped with 50 secondary channels; expandable to 100 channels:

6,050/4,600	140,000	1,550
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Model 5530-03 • kernel system with single DFEP equipped with 50 secondary channels; expandable to 150:

6,500/5,000	150,000	1,650
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Peripheral Port Expansion • 4-port asynchronous expansion unit required for additional operator terminals and system printers; provides 8 peripheral ports in conjunction with single Peripheral Port Controller supplied on kernel systems • additional port controllers and port expansion units can be added up to a maximum of 20 ports:

300/200	5,500	150
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Peripheral Port Controller • controls 2 4-port peripheral port units, 8 ports maximum; includes the first 4 ports • up to 2 additional Peripheral Port Controllers can be added per system (3 maximum):

600/450	10,350	250
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ANALYSIS Operator Terminal • keyboard-display terminal with 12-inch CRT; typewriter-style keyboard, numeric keypad, and function keys • displays 1920 characters at 24 lines x 80 columns; features nondestructive cursor • functions as system control console; displays menus, tables, and reports • single operator terminal included with 5530 kernel systems; additional terminals added at extra cost:

70/60	2,250	10
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ANALYSIS Printer • RO • 150-cps impact printer • 9x7 dot matrix • 132 columns • logs network alarms, provides a hard copy of test results, and prints network configuration information • single printer included with 5530 kernel systems; additional printers added at extra cost:

120/110	4,000	20
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400-lpm Line Printer • high-speed ANALYSIS Printer; can be used with or in place of 150-cps ANALYSIS printers:

1,800/1,300	36,500	225
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Disk Drive • 64M-byte rigid disk unit for database storage; 1 included in kernel ANALYSIS 5530 systems • up to 2 additional disk units per system, daisy-chained to the initial disk drive (3 maximum):

1,200/800	25,000	175
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Tape Unit • optional 45-ips tape unit for archival storage or system backup; includes its own controller and channel • single tape unit per system maximum:

1,900/1,400	40,000	225
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Expansion Cabinet • single expansion cabinet required for additional disk drive or tape unit:

150/80	2,010	NC
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DFEP Port Expansion • 4-port IBM BSC expansion unit supports additional DFEPs; includes controller and ports:

300/200	5,500	150
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Additional DFEPs • additional DFEPs up to a maximum of 6 can be attached locally or remotely from the CPU • perform communication and concentration functions for the ANALYSIS network; supply additional secondary channels • remote units require dedicated line running at 4800 bps, minimum • 3 basic units available with different maximum secondary port capacities with upgrades.

Model 5502-01 • DFEP with 10 ANALYSIS secondary channels, expandable to 50 channels:

800/600	15,500	150
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Model 5502-02 • DFEP with 10 ANALYSIS secondary channels, expandable to 100 channels:

1,250/1,000	28,200	160
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Model 5502-03 • DFEP with 10 ANALYSIS secondary channels, expandable to 150 channels:

1,700/1,400	38,200	170
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ANALYSIS Port Expansion • provides 10 ANALYSIS secondary channels to expand DFEP Models 5502-01 through -03 • PC card

Paradyne ANALYSIS Systems ANALYSIS 550, 5500 & 5530 Network Control & Management Reporting Systems

fits slot in DFEP cabinet:	<u>70/80</u>	<u>2,500</u>	<u>10</u>
5502-01 to 5502-02 DFEP Upgrade:	<u>480/400</u>	<u>127,000</u>	<u>25</u>
5502-02 to 5502-03 DFEP Upgrade:	<u>450/400</u>	<u>100,000</u>	<u>15</u>

ANALYSIS 5500/5530 Remote-Site Control

Network control functions at intermediate and remote sites implemented for Paradyne MPX Series modems equipped with optional diagnostic plug-in PC board • secondary channel supports network control functions • diagnostic control board resides in standalone modem enclosure.

MPX Modems With DMC Option • 2400-, 4800-, and 9600-bps MPX modems with optional Diagnostic Microcomputer (DMC) board contain integral ANALYSIS secondary channel and control circuitry • see Paradyne MPX Modem report for pricing and details.

Model 5506 ANALYSIS Hubbing Device • signal converter and companion hubbing devices route secondary channel around remote digital equipment such as nodal processors, multiplexers, and concentrators; supports multiple remote tail circuits • supports up to 16 additional lines for 1 ANALYSIS secondary channel by duplicating the channel.

Converter • converts RS-232C digital signals to RJ analog signals

• mounts on remote modem or controller • requires single hubbing device for each duplicated secondary channel:

<u>NA/NA mo</u>	<u>\$50 prch</u>	<u>NA maint</u>
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Hubbing Device • duplicates ANALYSIS secondary channel; provides anti-streaming for secondary channel • mounts on remote tail-circuit modem • one required per each duplicated secondary channel:

<u>NA/NA</u>	<u>150</u>	<u>NA</u>
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Model 4711 Two-Call Auto-Answer • unit switches unattended or attended site modem between 4-wire dedicated and two dial-up switched lines • automatically answers calls on dial-up lines • FCC-certified standalone unit • ANALYSIS system control:

<u>35/32</u>	<u>550</u>	<u>NC</u>
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Model 4700 Hot-Standby Adapter • standalone unit switches analog and digital connections between primary modem and hot-spare backup modem • ANALYSIS system control:

<u>35/32</u>	<u>800</u>	<u>NC</u>
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Master Modem Hot-Standby Adapter • switches analog and digital connections between primary central-site (master) modem and hot-spare backup modem • ANALYSIS system control:

<u>NA/NA</u>	<u>NA</u>	<u>NC</u>
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• **END**

Polygon Software Corp INTERCOMM TP Monitor System

■ PROFILE

Function • multithread TP monitor for IBM systems.

Computers/Operating Systems Supported • IBM System/370 (Model 135 and up), 3000, 4300, and compatible computers; OS/VS1, OS/VS2 (SVS and MVS), VM/370.

Networks & Protocols • SNA; SDLC and all standard IBM protocols.

Language Interfaces • COBOL, FORTRAN, PL/1, and IBM assembler.

DBMS Interfaces • available for IMS (DL/1), Cincom TOTAL, Software AG ADABAS, Cullinet IDMS, CCA Model 204, and Intel System 2000/80.

TP & File Access Methods • BTAM, TCAM, VTAM; BDAM, BSAM, QSAM, BISAM, QISAM, VSAM, and all other standard IBM access methods except BPAM.

Terminals • most standard IBM asynchronous, synchronous, and SDLC devices plus all compatible devices.

Special Features • optional Front-End interface; Generalized Front-End Interface (GFE); Generalized DBMS Interface (GDB); Multiregion Support Facility (MRS); AUTOGEN feature; Dynamic File Allocation (DFA) Special Feature.

Security • station, transaction, or station/transaction sign-on/sign-off security plus user-defined file access control via system-supplied command/control subsystem.

Logging/Accounting • internal system log (INTERLOG); System Accounting and Measurement (SAM) charge-back accounting facility available.

Failure Recovery • user-defined and system-controlled data checkpoint definition; recovery analysis uses log entries and accounting routines; when system is quiescent check-point is taken; thread continues when log is repositioned to failure point.

Current Version • 9.0.

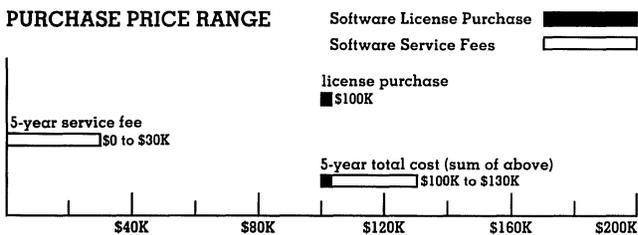
Installations • 275.

Comparable Systems • Mathematica ATLAS; Cincom ENVIRON 1; IBM CICS/VS.

Vendor • Polygon Software Corporation; 363 Seventh Avenue, New York, NY 10001 • 212-563-5858.

■ ANALYSIS

INTERCOMM is one of the oldest IBM-compatible communications monitors in the marketplace. It was introduced in 1968 by Pro-



POLYGON SOFTWARE INTERCOMM PRICING • solid bar shows single license purchase price, which includes all package facilities; open bar shows 5-year service fee but is calculated for 4 years (48 mos) because first-year maintenance is included in license purchase price.

gramming Methods Inc (PMI) and was later acquired by Informatics. Its sister TP monitor package, MINICOMM, also became part of Informatic's repertoire of proprietary software. In 1979, both INTERCOMM and MINICOMM were sold to SDA Products, Inc, a subsidiary of Software Design Associates. The saga continued, however, when, in June 1983 Polygon Software Corporation acquired both the products and the support team from SDA Products. Although Polygon never formally announced that MINICOMM was no longer being actively marketed, the product is not readily available. Therefore, we have to assume that it has faded away like all good old soldiers. The same seems to be happening to INTERCOMM, although, again, the vendor claims to be still marketing this large-scale TP monitor. It is notable, however, that there have been absolutely no changes made to the product, no enhancements, no new releases, and, therefore, no price increases/decreases. In other words, it appears that nobody is really doing anything with the product. In light of recent announcements by TSI International and Applied Data Research, informing their user base that their respective TP monitors would no longer be competing against IBM's CICS/VS, we can only wonder how long it will be before Polygon decides to concede.

INTERCOMM is, however, a highly technical, multifunctional telecommunications monitor with many table-driven, preprogrammed functions that minimize the amount of coding required from the applications programmer. For large OS/VS-class computer installations, only a few competitive systems can match the flexibility and richness of options available with INTERCOMM.

□ Strengths

INTERCOMM has a large repertoire of preprogrammed, automatically initiated facilities. It incorporates almost every communications operation one would expect of a sophisticated teleprocessing monitor. Users comment positively on its multithreading operations, its multiregion support capabilities, its ability to release program resources when no longer needed, and many other multiuser-support features. INTERCOMM has an exceptionally comprehensive recovery mechanism that supports recovery and restart under the most catastrophic failure conditions. INTERCOMM was unquestionably one of the best TP monitors on the market. In the past year or more, INTERCOMM has lost some of its technology edge.

□ Limitations

Because of its extensive built-in sophistication and automated facilities, INTERCOMM has been known to be difficult to configure and install. All TP monitors require careful and thoughtful planning, but INTERCOMM's highly complex structure requires the services of very knowledgeable and well-trained communications specialists to deliver the maximum benefits afforded by the system features. The extremely "well packed" feature-filled nature of the system also places heavy demands on system resources to make the features work, in spite of INTERCOMM's ability to dynamically release resources when they are not being used. The present vendor had committed to address these limitations, but quickly became aware that most users of such a powerful monitor have come to expect high levels of resource requirements in order to reach the level of sophistication provided by systems such as INTERCOMM. The demand for strong up-front technical talent is formidable but fortunately transitional. However, INTERCOMM's large appetite for system resources is a long-range characteristic that must be either accepted in exchange for INTERCOMM's substantial benefits, or rejected in favor of a less demanding, but probably less versatile, TP monitor.

Anyone looking at INTERCOMM should be aware that it is a highly efficient system, but the user should not expect any major

Polygon Software Corp INTERCOMM TP Monitor System

(if any at all) enhancements over what is currently available (which is what was available over a year ago).

■ OVERVIEW

Terms & Support

Terms • INTERCOMM is available on a purchase basis only; all operational facilities are included in the single, bundled price agreement; the license covers an entire facility, which may encompass multiple CPUs; multiple-copy discounts of 25% to 50% apply to additional licenses within the same company.

Support • maintenance, installation support, and training for the first year are included in the cost of the license; maintenance for successive years costs approximately 10% of the then-current license fee; installation support can run from 3 days to 10 days if necessary; concepts and facilities and application development courses are conducted on-site after installation is completed; complete documentation is also included in the sale, and hot-line support is available for problem resolution.

Component Summary

INTERCOMM's facilities are configured by the user from a menu of selectable features provided by the vendor. The features are all included (bundled) under one system price to the purchaser. Significant selectable features are summarized as follows:

Message Mapping Utilities (MMU) • transforms terminal-dependent formats to terminal-independent form and vice versa; initiated by a call from the application program.

AUTOGEN Facility • generates MMU macros online from sample screens input from an IBM 3270 (or compatible) CRT.

Data Entry System • provides a preprogrammed general-purpose data entry/verification capability.

Dynamic File Allocation (DFA) • permits an application to dynamically create and retrieve sequential data sets.

Generalized Front-End Facility (GFE) • provides the basic structure for interfacing to nonstandard communications devices.

Dynamic Data Queuing Facility (DDQ) • allows applications to dynamically create, retrieve, and delete logical data sets and/or queues of messages on a single BDAM data set.

Page Facility • allows terminal operators to browse through a multiscreen output message.

Model System Generator (MSG) • provides a working system based on user specifications to model the eventual system.

Multiregion Support Facility (MRS) • allows groups of application subsystems to execute in separate regions while the INTERCOMM Front-End resides in a Control Region.

Extended Security System (ESS) • provides dynamic definition of the security environment and allows multilevel control of access to system resources in a single- or multiregion system.

Product Definition

INTERCOMM is a large-scale telecommunications monitor designed to support an IBM OS/VS environment. It competes directly with IBM's CICS/VS program product. INTERCOMM consists of 4 distinct facilities: subsystem control, file handling, dispatching, and a teleprocessing interface. Communications are provided for device and line control operations; full resource management, job management, and task/program management capabilities are available, as are a host of utility programs and options to tailor the system to special environments.

INTERCOMM • bundled system including all user-selected features:

\$100,000 lcns NA mo \$7,500 serv

■ FUNCTIONAL FACILITIES

Computers/Operating Systems

INTERCOMM can be installed on any IBM System/370, 3000, 4300, or compatible computer capable of running under OS/VS1, OS/

VS2(SVS), or OS/VS2(MVS). Operations are also supported under VM/370.

Minimum Operating Requirements

The basic INTERCOMM system requires a minimum of 300K bytes of main storage. An additional 50K bytes (minimum) of main storage are required to support dynamic queue, control block, buffer, table, and I/O areas. Polygon Software reports that INTERCOMM is currently supporting systems with over 10,000 terminals.

Protocols & Network Interfaces

All standard IBM protocols and access methods (excluding BPAM) are supported, including SDLC. INTERCOMM also supports the networking facilities of SNA and can handle a wide variety of non-IBM asynchronous and synchronous terminals.

Access Methods

The full range of IBM-supported access methods is supported under INTERCOMM. These include BTAM, TCAM, and VTAM for support of SDLC/SNA devices. INTERCOMM also provides the GFE (Generalized Front-End) hardware line control computer interface for connecting several front-end minicomputer systems.

File/DBMS Interface

Although INTERCOMM can be configured to interface with general-purpose, homegrown data structures, it is used primarily with one of several popular database management systems. Standard interfaces are provided for Cincom TOTAL, IBM IMS (DL/I), Software AG ADABAS, Cullinet IDMS, Computer Corporation of America MODEL 204, and Intel System 2000. Polygon Software can provide nonstandard interfaces on special order.

Temporary Storage & Paging Facilities

INTERCOMM is table oriented and supports both dynamic and fixed storage buffering. The system's Resource Manager facility can allocate and assign core resources independently of the standard operating system GETMAIN/FREEMAIN facilities. The TP monitor is basically a multithread system but can be degraded to a single-thread environment if necessary. All core and disk queues are managed automatically by the system, and the number of threads supported depends solely on the amount of resources available to the system. Thread lengths are not fixed because each portion of an application program is handled as a separate program segment. Each message is processed as completely as possible until the application subsystem voluntarily gives up control. An optional Store/Fetch facility can temporarily store data in main memory or on disk. It is identified by a user-assigned key of up to 48 characters. This capability is sometimes referred to as a "scratch pad" facility.

The paging constraints of INTERCOMM are governed directly by the paging characteristics of the operating system. The Virtual Execution Group storage scheduling technique utilizes the operating system paging algorithm to manage program residency. It strives to optimize page loading to achieve the highest level of page utilization with the least number of page faults. The Look-Ahead-Page-Load facility checks each critical page boundary movement to ensure that needed pages are resident in real memory. Thus, when a potential page fault is detected, the system can pre-load the necessary page(s) overlapped with processing for other message traffic.

INTERCOMM supports 3 page-fixing methods: the user can provide a list of system or user modules to be fixed at system initialization time; the INTERCOMM control terminal operator, through the use of terminal commands, can dynamically fix or unfix individual modules in main storage; or the INTERCOMM Time-Zone utility can be used with the VS system control to alter page-fix characteristics during selected time periods.

LCNS: purchase price includes one year of service, installation support, and 2 weeks of on-site training. NA: no lease terms are offered. SERV: annual maintenance and enhancement charges after the first year. Prices have been in effect since September 1983.

Polygon Software Corp INTERCOMM

TP Monitor System

Message Switching Facilities

The Subsystem Controller and Dispatcher routines handle all message-switching functions. The path of each message is controlled by one or both of these routines. Control includes acquiring the message from the queue, formatting it, obtaining required data from online files, executing the application program, formatting the response, and directing the output to the proper terminal. Message switching is supported between application programs, terminals, and/or system programs either through a direct interface to the INTERCOMM queuing routine (via a 2-parameter CALL) or by an INTERCOMM-supplied subsystem. Through a series of priority structures, a message can be analyzed and sent on to a lower priority subsystem for processing.

If a receiving terminal is unable to receive a message, INTERCOMM reroutes the message to an alternate device, if one was specified, or queues the message until the receiving terminal comes up again, at which time all accumulated messages for that terminal are transmitted. All operating system task management and message transfer control are bypassed by INTERCOMM, and the operating system regains control only when no messages or when all messages are awaiting completion of I/O operations. Messages on queues waiting for transmission are preserved across system failures by a Message Restart facility. The highly parameterized Message Mapping Utilities (MMU) subsystem provides an interface between the application subsystem and any terminal-dependent message processing logic for both input and output messages. All tasks within queues are dispatched on a first-in/first-out basis within priority levels.

■ USER INTERFACES

Languages Supported

INTERCOMM interfaces with application programs written in COBOL, FORTRAN, PL/1, and IBM assembler language.

Host Operating System Interface

INTERCOMM interfaces with the host operating system through macro-generated tables. Tables exist for such system functions as: line control, including network configuration and transaction identification; message processing control; system control, including security functions, checkpoint/restart specifications, and logging requirements; and utility control, including MMU requirements, edit utility requirements, output utility formatting specifications, and display/change utility file descriptions. Other system-oriented tables are: a Verb Table, which lists all the valid transaction codes required for processing; Station Table and Device Table, which describe terminal device-dependent characteristics; System Parameter Table, which describes system-wide operating characteristics; a Data Set Control Table, which is generated automatically by the File Handler function to describe on-line data sets; and the Subsystem Control Table, which lists the characteristics (reentrancy, language, entry point, etc), queue specifications (core and/or disk queues), and scheduling specifications (resident or loadable, concurrent message processing limits, etc) for each subsystem.

In addition, INTERCOMM provides the user with station, transaction, and station/transaction sign-on/sign-off security. A full range of operator commands is available, and INTERCOMM allows user programs to place application log entries on the system log data set to clarify the status of message processing.

Batch Processing

Although INTERCOMM is designed to operate primarily in an online mode, batch operations can be handled easily through basically the same facilities used in the online environment. If both an online application and a batch task need to update a file concurrently, the File Handler is placed in the operating system's Link Pack Area so that the batch program can perform its I/O against the files via calls to the File Handler. This procedure avoids update problems and maintains file integrity.

Transaction Processing

All transaction processing is handled by the INTERCOMM Teleprocessing Interface, which controls the communications processing between the host computer and the connected terminals. User programs do not interface directly with terminals; they utilize a queuing mechanism that operates independently of the operating environment. All interface operations are transparent to the application program and include all message polling, addressing, and transmission functions. The File Handler performs all of the file accessing for the application programs. The File Handler notifies the Dispatcher of all I/O activities to provide internal task overlap management. The File Handler also controls files in a way that precludes updating conflicts. Multiple programs can access files in parallel.

The Subsystem Controller searches the control table for the next program/task. Once it receives a message from the process queue, it activates the appropriate program to start message processing. The Edit routine is one of the real-time utilities available with INTERCOMM. It is used to prepare messages from the terminals for processing by the applications programs. The Edit utility strips off the control characters and superimposes a predefined format onto the message. An Output utility determines the format of the output message/data, obtains the data to make up the output, and produces the actual message for the designated terminal. After the communications control characters are appended to the message, the message is passed back to the Telecommunications Interface for actual transmission.

Program Development

In the INTERCOMM environment, an application program is a subsystem that executes under the control of the Subsystem Controller. Many of the programming services offered by this system are invoked automatically. These include a monitor service via a standard call, conversation processing with a terminal, support for both reusable and/or reentrant programs, single-thread operations if required, a variety of mapping utilities, automatic conversational facility, multiscreen CRT output browsing, facility for subtasking applications with embedded WAITS, and automatic release of program resources in a failure situation. Application programs can be written in COBOL (ANS or IBM F), PL/1 (IBM F or Optimized), FORTRAN G or H, or the IBM assembler language. The application logic analyzes the input message, but the file is actually accessed by either INTERCOMM or a DBMS interface service routine. The application program can create one or more response messages to be sent to the originating terminal and/or other terminals.

Security

INTERCOMM offers an extensive set of security facilities. The standard system-supplied options include sign-on/sign-off security at the station, transaction, or station/transaction level. The user can also specify what operator is allowed to enter what type of transaction from which terminal. A system-supplied set of Extended Security System facilities supports more comprehensive control of system resources in a multiregion or single region INTERCOMM system and allows the security environment to be defined dynamically via a command language available to the user. Finally, many user exits are supplied to implement custom security routines and procedures.

Monitoring & Evaluation

INTERCOMM maintains the INTERLOG system log, which contains a historical record of all traffic within the monitor. It provides for system control and maintains complete performance documentation. It is a variable-length sequential data set that can reside optionally on disk or tape. System log entries are automatically posted at key processing points. Each message is logged at the time of entry on a subsystem queue. Aside from INTERCOMM system log entries on INTERLOG, the user can gather information from various user log entries. These entries can be instrumental in gathering statistics about specific operating conditions. In addition, application programs can place information on the system log data set. A charge-back accounting facility called SAM (System Accounting and Measurement) interacts with information

Polygon Software Corp INTERCOMM TP Monitor System

gathered in INTERLOG. Some of the statistics gathered for performance analysis include: terminal status, which can be requested at any time for any duration of time; file statistics, for assessing file organization and I/O frequency; subsystem statistics, which show the number of messages processed by each subsystem; off-line statistics, which can be generated per terminal, per transaction, or per application program, and which can be used to produce traffic histograms and/or response time reports; storage utilization statistics, which constitute global and/or detail core-use information; and system tuning statistics, which is an optional facility that allows INTERCOMM to gather information relating to its own performance characteristics. In all cases, the user specifies the testing period for gathering the statistics.

Failure Recovery Methods

The checkpoint/restart capability available with INTERCOMM is based on the system log. Checkpoint data is written to the log at checkpoint time. At restart time, the data is restored exactly as it was when the last checkpoint was taken. An option permits user data to be included in the checkpoint. The Message Restart facility restarts messages from the point of system failure and restores the status of all messages that had not completed output transmission. Recovery consists of reading the log in reverse sequence and replacing uncompleted messages into the application program or into terminal queues. Message classification and selectivity priorities can be established during restart. Both the restart and normal modes of INTERCOMM operate concurrently within a single execution. New messages are accepted from a live terminal network as soon as the log is repositioned to the failure point. The restart facility is transparent to the user, but the user is responsible for the table entries made at the system level. The entire restart system is coordinated with the recovery of the operating system files and/or DBMS file data. Data recovery is aided through the use of the File Recovery Special Feature, which is used to restore online disk files in the event of system failure. INTERCOMM also employs before-image and after-image processing to restore records.

A Backout-on-the-Fly (BOF) restart facility is executed following a program check, a program time-out, or a special request by a

subsystem. BOF follows the same methodology as file recovery and requires the Dynamic Data Queuing (DDQ) Special Feature. BOF places the thread's before and after images on a DDQ. If the thread completes successfully, then the DDQ is deleted. If the thread fails, it is backed out, and standard recovery action is invoked.

■ USER REFERENCE LIST

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

- Mr. James H. Thoms
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2000 Marcus Avenue
Lake Success, NY 11040
Tel: 516-574-6030
- Mr. Douglas Mike
Manager, Technical Services
Provident National Bank
Department 98-06-01
120 South 17th Street
Philadelphia, PA 19101
Tel: 215-585-5783
- Mr. Ed Glendenning
Supervisor Technical Support
Federal Aviation Administration
Aeronautical Center AAC-312
P.O. Box 25082
Oklahoma City, OK 73125
Tel: 405-686-2422

● END

Proteon ProNet-10/-80

Baseband Local Area Networks

■ PROFILE

Architecture • token-passing, star-shaped ring architecture with devices connected to a passive ProNet wire center providing a star-shaped ring; network physically arranged as a series of stars, see **Figure 1**.

Type • baseband; available in 2 compatible versions differentiated by transmission speed.

Transmission Speed • 10M bps for ProNet-10; 80M bps for ProNet-80.

Cable Length • depends on cable and network type • distance between wire centers or between wire center and host for ProNet-10, 50 meters (twisted pair), 300 meters (twinax cable), 600 meters with repeaters, 4 kilometers (ProNet fiber optic links, and 250 meters (infrared link) • for ProNet-80, distance between wire centers and/or hosts is 100 meters (twinax cable) and 2 kilometers (ProNet fiber optic links).

Applications • ProNet-10 designed to interconnect terminals and

hosts in office, industrial, educational, institutional, and campus environments • ProNet-80 designed for host-to-host communications, image processing, and high-speed backbone network to connect subnetworks.

Configurations • wire centers available with 4, 6, or 18 ports; up to 64 wire centers can be configured in a network supporting up to 254 nodes (hosts) on ProNet-10 or 240 nodes on ProNet-80, and 4,000 asynchronous terminals • Proteon provides interfaces to ASCII terminals with RS-232C interface; Unibus, Multibus, and Q-bus hosts, and IBM PCs • Proteon supplies software for ProNet, HDLC device drivers, TCP/IP, Ringway, and packet drivers diagnostics to run on DEC LSI-11, PDP-11, and VAX-11 hosts; Proteon also supplies NetWare and TCP/IP software to run on the IBM PC under MS-DOS.

Interface • hosts require a Host Specific Board for connection to host and Controller Board for connection to network; IBM PC requires IBM PC Interface System to connect the ProNet-10 • Proteon provides interfaces to Unibus, Q-bus, Multibus, and Universal bus systems for ProNet-10; Proteon provides interfaces to Unibus and Multibus systems only for ProNet-80.

Gateways • Digital Equipment Corporation DECnet; hosts with ProNet communication systems can participate fully in DECnet • NetWare for IBM PCs supports bridge to interconnect 2 ProNet-10 networks • between ProNet-10 and ProNet-80.

Support of Foreign Devices • Proteon sells no hosts or terminals although interfaces are oriented toward DEC equipment • provides RS-232C interface to asynchronous ASCII terminals and hosts; supported by TCP/IP Telenet software.

Network Management • Network Monitoring Facility senses packets and accumulates statistics on packet count, percentage of network utilization, and accumulated errors; also provides Help facility.

Protocols • software support for Transmission Control Processor/Internet Protocol (TCP/IP) protocols.

Distributed Functions • TCP/IP supports file transfers of text and image-mode information between systems; virtual terminal protocol allows users to logon to another system and have same capabilities as locally attached terminals • NetWare for IBM PCs on ProNet-10 provides support for file servers and print servers.

Support Software • TCP/IP available under 4.2BSD VAX UNIX, 2.9BSD PDP-11 UNIX and SUN-2 4.2BSD UNIX; SUN 2 is a workstation from Sun Microsystems; TCP/IP also available under MS-DOS or PC-DOS V2.0.

First Delivery • 1981 (ProNet-10); 1984 (ProNet-80); general deliveries begin June 1985 for ProNet-80.

Systems Delivered • over 250 ProNet-10s (over 3,000 nodes); 1 ProNet-80.

Comparable Systems • uses same protocol as IBM's announced token-ring LAN • ProNet-10 is general purpose LAN that competes with the 10M-bps Ethernet/IEEE 802.3 LANs such as Ungermann-Bass Net/One • ProNet-80 is fastest general purpose LAN currently available; Network Systems Corporation HYPERchannel offers 50M-bps data rate using CSMA/CA (Collision Avoidance) protocol.

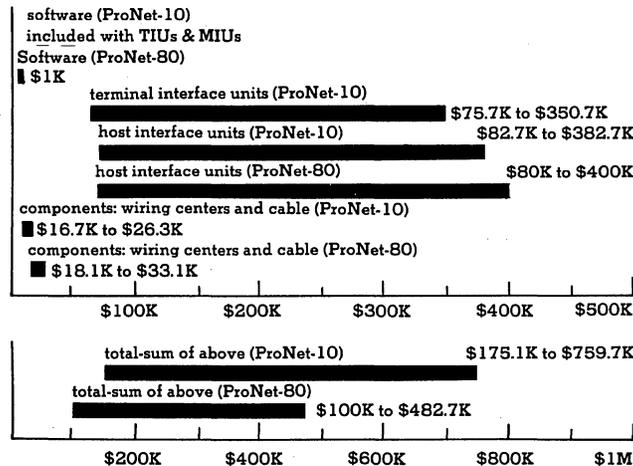
Vendor • Proteon; 4 Tech Circle, Natick, MA 01760 • 617-655-3340.

Canadian Headquarters • same as U.S.

Distribution • directly and through OEMs, manufacturer's representatives, and distributors • Bell Atlanticom is a distributor.

GSA Schedule • listed.

PURCHASE PRICE RANGE



PROTEON PRONET-10 AND PRONET-80 PURCHASE PRICING • **SMALL SYSTEM** for ProNet-10 interconnects 100 terminals with 100 ports on host computers; TCP/IP Telenet software is included with the TIUs (Terminal Interface Units) and MIUs (Machine Interface Units), Telenet User software on TIUs and Telenet Server software on the MIUs • **ProNet-10** small configuration includes an 8-port and 6 16-port TIUs, an 8-port and 6 16-port MIUs, 2 8-node Wire Centers, 100-meter twinax cable assembly, and Network Monitoring Facility • currently the TIUs and MIUs cannot interface to ProNet-80, thus the small ProNet-80 interconnects 10 PDP-11s running RSX-11M-PLUS • **ProNet-80** small configuration includes RSX-11M-PLUS HDLC ProNet Driver, 10 Unibus Interface Systems, two 8-node wire centers with external remote indicators, 100-meter twinax cable assembly, and Network Monitoring Facility • **LARGE SYSTEM** for ProNet-10 interconnects 500 terminals with 500 computer ports: TCP/IP Telenet software is included with TIUs and MIUs, Telenet user software with TIUs and Telenet server software with MIUs • **ProNet-10 Large System** configuration includes an 8-port and 31 16-port TIUs, an 8-port and 31 16-port MIUs, a 16-node wire center with 2 repeaters, a 16-node wire center with 1 repeater, 2 16-node wire centers with external/remote indicators, 3 100-meter twinax cable assemblies, and Network Monitoring Facility • **ProNet-80 large** configuration interconnects 50 PDP-11 hosts running under RSX-11M-PLUS • includes RSX-11M-PLUS Drivers, 50 Unibus Interface Systems, an 8-port and 3 16-port Wire Centers with external/remote indicators, 3 fiber-optic links (wire center-to-wire center), and Network Monitoring Facility.

Proteon ProNet-10/-80 Baseband Local Area Networks

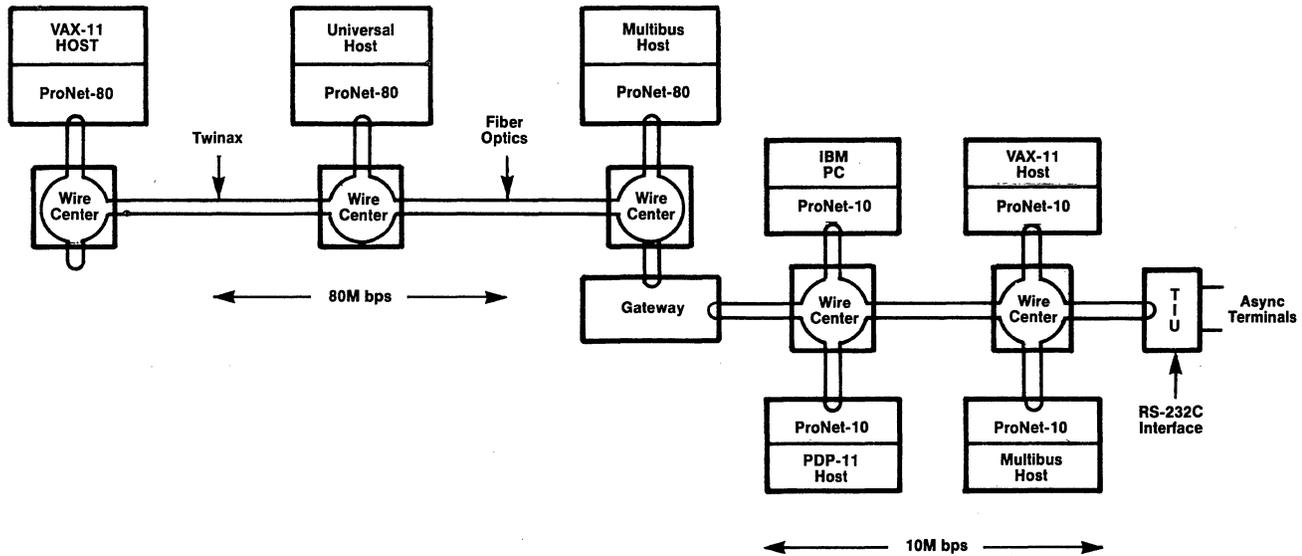


Figure 1 • Typical ProNet Network.

■ ANALYSIS

ProNet is a token-passing, star-shaped ring network that has been marketed since 1981. It uses the same architecture IBM has announced for the LAN that will run on the IBM Cabling System. Both IBM and Proteon have been actively involved in developing the IEEE 802.5 standard for a token-passing ring architecture which specifies a 4M-bps transmission rate. IBM's token-ring LAN will also operate at 4M bps. Proteon provides 2.5 and 20 times that transmission rate for ProNet-10 and -80, respectively, and it has installed a ProNet-10 on the IBM Cabling System for one of its customers.

The token-passing ring protocol allows the bandwidth to be used very efficiently. Proteon has stated that a performance monitor on a MIT (Massachusetts Institute of Technology) ProNet-10 LAN documents throughput data rates approaching 9.8M bps. This means that up to 9 file transfers between hosts at 1M bps can be performed concurrently over a ProNet-10 network. Maximum access delay for a host on a 25-node ProNet-10 is 40 milliseconds.

On a pure ring network, a failure at a node or a section of wire interrupts network communication. Not so with ProNet, its wire centers provide host attachment and bypassing. When a network node fails, the wire center detects it and bypasses that node, allowing network communication to continue.

Currently ProNet offers host interfaces to minicomputers and to IBM PCs. Host Specific Boards (HSBs) are available for Unibus, Q-bus, and Multibus systems. A Universal Bus HSB is available to attach minicomputers such as the Perkin-Elmer, Gould, and Hanis super minicomputers. Interfaces are also available for IBM PCs. Proteon also supplies networking software to support Digital Equipment computers and IBM PCs.

ProNet-80 was developed in a joint venture with the University of Wisconsin, which wanted to connect its many VAX computers located on campus, an application that required a higher-speed network than the ProNet-10. The ProNet-80 is currently up and running at the University of Wisconsin.

Proteon is still a small company with 80 employees. Through its technical talent, it has produced and installed hundreds of its token-passing ring networks before IBM has managed to install its first one. Proteon should still be in a very good position even when IBM produces its token-ring LAN. The 10M-bps ProNet-10 and 80M-bps ProNet-80 offers substantially greater throughput than IBM's 4M-bps LAN.

□ Strengths

Proteon is using an access protocol that is considerably superior to CSMA/CD for maintaining high throughput on a LAN. The access time delays can be calculated; unlike CSMA/CD, no collisions occur on the network and no network throughput is wasted on backoffs and retransmissions. Over 95% of the bandwidth on token-ring LANs is available to transmit user information. Throughput on CSMA/CD network deteriorate as traffic increases.

Proteon has considerable experience in the LAN business. The company has been delivering ProNet-10 LANs since 1981. Hundreds have been installed. Its list of customers is impressive. Also, Proteon has an OEM agreement with Bell Atlantic; the agreement authorizes Bell Atlantic to sell, install, and service ProNet in the mid-Atlantic region. This should produce many new ProNet installations.

ProNet-80 is in a class by itself in terms of high-speed LANs. Only Network Septers HYPERchannel at 50M bps is competitive.

□ Limitations

Proteon has been an engineering-driven company with little emphasis on marketing. Up to now, it appears to have succeeded despite itself. The company has had a superior product that has sold despite the lack of a marketing effort. It received additional venture capital financing in late 1983 to expand marketing and production. Proteon has since added a marketing-oriented president with the founder assuming the role of Chairman of the Board and Director of Development. A Vice President of Marketing and a Manager of Product Marketing were also added.

One of the critical phases in an innovative engineering-driven company is the transition to a marketing-driven company. The trick is to channel the engineering effort into an integrated product line that will solve the problems found in the company's chosen marketplace.

Proteon has dedicated itself to developing LANs that interconnect minicomputers and terminals. It has recently developed support for IBM PCs, and is now focusing its marketing effort on industrial, factory, research, and university environments. These are the environments that require high performance LANs. But even here, interfacing to IBM mainframes will be a must; the IBM 4300 is the leading system in CAD/CAM installations. Proteon is

Proteon ProNet-10/-80

Baseband Local Area Networks

developing additional HSBs to make ProNet the LAN of choice for its market.

■ NETWORK SUMMARY

Proteon offers a complete line of ProNet products for the interconnection of minicomputers and IBM PCs. ProNet is a baseband, token-ring, star-network. Devices connect to the networks through passive wire centers, which can support 4, 8, 12, or 16 nodes. A node can be a minicomputer, IBM PC, terminal interface unit (TIU) or machine interface unit (MIU). Wiring centers can be connected together so the network appears as a series of interconnected clusters.

Hosts connect to the wire center through an interface system, which consists of a Host Specific Board (HSB) and a Controller (CTL) board. Both ProNets use the same HSBs but require different CTLs. The HSB is the interface to the host system and contains 2K-byte receive and transmit buffers to store the transmitted and received information. The CTL interfaces to the network and handles the token-passing access protocol, transmissions, retransmissions, and connection/disconnection functions.

HSBs are available for Unibus, Q-bus, Multibus, and Universal bus systems. Currently, ProNet-10 has controllers that can connect to all these HSBs, but ProNet-80 has controllers to interface only to Unibus and Multibus HSBs.

Proteon provides packaged systems to interface RS-232C devices to ProNet-10 through 8/16-port Terminal Interface Units (TIUs) or Machine Interface Units (MIUs). These units include Transmission Control Protocol/Internet Protocol/Telnet (TCP/IP/Telnet) software to support the interchange of information between hosts and terminals and between networks. The only difference between an IU and TIU is the Telnet software. MIUs run Telnet server software and TIUs run Telnet user software.

The TIUs and MIUs include a Q-bus device to implement the interface, thus the interface to ProNet-10 is through a Q-bus HSB and CTL. Once a Q-bus interface is available for ProNet-80, the TIUs and MIUs can connect to that network also.

The RS-232C ports on the TIUs and MIUs allow the interconnection of any RS-232C devices without any changes to the host or terminal software. The network is transparent to the hosts and terminals connected to RS-232C ports.

The IBM PC Interface allows the interconnection of IBM PCs, PC/XTs, PC/ATs, and PC Compatibles on ProNet-10. Proteon offers the NetWare operating system from Novell to support the PC networking NetWare/P which also supports the TCP/IP protocols. Up to 64 IBM PCs (or compatibles) can share disks, printers, plotters, and other peripheral devices. The TCP/IP software supports file transfers. The Telnet software allow the IBM PC to act as a terminal to any mainframe on the network using remote login facility. Support for electronic mail is also available under NetWare.

Each host connects to the wire center through a quality sealed relay which is activated when the HSB gives the "join ring" command. A power failure at one host does not bring down the network and a host will not join the network if it fails a digital or analog loopback test. Hosts immediately disconnect from the network if the cable breaks.

The Wire Center also provides for automatic bypassing of failing nodes. Because the wire center operates as a complete ring, network segments on separate wire centers can continue functioning when another part of the network has failed.

A Network Monitoring Facility based on an IBM PC observes the traffic moving over the network and logs it for use by the network manager. It displays statistics including network conditions, packet count, percentage of utilization, and errors.

The network has 2 error-checking facilities: message parity and checking of codes in 4-to-6 coding scheme on ProNet-80.

Proteon has gateways running at several installations. By the end of the second quarter, Proteon will offer a standard gateway to interconnect a ProNet-10 with a ProNet-80.

■ SOFTWARE

Terms & Support

Terms • available for purchase only.

Support • provided by Proteon directly or through its OEMs, manufacturer's representatives, and distributors.

ProNet Software Components

ProNet-10 and ProNet-80 use the same software support modules. Network control and host interfaces are provided by firmware in the Host Specific and Controller Boards. Software for HDLC protocol drivers have been developed for Digital Equipment Corporation operating systems: RT-11, RSX-11M/M+, and VAX VMS. Ringway software provides DECnet drivers for DECnet/RSX and DECnet/VMS Phase III and IV products to allow ProNet hardware to provide DECnet functions. The TCP/IP drivers and network software provide file transfer virtual terminal remote login, and electronic mail transfer facilities. UNIX 4.2 BSD is distributed with full network support of TCP/IP protocols.

The NetWare Operating System is available for the IBM PC, XT, and AT. NetWare is provided by Novell, Inc.

Proteon also provides diagnostics for the ProNet host interface communication systems.

ProNet Software

The ProNet software consists of a series of diagnostic tests for the host communication systems: Unibus, Multibus, Q-bus, and IBM Personal Computer Systems.

p5000-DC ProNet Diagnostic & Echo Server for PDP-11 & LSI-11 • source and binary in DOS-11/XXDP format on 800-bpi tape:

\$150 prch

p5000-MC ProNet Diagnostic & Echo Server for PDP-11 & LSI-11 • source and binary in DOS-11/XXDP format on 1600-bpi tape:

150

p5000-MG ProNet Diagnostic & Echo Server for PDP-11 & LSI-11 • source and an out in Unix tar format on 1600-bpi tape:

150

p5000-YA ProNet Diagnostic & Echo Server for PDP-11 & LSI-11 • source only in RT-11 format on RX01 floppy disk:

100

p5000-YB ProNet Diagnostic & Echo Server for PDP-11 & LSI-11 • source and binary in XXPP format on RX01 floppy disk:

100

p5002-GA ProNet Diagnostic & Echo Server for VAX-11/750, 730, 725 • source and system image in RT-11 format on TU58 DEC tape-II:

100

p5002-YA ProNet Diagnostic & Echo Server for VAX-11/780, 785 • source and system image in RT-11 format on RX01 floppy disk:

100

p5003-22 ProNet Diagnostic & Echo Server of IBM PC • source and executable in MS-DOS 2.0 format on double-sided, 9-sector floppy:

100

p5004-MG ProNet Diagnostic & Echo Server for 68000 • source only in Unix tar format on 1600-bpi tape:

150

HDLC Device Drivers

The device driver provides a software interface between the operating system running on a computer and the ProNet host

PRCH: purchase price. Prices current as of May 1985.

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interface communication systems.

p5100-DA RT-11 HDLC ProNet Driver • on 800-bpi tape;
per network:

\$700 prch

p5100-MA RT-11 HDLC ProNet Driver • on 1600-bpi tape;
per network:

700

p5100-YA RT-11 HDLC ProNet Driver • on RX01 Floppy disk;
per network:

650

p5110-DC RSX-11MS HDLC ProNet Driver • on 800-bpi tape;
per network:

900

p5110-MC RSX-11MS HDLC ProNet Driver • on 1600-bpi
tape; per network:

900

p5110-YA RSX-11MS HDLC ProNet Driver • on RX01 Floppy
Disk; per node:

850

**p5120-GA VAX/VMS HDLC ProNet Driver for VAX-11/
750, 730** • on TU58 DEC tape-II; per node:

1,000

**p5120-MC VAX/VMS HDLC ProNet Driver for VAX-11/
780, 750, 730** • on 1600-bpi tape; per node:

1,000

**p5120-YA VAX/VMS HDLC ProNet Driver for VAX-11/
780** • on RX01 Floppy Disk; per node:

950

p5121 VAX/VMS HDLC ProNet Driver • license only; per
node:

950

p5130-DC RSX-11M-PLUS HDLC ProNet Driver • on
800-bpi tape; per network:

1,000

p5130-MC RSX-11M-PLUS HDLC ProNet Driver • on
1600-bpi tape; per network:

1,000

p5130-YA RSX-11M-PLUS HDLC ProNet Driver • on RX01
Floppy Disk; per network:

950

**Transmission Control Protocol (TCP)/Internet Protocol
(IP) Software**

The TCP/IP software implements the packet network protocols as adopted by the Department of Defense (DOD) as of January 1, 1983. IP is a datagram protocol, and TCP is a stream protocol layered on top of IP. The appreciation protocols FTP (file transfer protocol) use TCP/IP.

FTP allows the transfer of text and image mode files between 2 nodes on the network. Telnet allows a user on one computer or a Terminal Interface Unit (TIU) to logon to another computer and have the same capabilities as if the user terminal were attached directly to the network-attached computer. Telnet software consists of 2 modules: the User Telnet allows the user to access another computer; Server Telnet simulates the terminal at the destination computer.

The TCP/IP packages implement the standard DoD applications in addition to FTP and Telnet: Trivial File Transfer Protocol (TFTP); Finger (list of users on remote computer); and transfer of testing and diagnostic messages. Other local applications supported include remote copy (rcp), remote shell (rsh), remote magtape (rmt), and remote who (rwho).

The TCP/IP package offered for IBM PCs under MS-DOS or PC-DV2.0 or higher provides a subset of the TCP/IP protocols. It offers a User Telnet but no Server Telnet (MS-DOS is not a

multiuser system). The user appears to the access system as a DEC VT52 terminal.

The package includes User and Server TFTP, User Finger, and User and Server testing diagnostics.

p5221 TCP/IP/User Telnet • for 8-port Terminal Interface Unit (TIU); per TIU:

\$1,500 prch

p5222 TCP/IP/User Telnet • for 16-port Terminal Interface Unit (TIU); per TIU:

1,500

p5224 TCP/IP/Server Telnet • for 8-port Machine Interface Unit (MIU); per MIU:

2,500

p5225 TCP/IP/Server Telnet • for 16-port Machine Interface Unit (MIU); per MIU:

2,500

p5230 MS-DOS V2.0, V3.0 TCP/IP Package • for IBM PC:

250

Ringway Software

The Ringway software packages allow hosts with ProNet Communication Systems to participate in a DECnet network.

p5300-YA Ringway for RSX-11M • on RX01 Floppy Disk; Copies 1-3, each:

\$2,500 prch

Copies 4-20, Each:

1,200

p5301 Ringway Software Support for RSX-11M • per year; per network:

2,000

p5310-GA Ringway for VAX/VMS • on TU58 DEC Tape-II • Copies 1-3, each:

2,500

Copies 4-20, Each:

1,200

p5310-YA Ringway for VAX/VMS • on RX01 Floppy Disk; Copies 1-5, each:

2,500

Copies 6-20, Each:

1,200

p5311 Ringway Software Support for VAX/VMS • per year; per network:

2,000

p5312 Ringway Software Support for RSX-11M & VAX/VMS • per year; per network:

3,500

Packet Drivers

The packet drivers provide packet access to various operating systems.

P5400-MG UNIX V7 ProNet Packet Device Driver • on 1600-bpi tape:

\$150 prch

p5401-MG UNIX System V ProNet Packet Device Driver for Callan Unistar 68000 • on 1600-bpi tape:

150

IBM PC Software

Proteon supplies NetWare, a network operating system, and TCP/IP for the IBM PC, PC/XT, and PC/AT. TCP/IP is defined under the TCP/IP software section.

Proteon supplies NetWare/P and advanced NetWare/P.

NetWare/P allows IBM/PCs, XTs, ATs, and IBM PC compatibles

Proteon ProNet-10/-80 Baseband Local Area Networks

to share a filer server with up to 252M bytes of disk storage. Up to 3 printers including 2 serial, and a parallel printer can be connected to the NetWare/P file server. Each printer supports a queue of up to 100 files. a printing queue can be stopped, started, aborted, or routed to another printer. The order of documents can be rearranged, and special documents can be given print priority.

The NetWare/P file server can be used as a workstation and access local peripherals, such as a printer. A special Boot PROM available for NetWare workstations provides Remote System Reset (RSR) eliminating the need for workstation disk drives. Diskless workstations can use the network disk drive to store and retrieve data. NetWare file servers can support 54 PCs.

NetWare/P supports workstations using PC-DOS V2.0/3.0; it does not require separate disk partitions for files created under the different versions. Most existing PC-DOS applications will run under NetWare.

System security is provided through passwords, restricting a particular user's rights or restricting rights in an entire directory.

Advanced Netware/P has all the features of NetWare/P plus support for multiple file servers and bridges. A workstation can simultaneously use files from multiple file servers. The underlying network topology and interconnections are transparent to a user.

The NetWare Bridge is a PC that can contain 2 printed circuit boards in addition to the PC mother board. A network interface board for each of the 2 networks makes up the 2 boards. To interconnect 2 ProNet-10 networks, 2 p1300 IBM PC interface boards are required. The bridge can also be used to connect a modem to a network for a NetWare/Remote application.

The minimum configuration for a NetWare/P network is a PC file server with 256K-byte memory and a hard disk, IBM or IBM-compatible PC workstations with 128K-byte memories, NetWare/P software, Proteon p1300 IBM PC network interface board for the file server and for each PC workstation.

p5500 NetWare/P for MS-DOS V2.0 & V3.0 • with Key Card for IBM PC XT, AT; per network:

\$1,495 prch

p5501 NetWare/P for MS-DOS V2.0 & V3.0 • with SCSI Card for use with Hard Disk Subsystem (p28xx); per network:

1,745

p5504 NetWare Revision • upgrade:

195

p5506 Advanced NetWare/P 1.0 • per network:

1,595

p5514 Remote System Reset PROM • required for each diskless PC:

50

p5516 DOSGEN (FLESSGEN Diskless Boot) • 1 required per file server:

100

■ HARDWARE

Terms & Support

Terms • available for purchase only; directly and through OEMs, manufacturer's representatives and distributors; quantity discounts are available.

Support • directly and through OEMs, manufacturer's representatives, and distributors.

ProNet Hardware

The ProNet-10 and -80 use some common hardware besides the hardware unique to each LAN. The Host Specific boards are the same for both systems, but the controller boards are different. ProNet-10 can operate over twisted-pair, twinax, infrared link, and fiber-optic cable which ProNet-80 can operate only over twinax or fiber-optic cable. A network can use a combination of media.

Both networks are built around passive ProNet wire centers containing the physical ring; the network is composed of a series of interconnected stars. A wire center can connect from 4 to 16 nodes; it also provides for expansion with connections to adjacent wire centers.

Proteon provides a number of interfaces for ProNet-10: Host Interface Systems for Unibus, Q-bus, Multibus, and Universal Bus Systems; IBM Personal Computer Interface; Terminal Interface Units (TIUs); and Machine Interface Units (MIUs). Currently, Proteon supplies only Host Interface Systems for Unibus and Multibus Systems for ProNet-80.

■ HOST INTERFACE SYSTEMS

A Host Interface System consists of 2 boards: a host specific board (HSB) and a network control module (CTL). HSB processes communications for the host; functions include sequencing, buffering, and controlling. The HSBs are the same for ProNet-10 and -80; the HSB CTLs are different; includes two 2K-byte buffers one each for transmit and receive functions.

The CTL board manages all the network transmission functions; recognizes the node's address or a broadcast address and implements the token-passing protocol. In addition, the CTL for ProNet-80 contains two 4K-byte receive buffers to ensure no loss of data and a 4K-byte transmit buffer Interface System. The CTL for ProNet-80 is implemented using ECL technology.

Host Interface Systems are available for various computers. Proteon also sells the host specific boards and controllers boards separately.

p1000 Unibus Interface System 10M bps (HSB/CTL 10) • for ProNet-10:

\$3,150 prch

p1001 Unibus Host Specific Board (HSB) • for ProNet-10 or ProNet-80:

2,200

p1002 Unibus Control Card (CTL) • for ProNet-10:

950

p1010 Unibus Starter Kit • consists of 2 model p1000 Unibus Interface Systems and one Network Cable Assembly (10 Meters); software not included; for ProNet-10:

6,365

p1080 Unibus Interface System 80M bps (HSB/CTL80) • for ProNet-80:

8,000

p1082 Unibus Control Card 80M bps (CTL80) • for ProNet-80:

5,800

p1100 Q-bus Interface (HSB/CTL) • for ProNet-10:

3,150

p1101 Q-bus Host Specific Board (HSB) • for ProNet-10/-80:

2,200

p1102 Q-bus Control Card (CTL) • for ProNet-10:

950

p1110 Q-bus Starter Kit • consists of 2 Model p1100 Q-bus Interface Systems and 1 Network Cable Assembly (10 Meters); software not included; for ProNet-10:

6,365

p1200 Multibus Interface System (HSB/CTL) • for ProNet-10:

3,150

p1201 Multibus Host Specific Board (HSB) • for ProNet-10/-80:

2,200

p1202 Multibus Control Card (CTL) • for ProNet-10:

950

PRCH: purchase price. Prices current as of May 1985.

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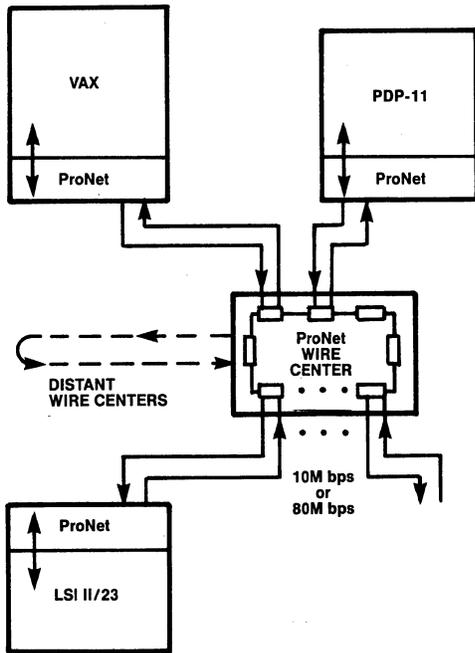


Figure 2 • ProNet Wire Center.

p1210 Multibus Starter Kit • consists of 2 Model p1200 Multibus Interface Systems and 1 Network Cable Assembly (10 Meters); software not included; for ProNet-10:

6,365

p1280 Multibus Interface System 80M bps (HSB/CTL80) • for ProNet-80:

8,000

p1282 Multibus Control Card 80M bps (CTL80) • for ProNet-80:

5,800

p1300 IBM PC Interface System • for ProNet-10:

799

p1310 IBM PC Starter Kit • consists of 2 Model p1300 IBM PC Interface Systems and 1 Network Cable Assembly (10 Meters); software not included; for ProNet-10:

1,663

p1400 Universal Bus Interface System (HSB/CTL) • for ProNet-10:

2,700

p1401 Universal Bus Interface • for ProNet-10/-80:

1,750

p1402 Universal Control Card • for ProNet-10:

950

Gateways

Proteon is developing gateways between ProNet and Ethernet and between ProNet-10 and ProNet-80. The gateways are based on the LSI-11/23 hardware and are already running at some customer sites, but are not yet available as standard products. They are scheduled to be available as standard products for general delivery by the end of the second quarter. The price range is expected to be from \$12,000 to \$14,000.

Terminal Interface Units (TIUs) & Machine Interface Units (MIUs)

TIUs and MIUs provide an RS-232C asynchronous interface

between ProNet-10 and an information processing device. Actually, they can be used to interconnect any RS-232C devices, such as asynchronous terminals and non-IBM PCs. TIUs/MIUs provide both hardware and software. Both are based on a Q-bus device; each TIU and MIU includes a Q-bus HSB and a Q-bus control card for ProNet-10. The only difference between an MIU and TIU is the Telnet software: TIUs run the user software and MIUs run server software.

p4015 8-Port Terminal Interface Unit • with p5221 TCP/IP/Telnet software:

\$9,700 prch

p4016 8-Port Machine Interface Unit • with p5224 TCP/IP/Telnet software:

10,700

p4025 16-Port Terminal Interface Unit • with p5222 TCP/IP/Telnet software:

11,000

p4026 16-Port Machine Interface Unit • with p5225 TCP/IP/Telnet software:

12,000

ProNet Wire Centers, Repeaters, Accessories & Cables

Wire Centers are totally passive devices that are used for both ProNet-10 and 80. They are self-contained units that include housing, printed circuit board, 4/8/16 relays, and associated transformers. Local expansion ports are available to connect adjacent wire centers. They include no power supplies. See Figure 2.

Repeaters extend the distance allowable between wire centers or between a wire center and a node.

The Network Monitoring Facility is based on an IBM PC. It monitors the network cable and logs statistics on network traffic and conditions. It provides 4 screens to help a network manager to tune and operate the network. It provides packet count, percentage of network utilization (per day, hour, minute, second), errors, and Help facilities.

p2000 8-Node Wire Center • external indicators:

\$1,220 prch

p2001 8-Node Wire Center • external remote indicators:

1,340

p2010 8-Node Wire Center • with 1 Repeater:

1,470

p2020 8-Node Wire Center • with 2 Repeaters:

1,720

p2100 16-Node Wire Center • external indicators:

2,040

p2101 16-Node Wire Center • external/remote indicators:

2,280

p2110 16-Node Wire Center • with 1 Repeater:

2,290

p2120 16-Node Wire Center • with 2 Repeaters:

2,540

p2400 4-Node Wire Center • external indicators; no local expansion:

295

p2411 4-Node Wire Center • external indicators; with local expansion:

335

p2412 8-Node Wire Center • linked 4/4 with local expansion:

630

p2413 12-Node Wire Center • linked 4/4/4 with local expansion:

925

p2500 4-Node Wire Center • in wall unit, external indicators;

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with local expansion:

	295
p2501 Wall Plate • 1 port:	10
p2200 Repeater • CTL-to-Wire Center:	300
p2210 Repeater • Wire Center-to-Wire Center (2 units):	600
p2300 Network Monitoring Facility:	15,000
p2910 Coax Adapter:	50
p2920 Male 15-Pin "D" Subminiature Connectors • 6 connectors:	70
p2922 Female 15-Pin "D" Subminiature Connectors • 6 connectors:	110
p2900-03 Network Cable Assembly • 3 meters of Twinax:	50
p2900-10 Network Cable Assembly • 10 meters of Twinax:	65
p2900-20 Network Cable Assembly • 20 meters of Twinax:	90
p2900-35 Network Cable Assembly • 35 meters of Twinax:	175
p2900-50 Network Cable Assembly • 50 meters of Twinax:	225
p2900-75 Network Cable Assembly • 75 meters of Twinax:	325
p2900-100 Network Cable Assembly • 100 meters of Twinax:	450
p2900-200 Network Cable Assembly • 200 meters of Twinax:	815
p2900-300 Network Cable Assembly • 300 meters of Twinax:	1,180

Hard Disk Subsystems

The hard disk subsystems are used with a file server on a network of IBM PCs running NetWare software.

p2802 20M-byte Disk Subsystem • 1 drive:	\$3,995 prch
p2804 45M-byte Disk Subsystem • 1 drive:	5,495
p2806 60M-byte Disk Subsystem • 1 drive:	7,695
p2809 90M-byte Disk Subsystem • 2 drives:	9,495
p2812 120M-byte Disk Subsystem • 2 drives:	12,995
p2813 150M-byte Disk Subsystem • 2 drives:	15,095
p2814 20M-byte Add-On Disk:	2,495
p2816 45M-byte Add-On Disk:	3,995
p2818 60M-byte Add-On Disk:	6,295

p2820 250M-byte Disk Subsystem • 2 drives:	23,990
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ProNet Fiber-Optic Products

Proteon provides Fiber-Optic Converters, cables, and accessories for use with both ProNet-10 and 80.

p3000 Fiber-Optic Link, Host-to-Host • 2 units:	\$2,300 prch
p3001 Fiber-Optic Link, Host-to-Wire Center • 2 units:	2,300
p3002 Fiber-Optic Link, Wire Center-to-Wire Center • 2 units:	2,300
p3010 Fiber Optic—1 Host Unit:	1,150
p3011 Fiber Optic—1 Wire Center Unit:	1,150
p3100 Redundant Fiber Optic Link Host-to-Host • 2 units:	2,900
p3101 Redundant Fiber Optic Link Host-to-WC • 2 units:	2,900
p3102 Redundant Fiber Optic Link WC-to-WC • 2 units:	2,900
p3110 Redundant Fiber Optic—1 Host Unit:	1,450
p3111 Redundant Fiber Optic—1 Wire Center Unit:	1,450
p3200 Dual-Ring Fiber-Optic Unit • host node:	1,700
p3201 Dual-Ring Fiber-Optic Unit • Wire Center Node:	1,700
p3900-nn Dual Fiber Cable Assy • for p3000 and p3100 series; nn is length in meters, price per meter:	3
p3910 Fiber Cable Connector • installed at factory:	100
p3911-10 Fiber Cable Connectors • package of 10:	100

□ Specification

ProNet uses a token-ring architecture. Although ProNet-80 is similar in architecture to ProNet-10, it offers a number of features more appropriate to the higher-speed network.

The 2 systems are synchronized differently. ProNet-10's clock is extracted from the data at each node, and the nodes are synchronized to each other at all times. In addition to this clocking technique, ProNet-80 synchronization is carried with the message. To accomplish this, Proteon has added a variable idle period preceding the token. A receiver ignores the idle time until it receives the token, at which time it resynchronizes itself. The transmitter and receiver at a node have independent clocks which are closely synchronized during the relatively short time during transmission of a packet.

The ProNet-10 uses a Manchester encoding scheme, which requires transmitting each bit and its complement essentially doubling the bandwidth required to transmit a message. The ProNet-80 uses a 4 into 6 code which means 6 bits are transmitted for each 4 bits of information. Thus, the required bandwidth is 1.5 times the bit rate.

The maximum packet length has been doubled for the ProNet-80 over ProNet-10: 4,090 bytes versus 2,044 bytes.

Also, the addressing scheme for ProNet-80 is slightly different from that of ProNet-10. Both use 8-bit source and destination addresses. ProNet-10 uses all 8 bits as a unit address, one of

Proteon ProNet-10/-80 Baseband Local Area Networks

the 25 possible addresses is reserved to broadcast to all units on the network leaving 254 addresses for individual units on the network. ProNet-80 divides the 9-bit address into two 4-bit addresses. One 4-bit address selects 16 groups of units on the network and the second selects up to 15 units within a group. One of the groups addresses only 14 units because an address is allocated to message broadcasting. This allows ProNet-80 to address only 239 individual units, but Proteon uses the 4-bit group address for group transmissions.

The ProNet-80 expands the packet format to include a 2-byte destination field and a 2-byte acknowledgement field. Individual bits can be set in the destination field to specify that a single, multiple, or all members of the group receive the packet. The 2-byte acknowledgement field is used to indicate a node within the group on the network that did not receive the message; one bit is available for each node. If the source node must retransmit a message, it can retransmit it only to the nodes that did not receive it previously. See **Figures 3a, 3b, and 3c**.

Both ProNet-10 and -80 use common Host Specific Boards and software. The controller board contains extra buffering for the ProNet-80: two 4K-byte receive buffers and a 4K-byte transmit buffer. The HSB includes one 2K-byte receive and one 2K-byte transmit buffer. Thus, ProNet-80 has a total of 3 receive buffers and 2 transmit buffers to ensure that data will not be lost.

Packet Format

The packet formats for ProNet-10 and ProNet-80 are presented in **Figures 3a, 3b, and 3c**.

Data packets can contain 0 to 2,044 bytes for ProNet-10 and ProNet-80. Interface buffer capacity dictates packet size. The end of the packet is marked by an End of Message (EOM) flag. The controller (CTL) board for ProNet-80 contains 4K-byte receive and transmit buffers. Currently, all HSB (Host Specific Boards) contain 2K-byte buffers. When an HSB with a 4K-byte buffer becomes available, the ProNet-80 can transmit packets with 4,090-byte data fields.

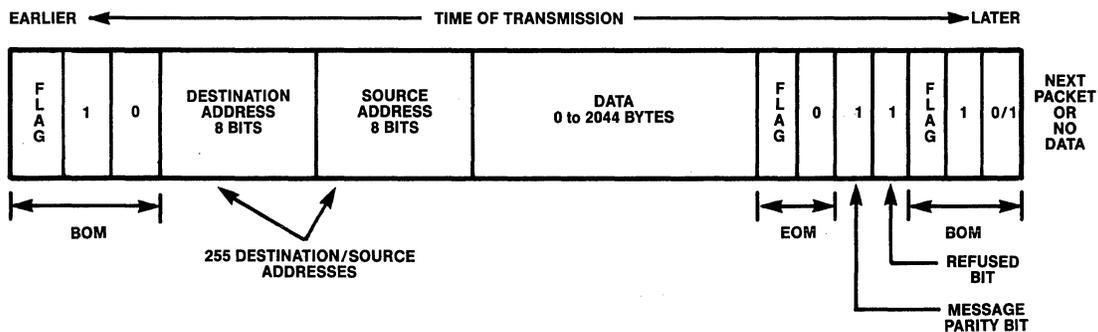


Figure 3a • ProNet-10 Packet Format.

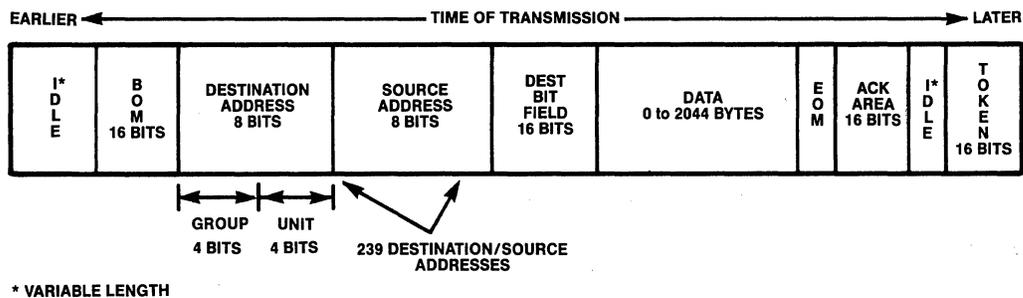


Figure 3b • ProNet-80 Group Address Packet Format.

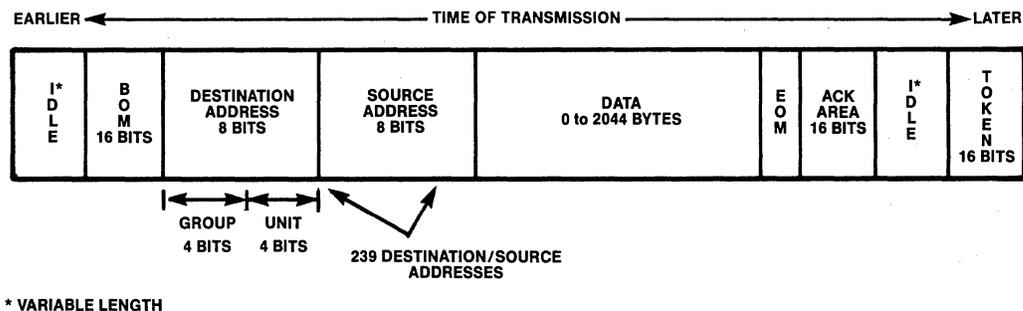


Figure 3c • ProNet-80 Standard Packet Format.

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Format • varies between ProNet-10 and 80 as shown in **Figures 3a, 3b and 3c**; ProNet-80 can perform group addressing and group acknowledgement; both can broadcast to all nodes on the network • ProNet-10 uses all 8 bits of Destination Address to select individual network node; address 255 used as broadcast address • ProNet-80 divides the Destination Address into a 4-bit Group Address and 4-bit Unit Address • for standard addressing, the node address consists of the combined group and unit address which can address nodes; one unit address in a group is reserved for broadcast addressing thus 239 nodes can be addressed, for group addressing, the 4-bit unit address is "0" and a 16-bit Destination Bit Field is included; the bits in this field function as a mask, set to select which nodes within the group are to receive the message • the 16-bit ACK field is used by each selected node to indicate that it did or did not copy the message: an "0" is an ACK, while a "1" is a NAK indicating the message was not copied • BOM (Beginning of Message) and Token differ only in the least significant bit; when a Token has been captured by a node with a message to send, it changes the least significant bit to an "0" and attaches its message • ProNet-80 requires the variable-length IDLE time to allow for node resynchronization • EOM-byte for ProNet-10 includes EOM followed by a parity bit for entire message and an ACK/NAK bit to inform source if message was received; if not received, source can retain token and retransmit; if received, source passes token to next node • EOM for ProNet-90 also includes an ACK/NAK bit, but invalid code-detected bit is in BOM or token.

Transmission Characteristics

Channel Encoding • ProNet-10 uses Manchester encoding to ensure a transition for every bit position; transmits complement of the bit in first half of bit time and true value in second half • ProNet-80 uses 4 into 6-bit code, the 4 into 6-bit coding techniques provides a highly reliable error detection mechanism between adjacent nodes • ProNet-10 as parity clocking only. See **Figures 4 and 5**.

Valid Code Patterns		
Code	Pattern	Comments
A	001111	BOM or TOKEN first byte
B	000011	'11110000' pattern in 'A B' resets timing
E	001011	
0	010011	
1	010101	
2	011001	
3	100011	
4	100101	
5	101001	
6	110001	
7	001101	
8	101100	
9	101010	
10	011100	
11	011100	
12	011010	
13	010110	
14	001110	
15	110010	
Code violations		
	000111	All unbalanced 6-bit code words
	111000	
	110100	

Figure 4 • ProNet-80 4 into 6 code.

Control Characters		
Character	Codes	Comments
TOKEN	A B 0 0	
TOKEN (error seen in last message)	A B E 0	
BOM	A B 0 1	
BOM (error seen in last message)	A B E 1	
EOM (as sent)	E 0	
EOM (message copied)	E 1	
IDLE	9 9 9 ...	

Figure 5 • ProNet-80 Control Characters.

Data Rate • 10M bps for ProNet-10; 80M bps for ProNet-80.

Carrier • does not use carrier to determine if cable is busy; uses BOM (Beginning of Message) and EOM (End of Message) to signal information on the cable.

Control Procedure

ProNet uses a token-passing protocol to provide cable access to the nodes on the network. When a node has data to transmit, it examines the BOM/Token bits to determine if it is a token. If it is a token, the node changes the token to a BOM (Beginning of Message) and attaches its message. If it is a BOM, the node examines the Destination Address bits to determine if the message is addressed to it or if the message is a broadcast message intended for all nodes.

In the case of ProNet-80, the address can be a group address. If the node is included in the addressed group, it examines the Destination Bit mask to determine if it is included in the group to receive the message. If it is included and is able to receive the message, the node copies the message. If it is included but not able to receive the message, the node puts a bit in its position in the ACK field.

In all cases, a node regenerates the message and sends it on to the next node. When the message returns to the source node, it removes it from the network. If a bit has been set in the ACK field, the source node holds the token and retransmits the message to those nodes that did not copy it. The number of retransmissions is controlled by software.

When individual node addressing is performed, the destination node places a bit in the "Refused" bit position in the EOM byte.

Except for retransmission, a node can hold the token for the transmission of one message before passing it on to the next node. All nodes have an equal opportunity to capture the token.

Transmission Medium

ProNet-10 can use twisted pair, twinax cable, fiber optic cable, or an infrared link. ProNet-80 can use twinax or fiber optic cable.

Use

ProNet-10 is a general purpose network that can be used to interconnect host computers and terminals as well as IBM Personal Computers. ProNet-80 is also a general-purpose network, but its high speed is appropriate for interconnecting hosts, interconnecting hosts with high-speed graphics terminals, or interconnecting networks. Both ProNet versions lend themselves to environments where transmission delays must be predictable. Throughput on token-passing networks **does not** degenerate as traffic increases.

• END

Protocol Computers (PCI) Protocol Converters

PCI Models 1051, 1071, 1076 & 1076X

■ PROFILE

Function • PCI 1051 emulates IBM 5251-11 or 5251-12 workstation and 5256 printers • PCI 1071 emulates IBM 3271 remote controllers, 3277-2 terminal, and 3284 printer • PCI 1076 and 1076X emulate IBM 3274C models or 3276-12 remote control unit, 3278-2 terminal, and 3287 printer • substitutes ASCII terminals/printers for IBM units • performs terminal management and control, and polling, data concentration, and network control.

Packaging • all models standalone, tabletop units attaching up to 7 terminals/printers in any combination.

Communications/Networks • supports single high-speed link; point-to-point, multipoint, dedicated, or dial-up; transmission speed to 9600 bps • supports CICS/VS, VTAM, CMS, TSO, TCAM • PCI 1051 and 1076 run under SNA/SDLC; PCI 1071 employs BSC protocol • PCI 1076X runs under SNA/SDLC but is equipped with an X.25 PAD • PCI 1071, 1076, and 1076X are remote units that attach to IBM System/370, 303X, 43XX, and 8100 mainframes via IBM 27XX and 37XX Communication Processors or Integrated Communication Adapter; the 1051 remotely attaches to communication adapter on an IBM System/34 or 38, or directly attaches to a workstation I/O channel • DTE and DCE interfaces are RS-232C for all controllers.

First Delivery • 1981 (1076); 1982 (1071/1051).

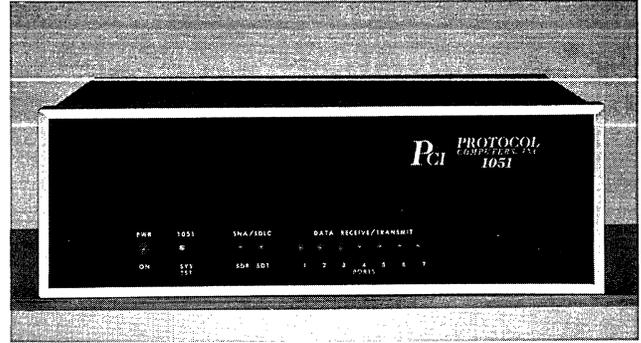
Systems Delivered • 6,000 (1076); 1,500 (1071); and 1,000 (1051).

Comparable Systems • PCI 1076 competes against Black Box A/S-3, CCI 8274C, Datastream 7741/874/776, DRA Hydra II, ICOT 35X, 36X, Infotron VTS 351/352, Innovative Electronics MC80/600/602, Kaufman Data 870/872, Local Data DataLynx/3274, Microm Micro 7400, Renex RT74, Thomas Engineering MZ-80, etc • comparable PCI 1071s are Data Plus PCT DP 350, DCA INA/ATC and Irmacomm, Diversified Data Resources Hydra II, Gandalf PIN 3270-E5 and -E7, ICOT 351/352, Innovative Electronics MC-80/300 and 400, MC-80/802 • PCI 1051 is comparable with AST Research 5251, Black Box PQ-4 (B/RO), Local Data Datalynx/5251, Perle Systems 350/525, Renex Translator RT 51, and Techland BlueLynx S/34/36/38.

Vendor • Protocol Computers, Inc; 6150 Canoga Avenue, Suite 100, Woodland Hills, CA 91367 • 800-425-5904 (toll free) or 818-716-5500.

Canadian Headquarters • Ahearn & Sopes; 100 Woodbine Down Boulevard, Rexdale, ON M9W 556 • 416-675-3999.

Distribution • through direct sales, manufacturer's representatives, and independent hardware distributors throughout the U.S.



and Canada.

GSA Schedule • unlisted.

■ ANALYSIS

The PCI 1051, 1071, 1076, and 1076X cluster controller fall into a category of products called "protocol converters." That term, however, is a misnomer for these products; they are actually **terminal and controller emulators**. However, like protocol converters, these devices are an important cost-saving alternative to IBM products for users who now, or plan to, operate within an IBM BSC and/or SNA/SDLC environment. They eliminate the added cost of IBM products and protect the users' investment in existing ASCII terminals.

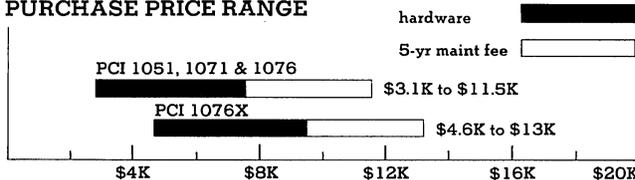
The PCI 1051 emulates the IBM 5251 workstation, as well as the 5256 printer. PCI 1071 emulates the remote versions of the old IBM 3271 controllers and the 3277 and 3287. The PCI 1076 emulates the remote 3274C models and the 3276-12, plus 3278-2 and 3287 terminal and printer. The 1076X is basically a 1076 with an X.25 PAD, which allows the controller to interface with private or public data networks.

PCI employs a somewhat different approach to handling its X.25 communications. At the terminal site, the aforementioned 1076X has facilities for converting the attached ASCII terminal inputs to SNA/SDLC or X.25 via a packet assembler-disassembler (PAD) facility. By employing dual protocol handling, the 1076X can be used for native mode SNA/SDLC communication or for an X.25 hookup. At the host end, PCI employs a different product to handle the 1076X's output. Called the PCI 73SX, it converts the packet data to SNA/SDLC protocol and passes the output to the host processor's communication handler. Keep in mind that anytime data passes through 2 conversions, as is the case here, response time will degrade appreciably.

PCI also offers a version of the 73SX called the R73SX, which allows products like the IBM 3780 and 3274 to attach to an X.25 network. The R73SX handles 3 input channels, packetizes the data, and passes it to a 73SX at the host site. According to the vendor, R73SX can also interface the 1076 output obviating the need for a 73SX. Keep in mind, however, that the R73SX only handles 3 channels versus 8 for the 73SX.

Products like the 1051, 1071, and 1076 are marketed as low-cost alternatives to the more expensive IBM products. The cluster controllers always cost far less than comparable IBM units, and the ASCII terminals can cost only one-third to one-quarter as much as an IBM keyboard-display. For example, IBM's low-cost

PURCHASE PRICE RANGE



PCI 10XX PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for hardware (solid bars) and associated 5-year maintenance (open bars) • small versions consist of PCI 1051-1, 1071-1, 1076-1, and 1076X-1 with single I/O port • large configurations consist of 1051-7, 1071-7, 1076-7, 1076X-7 controllers with 7 I/O ports, plus a paper CRT option and Coax Face option for each controller • all prices single-quantity purchase.

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PCI Models 1051, 1071, 1076 & 1076X

3178, priced at \$1,660, could be replaced by a host of \$500 terminals on the market. Likewise, available ASCII printers are priced far below IBM's 3284, provided you can find one. The 3284, like the 3271 controllers, have long since been dropped from the IBM product line.

While price is a primary factor in choosing between IBM and products like these, additional operating capabilities is another. Just about all of the IBM 3270 replacement product vendors offer facilities not available from Big Blue. In the case of PCI, the difference is the ability to handle remote dial-in terminals.

With both price and performance superiority, it is surprising why products like the PCI's haven't blown away IBM. There are a number of reasons, including user unawareness of the alternative products and the security umbrella associated with buying only IBM products. Another reason, however, is **efficiency**. Any product that emulates another and/or performs protocol conversion has built-in overhead in time and resources to execute the conversion. For these products, emulation and protocol conversion makes an ASCII terminal "appear as" and "behave as" an IBM 5251/3277/3278/3279 terminal as far as data presentation, edit, and control are concerned, and in converting the ASCII character stream into a 3277/3278/3279/5251 format. To emulate the operating characteristics, PCI converts ASCII keyboard commands into 5251/3270 commands. Since the ASCII keyboard probably does not have edit and control keys corresponding to those employed by IBM keyboards, users must key-in a predetermined set of keystrokes to effect the desired command. For example, to clear the screen requires a single keystroke on an IBM keyboard. To accomplish the same thing with a DEC VT100 emulating a 3278, the user must depress 2 keys. With the 3270, there are some 30 different operations plus 24 programmed functions that can be initiated with a single keystroke or a combined shift operation and keystroke. With PCI and everyone else, **at least 2** keystrokes are required.

The actual keyboard-command emulation is fairly rapid, since firmware executes the process. The inefficiency is at the operator level. Someone accustomed to using an IBM keyboard must learn a completely new keying pattern, and this often leads to reduced keying speeds and quite often keying errors. Even after the operator learns and becomes accustomed to the patterns, it still takes more time to enter multiple keystrokes. Another limiting factor is that some of these replacement products do not emulate the more sophisticated features of the 3270. For example, a "Read Modified Data Only" operation is not always supported, nor is the full complement of program function and program address keys. PCI claims that all 3270 functions are supported by both controller series.

The 3270 emulation code is in firmware and therefore not field-alterable without changing PROMs. IBM, on the other hand, employs a diskette for system software, making changes a lot easier.

Products like PCI's are strictly emulators and provide no advanced services such as file transfer. While this is of no consequence with asynchronous "dumb" terminals, it does limit its usefulness if personal computers are attached. (PCI does allow PC attachment, incidentally.) For that class of product, users are turning to emulators with file transfer capabilities, such as those offered by Winterhalter, DCA, Forte, and Techland.

In summary, for those needing first-class remote controllers (and local with the 1051), the PCI products are certainly worth considering. PCI has about 6,800 units in the field, and it does enjoy a fine reputation. Its prices are also competitive.

□ Strengths

The principal strength of products such as PCI's is the ability to substitute low-cost ASCII terminals and printers for higher-cost IBM components. The cost difference, in fact, can be as much as a 4-to-1 ratio in favor of the ASCII devices. In addition, PCI allows personal computers to communicate with IBM mainframes by emulating the display characteristics of the IBM 3278 and 5251 terminals. With the growing use of personal computers, this facility further adds to the overall utility of the PCI product.

The PCI controllers support a remote terminal dial-in facility. While

not unique to PCI (many other protocol converters support it as well), it does not exist on the IBM 3270. Remote dial-in allows users to configure certain controller ports to recognize the data rate and character format of a remote terminal dialing into the controller, and establish a session for it. For organizations with remote users requiring only occasional host-processor services, the dial-in facility is a low-cost solution. Without it, the remote site would need its own cluster controller or something that emulates it.

A somewhat unusual—and quite useful—feature of the PCI line is its "paper CRT" option. Essentially, this facility allows an ASCII keyboard-printer terminal to emulate an IBM 3278 or 5251, and provides full-screen editing. The paper CRT option can also be used with **personal computers** lacking the emulation software to support full-screen editing. Coupled with the remote dial-in facility, remote users with terminals that normally are incompatible with 3270 and 5251 equipment can communicate with the host and appear to be 3278s or 5251s. Executives who travel a great deal will appreciate the paper CRT, since it relieves them from having to carry bulky terminals to take advantage of 3278 or 5251 facilities.

PCI does a very good job of compensating for the lack of function and special-purpose keys on most ASCII terminals. While the controllers **cannot** substitute a key-for-key operation, they do employ a logical key arrangement for the simulation process. For example, the 3278 PF1 key is simulated by ESCAPE1, PF2 by ESCAPE2, etc. With the 5251, CMD1 is ESCAPE1, CMD2 is ESCAPE2, etc. There are 2 obvious advantages to using this arrangement. First, it makes learning the keying process much simpler; and second, it reduces the chance for operator error when more complex keying operations are employed.

The Coax Face option is another user benefit. It extends terminal placement distance from the PCI controller far in excess of that of an RS-232C cable. Coax Face, offered with all of the PCI controllers, connects an RS-232C-interfaced terminal to an RG-62A/U coaxial cable (same as used with the 3270). The combination of Coax Face and the coaxial cable allows each terminal to be located up to **5,000 feet** from the PCI controller, versus 50 feet with a conventional RS-232C and associated cable connection.

□ Limitations

The principal limitations of the PCI controllers are the lack of concurrent multihost communication support; limited terminal handling; and no direct-attachment facility (except the 1051). Also missing is the option for redundant logic and/or power supplies.

The 1071, 1076, and 1076X are strictly remote controllers that communicate with a 27XX, 37XX communication processor or the integrated communication adapter on the 43XX mainframe. Nothing is offered for local host connection to the byte or block multiplexer or selector channels on the host processor. Since both controllers have a dual-link facility, a useful enhancement would be the use of one for direct local connection. Lee Data Corporation offers such a controller with its Models 321 and 421, and we understand that it has been very successful. Of course, there's nothing to stop you from making a local connection via a modem to the communication processor, but that arrangement ties up communication ports.

All of the PCI controllers are available in versions with 1, 3, 5, or 7 ports. For the IBM 3270, this is the same as handled by the 3274-51C and 3276. Nothing like the 16-channel 3274-61C is available. While 7 terminals/printers may be adequate for small-to-low medium-sized installations, it's too limited for larger sites. The vendor should consider an upgrade path for these controllers to safeguard the user's investment as need inevitably change.

Also, the vendor should consider support for the column format of the 3278-5 for the 1071 and 1076. Since business users often need to display spreadsheet data, having a 132-column display format would make the 1071 and 1076 better suited for this application. The 5251 does not support 132-column lines.

All PCI controllers support only a single high-speed link between the controller and the host processor, placing it at a competitive disadvantage with products from ICOT and Datastream. Both of

Protocol Computers (PCI) Protocol Converters

PCI Models 1051, 1071, 1076 & 1076X

those companies offer units that can be configured with up to 2 independent high-speed links for communicating with separate processors, or different ports on the 27XX/37XX. In addition, users can switch between processors from the keyboard without losing the session on the switch-from host. The concurrent communication facility is invaluable, for it permits simple interaction between independent hosts without the inconvenience of interrupting a session and dialing up other processors. If you have an application where information is dispersed between different locations/hosts, the lack of a dual communication link makes operation more difficult.

PCI also offers no redundant control logic or power supplies for any of these units. A failure of either component will disable the controller, interrupting communication. While such redundancy is rare with products such as these, a form of it is offered by Datastream.

■ SOFTWARE

Terms & Support

Terms • firmware control bundled into basic system price.

Support • bundled with hardware.

■ HARDWARE

Terms & Support

Terms • offered on purchase basis only.

Support • all products warranted for 90 days from date of delivery • depot maintenance; telephone consulting during normal business hours (California time) • monthly or annual maintenance contracts available; prices shown in this report are for monthly contracts.

Overview

The PCI family is composed of 12 different products providing a myriad of emulation and/or protocol conversion services. The products evaluated in this report—the 1051, 1071, 1076, and 1076X—are designed to allow ASCII terminals/printers to interface with IBM host processors by emulating 3270 or 5251 facilities.

The 1051 emulates the IBM 5251-11 and 5251-12 workstations and the 5256 printer, and interfaces with the IBM System/34 and /38. The 1071 emulates the remote versions of the IBM 3271 controllers, 3277-2 terminals, and 3284 printers, and attaches to IBM System/370, 303X, 43XX, and 8100 mainframes. The 1076 and 1076X emulate the remote 3274C models, 3276-12, 3278-2 terminals, and 3287 printers, and attaches to the same hosts as the 1071.

Other members of the PCI family are the 71B/SNA, which converts 3271 controllers to 3274s; the 75B/SNA, which converts the 3275 controller to appear as a 3276; the 73SX, which emulates the 3274 or 3276, disassembles 7 channels of X.25 packetized data originating from a PCI 1076X, and converts it to SNA/SDLC; the R73SX is essentially the same product as the 73SX but handles only 3 channels; the 74D, a multihost controller that interfaces with a 3274/3276 and allows 7 IBM 3278-2s to access 6 ASCII hosts. Other products are the Videotext 67, a unit that accommodates videotext terminals and emulates the IBM 3767; and the 1067, which also emulates the IBM 3767 and supports up to 7 ASCII devices.

The PCI 1051, 1071, 1076, and 1076X all attach up to 7 terminals/printers in any combination. An eighth printer can also be attached to each terminal via the dynamic terminal facility (see Terminal/Printers section for details). Each controller can interface with only a single host processor at a time, a strong drawback (see Limitations). The 1071, 1076, and 1076X are all remote cluster controllers and interface with the host via a 27XX or 37XX communication processor, or the integrated communication adapter provided by some hosts (see Communications). The 1051 can be configured as a local or remote 5251-like workstation, and interfaces to the workstation I/O ports on a local System/34 or /38, or the host's integrated communication adapter for remote configurations.

The 1051 and 1076 run under SNA/SDLC, while the 1071 employs the BSC protocol. The 1076X is basically a 1076 with an X.25 PAD which assembles the controller's output into an X.25 format for connection to a packet network. At the host site, a PCI 73SX protocol converter disassembles the received packet, converts the data into an SNA/SDLC format, and passes the data directly to host facilities. No 1076X lookalike is employed at the host location. Another product, called the R73SX, can interface an IBM 3274/3276 directly and convert its output to X.25. Again, a 73X performs the disassembly and protocol conversion at the host location.

The PCI converters are delivered with the necessary firmware to execute emulation. The user must configure each asynchronous I/O port according to the type of device interfaced (terminal or printer), the input speed, autospeed, and DTE/DCE mode. Unfortunately, the parameter setups are established by DIP switches and jumpers located on the logic boards under the back cover of the controller, which makes it inconvenient to change parameters often. For ease of operation, port parameter changes should be handled by an ASCII terminal. On the synchronous port, the user establishes the SDLC or TSSC address, number of devices connected, and any timeouts. For X.25 the user must specify the first logical channel number, packet window, packet length, and frame timeouts. Again, DIP switches and jumpers are used for all synchronous settings. Once the controller is in operation, users can conduct tests from an attached terminal via a monitor port.

The PCI controllers will accommodate some 300 different independent models of ASCII terminals and printers. The user specifies the model during the configuration process, and the firmware handles the necessary conversion/emulation services. Each ASCII port can be programmed for data speeds up to 9600 bps for directly attached devices, and from 300 to 1200 bps for dial-in terminals employing autobaud. All terminals/printers must respond to XON/XOFF control signals for flow control.

Converters/Emulators

Model PCI 1051 • tabletop, standalone local or remote cluster controller supporting up to 7 ASCII terminals/printers in any combination • emulates IBM 5251-11 or 5251-12 workstations with attached 5256 printers • RS-232C DTE and DCE interface • remote dial-in with ABR at speeds to 9600 bps • single high-speed link, 9600-bps, SNA/SDLC protocol.

1051-1 • single-port version of PCI 1051:	\$3100 prch	\$30 maint
1051-3 • 3-port version of PCI 1051:	4,500	45
1051-5 • 5-port version of PCI 1051:	5,800	50
1051-7 • 7-port version of PCI 1051:	7,000	65

Model PCI 1071 • tabletop, standalone remote cluster controller supporting up to 7 ASCII terminals/printers in any combination • emulates IBM 3271 with attached 3277-2 terminals and 3284 printers • RS-232C DTE and DCE interface • remote dial-in with ABR at speeds to 9600 bps • single high-speed link, 9600-bps, BSC protocol.

1071-1 • single-port version of PCI 1071:	3,100	30
1071-3 • 3-port version of PCI 1071:	4,500	45
1071-5 • 5-port version of PCI 1071:	5,800	50

PRCH: single-unit purchase price. MAINT: monthly maintenance charge. NA: not applicable. All prices current as of March, 1985.

Protocol Computers (PCI) Protocol Converters

PCI Models 1051, 1071, 1076 & 1076X

1071-7 • 7-port version of PCI 1071:

7,000	65
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Model PCI 1076 & 1076X • tabletop, standalone remote cluster controller supporting up to 7 ASCII terminals/printers in any combination • emulates IBM 3274-C models or 3276-12 with attached 3278-2 terminals and/or 3287 printers • RS-232C DTE and DCE interfaces • remote dial-in with ABR at speeds to 9600 bps • single high-speed link, 9600-bps, SNA/SDLC; X.25 with 1076X.

1076-1 • single-port version of PCI 1076:

3,100	30
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1076-3 • 3-port version of PCI 1076:

4,500	45
-------	----

1076-5 • 5-port version of PCI 1076:

5,800	50
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1076-7 • 7-port version of PCI 1076:

7,000	65
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1076X-1 • single-port version of PCI 1076X:

4,100	30
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1076X-3 • 3-port version of PCI 1076X:

6,000	45
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1076X-5 • 5-port version of PCI 1076X:

7,300	50
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1076X-7 • 7-port version of PCI 1076X:

8,500	65
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Paper CRT Option • provides IBM 3278 or 5251 full-screen edit functions to hard-copy keyboard terminals • available on PCI 1051, 1071, 1076, and 1076X:

450	NA
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Coax Face Option • provides interface between RS-232C cable and RG-62A/U coaxial cable • allows existing coax to be utilized for RS-232C connections employed by most ASCII terminals; allows terminal to be located up to 5,000 feet from controller instead of 50 feet with RS-232C-connected cable • offered with PCI 1051, 1071, 1076, and 1076X:

150	NA
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Graphics Option • allows ASCII terminals with graphics capabilities to be utilized in SNA/SDLC environment; works in conjunction with host graphics package • offered with PCI 1071, 1076, and 1076X:

450	10
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Terminals/Printers

All controllers are delivered with emulation firmware that accommodates most commercially available asynchronous ASCII terminals and printers. The terminals and printers must contain an RS-232C DTE interface, and respond to XON/XOFF control signals for flow control.

Printers must be ASCII serial devices (receive-only, keyboard send/receive, buffered, or unbuffered). Each printer operates as a host-addressable system printer, a shared printer, or a local copy printer. With a special option called the Paper CRT, any ASCII hard-copy keyboard terminal can appear as full-screen IBM 3278-2 or 5251 terminals, and use its editing facilities.

While each PCI controller can attach up to 7 printers, a "dynamic" printer allocation feature allows an additional printer to also be furnished to the 1051, 1071, 1076, and 1076X. The extra printer "timeshares" a port with a terminal. Whenever the dynamic printer is active, the associated terminal cannot be used.

The PCI 1051 emulates the IBM 5251 workstations and the 5226 printer. PCI 1071 emulates the 3277-2 terminal and 3284 printer, while the 1076 and 1076X also emulate the 3287 and the 3278-2 terminal. According to the vendor, all display, editing, and control functions for these devices are supported and implemented via multiple keystrokes.

Communications

All controllers attach up to 7 ASCII terminals/printers via an RS-232C interface at distances up to 50 feet from the controller. Through the Coax Face option, RS-232C devices can connect to RG-62A/U coaxial cable, which allows the terminal device to be located 5,000 feet away.

In addition to supporting directly attached terminals, all controllers will accept remote dial-in over dedicated lines or the public switched network. The controllers have an autobaud detection facility and character format detection, allowing the controller to automatically adjust terminal transmission parameters. Acceptable remote transmission speeds are 300 to 1200 bps; the controllers recognize a 7-bit ASCII character with even parity. Locally connected terminals can operate at 9600 bps. All transmissions are full-duplex.

The 1071, 1076, and 1076X communicate with IBM S/370, 303X, and 43XX processors via 27XX or 37XX communications processors, or integrated communication adapters on the S/370 Models 115, 125, 135, 138, and 4331. Communication is point-to-point under BSC protocol for the PCI 1071 or SNA/SDLC for the 1076. In addition, the 1076X is equipped with an X.25 PAD, which allows ASCII devices to access IBM hosts via public or private data network. The 1076X assembles the controller's output into X.25 packets, and transmits them to a PCI 73SX protocol converter located at the host. This unit disassembles the packets, converts the data to SNA/SDLC, and passes it to the communication controller of the host processor. PCI 73SX handles 8 channels and costs \$5,500.

The 1051 communicates with IBM System/34 or /38 and runs under SNA/SDLC. The directly connected version of the 1051 emulates the IBM 5251-11 and connects to the host's workstation I/O ports. The remote 1051 emulates the 5251-12 and interfaces with the host's integrated communication adapters.

• END