Techland Systems Blue Lynx
Local & Remote Protocol Converters

■ **PROFILE**

Function • emulates IBM 3278/3279 terminals (local and remote Blue Lynx); remote version also emulates IBM 3274C/3276 cluster controllers • local version interfaces with IBM 3274/3276 • file transfer services under control of VM/CMS or MVS/TSO ◦ packaged keyboard emulates IBM PC and 3278/3279.

Packaging • printed circuit card fits into long slot in IBM PC, PC/XT, or compatible models • diskette-resident emulation software • keyboard replaces IBM PC version.

Communications/Networks • local Blue Lynx attaches to IBM 3274/3276 controllers for communication services • remote Blue Lynx emulates IBM 3274C/3276 and attaches to host System/370, 30XX, 43XX, 8100, and 3790 over point-to-point and multipoint lines at speeds to 9600 bps, half-/full-duplex, SNA/SDLC • RS-232C interface.

First Delivery • December 1984 (Local); November 1984 (Remote).

Systems Delivered • approximately 400 local; undisclosed remote.

Comparable Systems • ABM Computer Systems SC-Series, AST Research AST-PCOX/SNA/BSC, Avatar PA100 and PA100 Turbo, CXI Inc CXI 3278/3279, Forte Data Systems PJ3278/3279, DCA Irma, Micro-Integration Coax/Micro/BIS family, Pathway Design PC Path, Persyst Products Coax/3278 and PC/3270/3280/HASP, and Winterhalter DataTalker/PC and Coax.

Vendor • Techland Systems, Inc; 25 Waterside Plaza, New York, NY 10010 • 212-684-7788.

Canadian Distribution • Softsearch Corporation; 488 Wyecroft Road, Oakville, ON L6K 2G7 • 416-842-8240.

**Distribution** • sold through direct sales staff and retail sales outlets.

GSA Schedule • unlisted.

■ **ANALYSIS**

The Techland products are among the leading "protocol" converters that link personal computers (PCs) with incompatible IBM mainframes. Like so many products in this growing marketplace, the Blue Lynx units emulate the facilities and features of the IBM 3270.

The Blue Lynx offerings consist of a Local unit which interfaces with an IBM PC, PC/XT, or compatible models and emulates the display facilities of IBM 3278/3279 terminals. A Remote unit emulates the IBM 3274/3276 cluster controllers as well as the 3278/3279.
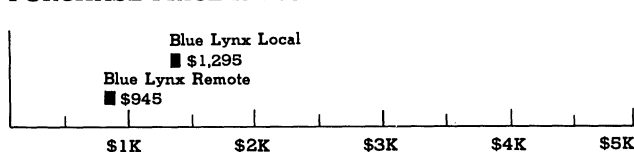
The Blue Lynx series are offered in a local version, which requires the IBM PC to connect to a 3274/3276 and a remote version, which emulates those cluster controllers. Both models emulate the 3278/3279, and include a keyboard specifically modified for 3278/3279 operations.

The Blue Lynx converters—like their competitors—do more than just emulate the characteristics of the IBM terminals/controllers; they also upload/download file data between the mainframe and PC and the converse. That's the principal strength (and difference) of these products.

File transfers involve uploading and downloading of data between the PC and host processor, and are under control of IBM's Conversational Monitor System (CMS) or Time Sharing Option (TSO). While those schemes for transferring files are easiest to use (for nonprogrammers) and require few host processing resources, they tend to be slow and somewhat limited (see Limitations).

A major limitation of the Local unit is its inability to handle communication directly with the host. It requires an IBM 3274/3276 controller to link the personal computer with the IBM mainframe. This could be an expensive proposition, as cited under Limitations.

In addition to the products evaluated in this report, Blue Lynx offers an IBM 5251-12 emulator and a data encryption device called AutoCrypt. The latter is an adapter board that protects the personal computer against inadvertent or deliberate access to tampering with data communication or stored data. Unfortunately, insufficient information was available at this writing to include those products in this report.

The Blue Lynx products compete against a host of protocol converters (see Comparable Systems), but most notably the DCA Irma, Forte PJ, AST Research PCOX and SNA, and the Winterhalter DataTalker/PC and Coax. The Blue Lynx Local offers comparable emulation services with the Forte PJ3278/3279 and AST-PCOX, but is slightly superior to the DataTalker/Coax and slightly inferior to the Irma PC. The Winterhalter product emulates only the IBM 3278 or 3279 Model 2, while the Blue Lynx Local emulates the 3278-2, -3, and -4 or

PURCHASE PRICE RANGE   hardware ▟▄▄▄▄▟

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        Blue Lynx Local
        ▮ $1,295
  Blue Lynx Remote
  ▮ $945
  |____|_____|_____|_____|_____|
     $1K      $2K      $3K      $4K      $5K
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TECHLAND BLUE LYNX SERIES PURCHASE PRICING bar graph covers prices for the basic versions of the Local and Remote products (solid bars) • no options or enhancements are indicated • all prices are single-quantity purchase • maintenance is negotiable.

Techland Systems Blue Lynx
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3279-2A or -2B. Irma PC, on the otherhand, emulates the same terminals as the Local plus the 3279-S3G (7-color) terminal. The Blue Lynx Local, however, comes with a PC-type keyboard modified to provide 3278/3279 functions. Irma has a modified keyboard also, but it costs $329 extra. The other 2 competitors offer no keyboard, but rather map 3278/3279 functions to the PCs.

Blue Lynx Remote is similar to the Winterhalter DataTalker/PC SNA, Irmacom/3270 Emulator, and AST-SNA. All units emulate the remote versions of the 3274 (principally the 51C and 61C models) and the 3276, plus the 3278/3279 terminals. The terminal models emulated by Remote are the same as for Local, so the same advantages and limitations apply. The Blue Lynx Remote is supplied with the same keyboard as furnished with the Local, while the competitors, except the previously noted Irma, have none.

As for price, Blue Lynx lists for more than DataTalker and AST but is less expensive than a comparable-priced Irma. Blue Lynx Local costs $1,295 versus $1,095 for DataTalker/Coax, $1,145 for AST-PCOX, and $1,594 for Irma PC with keyboard. Whether Techland's keyboard is worth the small difference in price is your decision.

The Remote Blue Lynx, priced at $945 with keyboard, is also priced higher than the nonkeyboard Winterhalter DataTalker/PC SNA ($695) and AST-SNA ($895) but less than DCA's Irmacom/3270 with keyboard ($1,224).

If you only need a product that emulates the aforementioned IBM terminals/controllers, there are a host of protocol converters to choose from. In fact, products from Black Box, Datastream, ICOT, Infotron, Local Data, PCI, Micom, and Innovative Electronics, to name a few, can do the same job and support multiple terminals/printers (see survey report 737 for details). Most of those products are standalone boxes, however, which require space on already crowded desks.

A primary reason for buying a Techland, DCA, Forte, AST, etc is to gain the facility to transfer data between the PC and mainframe. Unfortunately, this is not one of Techland's strengths (see Limitations).

□ Strengths

For those requiring only basic terminal/controller emulation, both Blue Lynx products satisfy the application. The Local and Remote versions both emulate the display characteristics of IBM 3278 Models 2, 3, or 4, or the 3278 Models 2A or 3A. The IBM 3278 printer is also emulated and allows a low-cost ASCII terminal to be substituted for the more costly IBM products.

The Blue Lynx Remote also emulates the IBM 3274 or 3276 controllers, saving the user the expense of buying—or attaching to—these fairly expensive products. The Remote unit also operates on a dial-in basis, freeing the user to place the personal computer in any convenient location.

The keyboard furnished as part of the Local and Remote converters is a modified version of the familiar IBM PC unit. The Techland product, however, has been designed to allow experienced IBM 3278/3279 operators to easily adapt to it. The most obvious difference between the 2 keyboards is the placement of the program function (PF) keys. On the PC, 10 PF keys are clustered down the left-hand side of the keyboard and can require multiple keystrokes to effect the operation. With Techland, 24 PF keys are grouped at the top of the keyboard and are single action in 3270 mode. Techland has also grouped most other 3270 keys together in positions familiar to experienced operators. The PC control keys are also grouped together, but not in the same locations familiar to those users.

The Techland keyboard is obviously geared at making the transition for the 3270 operator as easy as possible. While other vendors try to squeeze 40 to 50 extra key functions into the 83 keys on a standard IBM PC keyboard—which requires the operator to learn new patterns and multiple keystrokes—Blue Lynx has opted for simplicity albeit at the cost of size. The Techland keyboard is considerably larger than the PC's, but perhaps the increase in user productivity is worth the extra few inches of desk space.

Another strong feature is the pseudo-device address assignment capability. As is mentioned under Overview, users can assign component addresses such as terminals and printers to disk/diskette storage areas and have the host transfer data as though 6 actual devices were attached. Thus, multiple work sessions can be initiated over a single communication line.

The ability to upload/download files is also a strength but, as noted under Limitations, the method used, TSO and CMS, is a character/line-at-a-time transfer which is too slow for large file transfers.

□ Limitations

When compared with its principal competitors, the Blue Lynx comes up short in advanced capabilities such as fast file transfer and IBM 3270 PC display facilities. Blue Lynx transfers files under control of MVS/TSO or VM/CMS. While this scheme is the simplest to use for a technically unsophisticated user, it is also the slowest means of data transfer at that level.

The principal problem with TSO and CMS is that data is read a character or line at a time by the Editor, which signals back to the personal computer that the uploaded information is acceptable. For interactive applications, this isn't a real problem but for file transfers it's too slow. While actual data transfer rates were not available from Techland, competitive products running TSO and CMS upload at a rate between 55 and 255 cps. For that reason, DCA Irma, Forte PJ, and AST-SNA all offer optional file transfer utilities that bypass the Editor and thus can transfer data in the 2,000 to 4,000 cps range.

Another significant limitation is the lack of a multiwindow facility (a la IBM 3270 PC). Such a capability is extremely useful in program development and data comparison, and also eliminates the screen-erase switching operations required when changing operations. Both DCA and Forte offer this facility.

Minor limitations of the Blue Lynx line are the dependence of the Local unit on the IBM 3274/3276 for communication services, and the inability to interface ASCII terminals. The lack of 3274/3276 local emulation excludes the user of the product in any environment other than an IBM 3270 installation. Apparently, Techland's marketing strategy is based on the assumption that remote users have a more pressing need for such emulation—therefore the Blue Lynx Remote—and that local users have a 3274/3276 port available to them. Maybe so. However, since 3270 shops tend to load up the controller in order to justify its existence, ports might not be available. Therefore, the use of Blue Lynx-equipped personal computers might require the purchase of additional cluster controllers to handle them and the 3274/3276 cluster controllers aren't cheap.

One of the more popular applications for protocol converters is the substitution of low-cost ASCII terminals for expensive IBM offerings. While companies such as Datastream, ICOT, PCI, etc have targeted, and virtually dominate, that market segment, some vendors with products comparable to Techland's are now supporting ASCII terminals. AST and Forte are 2 examples.

You should also note that the Blue Lynx Remote requires a minimum of 198K bytes of RAM, which might affect the number of DOS commands that can be run. You'd be wise to check whether major DOS commands can be executed while in emulation mode.

■ SOFTWARE

□ Terms & Support

Terms • emulation software/firmware bundled into purchase price.

Support • maintenance provided by Techland or end seller • telephone consulting offered by Techland.

□ Utilities

The software utilities, provided as part of the emulation software/firmware, are designed to work with the personal computer and emulate the facilities of an IBM 3278/3279 terminal and 3287 printer. The Blue Lynx Remote also emulates an IBM 3274 or 3276 cluster controller.

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Two other services provided are file transfer and pseudo-device declaration and control. The file transfer facilities allow users to upload/download files between the host and mainframe, and the converse, under control of IBM TSO (Time Sharing Option) or the Conversational Monitor System (CMS). Both schemes, however, can be slow (see Limitations).

The pseudo-device facilities allow the user to assign component addresses corresponding to terminals and/or printers, but with the data actually going to a disk/diskette. This is especially useful for applications requiring concurrent data transfer and personal computer applications (see Strengths). Up to 6 pseudo-devices can be accommodated.

■ HARDWARE

□ Terms & Support

Terms ● offered on a purchase basis only ● discounts available.

Support ● maintenance provided by Techland or end seller ● telephone consulting offered by Techland.

□ Overview

Both Blue Lynx models allow the IBM PC, PC/XT, and compatible products to communicate with IBM mainframes. The Blue Lynx Local consists of a printed circuit board and emulation software that permits the PC to emulate the display characters of an IBM 3278 or 3279 terminal, plus an IBM 3287 printer. In addition, the vendor supplies as part of the emulator purchase price, a keyboard with both PC and 3278/3279 key layouts. The Local board has no data communication capabilities; it requires the PC to attach via coaxial cable to an IBM 3274/3276 cluster controller.

The Blue Lynx Remote links a remote (from the host) PC to a mainframe without need for an IBM 3274/3276. The Remote accomplishes this by emulating the communication characteristics of those remote controllers, plus it performs the display emulation of the 3278/3279 terminals and 3287 printer just like the Local Blue Lynx. The Remote also comes with the same keyboard furnished with the Local.

Techland supports both products with a file transfer facility which runs under VM/CMS or MVS/TSO. Both, however, are limited to screen-at-time transfers and thus are fairly slow (see Limitations).

The Remote version allows users to specify pseudo terminals, printers, and pseudo printers (data to disk instead of actual components) up to a combination of 6 devices. For an additional price, up to 32 devices can be supported. The additional devices allow the user to concurrently print, run a job, and edit with one terminal.

The Techland keyboard is actually an IBM design which is based on an IBM PC keyboard with keys added for 3270 terminal emulation. The layout is similar to the 3270 because the vendor feels that the user will make fewer mistakes if certain actions have dedicated keys. For example, there are 2 cursor movement pads to help prevent errors that can occur when the numlock key is toggled the wrong way. The 3270 Program Function (PF) keys are

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PRCH: single-quantity purchase price. NA MAINT: not applicable. Prices current as of June 1985.

emulated through a dedicated set of keys at the top of the keyboard, similar to those with the 3278/3279 keyboards.

In addition to normal PC/3270 keyboard functions, Techland allows the user to reconfigure the meaning of some of the keys. Through the use of a MAP routine, the entire keyboard can be redefined. As part of the standard MAP routine, 9 foreign language characters can be mapped to the keyboard.

□ Converters/Emulators

Blue Lynx Local ● printed circuit card plugs into IBM PC, PC/XT, or compatible models running under PC-DOS 1.1 or higher ● emulates IBM 3287 printer plus 3278-2, -3, -4 and 3279-2A or -3A (4-color) terminals; includes PC keyboard with an 83-key 3278/3279 typewriter layout ● coaxial (direct) connect to IBM 3274/3276 ● file transfer under VM/CMS or MVS/TSO ● requires 96K (DOS 1.1) or 128K (DOS 2.0) bytes of RAM and at least 1 diskette for emulation software:

$1,295 prch	**NA maint**

Blue Lynx Remote ● printed circuit card and software for emulating IBM 3270 controllers and terminals ● printed circuit card plugs into IBM PC, PC/XT, or compatible models running under PC-DOS 2.0 or higher ● emulates IBM 3274C/3276 controllers with 3278-2 or 3279-1A terminals and 3287 printer attached; includes PC keyboard with 3278/3279 layout ● remotely attaches to IBM System/370, 30XX, 43XX, 8100, or 3790 over point-to-point or multipoint lines at 9600 bps half-/full-duplex ● SNA/SDLC ● RS-232C ● file transfer under VM/CMS or MVS/TSO ● requires 198K bytes of RAM and at least 1 diskette for emulation software:

945	**NA**

□ Terminals/Printers

Both Blue Lynx products are designed to link IBM PC, PC/XT, or compatible models with IBM mainframes or host processors. To accomplish this, both the local and remote versions of Blue Lynx emulate the IBM 3278 or 3279 terminals. The remote version also emulates the 3274C remote cluster controllers as well as the 3276.

Printer emulation is offered only by the Blue Lynx Remote, and permits any ASCII printer to be attached to the personal computer via an RS-232C interface and appear to the host as an IBM 3287 dot-matrix printer.

□ Communications

The Blue Lynx Local requires the IBM 3274/3276 controllers for communication support. Those controllers attach to the IBM System/370, 30XX, 43XX, 8100, and 3790 processors over point-to-point and multipoint lines at speeds up to 9600 bps, half-/full-duplex, SNA/SDLC. Locally attached controllers transfer data at 56K bps. For a description of the IBM 3274/3276 controllers, see report 950-I048-3270.

Blue Lynx Remote emulates the IBM 3274C and 3276 remote cluster controllers, and transmits data to the host via point-to-point or multipoint lines at speeds from 110 to 9600 bps, half-/full-duplex, SNA/SDLC. Connection to host facilities is via RS-232C.

● **END**

Teleray Display Terminals
Series 7, 16 & 20 Buffered Terminals

■ PROFILE

Function ● microprocessor-controlled, buffered multipage, nonprogrammable ASCII terminals ● ANSI X3.64 compatible (all models); DEC VT102 compatible (all models); Data General D210 compatible (7-DDG and 20-DDG); DEC VT220 compatible (20-DDG); Esprit 1510 compatible (7-DHZ); Hewlett-Packard 2622/2624 compatible (7-DHP); Honeywell VIP 7301/7303 compatible (7-7300); Honeywell 7305 compatible (20-7305); Honeywell 7801 compatible (16-7801) ● APL and graphics models (16-APL and 16-GRF, respectively) ● Tektronix Plot 10, 4010/4014 graphics software option (Series 7 and 20).

Architectures Supported ● any architecture supporting any ASCII terminal.

Communications ● half-/full-duplex, asynchronous, 50 bps to 19.2K bps ● point-to-point ● character, line, block transmission modes ● RS-232C, RS-422, and 20-mA current-loop interfaces ● second RS-232C bidirectional port allows printer or second host processor attachment.

Operating Systems ● none.

Database Management ● none; only in association with host facilities.

Transaction Processing Management ● none; only in association with host facilities.

Support Software ● none; only in association with host processor.

Processor ● display-oriented control and communication functions ● local/remote initiated printing.

Terminals/Workstations ● single keyboard ● 1920-character display plus 25th line; horizontal smooth scrolling up to 255 columns ● bidirectional auxiliary RS-232C port for second host or local printer attachment.

First Delivery ● 1982 (Models 7, 7-DEC, 7-DDG, 7-7300, 16, 16-APL, 16-GRF, 16-7801); 1985 (Models 7-DHP, 7-DHZ, 20-DDG, 20-7305).

Systems Delivered ● approximately 50,000.

Comparable Systems ● competitive with a number of ASCII display terminals, typically DEC VT100/200 Series, Anderson-Jacobson 510/520, Beehive DM and ALT Series, Datagraphix

The 20-DDG is a new addition to the Teleray terminal line-up that includes a standard 14-inch screen, optional Tektronix 4010/4014 graphics support, and emulates DEC VT220 and Data General D210 terminals.

132, Esprit and Exec 80, Honeywell (HIS) VIP 7801 and 7300, Lear Siegler ADM Series, ADDS Viewpoint Series and Model 25, IBM 3101, Televideo 900 Series, and Data General D210.

Vendor ● Teleray, Division of Research Inc; Box 24064, Minneapolis, MN 55424 ● 612-941-3300.

Canadian Distribution ● none.

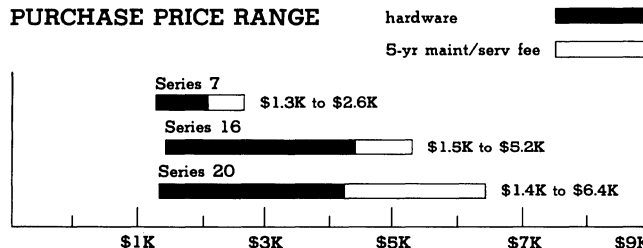**Distribution** ● through distributors and direct sales staff.

GSA Schedule ● listed.

■ ANALYSIS

In an effort to provide a cohesive approach for handling multihost environments, Teleray has added 4 new multiprotocol models to its display terminal family. Additions to the 7 Series include Models 7-DHP and 7-DHZ. Model 7-DHZ is compatible with DEC VT102 and Esprit 1510 terminals while the new 7-DHP offers DEC VT102 and Hewlett-Packard 2622/2624 compatibility. No changes occurred across the 16 Series line but the older 100 Series was dropped. In addition, a new DEC VT220-compatible series has been introduced and currently comprises Models 20-DDG and 20-7305. The 20-DDG emulates both DEC VT220 and Data General 210 units and the 20-7305 provides both DEC VT220 and Honeywell VIP 7305 emulation.

Teleray terminals maintain as somewhat low-profile position in the ASCII display terminal marketplace despite the fact that they are highly versatile devices. These display terminals provide cost-effective replacements for a variety of prominent terminals from leading vendors including DEC, Data General, Hewlett-Packard, Honeywell, and IBM. In addition to supporting other protocols, Teleray terminals are also equipped with an ANSI X3.64 compatible control mode. ANSI standard compatibility further extends system flexibility and presents a distinct advantage to users with a multivendor equipment policy. Teleray terminals also support a wide array of sophisticated features for extensive application flexibility. For instance, all Teleray terminals contain provisions for multiple keyboard formats, nonvolatile

PURCHASE PRICE RANGE

hardware ████████████

5-yr maint/serv fee ☐_____☐

Series 7
████☐ $1.3K to $2.6K

Series 16
☐ $1.5K to $5.2K

Series 20
████████☐ $1.4K to $6.4K

| $1K | $3K | $5K | $7K | $9K |

TELERAY SERIES 7, 16 & 20 PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for hardware products (solid bar) and associated 5-year maintenance ● **small Series 7** consists of Model 7 basic keyboard-display with 4K-byte buffer; **large** of Model 7-7300 with additional 4K-byte buffer storage ● **small Series 16** consists of Model 16 basic keyboard-display with 8K-byte buffer; **large** of Model 16-GRF graphics terminal with additional 8K-byte buffer storage ● **small Series 20** consists of Model 20-DDG keyboard-display with 2K-byte buffer; **large** of Model 20-7305 keyboard-display with additional 2K-byte buffer storage and Tektronix Plot 10 4010/4014 graphics option.

Teleray Display Terminals
Series 7, 16 & 20 Buffered Terminals

function keys, programmable control sequences, and programmable page formats. The addition of a medium-resolution business graphics capability based on Tektronix Plot 10 4010/4014 software option for the entire line-up enables users to convert numerical data to graphic or tabular format. Furthermore, Teleray terminals offer unique display characteristics. They are the only terminals (to our knowledge) which allow the user to enter and store a line up to 255 columns wide. (Most terminals in this class display 80-column lines and many are now supporting up to 132 columns.)

The Teleray display terminal line-up consists of 13 functional models, all of which are ANSI compatible and are offered in multiprotocol versions.

All Teleray units fall into a class called buffered editing terminals, which means that screen-data pages can be locally stored and edited with no intervention from the host processor. These facilities are among the strong points of the product, and are discussed under Strengths.

The data editing and formatting capabilities are typical to the industry with an exception: users may reinstate a last-deleted line or word. This time-saver can be easily appreciated by operators who have had to rekey an entire line due to inadvertent line or character deletion.

The 255-column capability, as was noted, is unique. Teleray implements it by mapping its standard 4-page scrolling buffer from 20 to 255 characters on the X-axis and 400 lines on the Y-axis. As users expand on the X-axis, the number of storable lines decreases correspondingly. For example, an 80-column entry could be up to 96 lines deep, which corresponds to 4 pages. A 132-column entry allows 59 lines or a little under 2.5 pages. A 255-column entry can only be 30 lines deep. All of these line depths double when the optional 4 pages are added. After pages exceeding 80 columns are entered, the screen is scrolled horizontally. Thus, a user would establish horizontal headings and scroll the data. This arrangement is ideal for applications with a wide range of values for each category displayed.

All of this operating flexibility increases unit cost. While the Teleray units are not the most expensive on the market, they are priced above other editing terminals such as the Televideo 900 series, ADDS Viewpoint 90, and Beehive ALT series. Of that group, only the ALT-008 has a greater local storage capacity (72 2K-byte pages versus eight 2K-byte pages for the Model 16).

□ Strengths

The principal strength of the Teleray terminal product line lies in its versatile support of various vendor's protocols. At the present moment, these terminals offer cost-effective alternatives to users of DEC, Data General, Hewlett-Packard, Honeywell, and Esprit systems. An IBM 3101-compatible model is currently being readied for October 1985 delivery. The vendor has also indicated that additional Honeywell and Hewlett-Packard-compatible versions are in the development stages. Multiple keyboard formats ranging from the Teleray general-purpose keyboard to DEC VT220 compatible and Honeywell multifunction keyboards further enhance the flexibility of Teleray's terminals. In addition, all Teleray models support ANSI compatibility which is a significant user benefit and will undoubtedly appeal to users operating in a multivendor environment.

Additional advantages can be derived from the new Triumph enclosure which sports a standard 14-inch CRT display and the Tektronix 4010/4014 graphics option. The majority of the competing products provide standard 12-inch displays with 14-inch screens available as an extra-cost option. Available for all models, the Tektronix 4010/4014 Plot 10 graphics support provides users with medium-resolution business graphics for improving presentations and aiding in the analysis of graphic and chart information. Presently, competing vendor DEC, does not provide any similar provision on its DEC VT220 contender.

Other strengths of the product line are local storage/editing emulation; multihost attachment; and a 255-column display. Local storage and editing are beneficial features that provide operating flexibility. The facility to store pages within the terminal and recall them on demand increases performance and is a convenient and effective alternative to maintaining data at the

host and retrieving it via the communication facility. In a shared communication environment cluttering the line with page transfers is inefficient and also delays other users who have more productive work. The facility to edit data locally also frees the communication facility. Depending on the Teleray model selected, users can store up to eight 2K-byte pages locally with the extended storage facilities.

The ASCII terminal emulation available with Model 7 allows that terminal to emulate another terminal's control characters plus operate in native mode, a significant benefit to users operating in a multivendor environment. For example, a user could program the terminal to emulate a Televideo 925 and switch between that mode and Model 7 mode directly from the keyboard.

The multihost attachment further adds to the utility of the terminals. Through the serial bidirectional RS-232C auxiliary interface on Models 7 and 16, the user can attach a **second host** to the terminal and interact with it by switching lines. Users can select between hosts via a keyboard command, or switching can be controlled via a host. Simultaneous host interaction is not permitted, and only the host currently "in-session" with the terminal can initiate host switching. The 2 host connections can be supported via local facilities, remote leased lines or the DDD network.

As an alternative to using the bidirectional auxiliary port available on all models for a second host processor, the port can be used on all models to attach a local printer. The advantage of this bidirectional buffered port is that it allows data from a host processor to be directed to the printer without first passing through the terminal's screen. Thus, terminals operating in block or nonechoed modes can continue to have data keyed to the screen during a print operation.

□ Limitations

While the 255-column line feature is beneficial for some applications, its usefulness is impaired by the 80-column limitation of the display itself. Any column from 81 and up must be horizontally scrolled before it can be displayed. One of the principal advantages of extended columns is that they easily handle such applications as multiple-headed spreadsheets and inventory listings. However, the user will not be able to print-out these extra-wide spreadsheets or inventory listings and is restricted by the 80-column display standard to a visual examination of the lengthy document. Although a unique feature, the 255-column line capability is probably seldom used.

The Teleray series of terminals are not upgradable across the product line. Therefore, a user cannot buy an 80-column Series 7 model and later upgrade to a 132-column Series 20 model. One of Teleray's chief competitors, DEC, does provide such an upgrade facility with its VT100.

At the present time, the Teleray line-up lacks a color model. Both DEC and ADDS have incorporated color display models into their current product lines for enhanced graphics viewing and increased operator productivity.

■ COMMUNICATION FACILITIES OVERVIEW

All terminal models operate in half-/full-duplex transmission modes over switched or dedicated facilities at asynchronous speeds of 50 bps to 19.2K bps. Online modes are point-to-point communication, keyboard-to-line/-display, line-to-display, line-to-printer, display-/buffer-to-line, and line-to-buffer/display/printer. Transmission modes are character/line/block. Terminals are equipped with an RS-232C DTE/DCE interface; 20-mA current-loop and RS-422 interfaces are optional.

A second host processor can be attached via the bidirectional RS-232C auxiliary interface supplied with all models. Two hosts cannot be active simultaneously, and switching between them is accomplished via the keyboard or by the "in-session" host (see Strengths). The second host can be a local or remote processor. Communication is via leased lines or the DDD network.

■ SOFTWARE

□ Operating System

None; firmware controls all functions.

Teleray Display Terminals
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■ HARDWARE

□ Terms & Support

Terms • terminal models are available for purchase or on 1- or 2-year lease • quantity discounts available.

Support • all purchased products warranted for 90 days • on-site maintenance by special arrangement only; user normally phones in description of problem via 800 number and, if necessary, vendor ships a new plug-in module with corrections • flat yearly maintenance fee of $150 covers module exchange for purchased units; maintenance included on rentals.

□ Overview

The Teleray terminal family consists of 13 ANSI models, all of which operate in character, line, and block modes. All terminals display 96 ASCII characters, 32 control characters, 64 mosaic graphics, 64 line drawings, and special symbols. All terminals operate in half-/full-duplex modes at speeds of 50 bps to 19.2K bps over switched or dedicated lines. All are ANSI X3.64 compatible.

Series 7, the lowest-priced line-up, displays 1920 characters (24 lines x 80 columns) and supports 128 ASCII character set plus 64 line drawing and scientific characters and 64 mosaics. This series allows lines up to 255 columns and employs horizontal scrolling to display data beyond 80 columns. All versions are based on the Model 7 which is a buffered editing terminal and contains a 4K-byte scroll buffer; a 4K additional buffer is optional. Thus, up to four 24-line x 80-column "pages" can be stored locally and vertically scrolled. Each model also contains a bidirectional RS-232C auxiliary port which allows attachment of a local printer, or permits the terminal to interface with a second host processor. ANSI compatibility is standard on all models. Series 7 models include versions that emulate DEC VT102, Data General D210, Honeywell VIP 7300, Hewlett-Packard 2622/2624, and Esprit 1510 terminals.

Series 16 terminals, also buffered editing terminals, have many of the same facilities as Series 7 units. All 4 support 1920-character displays, permit 255-column lines to be produced and horizontally scrolled, and have a bidirectional auxiliary RS-232C port for attaching a local printer or a second host processor. Series 16 models, however, have an 8K-byte scroll buffer with an 8K-byte option allowing up to eight 24-line x 80-column pages to be stored locally. Series 16 models support ANSI compatibility and include a separate model that emulates Honeywell's 7801 terminal as well as a model that supports the APL character set and a model that incorporates Tektronix 4010/4014, Plot 10 graphics software.

Series 20 represents the newest addition to Teleray's terminal offerings and currently encompasses Models 20-DDG and 20-7305. The new 20-DDG provides a product alternative to DEC VT220 and Data General D210 terminals while the 20-7305 is intended to replace Honeywell VIP 7305 terminals.

All 13 Teleray terminals employ a typewriter-style keyboard with separate numeric key cluster. The programmable functions, however, are different. Series 7 and 16 support 32 nonvolatile variable-length programmable functions of which 5 are on dedicated keys. In addition, 32 macro keys provide 64 nonvolatile programmable 8-character mini-functions. Series 20 models feature nonvolatile variable programming functions, 5 of which are on dedicated keys. In addition, all 106 keys on the 20-DDG keyboard and 112 keys on the 20-7305 keyboard can be recoded to provide approximately 200 customized functions for special applications.

Users may order any terminal in a C-Enclosure (called the Executive enclosure) which attaches its 9-inch CRT to a shaft for easy pivoting. The Triumph enclosure is the standard configuration and includes a 14-inch CRT and tilt/swivel base. The Rackmount enclosure consists of a 12-inch CRT in a standard 19-inch-wide EIA panel.

□ Model Packages

Model 7 Buffered Editing Terminal • keyboard display ASCII terminal with 12-inch CRT; displays 1920 characters at 24 lines x 80 columns • 2 operating modes—ANSI and user-definable controls • 128 ASCII character set, plus 64 line drawing and scientific characters and 64 mosaics • oversize characters, to quad wide/double high • up to 255-column lines can be produced and vertically scrolled • variable character matrix in 8x10 cell, plus contiguous graphics • 4K-byte scroll memory, expandable to 8K • detached typewriter-style keyboard with separate numeric key cluster • 32 nonvolatile variable length programmable functions, 5 on dedicated keys • 32 macro keys, providing 64 nonvolatile programmable 8-character minifunctions • 5 display attributes • 7 area qualifiers • smooth horizontal and vertical scrolling • 25th status/message/set up line • protect mode • monitor mode • calculator • time of day/elapsed time clock • screen saver • programmable (musical) operator alerts • half-/full-duplex at 50 to 19.2K bps • 256-byte receive buffer; character/line/block/local modes • buffered bidirectional auxiliary port • RS-232C communication interface; RS-422 and 20-mA current-loop optional • standard product has volatile display memory; nonvolatile, optional:

	$87 mo	$1,295 prch	$12.50 maint

Model 7-DEC • identical to Model 7, with added DECVT102-compatible operating mode:

	87	1,370	12.50

Model 7-DDG • identical to Model 7-DEC with added Data General D210-compatible operating mode:

	97	1,525	12.50

Model 7-DHP • identical to Model 7-DEC with added Hewlett-Packard 2622/2624-compatible operating mode:

	103	1,595	35.00

Model 7300 • identical to Model 7-DEC, with added Honeywell VIP 7300-compatible operating mode:

	109	1,720	12.50

Model 7-DHZ • identical to Model 7, with added Esprit 1510-compatible operating mode:

	85	1,335	12.50

Model 16 Buffered Editing Terminal • keyboard display ASCII terminal with 12-inch CRT; displays 1920 characters at 24 lines x 80 columns • 128-character ASCII set, plus 64 line drawing and scientific characters and 64 mosaics • up to 255 column lines can be produced and vertically scrolled • variable character matrix in 8x10 cell, plus contiguous graphics • 8K-byte scroll memory, expandable to 16K • detached typewriter-style keyboard with separate numeric key cluster • 32 nonvolatile variable length programmable functions, 5 on dedicated keys • 32 macro keys, providing 64 nonvolatile programmable 8-character minifunctions • 5 display attributes • 4 area qualifiers • smooth horizontal and vertical scrolling • 25th status/message/set up line • protect mode • monitor mode • calculator • time of day/elapsed time clock • screen saver • half-/full-duplex, at 50 to 19.2K bps • 256-character receive buffer • character/line/block/local modes • buffered bidirectional auxiliary port • RS-232C communication interface; RS-422 and 20-mA current-loop optional • standard product has volatile display memory; nonvolatile, optional:

	97	1,545	12.50

Model 16-APL • identical to Model 16, with added 96-character APL operating mode with true character overstriking, plus 32 sub-/superscript characters:

	110	1,745	12.50

Model 16-7801 • identical to Model 16, with added Honeywell VIP7801-compatible operating mode • 2K-byte receive buffer • 8K-/16K-byte scroll memory in ANSI mode only:

	119	1,895	12.50

Model 16-GRF • identical to Model 16, with added Tektronix 4010/4014/Plot 10-compatible graphics software:

	173	2,740	12.50

MO: monthly 1-year lease including maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for factory service. NC: no charge. NA: not available. All prices single quantity. Prices current as of August 1985.

Teleray Display Terminals
Series 7, 16 & 20 Buffered Terminals

Model 20-DDG ● keyboard display ASCII terminal with 14-inch CRT; displays 1920/3168 characters at 24 lines x 80/132 columns ● 96-character ASCII set, plus 64 control, 64 mosaic, 64 line drawing, and 94 downloadable characters ● up to 255 columns can be produced and horizontally scrolled ● variable character matrix in 10x12 cell ● 2K-byte scroll memory, expandable to 6K ● detached typewriter-style keyboard with separate numeric key cluster ● 20 programmable functions, 5 on dedicated keys ● entire keyboard (106 keys on 20-DDG and 112 keys on 20-7305) can be redefined to provide approximately 200 (20-DDG) and 220 (20-7305) programmable keys for custom applications ● 5 display attributes ● 4 area qualifiers ● smooth horizontal and vertical scrolling ● 25th status/message/set-up line ● protect mode ● monitor mode ● calculator ● time of day/elapsed time clock ● screen saver ● split-screen operation ● half-/full-duplex, at 50 to 19.2K bps ● 768-character receive buffer ● character/line/block/local modes ● buffered bidirectional auxiliary port ● RS-232C communication interface; RS-422 and 20-mA current-loop optional ● standard product has volatile display memory; nonvolatile optional:

90	1,395	35.00

Model 20-7305 ● same as 20-DDG but does not support downloadable character set ● supports DEC VT102 Honeywell VIP 7305-compatible operating modes only:

110	1,695	35.00

Tektronix Plot 10 Graphics Option ● provides all Teleray terminal models with Tektronix 4010/4014 operating mode compatibility for generating medium-resolution business graphics:

NA	1,095	NC

☐ CPU & Memory

All terminals are microprocessor controlled. Volatile and nonvolatile (battery-backed) RAM used for page scroll buffers and nonvolatile RAM for user-programmable functions; operating parameters maintained in CMOS. Firmware controls terminal functions.

Memory can be user-configured to suit the application. User-selectable parameters include line length, page length, and split-screen window size. Logical line length can be any number of characters from 20 through 255. The display line is fixed at 80 columns; shorter lines appear left justified with unusual character positions on right automatically blanked. If line length exceeds 80 columns, smooth horizontal scrolling advances each column on the display. Such scrolling is nondestructive.

Logical page length varies with horizontal line length. For example, an 80-column line could be 96 lines deep—with the standard 4-page memory—and double that with 8 pages. A 255-column line can be 30 lines deep with 4-page memory and double that with 8 pages. Teleray permits any unused nonvolatile display memory to be employed for dynamic program functions.

2-Page Volatile Memory Expansion ● adds additional 2 pages (4K bytes) of scroll memory to Series 7 models and Models 20-DDG and 20-7305:

NA mo	$155 prch	NC maint

4-Page Volatile Memory Expansion ● adds additional 4 pages (8K bytes) of scroll memory to Models 16, 16 APL, 16 GRF, and 16-7801:

NA	175	NC

2-Page Nonvolatile Memory Expansion ● provides 2 pages (4K bytes) of nonvolatile scroll memory to Models 20-DDG and 20-7305:

NA	195	NC

4-Page Nonvolatile Memory Expansion ● provides 4 pages (8K bytes) of nonvolatile scroll memory to Series 7 models (except for 7-DHP) and Series 16 models:

NA	195	NC

8-Page Nonvolatile Memory Expansion ● provides 8 pages (16K bytes) of nonvolatile memory to Series 16 models:

NA	345	NC

☐ I/O & Communications

All models operate in half-/full-duplex modes at selectable speeds of 50/75/110/134.5/150/300/600/1200/1800/2400/3600/4800/7200/9600 and 19.2K bps. Character format selectable as 7 or 8 bits with odd, even, or no parity, or mark or space. Online operating modes are point-to-point communication, keyboard-to-line/-display, line-to-display, line-to-printer, display-/buffer-to-line, and line-to-buffer/display/printer. All models are equipped with an RS-232C interface. As an option, users can select a 20-mA current-loop or RS-422 interface. When configured with 20-mA current-loop interface, the RS-232C interface still functions. A second host processor connection can be made via the terminal's bidirectional RS-232C port. Processor switching is initiated either via the keyboard or from the "in-session" processor. Second host can be local or remote processor.

All terminals provide a programmable 20-character auto-answer feature. All can employ jump or smooth scrolling of input data. Smooth vertical or horizontal scrolling of display data is scrolled at 6 or 12 lines per second. The capacity of the input/output buffer is 256 characters; DC1 (XON) and DC3 (XOFF) control signals prevent buffer overflow. Buffer overflow is safeguarded in 3 phases: when the buffer reaches 32 characters, the first DC3 is issued; a second DC3 is raised at 112 characters; and at 128 characters smooth scrolling is discontinued in favor of jump scrolling.

When the I/O buffer drops to 16 characters, a DC1 is issued and smooth scrolling/normal data flow resumes.

A total of 11 terminals operate in remote and local modes. In remote mode, character or block transmission can be selected; local echo can be invoked for character transmission. In local mode, keyed data is entered in the scroll buffer and displayed, but not transmitted.

Current-Loop Interface ● optional 20-mA current-loop interface for all models ● allows terminal to be located up to 1,000 feet from host:

NA mo	$60 prch	NC maint

RS-422 Interface ● optional RS-422 interface for all models ● allows terminal to be located up to 4,000 feet from host:

NA	70	NC

☐ Disk

No disk/diskette is supported.

☐ Terminals/Workstations

The entire family offers identical features in display, editing, and formatting functions. The major differences are in the display scroll buffer storage limit, the receive (I/O) buffer, terminal compatibility, and displayable characters.

A Scroll buffer capacity varies with models. Series 7 models have a 4K-byte scroll buffer, with 4K optional. Series 16 models contain 8K bytes and can be expanded to 16K bytes. Models 20-DDG and 20-7305 have a 4K-byte scroll buffer with 4K optional.

The receive buffer on all models except the 7-HNY, 16-7801, 20-DDG, and 20-7305 is 256 characters. Both 20-DDG and 20-7305 support a 768-character receive buffer. Flow control is handled by DC1 (XON) and DC3 (XOFF) control characters. Models 7-HNY and 16-7801 have a 2K-character I/O buffer, and flow control is also handled by the same control characters.

All models provide 96 ASCII, 32 control, 64 mosaic graphic, and 64 line-drawing characters. In addition, the Model 16-APL furnishes 96 APL characters and 32 sub-/superscript characters.

Every terminal can accommodate lines up to 255 columns. Of these, only 80 columns can be displayed at one time with the remainder horizontally scrolled. Such a display capability is unique and extremely useful in handling applications with a wide range of values for each heading.

Another notable facility offered with all terminals is the high number of user-programmable functions permitted. Series 7 and 16 models support up to 32 keys can be used for macro-coded functions, with each key shiftable for a total of 64 functions. Series

Teleray Display Terminals
Series 7, 16 & 20 Buffered Terminals

20 models support up to 20 programmable function keys. However, the keyboards on both 20-DDG and 20-7305 can be recoded to handle specialized applications. The keys used for macro coding, incidentally, normally provide editing functions such as character/line insert and delete, line erasing, memory clearing, cursor control, and numeric functions.

Operating parameters on all terminals are soft configured via the keyboard. Users can display a 66-line menu of parameters, or individual parameters can be diplayed on the 25th line of the screen.

Configuration ● tabletop keyboard-display with typewriter-style keyboard and separate number keypad ● each terminal accommodates a local serial printer.

Display ● 14 inches diagonal ● displays 1920/3168 characters at 24 lines x 80/132 columns; 255-column line capability ● 96 ASCII character set, 32 control characters, 64 mosaic graphic characters, and 64 line-drawing characters; 96 APL characters on Model 16-APL ● double-width/double-size characters (all models); quad-width/quad-size characters (20-DDG & 20-7305).

Edit & Format Features ● common features for all terminals include cursor up, down, left, right, home ● line feed/new line; next line ● index/reverse index ● tab forward/backward ● erase character, EOL, EOP ● insert/delete character/line ● reinstate last deleted line or word ● horizontal/vertical scrolling; smooth/jump/no scrolling ● split screen ● automatic character wraparound ● N-key rollover ● dim, blink, blank, underline, and reverse video ● auto-repeat keys ● protected fields.

Peripherals ● buffered, bidirectional RS-232C interface supports local printer attachment ● input from terminal or host processor.

□ Printers

Teleray offers no printer for any member of the family, but does provide a buffered, bidirectional RS-232C port for attaching a serial printer. The bidirectional feature bypasses the CRT screen when data transmitted from the host processor is directed to the attached printer, so that users can continue to key data for transmission during a print operation. This is a substantial performance boost and user benefit, as mentioned under Strengths.

● END

Teleray Display Terminals
Series 7, 16 & 100 Buffered Terminals

■ PROFILE

Function ● microprocessor-controlled, buffered multipage, nonprogrammable ASCII terminal ● APL and graphics models ● ANSI X3.64 compatible.

Architectures Supported ● any architecture supporting any ASCII terminal ● Model 7 emulates any ASCII terminal.

Communications ● half-/full-duplex, asynchronous, 50 bps to 19.2K bps ● point-to-point ● character, line, block transmission modes ● RS-232C, RS-422, and 20-mA current-loop interfaces ● second RS-232C bidirectional port allows printer or second host processor attachment.

Operating Systems ● none.

Database Management ● none; only in association with host facilities.

Transaction Processing Management ● none; only in association with host facilities.

Support Software ● none; only in association with host processor.

Processor ● display-oriented control and communication functions ● local/remote initiated printing.

Terminals/Workstations ● single keyboard ● 1920-character display plus 25th line; horizontal smooth scrolling up to 255 columns ● bidirectional auxiliary RS-232C port for second host or local printer attachment.

First Delivery ● 1982.

Systems Delivered ● not available.

Comparable Systems ● competitive with a number of ASCII display terminals, typically DEC VT100 Series, Anderson-Jacobson 510/520, Beehive DM and ALT Series, Datagraphix 132, Esprit and Exec 80, Honeywell (HIS) VIP 7801 and 7300, Lear Siegler ADM Series, ADDS Viewpoint Series and Model 25, IBM 3101, Televideo 900 Series and Data General D200.

Vendor ● Teleray, Division of Research Inc; Box 24064, Minneapolis, MN 55424 ● 612-941-3300.

Distribution ● through distributors and direct sales staff.

PURCHASE PRICE RANGE

hardware ▬▬▬▬▬

5-yr maint/serv fee ▭▭▭▭▭

Model 7
▬▬▬▭ $1.3K to $2.9K

Model 16
▬▬▬▬▭ $1.5K to $4K

Model 100
▬▭ $1.4K to $2.3K

| $1K | $2K | $3K | $4K | $5K |

TELERAY MODELS 7, 16 & 100 PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for hardware products (solid bar) and associated 5-year maintenance ● small Model 7 is basic keyboard-display with 4K-byte buffer; large Model 7 is Honeywell VIP 7300-compatible (Model 7-HNY) with 4K bytes of optional buffer storage ● small Model 16 is basic keyboard-display with 8K-byte buffer; large system is Model 16-GRF graphics terminal with Tektronix 4014 graphics software and 8K bytes of optional buffer storage ● small Model 100 is basic keyboard-display with 2K-byte buffer storage; large system is Model 100-DHZ Hazeltine 1510-compatible terminal with 2K-byte buffer storage ● all prices are single quantity purchase; volume discounts available.

■ ANALYSIS

The Teleray Series 7, 16, and 100 are ASCII buffered character- or block-mode terminals with typical editing and data communication facilities, but with unusual display characteristics. It is the only terminal (to our knowledge) which allows the user to enter and store a line up to 255 columns wide. (Most terminals in this class permit 80-column lines, and a few will handle up to 132 columns.) The 255-column feature is a benefit for the Teleray user, described under Strengths.

The 7, 16, and 100 families consists of 11 functional models, all of which are available in 9-, 12-, and 15-inch CRT configurations and are rackmountable. All are ANSI compatible, and all are offered in versions which emulate many of the leading terminals. For example, the Model 7 is offered with DEC VT102, Data General 200, Honeywell VIP 7300, or Hazeltine 1510 operating compatibility.

All Teleray units fall into a class called buffered editing terminals, which means that screen-data pages can be locally stored and edited with no intervention from the host processor. These facilities are among the strong points of the product, and are discussed under Strengths.

The data editing and formatting capabilities are typical to the industry with an exception: users may reinstate a last-deleted line or word. This time-saver can be easily appreciated by operators who have had to rekey an entire line due to inadvertent line or character deletion.

The 255-column capability, as was noted, is unique. Teleray implements it by mapping its standard 4-page scrolling buffer from 20 to 255 characters on the X-axis and 400 lines on the Y-axis. As users expand on the X-axis, the number of storable lines decreases correspondingly. For example, an 80-column entry could be up to 96 lines deep, which corresponds to 4 pages. A 132-column entry allows 59 lines or a little under 2.5 pages. A 255-column entry can only be 30 lines deep. All of these line depths double when the optional 4 pages are added. After pages exceeding 80 columns are entered, the screen is scrolled horizontally. Thus, a user would establish horizontal headings and scroll the data. This arrangement is ideal for applications with a wide range of values for each category displayed.

All of this operating flexibility increases unit cost. While the

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Teleray units are not the most expensive on the market, they are priced above other editing terminals such as the Televideo 900 series, ADDS Viewpoint 90, and Beehive ALT series. Of that group, only the ALT-008 has a greater local storage capacity (72 2K-byte pages versus 8 2K-byte pages for the Model 16).

☐ Strengths

The principal strengths of the product line are local storage/editing emulation; multihost attachment; and a 255-column display available with Models 7 and 16. Local storage and editing are beneficial features that provide operating flexibility. The facility to store pages within the terminal and recall them on demand increases performance and is a convenient and effective alternative to maintaining data at the host and retrieving it via the communication facility. In a shared communication environment cluttering the line with page transfers is inefficient and also delays other users who have more productive work. The facility to edit data locally also frees the communication facility. Depending on the Teleray model selected, users can store up to 8 2K-byte pages locally with the extended storage facilities.

The ASCII terminal emulation available with Model 7 allows that terminal to emulate another terminal's control characters plus operate in native mode, a significant benefit to users operating in a multivendor environment. For example, a user could program the terminal to emulate a Televideo 925 and switch between that mode and Model 7 mode directly from the keyboard.

The multihost attachment further adds to the utility of the terminals. Through the serial bidirectional RS-232C auxiliary interface on Models 7 and 16, the user can attach a **second host** to the terminal and interact with it by switching lines. Users can select between hosts via a keyboard command, or switching can be controlled via a host. Simultaneous host interaction is not permitted, and only the host currently "in-session" with the terminal can initiate host switching. The two host connections can be supported via local facilities, remote leased lines or the DDD network.

The keyboards furnished are also worth noting. All contain 32 keys which can be macro programmed to perform or initiate certain special functions. Up to 8 characters can be assigned to each key function. Further, these keys are shiftable for 64 programmable functions. Note that these keys are not typical dedicated programmable function keys. They normally are used for such operations as character insert, line insert, line clear, numerics, and cursor positioning. If you're not willing to sacrifice any or all of these functions, each keyboard contains 5 nonassigned programmable keys.

As an alternative to using the bidirectional auxiliary port on Models 7 and 16 for a second host processor, the port can be used on all models to attach a local printer. The advantage of this bidirectional buffered port is that it allows data from a host processor to be directed to the printer without first passing through the terminal's screen. Thus, terminals operating in block or nonechoed modes can continue to have data keyed to the screen during a print operation.

☐ Limitations

While the 255-column line feature of the 7 and 16 Series is beneficial to some applications, its usefulness is impaired by the 80-column limitation of the display itself. Any column from 81 and up must be horizontally scrolled before it can be displayed. One of the principal advantages of extended columns is that they easily handle such applications as multiple-headed spreadsheets and inventory listings. While Teleray's Model 100 does have a 132-column feature, it does not support extended columns or horizontal scrolling.

The other serious limitation of the entire family is the inability to be upgraded to intelligence. DEC, one of Teleray's competitors, supports this with its VT100, making that product more attractive to those that need or are contemplating extended local processing.

■ COMMUNICATION FACILITIES OVERVIEW

All terminal models operate in half-/full-duplex transmission modes over switched or dedicated facilities at asynchronous

speeds of 50 bps to 19.2K bps. Online modes are point-to-point communication, keyboard-to-line/-display, line-to-display, line-to-printer, display-/buffer-to-line, and line-to-buffer/display/printer. Transmission modes are character/line/block. Terminals are equipped with an RS-232C DTE/DCE interface; 20-mA current-loop and RS-422 interfaces are optional.

A second host processor can be attached via the bidirectional RS-232C auxiliary interface supplied with Models 7 and 16. Two hosts cannot be active simultaneously, and switching between them is accomplished via the keyboard or by the "in-session" host (see Strengths). The second host can be a local or remote processor. Communication is via leased lines or the DDD network.

The split-baud facility of the Model 100 allows the terminal to send/receive at different speeds. The DEC VT100, which this terminal emulates, has the same capability.

■ SOFTWARE

☐ Operating System

None; firmware controls all functions.

■ HARDWARE

☐ Terms & Support

Terms ● terminal models are available for purchase or on 1- or 2-year lease ● quantity discounts available.

Support ● all purchased products warranted for 90 days ● on-site maintenance by special arrangement only; user normally phones in description of problem via 800 number and, if necessary, vendor ships a new plug-in module with corrections ● flat yearly maintenance fee of $150 covers module exchange for purchased units; maintenance included on rentals.

☐ Overview

The Teleray terminal family consists of 11 ANSI models, all of which operate in character, line, and block modes. All terminals display 96 ASCII characters, 32 control characters, 64 mosaic graphics, 64 line drawings, and special symbols. All terminals operate in half-/full-duplex modes at speeds of 50 bps to 19.2K bps over switched or dedicated lines. All are ANSI X3.64 compatible.

Model 7, the lowest-priced member, displays 1920 characters (24 lines x 80 columns) and supports 128 ASCII character set plus 64 line drawing and scientific characters and 64 mosaics. This terminal allows lines up to 255 columns and employs horizontal scrolling to display data beyond 80 columns. Model 7 is a buffered editing terminal and contains a 4K-byte scroll buffer; a 4K additional buffer is optional. Thus, up to 4 24-line x 80-column "pages" can be stored locally and vertically scrolled. Model 7 also contains a bidirectional RS-232C auxiliary port which allows attachment of a local printer, or permits the terminal to interface with a second host processor. Model 7 operates under ANSI or user-defined controls, allowing it to emulate another terminal. Versions are offered with DEC VT102, Data General 200, Honeywell VIP 7300, or Hazeltine 1510 emulation.

Model 16, also a buffered editing terminal, has many of the same facilities as Model 7. Both support 1920-character displays, permit 255-column lines to be produced and horizontally scrolled, and have a bidirectional auxiliary RS-232C port for attaching a local printer or a second host processor. Model 16, however, has an 8K-byte scroll buffer with an 8K-byte option allowing up to 8 24-line x 80-column pages to be stored locally. Model 16 operates in ANSI mode, and is offered in versions compatible with Honeywell VIP 7801 and versions which run APL and Tektronix 4010/4014/Plot 10 graphics.

Model 100 emulates the DEC VT100 and displays data in 24-line x 80-column (1920 characters) and 24-line x 132-column (3168 characters) formats. Model 100 only has a single 2K-byte scroll buffer. The terminal supports a 128-character ASCII set plus 32 special graphics characters, and has a bidirectional RS-232C auxiliary port for attaching a local printer. A version of Model 100 offers Hazeltine 1510 compatibility.

All 3 terminals employ a typewriter-style keyboard with separate

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Series 7, 16 & 100 Buffered Terminals

numeric key cluster. The programmable functions, however, are different. Models 7 and 16 support 32 nonvolatile variable-length programmable functions of which 5 are on dedicated keys. In addition, 32 macro keys provide 64 nonvolatile programmable 8-character mini-functions. Model 100 offers 32 nonvolatile variable-length programming functions, 10 of which are on dedicated keys.

Users may order any terminal in a C-Enclosure (called the Executive enclosure) which attaches its 9-inch CRT to a shaft for easy pivoting. The N-Enclosure is the standard configuration and includes a 12-inch CRT and nontilt/swivel base. The NN-Enclosure features a 15-inch CRT.

☐ Model Packages

Model 7 Buffered Editing Terminal ● keyboard display ASCII terminal with 12-inch CRT; displays 1920 characters at 24 lines x 80 columns ● 2 operating modes—ANSI and user-definable controls ● 128 ASCII character set, plus 64 line drawing and scientific characters and 64 mosaics ● oversize characters, to quad wide/double high ● up to 255-column lines can be produced and vertically scrolled ● variable character matrix in 8x10 cell, plus contiguous graphics ● 4K-byte scroll memory, expandable to 8K ● detached typewriter-style keyboard with separate numeric key cluster ● 32 nonvolatile variable length programmable functions, 5 on dedicated keys ● 32 macro keys, providing 64 nonvolatile programmable 8-character mini-functions ● 5 display attributes ● 7 area qualifiers ● smooth horizontal and vertical scrolling ● 25th status/message/set up line ● protect mode ● monitor mode ● calculator ● time of day/elapsed time clock ● screen saver ● programmable (musical) operator alerts ● half-/full-duplex at 50 to 19.2K bps ● 256-byte receive buffer; character/line/block/local modes ● buffered bidirectional auxiliary port ● RS-232C communication interface; RS-422 and 20-mA current-loop optional ● standard product has volatile display memory; nonvolatile, optional:

$87 mo	**$1,295 prch**	**$12.50 maint**

Model 7-DEC ● identical to Model 7, with added DEC VT102-compatible operating mode:

87	1,370	12.50

Model 7-DDG ● identical to Model 7-DEC with added Data General D200-compatible operating mode:

97	1,525	12.50

Model 7-HNY ● identical to Model 7-DEC, with added Honeywell VIP 7300-compatible operating mode:

109	1,720	12.50

Model 7-HAZ ● identical to Model 7, with added Hazeltine 1510-compatible operating mode:

85	1,335	12.50

Model 16 Buffered Editing Terminal ● keyboard display ASCII terminal with 12-inch CRT; displays 1920 characters at 24 lines x 80 columns ● 128-character ASCII set, plus 64 line drawing and scientific characters and 64 mosaics ● up to 255 column lines can be produced and vertically scrolled ● variable character matrix in 8x10 cell, plus contiguous graphics ● 8K-byte scroll memory, expandable to 16K ● detached typewriter-style keyboard with separate numeric key cluster ● 32 nonvolatile variable length programmable functions, 5 on dedicated keys ● 32 macro keys, providing 64 nonvolatile programmable 8-character mini-functions ● 5 display attributes ● 4 area qualifiers ● smooth horizontal and vertical scrolling ● 25th status/message/set up line ● protect mode ● monitor mode ● calculator ● time of day/elapsed time clock ● screen saver ● half-/full-duplex, at 50 to 19.2K bps ● 256-character receive buffer ● character/line/block/local modes ● buffered bidirectional auxiliary port ● RS-232C communication interface; RS-422 and 20-mA current-loop optional ● standard product has volatile display memory; nonvolatile, optional:

97	1,545	12.50

Model 16-APL ● identical to Model 16, with added 96-character APL operating mode with true character overstriking, plus 32 sub-/superscript characters:

110	1,745	12.50

Model 16-7801 ● identical to Model 16, with added Honeywell VIP 7801-compatible operating mode ● 2K-byte receive buffer ● 8K-/16K-byte scroll memory in ANSI mode only:

119	1,895	12.50

Model 16-GRF ● identical to Model 16, with added Tektronix 4010/4014/Plot 10-compatible graphics software:

173	2,740	12.50

Model 100 Buffered Editing Terminal ● keyboard display, DEC VT100-emulating ASCII terminal, with 12-inch CRT; displays in formats of either 24 lines x 80 columns (1920 characters) or 24 lines x 132 columns (3168 characters), plus wide mode (double-width characters) in either case ● double-high characters, also 128-character ASCII set, plus 32 special graphics characters ● 7x9 dot character matrix, plus descenders ● detached typewriter-style keyboard with separate numeric key cluster ● 32 nonvolatile variable-length programmable functions, 10 on dedicated keys ● 6 display attributes ● 4 smooth scroll rates protect mode ● monitor mode ● split screen ● split baud ● screen saver ● half-/full-duplex, at 50 to 19.2K bps ● 2K-byte scroll buffer ● 256-character receive buffer ● character/line/block/local modes ● bidirectional peripheral port ● programmable answerback and terminal identifier messages ● RS-232C communication interface; RS-422 and 20-mA current loop, optional:

88	1,395	12.50

Model 100-DHZ ● identical to Model 100 with added Hazeltine 1510-compatible operating mode:

101	1,595	12.50

All terminals are available in several alternative enclosure styles/CRT sizes: 9-inch CRT (C-style), 15-inch CRT (NN-style), 12-inch CRT (N- and M-styles). Where the prices listed in the Models section apply to the N- and M-styles, C-styles typically cost $150 more, and NN-styles, typically $250 more. White phosphor CRTs are standard for the 12-inch styles; green and amber are available options. Green phosphor CRT is standard for the 15-inch style; amber, optional. Green phosphor CRT is standard for the 9-inch style; white and amber not offered.

☐ CPU & Memory

All terminals are microprocessor controlled. Volatile and nonvolatile (battery-backed) RAM used for page scroll buffers and nonvolatile RAM for user-programmable functions; operating parameters maintained in CMOS. Firmware controls terminal functions.

Memory can be user-configured to suit the application. User-selectable parameters include line length, page length, and split-screen window size. Logical line length can be any number of characters from 20 through 255. The display line is fixed at 80 columns; shorter lines appear left justified with unusual character positions on right automatically blanked. If line length exceeds 80 columns, smooth horizontal scrolling advances each column on the display. Such scrolling is nondestructive.

Logical page length varies with horizontal line length. For example, an 80-column line could be 96 lines deep—with the standard 4-page memory—and double that with 8 pages. A 255-column line can be 30 lines deep with 4-page memory and double that with 8 pages. Teleray permits any unused nonvolatile display memory to be employed for dynamic program functions.

4-Page Volatile Memory Expansion ● adds additional 4 pages (8K bytes) of scroll memory to Models 16, 16 APL, 16 GRF, and 16-7801:

NA mo	$275 prch	NC maint

4-Page Nonvolatile Memory Expansion ● adds additional 4 pages (8K bytes) of scroll memory to Models 16, 16 APL, 16 GRF, and 16-7801 ● replaces 2-page volatile memory in Models 7, 7-DEC, 7-DDG, 7-HNY, and 7-HAZ:

NA	430	NC

MO: monthly rental charge including maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for factory service. NC: no charge. NA: not available. All prices single quantity. Prices effective as of June 1984.

Teleray Display Terminals
Series 7, 16 & 100 Buffered Terminals

2-Page Volatile Memory Expansion ● adds additional 2 pages (4K bytes) of scroll memory to Models 7, 7-DEC, 7-DDG, 7-HNY, and 7-HAZ:

NA	165	NC

☐ I/O & Communications

All models operate in half-/full-duplex modes at selectable speeds of 50/75/110/134.5/150/300/600/1200/1800/2400/3600/4800/7200/9600 and 19.2K bps. Character format selectable as 7 or 8 bits with odd, even, or no parity, or mark or space. Online operating modes are point-to-point communication, keyboard-to-line/-display, line-to-display, line-to-printer, display-/buffer-to-line, and line-to-buffer/display/printer. All models are equipped with an RS-232C interface. As an option, users can select a 20-mA current-loop or RS-422 interface. When configured with 20-mA current-loop interface, the RS-232C interface still functions. A second host processor connection can be made via the terminal's bidirectional RS-232C port. Processor switching is initiated either via the keyboard or from the "in-session" processor. Second host can be local or remote processor.

All terminals provide a programmable 20-character auto-answer feature. All can employ jump or smooth scrolling of input data. Smooth vertical or horizontal scrolling of display data is scrolled at 6 or 12 lines per second. The capacity of the input/output buffer is 256 characters; DC1 (XON) and DC3 (XOFF) control signals prevent buffer overflow. Buffer overflow is safeguarded in 3 phases: when the buffer reaches 32 characters, the first DC3 is issued; a second DC3 is raised at 112 characters; and at 128 characters smooth scrolling is discontinued in favor of jump scrolling. When the I/O buffer drops to 16 characters, a DC1 is issued and smooth scrolling/normal data flow resumes.

All terminals operate in remote and local modes. In remote mode, character or block transmission can be selected; local echo can be invoked for character transmission. In local mode, keyed data is entered in the scroll buffer and displayed, but not transmitted.

Current-Loop Interface ● optional 20-mA current-loop interface for all models ● allows terminal to be located up to 1,000 feet from host:

NA mo	$60 prch	NC maint

RS-422 Interface ● optional RS-422 interface for all models ● allows terminal to be located up to 4,000 feet from host:

NA	70	NC

☐ Disk

No disk/diskette is supported.

☐ Terminals/Workstations

The entire family offers identical features in display, editing, and formatting functions. The major differences are in the display scroll buffer storage limit, the receive (I/O) buffer, terminal compatibility, and displayable characters.

Scroll buffer capacity varies with models. Model 7 has a 4K-byte scroll buffer, with 4K optional. Model 16 contains 8K bytes and can be expanded to 16K bytes. Model 100 has only 2K bytes of scroll buffer with no expansion feature and is strictly a DEC VT100 lookalike.

The receive buffer on all models except the 7-HNY and 16-7801 is 256 characters, and flow control is handled by DC1 (XON) and DC3 (XOFF) control characters. Models 7-HNY and 16-7801 have a 2K-character I/O buffer, and flow control is also handled by the same control characters.

All models provide 96 ASCII, 32 control, 64 mosaic graphic, and 64 line-drawing characters. In addition, the Model 16-APL furnishes 96 APL characters and 32 sub-/superscript characters.

Every terminal except the 100 and 100-DHZ can accommodate lines up to 255 columns. Of these, only 80 columns can be displayed at one time with the remainder horizontally scrolled. Such a display capability is unique and extremely useful in handling applications with a wide range of values for each heading. The 100 and 100-DHZ display both 80- and 132-column lines.

Another notable facility offered with all terminals is the high number of user-programmable functions permitted. Up to 32 keys can be used for macro-coded functions, with each key shiftable for a total of 64 functions. The Series 7 and 16 keys used for macro coding, incidentally, normally provide editing functions such as character/line insert and delete, line erasing, memory clearing, cursor control, and numeric functions.

Operating parameters on all terminals are soft configured via the keyboard. Users can display a 66-line menu of parameters, or individual parameters can be diplayed on the 25th line of the screen.

Configuration ● tabletop keyboard-display with typewriter-style keyboard and separate number keypad ● each terminal accommodates a local serial printer.

Display ● 12 inches diagonal ● displays 1920 characters at 24 lines x 80 columns; 255-column line capability ● 96 ASCII character set, 32 control characters, 64 mosaic graphic characters, and 64 line-drawing characters; 96 APL characters on Model 16-APL.

Edit & Format Features ● common features for all terminals include cursor up, down, left, right, home ● line feed/new line; next line ● index/reverse index ● tab forward/backward ● erase character, EOL, EOP ● insert/delete character/line ● reinstate last deleted line or word ● horizontal/vertical scrolling; smooth/jump/no scrolling ● split screen ● automatic character wraparound ● N-key rollover ● dim, blink, blank, underline, and reverse video ● auto-repeat keys ● protected fields.

Peripherals ● buffered, bidirectional RS-232C interface supports local printer attachment ● input from terminal or host processor.

☐ Printers

Teleray offers no printer for any member of the family, but does provide a buffered, bidirectional RS-232C port for attaching a serial printer. The bidirectional feature bypasses the CRT screen when data transmitted from the host processor is directed to the attached printer, so that users can continue to key data for transmission during a print operation. This is a substantial performance boost and user benefit, as mentioned under Strengths.

● END

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

■ PROFILE

Function ● general-purpose, nonprogrammable interactive keyboard-display ASCII terminals ● Esprit 1410, ADDS Regent 25, Lear Siegler ADM 3A/5 compatible (910); ADDS Viewpoint compatible (914); DEC VT52/100/220, ANSI compatible (922); DEC VT52/100, ANSI compatible (970).

Architectures Supported ● any architecture supporting an ASCII terminal; local/remote attachment.

Communications ● half-/full-duplex, asynchronous, 50 bps to 19.2K bps ● point-to-point ● character, line, and block transmission modes ● RS-232C, RS-422, and 20-mA current-loop interfaces.

Operating System ● CP/M with WordStar option.

Database Management ● none; only in conjunction with host facilities.

Transaction Processing Management ● none; only in association with host facilities.

Support Software ● word processing option.

PURCHASE PRICE RANGE   hardware ■■■■■■

Personal Terminal
■■■■■■■■ $499 to $1,127
Model 910
■■■■■■■■■■ $649 to $2,244
Mode 910 Plus
■■■■■■■■ $699 to $2,294
Model 914
■■■■■■■■■■ $699 to $2,454
Model 921
■■■■■■ $695 to $2,290
Model 922
■■■■■■■■ $995 to $2,590
Model 924
■■■■■■■■■ $899 to $2,654
Model 925E
■■■■■■■ $795 to $2,390
Model 925
■■■■■■■ $995 to $2,560
Model 950
■■■■■■■■■ $1,195 to $2,830
Model 970
■■■■■■■■■ $1,495 to $3,090

$1K $2K $3K $4K $5K
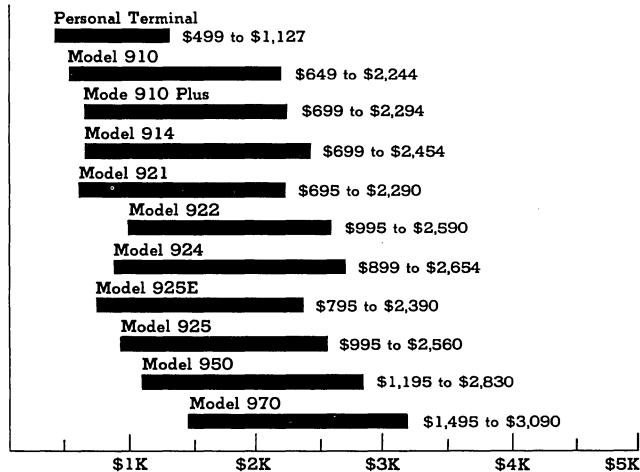
TELEVIDEO PRICING BAR GRAPH covers the purchase price range between "small" and "large" configurations for individual product members ● **small** Personal Terminal consists of basic keyboard display; **large** configuration adds a telephone and 300/1200-bps modem ● **small** 910 consists of basic keyboard display; **large** configuration adds a Model TP750 printer ● **small** 910 Plus consists of basic keyboard display; **large** configuration adds a Model TP750 printer ● **small** 914 consists of a basic keyboard display; **large** configuration adds a Model TP750 printer ● **small** 921 consists of basic keyboard display; **large** configuration adds a Model TP750 printer ● **small** 922 consists of basic keyboard display; **large** configuration adds 1 page of memory and Model TP750 printer ● **small** 924 consists of basic keyboard display; **large** configuration adds 3 pages of memory and a Model TP750 printer ● **small** 925E consists of basic keyboard display; **large** configuration adds a Model TP750 printer ● **small** 925 consists of basic keyboard display; **large** configiuration adds 1 page of memory and Model TP750 printer ● **small** 950 consists of basic keyboard display; **large** configuration adds 3 pages of memory and Model TP750 printer ● **small** 970 consists of basic keyboard display; **large** configuration adds Model TP750 printer ● **Note**: all service through third-party or via depot service.

Processor ● display-oriented control and communication logic ● local/remote initiated printing.

Terminals/Workstations ● single-keyboard 1920-character display; 1920-/3168-character display on Model 970 and Model 922 ● 960-/1920-character display on Personal Terminal auxiliary printer port for local printer attachment.

First Delivery ● 1980 (950); 1981 (910, 925, 970); 1982 (910 Plus); 1983 (914, 924, Personal Terminal); 1984 (921, 922, 925E).

Systems Delivered ● over 370,000.

Comparable Systems ● competitive with a number of ASCII display terminals, typically DEC VT100 and VT200, Anderson-Jacobson 510/520, Beehive DM and ALT Series, Datagraphix 132, DEC VT100, Esprit II and Exec 80, Lear-Siegler ADM Series, ADDS Viewpoint Series, and IBM 3101.

Vendor ● Televideo Systems, Inc; 550 East Brokaw P.O. Box 6602, San Jose, CA 95150 ● 408-971-0255.

Canadian Headquarters ● none.

Distribution ● sold through local Televideo sales offices and through distributors worldwide.

GSA Schedule ● listed.

■ ANALYSIS

As a forerunner in the industry, Televideo makes a conscious effort to enhance its comprehensive line of display terminals. This past year has proven no exception with introductions of 3 new terminal models. The 925E is an extended version of the 925 with 5 additional programmable function keys and ergonomic design features such as a tilt/swivel CRT; and a low-profile, DIN standard keyboard. Priced at $200 less than its predecessor, the 925E fully emulates the 925 but doesn't support the 925's local/duplex edit mode. The new Model 921 is an economical 900 Series alternative with 15 selectable embedded/nonembedded field attributes. With a $695 price tag, the 921 resides in the middle of

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

the 900 Series line-up, and provides 910 Plus compatibility, 16 programmable function keys, low-profile keyboard, along with buffered and bidirectional printer ports.

Intended to compete head-on with DEC's VT220 terminal, the Televideo 922 joins the high-end 970 as only the second in the Televideo series to support the ANSI X3.64 standard. Compatibility with other vendor's terminals (via ANSI X3.64) as well as with DEC VT52/100/200 units certainly broadens the marketing scope of the new 922. Advanced features including 24x80/132 character displays, a choice of 8 multinational character sets, split-screen/scrolling modes, and character/block/local transmission mode place the 922 in the 970 and 950 performance bracket. However, the 922 only supports 1 page of display memory as opposed to the 3 and 4 pages of display memory on the 970 and 950, respectively. In addition, the 922 improves upon the DEC VT100/220 keyboard layout with the standard placement of the Return, Shift, and Escape keys; and with the addition of Tab Bar, Double Zero, and Clear Entry keys.

For the future, Televideo is planning to release its current 914/924/970 optional Tektronix Plot 10 graphics board for the new Models 925E, 921, and 922.

The Televideo product line offers character-/block-mode transmission, adequate data editing and formatting, split-screen data formatting and Tektronix Plot 10 graphics compatibility (on some models), and such advanced features as a bidirectional printer port for attaching a printer directly to the terminals. Televideo is also one of the few vendors to offer local-mode formatting, whereby screen building, formatting, and editing can be done with no host-processor interaction. Completed screens (pages) are held in local storage and block-transferred to the host.

The Televideo 900 Series consists of Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, and 970. Another product included in this report is the Personal Terminal, an ASCII product designed primarily as an executive information terminal. Since the Personal Terminal lacks many of the editing, formatting, and special features of the 900 Series and its competitors, a comparative analysis of its features versus the 900 Series competitors is not included in this report.

The Televideo 900 Series competes against well over 100 products in the marketplace. Obviously, we cannot do a one-for-one comparison of each in this analysis; but if you are interested in the technical details and prices of their products, refer to the Display Terminals Survey report 720. As a representative sample, however, we'll look at how Televideo measures up against the ADDS Viewpoint/60, 60 Plus, and 90; Beehive DM and ALT; DEC VT100 and VT200; and IBM 3101.

The ADDS (Applied Digital Data Services) Viewpoint/60, 60 Plus, and 90 compete at every level. The Viewpoint/60 is competitive with the Televideo 910, 910 Plus, 914, 921, 924, 925, and 925E, while the Viewpoint/90 rivals all of the same plus the 922, 950, and 970. The Viewpoint/60 and 90 offer about the same capabilities for data editing, protected fields, character-/block-mode transmission, and provide a local printer port. However, Viewpoint/60 and Viewpoint/60 Plus has no scrolling buffer (all scrolling is destructive), while the 914, 924, and 925 offer one as an option. Scrolling allows the user to create and store multiple-screen pages which can be used later.

Other differences lie with the number of program function keys—i.e., keys with user-assigned codes which trigger an operation at the host processor—and keyboard mobility. Both the Televideo and ADDS products provide "shiftable" programmable functions, whereby 2 separate functions are assigned to each key. Thus, 8 function keys produce 16 different user-programmable functions.

The Viewpoint/60 and Viewpoint/60 Plus support 8 programmable function keys (shiftable to 30 functions) while the 914, 921, 924, 925, and 925E offer 3 (shiftable to 6 functions), 16 (shiftable to 32 functions), 16 (shiftable to 32 functions), 11 (shiftable to 22 functions), and 16 (shiftable to 32 functions), respectively. The keyboard on the ADDS product line is detached which provides more increased placement flexibility. The Televideo 910 and 910 Plus are the only 900 Series offerings with

attached keyboards. The Viewpoint/60 and Viewpoint/60 Plus both support tilt/swivel CRTs; this facility is included on all Televideo models except for the 910 and 910 Plus. Televideo also offers French, German, and Spanish character sets on most models; ADDS charges extra. The basic price of the Viewpoint/60 is $895, the Viewpoint/60 Plus is priced at $749. The 910, 910 Plus, 914, 921, 924, 925, and 925E are priced at $649, $699, $699, $695, $899, $995, and $795, respectively.

The Viewpoint/90 is a flexible terminal offering both 80- and 132-character (column) lines. An optional 4K RAM scroll buffer ($30) allows users to establish one 48-line or two 24-line pages, and both horizontal and vertical scrolling are supported. The new Televideo Model 922 and Model 970 support 132-character lines, and horizontal and vertical scrolling. The top-of-the-line Model 970 stores 24-, 48-, or 72-line pages in memory. The 72-line page, however, can only be formatted with 80-character lines.

Split-screen operation, which divides the displayed contents into separate regions, is supported on Televideo Models 922, 924, 925, 950, and 970. Viewpoint/90 features split screen and line lock. Split-screen operation is typically used to compare different types of data. For example, a segment of information can be retained on the screen, while another segment of data is scrolled by it. Line lock lets users lock (retain) a line of data and scroll information under it. The Televideo 970 also provides line lock.

Another form of scrolling is called smooth scrolling. It allows users to vary the speed at which data received from the host processor appears on the screen. This benefits ease of reading. The Televideo 922, 924, 950, and 970 offer it, plus the ability to halt screen painting entirely. The Viewpoint/90 lacks these features.

The ADDS and Televideo terminals contain an RS-232C communication interface, and RS-422 is offered as an option. Televideo also provides an optional 20-mA current-loop interface. The purchase price of the basic Viewpoint/90 is $1,095, or about $100 less than last year. The Televideo 922, 950, and 970 cost $995, $1,195, and $1,495, respectively.

For most of the critical functions, ADDS competes very well against Televideo. Model 970 does offer a few more features than Viewpoint/90 (see Model Package and Terminal/Workstation details), but overall, these products compete equally well against one another.

The DM Basic terminal from Beehive International displays 1920 characters and has a detached keyboard with a 14-key numeric pad and special function keys. It operates in character/line/block modes and transmits data at 110 bps to 19.2K bps. Standard interface is RS-232C or 20-mA current loop. Its price of $930 is in the same range as the Model 925, but it lacks the power of the Televideo product.

The DM Standard also displays 1920 characters, but has a split-screen and line-lock facility. Its detachable keyboard has 16 programmable function keys (shift-activated to 22 functions) plus a 12-key numeric pad. The Standard operates in character/line/block modes, and transmits data at 110 bps to 19.2K bps. Standard communication interface is RS-232C or 20-mA current loop. This terminal also has an RS-232C bidirectional auxiliary interface. Priced at $1,145, the Standard is quite competitive price-wise and technically with the Model 950. The DM Plus has the same features as the Standard model but also includes forms-mode operation and an RS-232C or RS-422 communication interface. Its price is $1,345.

The ALT-004 and ALT-008 terminals compete against the Televideo 970 and DEC VT100. Both Beehive terminals support 1920-/3168-character displays, have 16 preprogrammed and 8 user-programmable function keys, and 9 resident foreign character sets. Both operate in character/line/block modes, employ RS-232C, RS-422, or 20-mA current-loop interfaces, 50-bps to 19.2K-bps transmit speeds, and an RS-232C bidirectional auxiliary port. The ALT-008, however, includes split screen with line lock and 16 2K-byte pages of memory expandable to 64 pages. The ALT-004 does not support split screen with line lock and has but a single 2K-byte buffer. Both terminals, however, do support ANSI X3.64. Priced at $995, the

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

ALT-004 competes against the Model 925. The Televideo product does not support a 3168-character display (132 columns x 24 lines) or ANSI X3.64. It does, however, provide a 2K-byte memory buffer plus an additional 2K-byte expansion.

The ALT-008, priced at $1,495, "blows the doors off" the Televideo Model 970. While that unit is identically priced, it has only 3 pages of buffer memory. The ALT-008 is also DEC VT100/131 compatible.

Against DEC, Televideo competes with the older VT100 and the recently announced VT200. The VT200, destined to replace the ubiquitous VT100, emulates all functions of that terminal family and offers many additional facilities. Consisting of the VT220, 240, and 241, all provide as standard features: 24-line x 132-character display formats; printer port; local echo; word processing; 15 programmable function keys; plain language menu setup; downline loadable character sets; multinational character sets (French, German, and Spanish); and a nonglare screen. In addition, the VT240 and 241 have a 240x800 pixel bit-mapped graphics facility, and support Tektronix 4010/4014 graphics. An integral modem (optional) can also be fitted on the VT240 and 241.

In contrast, the 132-character line is standard on the VT102 and 131 and optional on the VT100 and 125. A printer port is standard on VT102, 125, and 131 but not offered at all on VT100 and 101. Local echo is standard on VT101, 102, and 131, but unavailable on the VT100 and 125. Word processing is offered with VT100, 102, and 125 only. None of the VT100 models support programmable function keys. Bit-mapped graphics is optional on VT100 and standard on VT125. None of the VT100 models support plain language menu setups, downline loadable character sets, or multinational character sets; and a nonglare screen is optional on all.

None of the VT200 models support block mode transmission or local editing, both of which are standard on the Telvideo 922, the newly released DEC VT52/100/220 and ANSI compatible terminal. The VT220 also does not support ReGIS or Tektronix graphics software. The ReGIS protocol is a standard facility on VT 125 and is optional on the VT100. Although the Televideo 922 doesn't presently support the Tektronix Plot 10 graphics board, it is planned as a future option. The DEC VT220 currently provides no provision for a bidirectional printer port or an integral modem/auto-dialer option, both of which are offered on VT240/241 terminals. The basic prices for the VT200 Series are $1,395 (220); $2,195 (240); and $3,195 (241). A similarly equipped Televideo 922 has a purchase price of $995.

The VT100 family includes Models VT100, 101, 102, 125, and 131. The VT100 forms the basis for the entire line, and all models are essentially upgradable, expanded versions of the VT100. Thus, users can begin with a simple VT100, and by adding options, develop it into a very powerful terminal.

The VT100 supports a 132-character line just as the Televideo Model 970, but only 14 lines can be assembled versus 24 for Televideo. To increase the format to 24 lines on the VT100, an extra-cost advanced video option ($140) must be added. Otherwise, the VT100 offers many capabilities similar to the 970, such as bidirectional vertical scrolling, smooth and jump scrolling, split-screen operation, and double-width/double-height characters. However, the VT100 operates in character-only mode versus character, line, and block modes for the 970. While many of the edit and format features are comparable, the VT100 does not support character/line insert/delete editing or protected fields, and contains only 4 programmable function keys. And at a price of $1,945, the VT100 clearly isn't in the 970's price range.

The VT101 is a VT100 with local echo. The price is $1,350. The VT102 is much closer to the Model 970 in price and capability. It has all of the standard VT100 features plus a 3168-character display capability. The VT102 supports character/line insert/delete editing plus a local printer interface. It, however, is also a character-only terminal and is priced at $1,710.

The VT125 is a VT100 with an extensive graphics capability. It executes DEC's ReGIS (Remote Graphics Instruction Set),

produces bit-mapped graphics, and generates vectors and curves. Graphic resolution is 768x240 pixels, and color output is optional. Nothing in the Televideo 900 line comes close to this terminal. Its price is $3,800.

The VT131 has all the features of the VT102 but supports character- and block-mode transmission. While the performance of this unit is closest to the Model 970, its price of $1,825 is much higher.

DEC's marketing strategy for the VT100 is obvious. Its terminal can be upgraded to handle 132-character lines, graphics, word processing, or personal computer requirements. While its price is high, users can buy with confidence that as their requirements change, they need only purchase an upgrade kit.

The IBM 3101 consists of Models 10, 12, 13, 20, 21, 22, and 23. Models 10, 12, and 13 operate in character mode only, while the others operate in character or block mode. IBM's 3101 competes against Televideo Models 910 Plus, 914, 921, 924, 925, and 925E.

Models 10, 12, and 13 differ only by their communication and printer interfaces. Model 10 uses an RS-232C interface for both communication and printer; Model 12 offers switch-selectable RS-232C and 20-mA current-loop communication interface, and RS-232C for the printer. Model 13 has switch-selectable RS-232C and RS-422 interfaces, and an RS-232C for the printer port. All these terminals offer only limited edit and format features, and do not support facilities such as protected fields. They do have 8 programmable function keys and allow scrolling. Model 10 is priced at $1,405, while Models 12 and 13 are priced at $1,430.

Models 20, 22, and 23 are basically the same as Models 10, 12, and 13 except they support switch-selectable character and block transmission modes, protected fields, and slightly better editing facilities. Model 20 sells for $1,625, while Models 22 and 23 are priced at $1,650. Models 10, 12, and 13 can be field upgraded to a Model 20, 22, or 23.

From the preceding analysis, it should be clear that on a features versus cost basis, Televideo has a lot going for it. Televideo's low prices are possibly due to its manufacturing process. Components such as cases, tubes, and power supplies are produced in Korea and shipped to the U.S. for final assembly. Low labor costs and high production rates associated with manufacturing components in Korea contribute to a strong price leverage for Televideo, and it has used it to gain a market advantage. Televideo has also done its marketing homework. For a company which just entered the well-established interactive terminal market in 1978, it is prospering; revenues have skyrocketed from $2 million to $200 million, placing Televideo among the leaders of its market.

☐ Strengths

Price and performance, that sums up the entire Televideo 900 line. From end-to-end, the products provide solid features in the areas of data editing, formatting, and control; and its data communication facilities are first rate.

As the preceding analysis shows, the low end of the line receives abundant competition from ADDS and Beehive, but Televideo offers a little more. At the upper end of the market, strong competition comes from the ADDS Viewpoint/90 and DEC VT100/200 products. In fact, the Viewpoint/90 is priced below the Model 970.

The new Model 922 provides a viable, cost-effective alternative to the DEC VT220. Priced $400 less than the DEC terminal, the Televideo offering is also designed to accommodate an in-the-works Tektronix Plot 10 option which is not available on the DEC VT220. Furthermore, the Televideo 922 offers ANSI X3.64 compatibility which is a significant advantage for users operating in a multiple-vendor environment.

One of the more outstanding features offered on the Models 914, 921, 922, 924, 950 and 970 is the bidirectional printer port for an auxiliary printer. This port allows the host to directly transmit data to the printer without interfering with terminal activity. Users can continue to enter data on the screen while the printer produces copy. This is a strong overall performance boost, and many

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

competitive terminals are now using it. The ability to do local editing is also a real benefit. With it, users can build screens, edit, and reformat data with no host service required. They can also store pages locally for easy recall, and transmit data in block mode to the host. The latter is extremely useful if the terminals are tied together via a statistical multiplexer. With that device, the "channel slot" of a terminal not transmitting data is given to one that is, which increases overall throughput. If the terminal is operating in character duplex mode, each keyed character is sent to the host and echoed back. This makes for a very inefficient use of both the communication facility and multiplexers.

□ Limitations

The 900 Series has a few limitations which detract from its overall appeal. With the exception of the Models 970 and the 922, remaining models **do not** conform to ANSI standards which means those terminals can communicate with only each other or the terminals they emulate. For companies with a multivendor equipment policy, this limitation might prove unacceptable.

The 900 Series are not upgradable across the product line. Thus, a user cannot buy an 80-column unit and later upgrade to a 132-column Model 970. One of Televideo's chief competitors, DEC, allows such an upgrade with its VT100.

At the present time, the Televideo 900 Series line-up lacks a color display model. Chief competitors DEC and ADDS, both have incorporated models with selectable color displays into their product families for enhanced graphics viewing and increased operator productivity.

■ COMMUNICATIONS FACILITIES OVERVIEW

All members operate as general-purpose, half-/full-duplex asynchronous ASCII display terminals at rates from 50 bps to 19.2K bps. Online operating modes are: point-to-point, keyboard-to-line/display, line-to-display, line-to-printer, display/buffer-to-line, and line-to-buffer/display/printer. Transmission mode is character/line/block. The terminals are equipped with an RS-232C interface, with RS-422 and 20-mA current-loop interfaces offered as options on some terminals. All terminals follow the ASCII protocol, and invoke flow-control via XON/XOFF or DTR.

With the exception of Models 970 and 922, the Televideo terminals are compatible only with themselves and/or the terminals they emulate. The Model 970 and 922 conform to ANSI X3.64 specifications and are compatible with other such terminals.

■ SOFTWARE

For most of the terminals, Televideo offers no software support. It will, however, furnish the Tektronix 4010/4014 graphics board with mouse for the 914, 924, and 970, and allow Models 925/950 to be equipped with MicroPro International's Wordstar word processing package. All other terminals in the family must rely on the host processor for software services.

2250900 925 CP/M Wordstar ● provides Model 925 with CP/M operating system and Wordstar in EPROM form; includes keyboard overlay:

| | $100 prch | NA maint |

2187400 950 CP/M Wordstar ● provides Model 950 with CP/M operating system and Wordstar in EPROM form; includes keyboard overlay:

| | 100 | NA |

□ Operating System

None; firmware controls all functions. CP/M is employed with Wordstar option.

■ HARDWARE

□ Terms & Support

Terms ● terminal models offered on purchase basis only ●

quantity discounts available.

Support ● third-party maintenance support provided by General Electric Apparatus Service Division and Computer Service Centers ● on-site and depot service plans ● on-site monthly service rates range between $15 to $20; depot monthly rates range between $11 to $16, depending on model ● monthly rate covers service Monday through Friday between 8.00 AM and 5.00 PM.

□ Overview

The Televideo 900 family consists of 10 ASCII keyboard-displays designed to provide character-/block-mode operation, and transmit data at speeds ranging from 50 bps to 19.2K bps. All display 128 ASCII characters except Models 910, 910 Plus, 914, and 924 which support 96 ASCII characters. European character sets in French, German, and Spanish are provided on all; the Model 924 also contains Portuguese, Norwegian, Danish, and Swedish/Finnish character sets.

The overall data editing and formatting capabilities of individual members are similar. The major differences are cursor positioning, scrolling, and split-screen formatting. For details, see Terminals/Workstations.

Models 910 and 910 Plus are both configured by DIP switches located on the edge of the control logic board. All others are all soft configured from the terminal's keyboard. The Model 970 also permits temporary configuration parameters for short-term needs. These parameter changes are lost when the terminal is reset or switched off; however, they can be transferred to permanent storage.

Televideo also markets the Personal Terminal which is designed to function as an executive information terminal. It provides a 9-inch screen, limited editing and formatting capabilities, and can accommodate the installation of 1 of 2 optional modems (300 or 300/1200 bps). It can also support an optional telephone handset and cradle and provides a built-in directory feature for storing frequently used telephone numbers.

While Televideo provides no sophisticated self-checking routines, integrity checks of the hardware/software are performed when the terminal is powered up. A failure indication and test failed are displayed.

Each terminal is equipped with an RS-232C port for attaching a local printer. Some units have bidirectional printer ports, allowing simultaneous printing and data keying operations. All terminals have an RS-232C communications interface.

Many models will emulate their leading competitors, as well as other members of the Televideo 900 Series. For example, the Model 910 and 910 Plus emulate the ADDS Model 25, Esprit 1410, and Lear Siegler ADM 3A/S. Televideo also offers a no-cost option that permits its popular Model 970 to emulate Models 925 and 950 and therefore run their software. A Model 970 with this facility is designated the **Model 970/50**.

Model Packages

910 Display Terminal ● keyboard-display ASCII terminal with 12-inch CRT ● displays 1920 character at 24 lines x 80 characters ● 7x8 dot matrix ● 2K-byte page memory ● attached typewriter-style keyboard with separate numeric cluster; 11 programmable function keys ● strappable French, German, and Spanish character sets ● half-/full-duplex 50-bps to 19.2K-bps operation ● 256K-byte buffer; DTR, DSR, and DCD flow control ● character mode operation; RS-232C communication port interface ● bidirectional buffered serial printer port ● 20-mA current-loop interface optional ● emulates ADDS 25, Esprit 1410,

PRCH: purchase price. MAINT: maintenance pricing not available. Prices current as of March 1985.

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

and Lear Siegler ADM 3A/5:

	$649 prch	NA maint

910 Plus Display Terminal • same as 910, except supports character-/block-mode transmission:

	699	NA

914 Display Terminal • keyboard-display ASCII terminal with 12-inch tilt and swivel CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x8 dot matrix • detached, typewriter-style keyboard with separate numeric cluster; 3 programmable function keys 6 programmable functions) with 256K-byte total capacity • editing keys • terminal operating parameter configuration established via menu; temporary configurations supported • half-/full-duplex • 150-bps to 19.2K-bps operation; character/block/local transmission modes; RS-232C communication port interface • bidirectional buffered RS-232C serial printer port • RS-422 or 20-mA current-loop interfaces optional • emulates ADDS Viewpoint terminal:

	699	NA

921 Display Terminal • keyboard-display ASCII terminal with 12-inch tilt and swivel CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x8 dot matrix • detached, typewriter-style keyboard with separate numeric key cluster; 16 programmable function keys (32 programmable functions) • United Kingdom, French, German, Spanish character sets • editing keys • scrolling mode • terminal operating parameter configuration via menu; temporary configurations supported • half-/full-duplex • 50-bps to 19.2K-bps operation • character/ block transmission mode • serial printer port; bidirectional printer port • RS-232C communication/printer interface; RS-422 or 20-mA current-loop interface optional • emulates Televideo 910 Plus:

	695	NA

922 Display Terminal • keyboard-display ASCII terminal with 12-inch tiltt and swivel CRT; displays 1920/3168 characters at 24 lines x 80/132 characters; 25th status line • 6x8 dot matrix • detached typewriter-style keyboard with separate numeric key cluster; 15 programmable function keys (30 programmable functions) • United Kingdom, French, German, Spanish, Portuguese, Norwegian/Danish, Swedish/Finnish character sets • editing keys • split screen • terminal operating parameter configuration established via menu; temporary configurations supported • half-/full-duplex • 50-bps to 19.2K-bps operation • character/block transmission mode • serial printer port; bidirectional printer port • RS-232C communication/printer interface; 20-mA current-loop interface • emulates DEC VT52/100/220:

	995	NA

924 Display Terminal • keyboard-display ASCII terminal with 12-inch tilt and swivel CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x8 dot matrix • 2K-byte page memory; 3 extra pages optional • detached typewriter-style keyboard with separate numeric key cluster; 16 programmable function keys (32 programmable functions) with 512K-byte total capacity • United Kingdom, German, French, Spanish, Portuguese, Norwegian, Danish, and Swedish/Finnish character sets • editing keys • split screen • terminal operating parameter configuration established via menu; temporary configurations supported • half-/full-duplex • 150-bps to 19.2K-bps operation; character/block/local transmission modes; RS-232C communications port interface • serial printer port; bidirectional printer port • RS-422 or 20-mA current-loop interface optional • emulates Televideo 925/950 (optional):

	899	NA

925 Display Terminal • keyboard-display ASCII terminal with 12-inch tilt and swivel CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x8 dot matrix • 2K-byte page memory; second page optional • detached, typewriter-style keyboard with separate numeric key cluster; 11 programmable function (22 programmable functions) and 5 editing keys • split screen • terminal operating parameter configuration established via menu • half-/full-duplex • 50-bps to 19.2K-bps operation • character/block transmission mode • serial printer port;

bidirectional printer port • RS-232C communication/printer interface; 20-mA current-loop optional • emulates Televideo 912/920:

	995	NA

925E Display Terminal • keyboard-display ASCII terminal with 12-inch tilt and swivel CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x8 dot matrix • 2K-byte page memory; second page optional • detached, low-profile typewriter-style keyboard with separate numeric cluster • 16 programmable functions keys (32 programmable functions) • editing keys • split screen • terminal operating parameter configuration established via menu; temporary configurations supported • half-/full-duplex • 50-bps to 19.2K-bps operation • character/block transmission mode • serial printer port; bidirectional printer port • RS-232C communication/printer interface; 20-mA current-loop optional • emulates Televideo 925:

	795	NA

950 Display Terminal • keyboard-display ASCII terminal with 12-inch tiltable CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x8 dot matrix • 2K-byte page memory; 3 extra pages optional • split screen with line locks • detached, typewriter-style keyboard with separate numeric key cluster; 11 programmable function (22 programmable functions) and 5 editing keys • terminal operating parameter configuration via 25th line setup commands • half-/full-duplex • 50-bps to 19.2K-bps operation • character/block/local transmission mode • serial printer port; bidirectional printer port • RS-232C communication/printer interface; 20-mA current-loop optional:

	1,195	NA

970 Display Terminal • keyboard-display ASCII terminal with 14-inch tiltable CRT; displays 1920/3168 characters at 24 lines x 80/132 characters; 25th status line • single-/double-width/ height characters • 24/48/72-line page memory • split screen with line locks • detached, typewriter-style keyboard with separate numeric key cluster; 16 programmable function (32 programmable functions) and 13 separate editing and control keys • terminal operating parameter configuration established via menu; temporary configurations supported • half-/full-duplex • 50-bps to 19.2K-bps operation • character/block/local transmission mode • serial printer port; bidirectional printer port • RS-232C communication/printer port; RS-422 and 20-mA current-loop interface optional • ANSI 3.64 compatible:

	1,495	NA

Personal Terminal • keyboard-display ASCII terminal with 9-inch CRT; displays 960/1920 characters at 24 lines x 40/80 characters; 25th status line • 5x7 dot matrix • attached typewriter-style keyboard; 7 programmable function keys (14 functions with shift) • built-in telephone directory holds 28 numbers; auto-dial 10-number facility when optional telephone is attached • half-/full-duplex 110-bps to 19.2K-bps operation; block transmission mode • RS-232C communication port interface • bidirectional buffered RS-232C serial printer port.

Basic PT with 9-inch screen and attached keyboard:

	499	NA

Basic PT with 300-bps modem:

	648	NA

Basic PT with 300/1200-bps modem:

	1,048	NA

Basic PT with telephone handset and cradle:

	578	NA

Basic PT with telephone and 300-bps modem:

	727	NA

Basic PT with telephone and 300/1200-bps modem:

	1,127	NA

PRCH: purchase price. MAINT: maintenance pricing not available. Prices current as of March 1985.

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

2169700 Conversion Kit ● converts 910 Plus to 910 operation:

25	NA

2169100 Conversion Kit ● converts 910 to 910 Plus operation:

25	NA

97050 Conversion Kit ● converts Model 970 to run Model 925/950 software:

100	NA

☐ CPU & Memory

All terminals are microprocessor controlled. RAM is employed for page scrolling and temporary terminal operating parameter configuration. Firmware controls terminal functions.

3209300 Memory Upgrade ● provides second, third, and fourth pages for Models 914 and 924:

$160 prch	NA maint	

2001500 Memory Update ● provides second page for Models 925 or 950:

40	NA

2001600 Memory Upgrade ● provides third and fourth pages for Model 950:

80	NA

2231700 Memory Upgrade ● provides second, third, and fourth pages for Model 950:

120	NA

☐ I/O & Communications

All members of the Televideo family support point-to-point asynchronous ASCII communication. Transmission rates are 50 bps to 19.2K bps for Models 910, 910 Plus, 921, 922, 925, 925E, 950, and 970. The 914 and 924 operate at 150 bps to 19.2K bps. The Personal Terminal runs at 110 bps to 19.2K bps. All communication is conducted over switched or dedicated lines in half-/full-duplex mode and support echoplexing in interactive (character) mode. Transmission character parity is selectable for odd, even, or none. Character framing can include 1 or 2 stop bits.

Operating parameters for Models 910 and 910 Plus are established via DIP switches; operating parameters for all other models are soft configured. Operating parameters are displayed in a menu format on the 25th line for all other models. All parameter changes to the operating configuration are established from the terminal's keyboard. Parameters on all models are retained in nonvolatile memory. Model 970 users can establish temporary configuration changes which are held in volatile storage. These changes, however, can be transferred to the nonvolatile memory area. On Models 910 and 910 Plus parameters such as character size (7 or 8 bits), parity, stop bits, local edit, terminal emulation mode, transmission speed, transmission mode, character set (English, French, German, or Spanish), and edit and control functions are all selected via DIP switches mounted on the edge of the logic/control board.

All terminals are equipped with an RS-232C interface. Both RS-422 and 20-mA current-loop interfaces are optional. The RS-232C is the standard interface for connecting the terminal to a communication line and a local printer to the terminal. Through this interface, the host computer can transfer data directly to the printer, or the terminal can initiate a local print operation.

Operating modes vary with the terminals. All can communicate in character or block modes, but Models 914, 924, 950, and 970 can also support single-line transmission. In addition, the latter 4 terminals can operate in local mode, whereby data is keyed to the screen as in block mode but does not pass through the communication facility. To transfer data to the host, the block transmission mode is selected.

These terminals also support smooth and jump scrolling to vary the speed at which data appears on the screen.

Direct host attachment in local processing mode is supported through the RS-232C/422 or 20-mA current-loop interfaces. The maximum distance between the host processor and terminal is 50 feet for RS-232C; 4,000 feet for RS-422; and 1,000 feet for current loop.

2131000 Current-Loop Interface ● 20-mA current-loop interface for 910 or 910 Plus:

$50 prch	NA maint

2131100 Current-Loop Interface ● 20-mA current-loop interface for 914, 924, or 925:

60	NA

☐ Disk

No disk/diskette is supported.

☐ Terminals/Workstations

Display, editing, and formatting features are similar for the entire family. Notable differences are screen updating (called scroll up/no scroll), split-screen operation, auto-page, line lock, and automatic character wraparound.

The split-screen function divides the screen into 2 separate regions, useful for comparing data. Line lock allows the user to lock 1 or more lines on the screen and scroll data under them. This is also used for data comparison. Auto-page automatically advances line 1 (top line) off the screen when data is entered following line 24. This is a convenience feature. Automatic character wraparound automatically advances text entry to column 1 of next line when column 80 of previous line is reached. This is also a convenience feature.

Model 970 and Model 922 allow users to format the screen in a 24-line x 80- or 132-character (column) format. In addition, users can create pages in storage with 24/48/72-line page configurations. A 24- and 48-line page is permitted regardless of the column width; a 72-line page, however, can only be formatted with an 80-column width.

The Personal Terminal, the newest product in the line, is more of an executive information terminal with limited data editing facilities (line insert/delete; line or page erase are only functions supported). This terminal displays data in 24-line x 40- or 80-character formats, providing 960/1920 displayable characters.

Configuration ● tabletop keyboard-display with typewriter-style keyboard; separate numeric key on all models except Personal Terminal ● movable keyboards on all models except 910 and 910 Plus ● each terminal accommodates a local serial printer and may be equipped with European character sets (French, German, Spanish on most plus Portuguese, Norwegian, Danish, and Swedish/Finnish on Model 924).

Display ● 12 inches for all except Model 970 and Personal Terminal, which are 14 and 9 inches, respectively ● displays 1920 characters at 24 lines x 80 characters (all models); 960 characters selectable on Personal Terminals; 3168 characters (24 lines x 132 characters) selectable on Model 970 and Model 922 ● 96 displayable ASCII characters on Models 910, 910 Plus, 914, and 924; 128 displayable characters on all others; line graphics on Models 914, 940, 970, and Personal Terminal; 32 ASCII control characters on all.

Edit & Format Features ● common features for all terminals include cursor up, down, left, right, home ● blinking, underline, blank cursor ● addressable cursor for row and column ● line feed, new line ● tab forward/backward, field tabs ● scrolling ● typematic keys ● clear character, EOL, EOP; clear unprotected fields ● blink/blank field; underlining ● character/line insert/delete ● individual edit and control features are addressable cursor for page; read cursor page, row, and column (all except Models 910 and 910 Plus); set lines per page (Models 925, 950, and 970); scroll up/no scroll (Models 914, 921, 922, 924, 925, 925E, 950, and 970); reverse video background (all except Model 910 and 910 Plus); auto-page (all except Model 910 and 910 Plus); split screen (Models 924, 922, 925, 925E, 950,

Televideo 900 Series Display Terminals
Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970 & Personal Terminal

and 970); line lock (Models 950 and 970); horizontal and vertical scrolling; and automatic character wraparound (Models 950 and 970).

Peripherals • RS-232C interface supports local printer attachment • input from terminal or host processor.

914/924 GR Graphics Board • converts Models 914 and 924 to Plot 10 graphic compatibility with Tektronix 4010/4014 terminals • features 8 line types, point and incremental plot modes, alpha screen overlaid by graphics screen, poly and bar fill, 32K display RAM, 640x240-pixel resolution, optional crosshair cursor with mouse control:

$525 prch	**NA maint**

970GR Graphics Board • converts Model 970 to Plot 10 graphic compatibility with Tektronix 4010/4014 terminals • same features as 914/924GR Graphics Board:

625	NA

Mouse • optional crosshair cursor with mouse control:

149	NA

☐ **Printers**

Televideo offers 2 serial printers (Models TP 720 and TP 750) for attachment to the terminal via an RS-232C or 20-mA current-loop interface. Terminal Models 910 and 910 Plus employ a standard RS-232C interface, while all models use a bidirectional RS-232C. With bidirectional, data transmitted from the host processor to the

attached printer bypasses the screen so that users can continue to key data for transmission during a print operation. This is a significant performance boost, as mentioned under Strengths.

All terminal members also support a current-loop interface. The user straps pins on the standard 25-pin EIA connector to handle transmit/receive operations.

TP 720 Printer • letter-quality 18-cps impact printer • 100-character daisy wheel • 10, 12, or 15 cpi; proportional spacing, 82 to 220 characters per line • 6 lpi; friction feed platen • English, French, German, Spanish, Italian, Swedish, and Danish character sets • Centronics-compatible parallel interface (500 cps); $100 optional RS-232C serial interface (300 to 2400 bps):

$599 prch	**NA maint**

TP 750 Printer • letter-quality bidirectional 50-cps impact printer with 1500-character print buffer • 96-character daisy wheel • 6/8 lpi, 10, 12, or 15 cpi (136, 163, 204 columns, respectively); proportional spacing, 116 to 271 characters per line; 120 (horizontal) x 48 (vertical) increments per inch • 15-inch maximum paper width • prints up to 6 copies • optional bidirectional forms tractor and cut sheet feeders • electrical interface is Centronics parallel (std), Diablo, Qume, or IEEE-488 parallel (opt), or $100 optional RS-232C serial at 110 to 9600 bps (opt):

1,595	NA

• **END**

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Telex TC 270 Series
Information Display System

■ PROFILE

Function ● remote standalone or cluster, 3270-compatible display terminal system for inquiry/update, data entry, and program development ● all processing and database services handled by host unless personal computer option is employed ● local storage for frequently used screen format ● can communicate concurrently with up to 2 host processors.

Architectures Supported ● used with IBM S/360, S/370, 3030, 3081, and 4300 processors, and with 3790 Communications Systems ● S/370 and 4300 function under SNA/SDLC architecture ● S/360, S/370, and 4300 operate under BSC ● remote attach by nonswitched private or switched dial line communications facilities in BSC/SDLC at rates up to 19,200 bps for SDLC; 56K bps optional.

Communications ● CICS/VS under ACF/VTAM, ACF/VTAME, ACF/TCAM for OS/VS and DOS/VS ● IMS/VS under BTAM and ACF/VTAM ● single line ● up to 19,200 bps; BSC/SDLC protocols; half-/full-duplex ● ASCII/EBCDIC code ● point-to-point/multipoint ● RS-232C interface ● interfaces with IBM 27XX and 37XX communications processor.

Operating System ● service through host processor under DOS, DOS/VS, DOS/VSE, OS, OS/VS, VM 370.

Database Management ● none; only in association with host IMS/VS and CICS/VS facilities unless personal computer option is employed.

Transaction Processing ● primarily through CICS or IMS which acts as terminal-oriented transaction monitor with file processing facilities ● supports send/receive batch and inquiry tasks ● local processing via personal computer.

PURCHASE PRICE RANGE   hardware ████████

5-yr maint/serv fee ☐

TC 174
████████☐ $23K to $93K

TC 274C
████████☐ $28K to $98K

TC 276
██☐ $5.3K to $34K

TC 476
██████████████☐ $12K to $184K

TC 479
██████████████☐ $16K to $196K

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

TELEX CORP TC SERIES PURCHASE PRICING bar graph covers price ranges between "small" and "large" configurations for hardware (solid bars) and associated 5-year period maintenance (open bars) ● **TC 174** small configuration consists of an 8-port controller, 4 TC 078 keyboard displays, 2 printer interfaces, and 2 TC 286F printers; large configuration consists of a 24-port controller, 8 TC 078, 8 TC 080, 3 TC 179 keyboard-displays, 19 printer interfaces, 2 TC 279D and a TC 289C printer ● **TC 274C** small configuration consists of an 8-port controller, 4 TC 078 keyboard-displays, 2 printer interfaces, and 2 TC 286F printers; large configuration consists of 24-port controller, 1 dual-host link, 8 TC 078, 8 TC 080, 3 TC 179 keyboard-displays, 3 printer interfaces, a TC 279D and a TC 289C printer ● **TC 276** small configuration consists of TC 276-2 controller display with keyboard; large configuration consists of TC 276-4 TC 078 keyboard-displays, 2 TC 286F printer, and 2 printer interfaces ● **TC 476** small configuration consists of a TC 476B controller-display with keyboard, with 4 printer interface, and a TC 286F printer; large configuration consists of 8 TC 476S controller-displays with keyboards, 8 printer interfaces, 8 I/O expanders, a Model 909 modem cluster adapter, and 8 TC 286F printers ● **TC 479** small consists of TC 479B and same peripherals as TC 476B; large configuration consists of TC 479S with same configuration as the TC 476S. All prices single-quantity purchase; discounts are available.

Support Software ● supported by and employs software and program facilities of host processor ● no local independent (from host) off-line programming/processing capabilities except for personal computer ● system diagnostics checks DTE and DCE.

Processor ● 16-bit microprocessor.

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

First Delivery ● 1979.

Systems Delivered ● about 400,000 terminals.

Comparable Systems ● Davox 1000, Harris 9200, IBM 3270, Memorex 2070, MDS 92X and Hero, ITT Courier 270 and 9000, Memorex 2070, NCR 7950, Lee Data 300/400, and others.

Vendor ● Telex Computer Products, Inc; 6422 East 41st Street, Tulsa, OK 74135 ● 918-627-1111.

Canadian Headquarters ● Tulsa Computer Products; 332 Consumers Road, Willowdale, ON M2J 1P8 ● 416-494-4444.

Distribution ● direct through Telex sales offices.

GSA Schedule ● listed.

■ ANALYSIS

Many vendors attempt to compete against the IBM 3270 by offering lower priced and more readily available equivalents. Others follow the same strategy but add innovative enhancements to their product line. The former group as a whole does well against IBM; the latter group does extremely well.

The Telex product line belongs to the latter group. Consisting of a family of cluster controllers, standalone control-unit/display workstations, keyboard displays, and printers, the products offer all of the important features of their IBM counterparts and then some. For example, the Telex 274C cluster controller competes with the IBM 3274-41C, but unlike that unit it supports 2 **independent high-speed communication links.** The Telex 178, 278-X, and 279-X terminals are identical to the IBM 3178, 3278, and 3279-A, except the Telex products can directly attach a

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Telex TC 270 Series
Information Display System

printer to handle screen printing. The IBM terminals must contend with others for use of one of the cluster-attached printers.

Telex shows further innovation with its TC 276, 476, and 479 standalone control-unit displays. The TC 276 competes with all models of the IBM 3276 but, unlike the IBM product, provides a model (Model 5) which displays 132-column lines. Thus, the 276-5 is well-suited for directly displaying a conventional computer-printout line. To get the same display capability with IBM, users must turn to the 3180 or 3278-5—cluster-controlled terminals. The TC 476 is a very unusual unit at first glance; it looks like a TC 276-2 in that it displays 1920 characters. However, the 276 model accommodates up to 7 slaved terminals/printers, whereas the 476 only accommodates a single light pen or low-speed printer. But, up to 16 TC 476s can be daisy-chained at distances up to 5,000 feet. The marketing strategy behind the TC 476 is 2 pronged. First, since the terminal is not designed to cluster slaved devices, it is simpler and less expensive to produce. This makes it very attractive to organizations needing a single terminal who do not want to incur the expense of a protocol converter to make that terminal "look like" a 3276. The ability to daisy-chain 16 devices provides a limited form of clustering without the additional cost of a controller, and it satisfies growth requirements. The TC 479 is identical to the 476, except the former supports 4-color displays while the latter is a monochrome unit.

Until a few months ago, Telex lagged IBM in providing a powerful standalone personal computer which could also function in a 3270 environment. While IBM had its laudable 3270 PC, Telex only offered PROFFIT—an IBM 5150 lookalike that attaches to the PC 278-X. Telex has improved its position significantly with its new TC 1186 Intelligent Workstation, a device with facilities similar to the 3270 PC.

Telex was somewhat slow to respond to IBM's low-cost 3179 and 3180, 2 units that made life miserable for the plug-compatible vendors, but respond it did. The 3179 is a low-cost version of the 3279-S2B, a color terminal most frequently targeted by the lookalike vendors. Telex's response is the TC 079, a unit that matches IBM's 3179 but is priced far less. Telex has also added a low-cost substitute for the 3279-S2A, S2B, and S3G called the TC 179. Again the Telex units are comparable to IBM but cost less.

Against the multiple screen format IBM Model 3180, Telex puts its new TC 080 series. The TC 080, like the 3180, supports 4 different display formats (3564, 3440, 2560, and 1920 characters); however, the Telex units are offered as **individual** models which the IBM products support **all** formats in 1 terminal. We think Telex made a marketing mistake with that decision (see Limitations).

Telex was also slow to introduce a terminal multiplexer to match IBM's 3299. However, the new TC 299 seems to fill the bill at a lower price.

Telex displays marketing savvy with its design strategy for 100 percent IBM compatibility, making it possible to **directly connect** IBM terminals and printers to its controllers, and vice versa. Many vendors opt against this mix and match strategy in favor of selling complete systems. This approach, however, limits the market to those who either have no IBM components or are leasing or renting them. Most users with purchased IBM equipment are reluctant to replace it unless (1) the products no longer meet their needs and/or (2) they no longer like it. An area where IBM controllers are deficient is dual-host communication. Telex provides this with its 174 and 274C; both will also handle IBM terminals/printers.

Telex prices its products 30 to 40 percent below the IBM umbrella. That, along with product innovations for increased user benefits, makes them extremely attractive and competitive in the marketplace.

In summary, Telex seems to be back on track in the price-performance game with the introduction of its new TC 078, 079, 080, 179, and 1186. These products should compete well against the IBM 3178, 3179, 3180, and 3270 PC, and all are **plug-compatible** replacements that work with IBM **and** Telex controllers. In addition, Telex has demonstrated considerable innovation with its TC 479, an IBM 3276 replacement that provides a color capability not offered by IBM. For those users

who can live with a display-controller that cannot attach slaved displays but who need a color facility, TC 479 is an interesting product.

In the future, it wouldn't be surprising to see the TC 479 enhanced with the extended display characteristics now employed with the TC 276. The current TC 178, 278, and 279 will probably be phased out in favor of the new low-cost terminals. Nobody, except maybe IBM, can support that much product overlap.

☐ Strengths

The principal strengths of this product line rest with the dual-host capability of the TC 174/274C; the local screen format storage option on the 274C; the response-time monitor on all terminals the TC 1186; the local printer attachment (interface) on all terminals; the TC 186 and the overall price-competitiveness/technical innovation of the product line.

The dual-host interface facility means that the 174 or 274C cluster controllers can concurrently communicate with 2 independent hosts. For large organizations and/or those with distributed processing, this capability presents a measure of flexibility not offered by IBM. Dual-host interaction adds far more flexibility to the network since users have the option of dialing (if necessary) other compatible hosts.

The local screen format storage facility offered with the TC 274C allows frequently used screen formats to be downline loaded from the host and stored within the controller. Telex implements this through a 128K-byte RAM option which stores and retrieves the formats. The net result of this local storage is that it increases user productivity by reducing wait-times for format retrieval, cuts the overhead on the host front end, and reduces overall communication costs.

The response-time monitor is a strong user benefit for spotting communication overloads and/or terminal-mix incompatibility. Offered on all terminals, it measures and displays system response time to last transaction, longest-response, fastest-response, and average-response time. It also shows the number of transactions recorded since the counter was reset, and the total response time for all transactions since the counter was reset.

The ability to interface a printer directly to the terminal is another performance enhancement and user benefit. Direct data transfer from screen to printer reduces the load on the cluster controller, and eliminates the printing bottlenecks that can occur when too many terminals are bidding for the services of too few cluster printers. Since these printers can also receive data directly from the host (via controller of course) it further speeds the delivery of data. IBM still does not support a direct printer attachment to its 3270 terminals.

While the PROFFIT personal computer attachment did a commendable job of providing local processing services, the TC 1186 Intelligent Workstation far outstrips it. Designed to compete with the IBM 3270 PC, it can be configured with up to 512K bytes of RAM, a 10MB Winchester hard disk, 360KB of 5.25-inch diskette, and runs under MS-DOS. The 1186 can also be fitted with an extended display/communication facility which supports up to 7 independent display windows, and transfer files upline and downline to the host processor.

To handle file transfer, Telex employs a modified version of the Forte PJ which provides 3278/3279 emulation and uploads file data **without** employing the TSO editor. (The editor is a prime bottleneck in most upload operations and is the prime contributor to the lethargic data-transfer speeds users must put up with.) It appears that the Telex version of PJ also has Forte's new Forte Net TSO software, since the file transfer speeds quoted are 4,500 to 6,000 characters per second. Be aware that during file transfers the personal computer cannot be used for other processing tasks, since MS-DOS does not support this level of concurrent processing.

The TC 299 multiplexer is a welcome addition, since it reduces the number of coaxial cable runs needed to service terminal-to-controller connections. The 299 combines up to 8 terminals/printers on a coaxial cable, dramatically reducing the cost of cables normally needed to handle this configuration by a factor of 7. The 299 also allows terminals/printers to be located

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beyond the 5000-foot-per-unit limit imposed by IBM for units attached via coaxial cable. Using the 299, terminals can be located up to 4,920 feet from the controller.

□ Limitations

While the Telex line does exhibit some notable technical innovations, it lacks many features which appeal to distributed processing users. Specifically, the product line lacks the facility to communicate with local and remote hosts via the **same** controller; it cannot interface asynchronous terminals such as those used with minicomputers; and it lacks a spooler, data compression, and peer-to-peer terminal addressing.

Having one controller which handles both local and remote host connections is a real asset. Organizations can build local terminal clusters which can be serviced by an on-site host, plus interact with a remote computer for other services. While neither Telex nor IBM offer this facility, Lee Data does with its Models 321 and 421 controllers.

Another very useful feature, especially to users with networks incorporating minicomputers, is the ability to handle asynchronous ASCII/Teletype terminals. This, of course, can be done through protocol converters, but those devices are costly add-ons. In addition, if the site currently does not have asynchronous terminals but wishes to interact with a minicomputer, users must incur the cost of the terminal and software to control it. Lee Data, again, offers a simple solution with its "all-in-one" Model 1220 terminal. That device emulates an ASCII/TTY terminal, and allows users to switch from 3270 mode to asynchronous mode with simple keyboard commands. In addition, Model 1220 incorporates all features of IBM's 3278-2 through -5 terminals, allowing users to switch modes from the keyboard. IBM offers a similar capability with its 3180 Model 1.

When up to 32 devices are operating online, every bit of the available bandwidth must count. A data compression capability provides such a service by eliminating unnecessary data such as zeros, blanks, and redundant characters. The Telex products could certainly benefit from this capability.

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 inhibiting the overall data communications function. Neither IBM nor Telex offer a spooler.

Telex, like IBM, also does not allow remote terminals to access the controllers via dial-up facilities. This capability adds considerable operating flexibility and is available from a number of 3270 protocol vendors (e.g., Datastream, Protocol Computers, Innovative, etc).

Another limitation is lack of data encryption. When transmitting sensitive information over a communication network, some ability to encrypt this information is a strong benefit. In fact, some organizations—especially those dealing in financial matters—insist on data encryption. IBM offers this with the 3270; Telex does not.

The final limitation is the fixed screen format of the TC 080 terminal, which is targeted at the 3180 market. But unlike the IBM product which is an all-in-one terminal supporting 4 discrete screen formats (3564, 3440, 2560, and 1920 characters), the TC 080 is offered in **4 different** versions; each supports only **one** display format. For example, the TC 080 Model 2 displays 1920 characters while the Model 3 displays 2560 characters. Users who need format flexibility should consider the all-inclusive screen formatting employed by IBM (and Lee Data, ICOT, and ITT Courier). With these omni products, users can employ a single terminal to handle diverse applications such as data entry, inquiry/update, program development, etc. They can also switch between 80- and 132-column display formats via single-key depression. It is puzzling that Telex packaged the TC 080 in 4 separate versions.

It certainly has technical competance to produce an omni terminal, and the cost factor between a single- and multiple-format terminal isn't that great.

■ COMMUNICATIONS FACILITIES OVERVIEW

□ Distributed Communications

All Telex products are remote units which interface with the IBM S/360, S/370, 4300, and 303X and are controlled by BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, ACF/VTAME, and EXTM. For a description of those communications access methods, **see report 950-I048-3270**.

□ Distributed Configurations

The Telex TC family is made up of 3 principal components: control units, display terminals, and associated printers. Cluster configurations are built around the TC 174 and TC 274C cluster controllers, and the TC 276 control-unit display station. These controllers provide control, buffer, and multiplexing facilities for directly attached terminals and printers which include the Telex 078, 079, 080, 178, 179, 278, 279 displays and 281B, 286F, 287D, 289C, and 387 printers. Unlike IBM, Telex allows its terminals to directly attach printers which may be used to print screen data directly, or receive data from the host via the cluster controller.

Telex also offers 2 standalone replacements for the IBM 3276 called the TC 476 and TC 479. Both Telex units offer the same operating facilities, but the TC 479 also supports 4- or 7-color displays. Unlike their IBM counterparts, the 476 and 479 cannot attach slaved terminals.

For those requiring standalone processing, Telex offers the TC 1186 Intelligent Workstation. An IBM 3270 PC lookalike, it can also be attached to Telex TC 274C or IBM 3274 controllers. Supporting the TC 1186 are 3 printers: the 181 GP, 182, and 186 AP.

The controllers are all remote units and communicate with the host via leased lines or the DDD at speeds of up to 19.2K bps. The controller can be configured to operate as BSC, SDLC, or both. The following outlines the display cluster configurations.

TC 174 Remote Cluster Controller ● accommodates 8 or 16 display terminals or printers in any combination ● provides single or dual high-speed links for addressing separate host processors ● transmits at 9600 bps each link under BSC or SDLC.

TC 274C Remote Cluster Controller ● accommodates 8, 16, 24, or 32 display terminals or printers in any combination ● provides single or dual high-speed links for addressing separate host processors ● transmits at 19.2K bps on single link under SDLC; 9600-bps single link under BSC; or 9600 bps under dual-link configuration regardless of protocol.

TC 276 Control Unit Display Station ● standalone control unit/display or cluster of up to 7 slave display terminals and/or printers ● offered in BSC or SDLC versions; BSC/SDLC optional ● transmit speed of 9600 bps.

TC 476 Control Unit Display Station ● standalone control-unit/display, or up to 16 units can be daisy-chained up to 5,000 feet apart ● offered in BSC or SDLC versions; BSC/SDLC optional ● transmit speed to 9600 bps.

TC 479 Control Unit Display Station ● same as TC 476, except supports 4-color or optional 7-color displays.

□ Distributed Utilities

The Telex units employ those utilities offered by IBM for the 3270. These include the Display Exception Monitoring Facility (DEMF); Device Independent Display Operator Console Support (DIDOCS); Network Problem Determination Application (NPDA); Status Display Support (SDS); Interactive Instruction System (IIS); and Service Level Reporter (SLR). See report **950-I048-3270** for a description.

■ SOFTWARE

The Telex TC 270 Series operates under the same systems software as the IBM 3270. When the Professional Office Computer (PROFFIT) option for the TC 278-2 is employed, that personal computer performs local processing under the CP/M 86 operating system and employs software written for that product. A

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description of the **IBM 3270 software** is presented in report **950-I048-3270**.

☐ Operating Systems

Compatible operating systems are OS, DOS, OS/VS1, OS/VS2(SVS), OS/VS2(MVS, MVS/SE, MVS/SP), DOS/VS, DOS/VSE, and VM/370. The Time Share Option (TSO) can be used under all OS/DOS facilities.

☐ Data Management

Again, all IBM 3270 systems can be used, including: Advanced Text Management System II (ATMS-II); Airline Control Program (ACP); Customer Information Control System (CICS/VS); Information Management System (IMS & IMS/VS); Data Language/1 (DL/1); SQL/Data System; and Storage and Information Retrieval System (STAIRS/VS).

☐ Communications/Networks

TC 174, 274C, 276, 476, and 479 can be configured as clusters of terminals and printers. Local control is handled by the cluster control unit which interacts with the host under BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, and VTAME.

☐ Application Development Aids

The IBM-developed aids offered for the 3270 can be used with the Telex products. The principal offerings are Conversational Monitoring System (VM/CMS); Display Management System (DMS/VS); Generalized Information System (GIS/VS); Structured Program Facility (SPF);, Interactive System Productivity Facility (ISPF); Virtual/Storage Personal Computing (VSPC); VS/APL; and SCRIPT.

■ HARDWARE

☐ Terms & Support

Terms ● all products are available for a purchase lease under a 2- or 3-year lease ● leased terms do not include maintenance ● volume discounts are available ranging from 15 to 40 percent.

Support ● support is rendered through regional centers by Telex field-service personnel ● telephone consulting is also available.

☐ Packaged Components/Overview

The Telex TC 270 Series is a family of cluster terminal systems and standalone terminals that emulate the IBM 3270 with characteristics and features of an IBM 3274-41C Control Unit (cluster controller), IBM 3276-2 and -12 Control Unit Display Station, IBM 3178, 3179, 3180, 3278, 3279 Display Stations, and IBM 3287, 5210, 3268, and 3289 printers. Specific display stations emulated are the 3178 Models C1 and C2; 3179 Model 1; 3180 Model 1; 3278 Models 2 through 5; and the 3279 Model S2A 4-color display station. The Telex keyboards also duplicate the IBM offerings.

Telex offers 3 terminal-cluster controllers; TC 174, TC 274C, and TC 276. TC 174 emulates the IBM 3276 but, **unlike** that product, clusters 8 or 16 terminals/printers. (The 3276 clusters 7 devices). Acceptable peripherals are the Telex TC 078, 079, 080, 178, 179, and 278 terminals and/or 286F and 289C printers. The TC 174 will also accommodate IBM 3270 Category A devices (except 3290). The TC 174 also differs from the IBM product in that it addresses and communicates with 1 or 2 **independent hosts**. No IBM 3270 controller offers this facility. Like the 3276, the TC 174 also supports BSC or SDLC protocols, and in addition, both protocols as an option. However, an 8-terminal/printer cluster is restricted to the same protocol. Although the TC 174 emulates the 3276, it is not **physically** the same type of product. It has no keyboard-display of its own, and supports a full 16 terminal/printer configuration.

The TC 274C emulates the IBM 3274-41C and supports 8, 16, 24, or 32 terminal/printer configurations. This unit attaches the same terminals/printers as the TC 174, and also accommodates IBM 3270 Category A devices (except 3290). Like the TC 174, this controller supports 1 or 2 independent high-speed data links, and runs under BSC/SDLC protocols. The TC 274C also differs from the IBM product in that local storage is available for holding frequently used screen formats. IBM has no such facility, and requires that each format be downline loaded from the host.

The TC 276 Control Unit Display Station is virtually identical to the IBM 3276. It contains its own keyboard display and attaches up to 7 slaved displays/printers. It is also offered in BSC and SDLC versions. The TC 276 emulates the 3276 Models 2, 3, 4, 11, 12, 13, and 14; in addition, Telex offers a Model 5 which produces a 27-line x 132-character display format—something IBM does not have.

In addition to these "conventional" IBM-like controllers, Telex offers 2 unique units called the TC 476 and TC 479. Both units emulate the IBM 3276 Models 2 and 11, but differ in that the Telex products are strictly standalone units attaching either a light pen or printer. They do not interface subordinate keyboard-displays like the IBM products. The TC 476 and 479 also have the facility to be daisy-chained (through interface and communication options) with up to 15 similar devices, creating a local network of 16 TC 476s or 479s. Coaxial cable interconnects the units which can be located 5,000 feet apart. IBM offers no such facility with the 3270. The principal difference between the TC 476 and TC 479 is that the latter has 4-color display.

The Telex keyboard display terminals and their IBM counterparts (shown in parentheses) consist of the TC 078 (3178), TC 079 (3179), TC 080 (3278-2 through 5), TC 179 (3179), TC 178 (3178), TC 278-X (3278-2 through 5), and TC 279-X (3279). The newer 078, 079, 080, and 179 models will undoubtedly eventually replace the older 178, 179, 278-X, and 279-X models.

The 078, 079, 080, 178, and 179 all include a choice of typewriter-style or data-entry keyboards as standard equipment, while keyboards are optional on the 278 and 279. The keyboards are available in arrangements equivalent to IBM's 3178, 3179, 3180, 3278, and 3279, but Telex has simplified keyboard operation by providing single-key clear and single-key program attention functions. IBM requires at least 2 keystrokes. Another Telex enhancement is local printer attachment. Every keyboard/display, including the TC 276, 476, and 479 can directly attach a 100-cps matrix printer. This can be used to directly print screen contents and/or receive data from the host via the controller.

The TC 178 Model 2 is the only terminal in the TC 270 Series family that can accommodate a personal-computer attachment to handle local processing. This upgrade is provided by Telex's Professional Office Computer (PROFFIT), a device similar to IBM's 5150. PROFFIT is provided with 128K-byte RAM, a single double-sided 320K-byte diskette drive, and CP/M-86 operating system. Enhancements include memory expansion to 640K bytes, and an additional 320K-byte diskette drive.

For those requiring more power, Telex offers the Model 1186 Intelligent Workstation, a multifunction terminal compatible with the IBM PC and PC/XT and capable of emulating the IBM 3278-2 for attachment to a 3274 controller. The 1186 employs a 16-bit microprocessor and a 16-bit data path, and can be configured with up to 512K bytes of RAM, a 10MB Winchester hard disk plus 320KB of diskette. It also supports graphics and high-level programming languages such as GW-BASIC.

The printers are comparable with their IBM counterparts, but are priced lower. The one exception is the Telex 281B, a 100-/120-cps matrix printer which attaches to the TC 078, 079, 080, 178, 179, 276, 278, 279, 476, and 479. IBM does not offer this type of product.

All Telex controllers are remote units, and interface with their IBM hosts via 270X/370X/3275 front-end controllers. Communication access methods are BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, ACF/VTAME, and EXTM. All operate under BSC or SDLC, and the TC 174 and 274C can optionally operate under both protocols. Data transmission is half-/full-duplex at 9600 bps for BSC and 19.2K bps for SDLC. If dual high-speed lines are employed with TC 174 and 274C, the maximum data rate is 9600 bps for each link.

☐ Controllers

Telex offers 2 cluster control units and 4 terminal-controller combinations. The cluster controllers are designated TC 174 and TC 274C, and cluster up to 16 and up to 32 terminals/printers,

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respectively. The terminal-controllers are the TC 276, TC 476, TC 479, plus a special library unit called TC 476L. The TC 276 is much like the IBM 3276, and can attach and control up to 7 slave terminals/printers. The TC 476 and 479 provide the same operating facilities as the TC 276, but cannot support slaved terminals. Up to 16 TC 476s and 479s, however, can be daisy-chained to provide a local multiterminal facility, each of which communicates independently with the host. The TC 476L is basically a 476, but can be ordered with special library-oriented keyboards and the facility for handling the American Library Association Machine Readable Catalog Record (ALA-MARC) codes. Up to 16 TC 476Ls can also be daisy-chained.

The TC 174 is actually 2 TC 276s combined. Users have the option of configuring 8- or 16-terminal/printer clusters, and can transmit data to 1 or 2 independent hosts. The TC 274C is a replacement for the IBM 3274-41C, and can handle 8, 16, 24, or 32 terminals/printers. Unlike IBM, however, the TC 274C can also be configured to communicate with 2 independent hosts, and can locally store screen formats. Both of these facilities require that the optional 128K bytes of RAM be specified. Since this RAM is employed both to handle the extended communication control associated with a 2-port controller and also store the downline-loaded screen formats, the use of a dual-port controller diminishes the number of locally stored formats.

Both controllers will attach and control Telex terminals and printers **or** their IBM equivalents. Vendor products can even be **mixed**. This facility is extremely useful and a good marketing move for Telex (see Strengths).

The TC 276's display capability is the same as IBM's 3276-2, 3, 4, 11, 12, 13, and 14. In addition, Telex offers a Model 5 with a 27-line x 132-character format which produces 3,564 displayable characters. IBM has no counterpart.

The TC 476 and 479 emulate the IBM 3276-2 and -12 and display 1920 characters (24 lines x 80 columns). The 479 supports 4 colors.

TC 174 Remote Controller

174 Models 1 & 2 Remote Control Units ● tabletop cluster controller supports 8- or 16-display stations or printers ● equivalent to 2 IBM 3276 or 2 Telex 276 controllers combined ● attaches IBM Category A devices (except 3290), or Telex 078, 079, 080, 178, 179, 278, 286F, and 289C ● can operate under BSC, SDLC, or BSC/SDLC; protocol mixing not permitted within 8-channel groups ● communicates with IBM S/360, S/370, 4300, and 30XX processors at speeds up to 9600 bps, half-/full-duplex mode ● 1 or 2 independent high-speed links.

174 Model 1 ● 8-port controller; BSC or SDLC; EBCDIC/ASCII:

$150/$130 mo	$5,000 prch	$28 maint

174 Model 2 ● 16-port controller; BSC or SDLC; EBCDIC/ASCII; single or dual high-speed links:

250/225	8,500	35

FC 003 BSC/SDLC Program ● factory-installed option supports a single 8-port cluster in BSC/SDLC modes:

17/14	750	4

FC 006 BSC/SDLC Program ● same as FC 003, except for second 8-port cluster:

17/14	750	4

FC 009 BSC Program ● field-installed option converts controller from SDLC to BSC mode:

100/95	3,500	35

FC 010 SDLC Program ● same as FC 009, except converts BSC controller to SDLC:

100/95	3,500	35

FC 011 BSC/SDLC Program ● field-installed option converts controller for operation in BSC/SDLC modes:

117/109	4,250	35

FC 35 BSC to SDLC Upgrade ● field-installed option upgrading single 8-port controller from BSC to SDLC mode:

NA/NA	350	NA

FC 36 BSC to SDLC Upgrade ● field-installed option upgrades 16-port controller from BSC to SDLC:

NA/NA	600	NA

TC 274C Remote Controller

274C Remote Control Unit ● floor-console cluster controller supports 8 to 32 display stations or printers equivalent to IBM 3274-41C ● attaches IBM Category A devices (except 3290) or Telex 078, 079, 080, 178,179, 278, 279, 286F, 289C, and 387 ● can operate under BSC/SDLC ● 128K bytes of RAM; RAM expansion for local screen-format storage ● half-/full-duplex communication with IBM S/360, S/370, 4300, and 30XX processors at speeds of 19.2K bps via single link under SDLC, 9600 bps via single link under BSC, or 9600 bps via dual link under BSC or SDLC ● 1 or 2 independent high-speed links ● 56K bps SNA/SDLC optional.

TC 274C ● 8-port controller; BSC/SDLC; EBCDIC/ASCII; print buffering; local screen-format storage; single high-speed link:

$395/$345 mo	$10,000 prch	$45 maint

TC 274C ● 16-port controller; BSC/SDLC; EBCDIC/ASCII; print buffering; local screen-format storage; single high-speed link:

432/377	11,000	47

TC 274C ● 24-port controller; BSC/SDLC; EBCDIC/ASCII; print buffering; local screen-format storage; single high-speed link:

469/409	12,000	49

TC 274C ● 32-port controller; BSC/SDLC; EBCDIC/ASCII; print buffering; local screen-format storage; single high-speed link:

506/441	13,000	51

TC 274C Dual Host ● dual host communication facilities for all models of TC 274C ● includes 128K-byte local storage for print buffer and local screen format storage:

36/28	750	6

FC 50 Device Adapter ● adds I/O ports 9 through 16 to controller:

35/30	1,000	2

FC 51 Device Adapter ● adds I/O ports 17 through 24 to controller:

35/30	1,000	2

FC 52 Device Adapter ● adds I/O ports 25 through 32 to controller:

35/30	1,000	2

FC 31 Expanded Main Storage ● adds 128K bytes of RAM to controller storage ● prerequisite for high-speed communication link, local print buffering, and/or local screen format storage:

30/22	750	6

Wideband Facility ● provides single-link data transfer rate of 56K bps ● available for all models of TC 274C:

58/47	1,380	5

Print Buffer ● local storage of terminal-initiated print operation when target cluster printer is busy ● requires FC 31:

NC/NC	NC	NC

Double-Density Diskette ● storage medium for local configurations:

NC/NC	NC	NC

Local Screen-Format Storage ● supports local storage of frequently used screen formats ● requires FC 31:

NC/NC	NC	NC

TC 276 Control Unit Display Station

Configuration ● standalone display or cluster-controller/display;

MO: monthly 2-year/3-year lease prices; does not include maintenance. PRCH: single-quantity purchase price. MAINT: monthly maintenance charge. NA: not available/applicable. NC: no charge. Prices current as of February 1985.

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attaches up to 7 slave display terminals and/or printers • modular detached keyboard (see Keyboards for listing) • attaches single light pen or printer • fixed base • BSC or SNA/SDLC versions; available with both BSC and SDLC capabilities • communicates with IBM S/360, S/370, 4300, and 30XX.

Display • 15-inch diagonal • 8x15 dot matrix • 3564-character 27-line x 132-character (column) format (Model 15); 3440-character 43-line x 80-character format (Models 4 and 14); 2560-character 32-line x 80-character format (Models 3 and 13); 1920-character 24-line x 80-character format (Models 2 and 12); all have extra status indicator line • 96 EBCDIC or ASCII character sets • blink or nonblink cursor.

Edit & Format Features • cursor up, down, left, right, return, home • tab, backtab, backspace • cursor address right • erase to EOF; clear input • character insert/delete • protected fields and numeric-only fields • light-pen field select • intensity and nonintensity attributes.

Communications • see Communications section for details.

Peripherals • selector light pen or 281B matrix printer • up to 7 Telex 078/079/080/178/179/278/279 or IBM 3278 terminals; a Telex 286F, 287D, 289C, or IBM 3287/3289 printers.

TC 276-2 • remote BSC with 1920-character display:

$171/$152 mo	$5,350 prch	$30 maint

TC 276-3 • remote BSC with 2560-character display:

183/161	5,600	30

TC 276-4 • remote BSC with 3440-character display:

185/163	5,700	30

TC 276-12 • remote SDLC with 1920-character display:

171/152	5,350	30

TC 276-13 • remote SDLC with 2560-character display:

183/161	5,600	30

TC 276-14 • remote SDLC with 3440-character display:

185/163	5,700	30

TC 276-15 • remote SDLC with 3564-character display:

198/177	6,150	30

TC 276 Terminal Upgrades • field-installable model upgrades/changes available on purchase basis only.

FC 23 Models 2 to 3 or Models 12 to 13:

NA/NA	350	NA

FC 24 Models 2 to 4 or Models 12 to 14:

NA/NA	300	NA

FC 25 Models 12 to 15:

NA/NA	500	NA

FC 26 Models 3 to 4 or Models 13 to 14:

NA/NA	200	NA

FC 27 Models 13 to 15:

NA/NA	500	NA

FC 28 Models 14 to 15:

NA/NA	500	NA

FC 34 BSC/SDLC Capability • provides switch-selectable SDLC or BSC operation for all models except Model 15:

17/14	750	3

FC 04 SDLC Conversion Kit • for field conversion of BSC terminals to SDLC operation • purchase-only basis:

NA/NA	700	NA

FC 16 Row & Counter Feature • counts and displays number of keystrokes per row and column:

11/9	300	2

FC 18 Response-Time Indicator • measures and displays system response time to last transaction, longest response, fastest response, and average response time:

4/3	50	NA

FC 21 Tilt & Rotate Stand • for all models:

NA/NA	125	NA

FC 12 Security Keylock • for all models:

NA/NA	30	NA

FC 37 Selector Light Pen • for all models:

10/9	350	4

FC 35 Audible Alarm • for all models:

2/2	55	NC

TC 476 Control Unit Display Station

Configuration • standalone display controller equivalent to 3276-2 and -12; up to 16 units can be daisy-chained up to 5,000 feet apart • modular detached keyboard (see Keyboards for listing) • fixed base • attaches single printer per display-controller, or single light pen; OCR wands or bar-code reader supported by TC 476L • BSC or SNA/SDLC versions; field upgradable to SNA/SDLC • attaches to IBM S/360, S/370, 4300, and 30XX.

Display • 15-inch diagonal • 8x15 dot matrix • 1920-character 24-line x 80-column format; 25th status line • 96 EBCDIC/ASCII character sets; ALA-MARC optional on TC 476L • blink or non-blink cursor.

Edit & Format Features • cursor up, down, left, right, return, home • tab, backtab, backspace • cursor address right • erase to EOF; clear input • character insert/delete • protected fields and numeric-only fields • reverse video, blinking, intensity, underline fields (TC 476L only); intensity and nonintensity all others • light pen field select.

Communications • see Communications section for details.

Peripherals • selector light pen or 281B matrix printer • OCR wand or bar-code reader on TC 476L.

TC 476B • remote BSC with 1920-character display:

$88/$73 mo	$2,800 prch	$30 maint

TC 476S • remote SDLC with 1920-character display:

88/73	2,800	30

TC 476L • remote BSC with 1920-character display:

88/72	2,250	26

SDLC Conversion Kit • field converts BSC terminals to SDLC operation • purchase-only basis; $100 field-installation charge:

NA/NA	500	NA

FC 13 Tilt & Rotate Stand • for all models:

NA/NA	125	NA

FC 35 Audible Alarm • for all models:

2/2	55	NA

FC 36 Security Keylock • for all models:

NA/NA	30	NA

FC 37 Selector Light Pen • for all models:

10/9	350	4

FC 51 Character Set • foreign character set; available on TC 476L only:

4/3	100	NA

TC 479 Control Unit Color Display Station

Configuration • standalone display controller equivalent to IBM 3276-2 or -12; up to 16 units can be daisy-chained up to 5,000 feet apart • fixed-base display and modular-detached keyboard (see Keyboard listings) • attaches single printer or single light pen per controller • BSC or SNA/SDLC versions; field upgradable to SNA/SDLC.

Display • 15-inch diagonal • 4-color support (red, green, white, blue) • 8x15 dot matrix • 1920-character 24-line x 80-column format; 25th status line • 96 EBCDIC character set • blink or nonblink cursor.

Edit & Format Features • cursor up, down, left, right, return, home • tab, backtab, backspace • cursor address right • erase to

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EOF; clear input ● character insert/delete ● protected fields and numeric-only fields ● reverse-video, blinking fields; intensity and nonintensity all others ● row and column indicator ● light pen field select.

Communications ● see Communications section for details.

Peripherals ● selector light pen or 281B matrix printer.

Keyboards ● see Keyboards section for details.

TC 479B ● remote BSC with 1920-character display:

	$164/$141 mo	$4,200 prch	$30 maint

TC 479S ● remote SDLC with 1920-character display:

	164/141	4,200	30

SDLC Conversion Kit ● field converts BSC terminals to SDLC operation ● purchase-only basis; $100 field-installation charge:

	NA/NA	500	NA

FC 35 Audible Alarm for both models:

	2/2	55	NA

FC 36 Security Keylock ● for both models:

	NA/NA	30	NA

FC 37 Selector Light Pen ● for both models:

	10/9	350	4

FC 18 Response-Time Indicator ● measures and displays system response time to last transaction, longest response, fastest response, and average response times:

	5/3	50	NA

☐ I/O Channels

Remote host processor attachment is established via communications facilities to channel-connected transmission control units/adapters. Local terminal and printer attachment to control units device adapter expansions, such as those shown for TC 274C and TC 276.

The TC 078, 079, 080, 178, 179, 278, and 279 terminals (display stations) and 476, 476L and 479 all attach a selector light pen, and optionally connect the Model 281B printer through a serial interface.

FC 17 Printer Interface ● connects Telex 281B printer to TC 078, 079, 080, 179, 278-X, and TC 279 terminals:

	$9/$7 mo	$300 prch	$2 maint

FC 19 Printer Interface ● connects Telex 281B printer to TC 178 terminal:

	NA/3	75	NA

TC 44 Printer Interface ● connects Telex 281B to TC 476, 476L, and 479 terminal-control unit:

	12/10	500	NA

☐ Communications

The Telex controllers communicate with S/360, S/370, 4300, and 30XX processors over leased lines or the DDD to channels attached to the 2701, 2703, 3704, 3705, or 3725 communications controller or front end. The TC 174 and 274C controllers can connect to 2 independent hosts.

Both controllers can be ordered with BSC, SDLC, or BSC/SDLC protocol-handling facilities. In addition, any controller can be field-modified to accommodate other than the protocol installed at the factory. For example, an SDLC-handling controller can be modified to handle BSC. The standard data transmission rate for the TC 174, 274C, 276, and 476 is 9600 bps. If the 274C is configured as a single high-speed link controller operating under SDLC, the transmission rate is 19.2K bps or optionally 56K bps. For a dual high-speed link version, the data rate is 9600 bps for each line.

The TC 476, 476L, and 479 can function as standalone units; up to 16 units can be daisy-chained up to 5,000 feet apart via an optional Model 909 Modem Cluster Adapter (MCA) which handles the necessary controls to the TC 476, 476L, and 479.

FC 40 Model 909 Modem Cluster Adapter ● interfaces and controls to connect up to 16 daisy-chained TC 476, 476L, or 479

terminal controllers:

	$9/$8 mo	$200 prch	NA maint

FC 41 I/O Expander ● provides extended serial interface for daisy-chaining TC 476, 476L, or 479:

	9/8	200	NA

Terminal Multiplexer

The TC 299 Terminal Multiplexer connects catagory A terminals to the TC 274 or IBM 3274 Control Unit (except the 51C) and reduces coaxial-cable requirements by combining the outputs of up to 8 terminals on a single coaxial cable connected to the controller. Up to four 299s can be attached to the TC 274 or IBM 3274, except the 61C which is limited to 2. The 299 can be located up to 4,920 feet from each terminal, and the same distance from the controller. Thus, terminals connected in this fashion can be located up to 9,840 feet from the control unit.

TC 299 Terminal Multiplexer ● time-division multiplexer (TDM) accommodates 8 category A terminals connected to a TC 274 or IBM 3274:

	$46/$39 mo	$1,000 prch	$8 maint

☐ Workstations/Terminals

The terminals attachable to the TC 174, 274C, and 276 are plug-compatible replacements for IBM 3178, 3179, 3180, 3278, and 3279 terminals. Telex controllers will also accept the applicable IBM terminals.

The Telex terminals offer the same display, edit, and format features as their IBM counterparts. Until September 1983, the Telex products enjoyed 2 advantages over comparable terminals: (1) a **response-time monitor** which measures "turnaround" from the time the user hits the transmit key until a response is displayed, and (2) a direct printer attachment to the terminal. IBM now offers a response-time monitor, but no similar printer capability.

Like IBM, Telex also offers a personal computer attachment to its 278-2 terminal. Called PROFFIT (Professional Office Computer), it is similar to IBM's 5150 personal computer and runs the same communication and control programs. Also like IBM, the personal computer does not interfere with the 278-2 native-mode operation.

PROFFIT contains 128K bytes of RAM expandable to 640K. Standard diskette storage consists of a single-sided, double-density, 5.25-inch diskette drive with a 160K-byte capacity. A second 160K drive is optional. The personal computer runs under CP/M-86; MS-DOS is optional. Auxiliary I/O consists of 2 serial RS-232C ports and a parallel printer port. PROFFIT employs an Intel 8080 microprocessor with a 16-bit architecture and an 8-bit data bus. Its serial interface to the 278 transfers data at 9600 bps.

A standalone personal computer is also available which emulates the IBM 3278-2 and is compatible with the IBM PC and PC/XT. Called the Model 1186 Intelligent Workstation, it employs an Intel 80186 16-bit micro with a 16-bit data path and can be configured with up to 512K bytes of RAM, 10MB of Winchester hard disk and 360KB of 5.25-inch diskette. The 1186 runs under MS-DOS and comes with Micro Soft's GW-BASIC. Its RS-232C or RS-422 interface permits data transfer at 9600 bps. The 1186 can also be equipped with an extended display/communication option which permits **7 independent windows** to be established (each containing a separate application); and allows files to **uploaded/downloaded** to/from the host processor.

The Telex TC 078, 079, and 080 are equivalent to IBM 3178, 3179, and 3180 Model 1, respectively. The TC 080, however, differs from the IBM 3180 in that the latter supports 4 different screen display formats in a single terminal, while the TC 080 is offered in 4 **different** models each supporting a single display format.

The new Telex TC 179 essentially competes with the IBM 3279 Models S2A, S2B, and S3G, but transcends the IBM model in display capacity. While the top-of-the-line 3279-S3G displays 2560 characters, the TC 179 Model 4 provides a 3440 character display. As with **all** Telex TC terminals, the TC 179 is priced below IBM computer parts.

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The Telex TC 178 and 278 are replacements for the IBM 3178 and 3278-2 through -5. The TC 279 series provide a 4-color display and replaces the IBM 3279 Model S2A. The TC 279, like the newer TC 179, also provides 3440-, 2560-, or 1920-character display, while the IBM 3279-S2A displays only 1920 characters.

TC 078 Keyboard-Display Terminal

Configuration ● cluster display terminal for Telex 174/274C/276 controller or attaches directly to IBM 3274/3276 controller and IBM Display/Printer Adapter S/43XX ● modular detached typewriter (EBCDIC/International) or data entry style keyboards ● attaches single printer or light pen ● tilt and swivel base.

Display ● 12-inch diagonal ● 9x12 dot matrix ● 1920-character 24-line x 80-column format; 25th status line ● 96 EBCDIC or International character sets ● underline or reverse video, blinking or nonblinking cursor.

Edit & Format Features ● cursor up, down, left, right, return, home ● new line, tab, backtab, backspace ● cursor address units ● erase to EOF; clear input ● character insert and delete ● protected and numeric-only fields ● blink, intensity, reverse video, underscore, and nondisplay attributors ● light pen field select ● selectable all uppercase or upper-/lowercase character ● typematic.

Communications ● via controller (see Communications for details).

Peripherals ● selector light pen or 281B matrix printer.

TC 078 Terminal ● 1920-character display and typewriter-style keyboard with numeric or program function pad ● security keylock, numeric keylock, volume-adjustable alarm, and automatic screen cutoff:

$61/$47 mo	$1,550 prch	$9 maint

078 Data Entry Keyboard ● data entry-style keyboard with 12-key numeric pad:

NA/NA	NA	NA

078 Typewriter-Style Keyboard ● EBCDIC typewriter-style keyboard with 12 program function key (PF 13-24) keypad:

NC/NC	NC	NA

078 Typewriter-Style Keyboard ● EBCDIC typewriter-style keyboard with 12 program function key (PF 13-24) keypad alternate action:

NC/NC	NC	NA

FC 37 Selector Light Pen:

10/9	350	4

TC 079 Color Keyboard-Display Terminal

Configuration ● cluster display terminal for Telex 174/274C/276 controllers or attaches directly to IBM 3274/3276 controllers and IBM Display/Printer Adapter S/43XX ● modular detached typewriter (EBCDIC/International) or data entry-style keyboards ● attaches single printer or light pen ● tilt and swivel base.

Display ● 12-inch diagonal ● 4-color display (red, green, blue, white) or 7-color (red, green, blue, white, yellow, turquoise, pink) ● 9x12 dot matrix ● 1920 characters, 24 lines x 80 columns; 25th status line ● 96 EBCDIC or International character set ● underline or reverse video, blinking or nonblinking cursor.

Edit & Format Features ● cursor up, down, left, right, home, return ● erase to EOF; clear input ● character insert/delete ● protected and numeric-only fields ● tab, backtab ● light pen field select ● selectable all uppercase or upper-/lowercase character ● typematic functions.

Communications ● via controller (see Communications for details).

Peripherals ● selector light pen or 281B matrix printer.

TC 079-Model 1 Terminal ● 4-color, 1920-character display and typewriter-style keyboard with numeric or program function pad ● security keylock, numeric keylock, volume-adjustable alarm, and automatic screen cutoff:

$82/$65 mo	$2,095 prch	$12 maint

TC 079 Model 2 Terminal ● same as Model 1, except supports 7-color display:

86/68	2,195	12

079 Data-Entry Keyboard ● data entry-style keyboard with 12-key numeric pad:

NA/NA	NA	NA

079 Typewriter-Style Keyboard ● EBCDIC typewriter-style keyboard with 12 program function key (PF 13-24) keypad:

NC/NC	NC	NA

079 Typewriter-Style Keyboard ● EBCDIC typewriter-style keyboard with 12 program function key (PF 13-24) keypad alternate action:

NC/NC	NC	NA

FC 37 Selector Light Pen:

10/9	350	4

TC 080 Keyboard-Display Terminal

Configuration ● cluster display terminal for Telex 174/274C/276 controllers or attaches directly to IBM 3274/3276 controller and IBM Display/Printer Adapter S/43XX ● modular detached typewriter (EBCDIC/International) or data entry-style keyboards ● attaches single light pen, printer or mag stripe reader ● tilt and swivel base.

Display ● 15-inch diagonal ● dot matrix is 7x9 (Models 2 through 5), 9x16 (Model 2), 9x13 (Models 3 and 5), 9x12 (Model 4) ● 3564 characters, 27 lines x 132 characters (Model 5); 3440 characters, 43 lines x 80 columns (Model 4); 2560 characters, 32 lines x 80 columns (Model 3); 1920 characters, 24 lines x 80 columns (Model 2); all have extra status line ● 96 EBCDIC or International character set ● underline or reverse video, blinking or nonblinking cursor.

Edit & Format Features ● cursor up, down, left, right, home, return, select ● erase to EOF; clear input ● character insert/delete ● protected and numeric-only fields ● reverse video ● displayable/nondisplayable characters ● light pen field select ● tab, backtab; selectable all uppercase or upper-/lower-case characters ● typematic functions.

Communications ● via controller—see Communications section for details.

Peripherals ● selector light pen, mag stripe reader or 281B matrix printer.

TC 080 Model 2 ● 1920-character display and typewriter-style keyboard with numeric or program function pad ● operator features consists of security keylock, numeric lock, volume-adjustable alarm, and automatic screen cutoff:

$82/$66 mo	$2,195 prch	$13 maint

TC 080 Model 3 ● 2560-character display with same keyboard choice and operator features as Model 2:

82/66	2,195	13

TC 080 Model 4 ● 3440-character display terminal; same operator features and keyboard choices as Model 2:

82/66	2,195	13

TC 080 Model 5 ● 3564-character display terminal; same operator features and keyboard choices as Model 2:

82/66	2,195	13

080 Data Entry Keyboard ● data entry-style keyboard with 12-key numeric pad:

NA/NA	NA	NA

080 Typewriter-Style Keyboard ● EBCDIC typewriter-style keyboard with 12 program function key (PF 13-24) keypad:

NC/NC	NC	NA

080 Typewriter-Style Keyboard ● EBCDIC typewriter-style keyboard with 12-key numeric pad and PF 13-24 alternate action:

NC/NC	NC	NA

FC 16 Row & Counter Feature ● counts and displays number of

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keystrokes per row and column:

15/9	300	2

FC 18 Response-Time Indicator • measures and displays system response time to last transaction, longest response, fastest response, and average response times:

5/3	50	NA

FC 37 Selector Light Pen:

15/9	350	4

TC 179 Color Keyboard-Display Terminal

Configuration • cluster display terminal for Telex 174/274C/276 controllers or attaches directly to IBM 3274/3276 controllers and IBM Display/Printer Adapter S/43XX • modular detached typewriter (EBCDIC/International) or data entry-style keyboards • attaches single printer, light pen, or mag stripe reader • tilt and swivel base.

Display • 14-inch diagonal • 4-color display (red, green, blue, white) • dot matrix is 7x9 (Models 2 through 4), 9x16 (Model 2), 9x13 (Model 3), 9x12 (Model 4) • 3440 characters, 43 lines x 80 columns (Model 4); 2560 characters, 32 lines x 80 columns (Model 3); 1920 characters, 24 lines x 80 columns (Model 2); all have extra status line • 96 EBCDIC or International character set • underline/reverse video, blinking/nonblinking cursor.

Edit & Format Features • cursor up, down, left, right, home, return, select • erase to EOF; clear input • character insert/delete • protected and numeric-only fields • reverse video • displayable/nondisplayable characters • light pen field select • tab, backtab; selectable all uppercase or upper-/lowercase characters • typematic functions.

Communications • via controller—see Communications section for details.

Peripherals • selector light pen, mag stripe reader or 281B matrix printer.

TC 179 Model 2 • 4-color, 1920-character display and typewriter-style keyboard with numeric or program function pad • operator features consists of security keylock, numeric lock, volume-adjustable alarm, and automatic screen cutoff:

NA/NA mo	$2,295 prch	$14 maint

TC 179 Model 3 • 4-color, 2560-character display with same keyboard choice and operator features as Model 2:

108/86	2,795	14

TC 179 Model 4 • 4-color, 3440-character display with same keyboard choice and same operator features as Model 2:

115/91	2,995	14

179 Data Entry Keyboard • data entry-style keyboard with 12-key numeric pad:

NA/NA	NA	NA

179 Typewriter-Style Keyboard • EBCDIC typewriter-style keyboard with 12 program function key (PF 13-24) keypad:

NC/NC	NC	NA

179 Typewriter-Style Keyboard • EBCDIC typewriter-style keyboard with 12-key numeric pad and PF 13-24 alternate action:

NC/NC	NC	NA

FC 16 Row & Counter Feature • counts and displays number of keystrokes per row and column:

15/9	300	2

FC 18 Response-Time Indicator • measures and displays system response time to last transaction, longest response, fastest response, and average response times:

5/3	50	NA

FC 37 Selector Light Pen:

15/9	350	4

Extended 7-Color Support • displays colors red, green, blue, white, yellow, turquoise, and pink:

NA/NA	NA	NA

178 Keyboard-Display Terminal

Configuration • cluster-display terminal for Telex 174/274C/276 controllers or attaches directly to IBM 3274/3276 • modular detached typewriter (ASCII or EBCDIC) and data entry-style keyboards • attaches single printer or light pen • fixed base.

Display • 12-inch diagonal • 7x12 dot matrix • 1920-character 24-line x 80-column (character) format; 25th status line • 96 ASCII or EBCDIC character sets • blinking and nonblinking cursor.

Edit & Format Features • cursor up, down, left, right, home, return, select • tab/skip, backtab, backspace • cursor address write • erase to EOF; clear input • character insert/delete • protected fields; numeric-only fields; displayable/nondisplayable characters • light-pen field select • selectable all uppercase or upper-/lowercase characters • typematic functions.

Communications • via controller—see Communications section for details.

Peripherals • selector light pen or 281B matrix printer.

TC 178 Model 2 • 1920-character display with choice of FC 74, 77, 83, 92, 106, 113, or 114 keyboard:

$55/$42 mo	$1,550 prch	$12 maint

FC 72 Tilt & Rotate Stand:

NA/NA	50	NA

FC 16 Row & Counter Feature • counts and displays number of keystrokes per row and column:

15/9	300	2

FC 18 Response-Time Indicator • measures and displays system response time to last transaction, longest response, fastest response, and average response time:

5/3	50	NA

FC 12 Security Keylock:

NA/NA	30	NA

FC 37 Selector Light Pen:

15/9	350	4

FC 35 Audible Alarm:

NA/NA	30	NC

FC 74 Keyboard • EBCDIC typewriter-style with 24 program function keys:

NC/NC	NC	NA

FC 75 Keyboard • EBCDIC typewriter-style with 12 program function (PF) key keypad:

15/14	600	NA

FC 76 Keyboard • EBCDIC typewriter-style with numeric keypad:

10/9	400	NA

FC 77 Keyboard • data entry-style with numeric keypad:

NC/NC	NC	NA

FC 78 Keyboard • data entry-style with keypunch layout:

15/14	600	NA

FC 79 Keyboard • ASCII typewriter-style layout with function keypad:

15/14	600	NA

FC 80 Keyboard • ASCII typewriter-style layout with numeric keypad:

15/14	600	NA

FC 83 Keyboard • EBCDIC typewriter-style with 24 program function (PF) keys, single-key clear, and 2 program attention keys:

NC/NC	NC	NA

FC 92 Keyboard • EBCDIC typewriter-style with numeric keypad, 12 alternate function keys, 2 program attention (PA) keys, and single-key clear:

NC/NC	NC	NA

FC 106 Keyboard • EBCDIC data entry-style with 10-key numeric

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pad and single-key clear:

	NC/NC	NC	NA

FC 113 Keyboard • EBCDIC typewriter-style with 12 program functions, 12 alternate function keys, 2 program attention (PA) keys, and single-key clear:

	NC/NC	NC	NA

FC 114 Keyboard • EBCDIC typewriter-style with 12 program function (PF) key keypad and 12 alterate function keys:

	NC/NC	NC	NA

TC 278-X Keyboard/Display Terminal

Configuration • cluster-display terminal for Telex 174/274C/276 controllers, or attached directly to IBM 3274/3276 • modular detached typewriter- (ASCII or EBCDIC) and data entry-style keyboards • fixed base • attaches light pen or printer • upgradable to personal computer via PROFFIT option.

Display • 15-inch diagonal • 9x14 dot matrix (Model 2); 9x12 dot matrix (Models 3, 4, 5) • 3564 characters, 27 lines x 132 columns (Model 5); 3440 characters, 43 lines x 80 columns (Model 4); 2560 characters, 32 lines x 80 columns (Model 3); 1920 characters, 24 lines x 80 characters (Model 2); all have extra status line • 96 ASCII or EBCDIC character set • blinking and nonblinking cursor.

Edit & Format Features • cursor up, down, left, right, home, return, select • cursor address write • erase to EOF; clear input • character insert/delete • protected and numeric-only fields • reverse video • displayable/nondisplayable characters • light-pen field select • typematic functions • selectable all uppercase or upper-/lowercase characters • tab, backtab.

Communications • via controller—see Communications section for details.

Peripherals • selector light pen or 281B matrix printer.

TC 278-2 • 1920-character display:

	$53/$47 mo	$2,100 prch	$12 maint

TC 278-3 • 2560-character display:

	64/58	2,300	13

TC 278-4 • 3440-character display:

	65/59	2,500	14

TC 278-5 • 3564-character display:

	77/70	2,800	15

TC 278 Display Upgrades • field-installable model upgrades/changes available for purchase only.

FC 23 Model 2 to Model 3:

	NA/NA	550	NA

FC 24 Model 2 to Model 4:

	NA/NA	660	NA

FC 25 Model 2 to Model 5:

	NA/NA	1,050	NA

FC 26 Model 3 to Model 4:

	NA/NA	600	NA

FC 27 Model 3 to Model 5:

	NA/NA	1,050	NA

FC 28 Model 4 to Model 5:

	NA/NA	1,050	NA

FC 12 Security Keylock • for all models:

	NA/NA	30	NA

FC 16 Row & Counter Feature • counts and displays number of keystrokes per row and column:

	11/9	300	2

FC 37 Selector Light Pen • for all models:

	10/9	350	4

FC 35 Audible Alarm • for all models:

	2/2	55	NC

FC 18 Response-Time Indicator • measures and displays system response time to last transaction, longest response, fastest response, and average response time:

	4/3	50	NA

FC 21 Tilt & Rotate Stand • for all models:

	NA/NA	125	NA

FC XX Keyboard • same as offered with TC 279-X.

Professional Office Computer (PROFFIT) • provides personal computer attachment to TC 278-Z • 128K bytes of RAM and single double-sided 320K-byte diskette drive • CP/M-86:

	88/63	1,830	25

FC 26 Double-Sided Diskette Drive • adds second 320K-byte diskette drive to PROFFIT:

	22/16	450	5

FC 15 Memory Upgrade • 256K RAM module:

	16/12	325	2

FC 16 Memory Upgrade • 384K RAM module:

	38/27	775	4

FC 17 Memory Upgrade • 512K RAM module:

	53/38	1,100	6

FC 18 Memory Upgrade • 640K RAM module:

	69/49	1,425	8

TC 279 Color Keyboard/Display Terminal

Configuration • color cluster-display terminal for Telex 174/274C/276 controller; also attaches directly to IBM 3274/3276 • modular detached typewriter- (ASCII or EBCDIC) and data entry-style keyboards • fixed base • attaches light pen or printer.

Display • 15-inch diagonal • 4 colors • 9x14 dot matrix (Model 2A); 9x12 dot matrix (Models 3A and 4A) • 3440 characters, 43 lines x 80 columns (Model 4A); 9x12 dot matrix (Models 3A and 4A) • 3440 characters, 43 lines x 80 columns (Model 4A); 2560 characters, 32 lines x 80 columns (Model 3A); 1920 characters, 24 lines x 80 columns (Model 2A); all have extra status line • 96 ASCII or EBCDIC character set • blinking and nonblinking cursor.

Edit & Format Features • cursor up, down, left, right, home, return, select • erase to EOF; clear input • character insert/delete • protected and numeric-only fields • reverse video • displayable/nondisplayable characters • light-pen field select • tab, backtab, selectable all uppercase or upper-/lowercase characters • typematic functions.

Communications • via controller—see Communications section for details.

Peripherals • selector light pen or 281B matrix printer.

TC 279-2A • 4-color, 1920-character display terminal:

	$89/$76 mo	$3,350 prch	$12 maint

TC 279-3A • 4-color, 2560-character display terminal:

	99/85	3,600	13

TC 279-4A • 4-color, 3440-character display terminal:

	104/88	3,850	14

FC 12 Security Keylock • for all models:

	NA/NA	30	NA

FC 16 Row & Counter Feature • counts and displays number of keystrokes per row and column:

	11/9	300	2

FC 18 Response-Time Indicator • measures and displays system response time to last transaction, longest response time to last transaction, longest response, fastest response, and average response time:

	4/3	50	NA

FC 21 Tilt & Rotate Stand • for all models:

	NA/NA	125	NA

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FC 37 Selector Light Pen • for all models:

10/9	350	4

FC 35 Audible Alarm • for all models:

2/2	55	NC

TC 1186 Intelligent Workstation • multifunction terminal compatible with IBM PC and PC/XT; also emulates IBM 3278-2 for use in 3274 environments • standard features include Intel 80186 microprocessor with 16-bit data path and 6-MHz clock speed; 128K bytes of RAM expandable to 512K; 32K bytes of ROM • dual 5.25-inch doubled-sided, double-density diskettes with 360K bytes each; optional 10M-byte hard disk • MS-DOS operating system; GW-BASIC • 12-inch CRT with 7x9 dot character matrix; color and monochrome RGB color graphics 640x200 pixel addressability (8x8 dot character) • detached PC-compatible and 3278/style keyboard • RS-232C, RS-422, and parallel ports; coax board/3270 support optional.

TC 1186 Model 1 • 12-inch color and monochromatic tilt and swivel monitor, dual 5.25-inch diskette, MS-DOS, 2 serial ports (RS-232C and RS-422) and single parallel printer port; PC or 3278 keyboard; all other standard features:

145/103	3,025	31

1186 Model 10 • 12-inch color and monochrome tilt and swivel monitor, single 5.25-inch diskette, 10M-byte Winchester hard disk, MS-DOS, 2 serial ports (RS-232C and RS-422) and single parallel printer port; PC or 3278 keyboard; all other standard features:

239/170	4,980	32

RAM Upgrade • 128K RAM upgrade for Models 1 and 10; maximum of 3 units:

10/7	200	NC

Extended Display/Communications • provide facility for simultaneously displaying 7 concurrent independent applications • communications facility also uploading/downloading files under TSO CMS control:

NA/NA	600	NA

3270 Coaxial Interface • allows Model 1 to connect to Telex 274 or IBM 3274 controllers via coaxial cable:

NA/NA	42	NC

3270 Coaxial Interface • allows Model 10 to connect to Telex 274 or IBM 3274 controllers via coaxial cable:

NA/NA	61	NC

☐ Keyboards

Aside from the special keyboards offered with the FC 178, Telex provides a number of keyboards compatible with the 276, 278, 279, 476, and 479. In the following list, FC 80 through FC 113 keyboards are available for TC 178, 278, and 279 only. All others, with the exception of FC 88 and FC 93 through FC 104, are available for TC 276, 476, and 479.

TC 80 Keyboard • EBCDIC typewriter-style with 24 program function (PF) keys:

$15/$14 mo	$600 prch	NA maint

TC 81 Keyboard • same as TC 80, except has single-key clear:

15/14	600	NA

TC 82 Keyboard • same as TC 80; except also has 2 single-key activated program attentions (PA):

15/14	600	NA

TC 83 Keyboard • same as TC 82, except also has single-key clear:

10/9	400	NA

TC 84 Keyboard • EBCDIC typewriter-style with 12 program function (PF) keys:

15/14	600	NA

TC 85 Keyboard • same as TC 84, except has single-key clear:

15/14	600	NA

TC 86 Keyboard • same as TC 84, except has 2 single-key activated program attentions (PA):

15/14	600	NA

TC 87 Keyboard • same as TC 86, except has single-key clear:

15/14	600	NA

TC 88 Keyboard • same as TC 87, except also conforms to IBM RPQ 8K0808 • not available for TC 276, 476, or 479:

15/14	600	NA

TC 89 Keyboard • EBCDIC typewriter-style with numeric keypad and 12 alternate-action program function (PF) keys:

15/14	600	NA

TC 90 Keyboard • same as TC 89, except has single-key clear:

15/14	600	NA

TC 91 Keyboard • same as TC 89, except also has 2 single-key activated program attentions (PA):

15/14	600	NA

TC 92 Keyboard • same as TC 91, except has single-key clear:

10/9	400	NA

TC 93 Keyboard • ASCII typewriter-style with 24 program function (PF) keys • not available for TC 276, 476, 479:

15/14	600	NA

TC 94 Keyboard • same as TC 93, except has single-key clear:

15/14	600	NA

TC 95 Keyboard • same as TC 93, except also has 2 single-key activated program attentions (PA):

15/14	600	NA

TC 96 Keyboard • same as TC 95, except has single-key clear:

15/14	600	NA

TC 97 Keyboard • ASCII typewriter-style with 12 program function (PF) keys • not available for TC 276, 476, 479:

15/14	600	NA

TC 98 Keyboard • same as TC 97, except has single-key clear:

15/14	600	NA

TC 99 Keyboard • same as TC 97, except also has 2 single-key activated program attentions (PA):

15/14	600	NA

TC 100 Keyboard • same as TC 99, except has single-key clear:

15/14	600	NA

TC 101 Keyboard • ASCII typewriter-style with numeric keypad and 12 alternate-action program function (PF) keys • not available for TC 276, 476, 479:

15/14	600	NA

TC 102 Keyboard • same as TC 101, except has single-key clear:

15/14	600	NA

TC 103 Keyboard • same as TC 101, except also has 2 single-key activated program attentions (PA):

15/14	600	NA

TC 104 Keyboard • same as TC 103, except has single-key clear:

15/14	600	NA

TC 105 Keyboard • EBCDIC data entry-style with 10-key numeric pad:

15/14	600	NA

TC 106 Keyboard • same as TC 105, except has single-key clear:

10/9	400	NA

TC 107 Keyboard • EBCDIC data entry-style:

15/14	600	NA

TC 108 Keyboard • same as TC 107, except has single-key clear:

15/14	600	NA

Telex TC 270 Series
Information Display System

TC 109 Keyboard • EBCDIC data entry-style with 10-key numeric pad:

15/14	600	NA

TC 110 Keyboard • same as TC 109, except has single-key clear:

15/14	600	NA

TC 111 Keyboard • EBCDIC data entry-style with key-punch layout:

15/14	600	NA

TC 112 Keyboard • EBCDIC data entry-style with single-key clear:

15/14	600	NA

TC 113 Keyboard • EBCDIC typewriter-style with 12 program function (PF) keys, 12 alternate-action program keys, 2 single-key activated program attentions (PA), and single-key clear:

10/9	400	NA

FC 53 Keyboard • ASCII or EBCDIC typewriter-style with 12 program function (PF) keys • available on TC 476L only:

10/9	400	NA

FC 54 Keyboard • typewriter-style with ALA/MARC keycaps • available on TC 476L only:

14/12	500	NA

FC 55 Keyboard • typewriter-style with foreign language keycaps • available on TC 476L only:

14/12	500	NA

☐ Printers

The Telex printers consist of 5 tabletop serial matrix, 2 serial daisywheels, and a pedestal-mounted spinning-belt character printer. Three printers, the 181 GP, 182 and 186 AP, attach only to the TC 1186. The 281B is a "screen" printer which interfaces with the TC keyboard-display products.

181 GP Printer

Configuration • tabletop serial matrix impact • 2000-character buffer • attaches to TC 1186 workstation.

Printer • 120-cps bidirectional; 12x8 dot matrix (at 80 columns) and 9x8 dot matrix (132 columns) • logic-seeking circuits • 96 ASCII/Programmable Graphics/International character set • 80/132 columns • 10 cpi (80 columns) or 17 cpi (132 columns); 2, 3, 4, or 8 lpi • pin-feed sprocket • 3-part forms:

$31/$22 mo	$640 prch	$8 maint

182 GP Printer

Configuration • same as 181 GP.

Printer • 120-cps bidirectional; 9x8 dot matrix • logic-seeking circuits • 96 ASCII/Programmable Graphics/International character set • 132/218 columns • 10 cpi (132 columns) or 17 cpi (218 columns); 2, 3, 4, or 8 lpi • pin-feed sprocket • 3-part forms:

$45/$32 mo	$940 prch	$9 maint

186 AP Letter-Quality Printer

Configuration • tabletop daisywheel impact printer • 1920-character buffer • attaches to TC 1186 workstation.

Printer • 40-cps bidirectional • 96 ASCII character set • 136/163 columns • ribbon cartridge • friction feed; 3-part forms:

$108/$77 mo	$2,250 prch	$30 maint

281B Printers

Configuration • tabletop serial matrix impact • 1920-character buffer • attaches to TC 078, 079, 080, 178, 179, 276, 278-X, 476, and 479 displays.

Printer • 100-cps (standard) or 120-cps (with PROFFIT) bidirectional 7x9 dot matrix impact • 96 ASCII/EBCDIC character sets; European character sets optional • 80/132 columns • 10 cpi (80 columns) or 17 cpi (132 columns); 2, 3, 4, or 8 lpi • roll- or pin-feed, adjustable sprocket • 3-part forms.

TC 281B Matrix Printer • 100 cps:

$34/$26 mo	$900 prch	$21 maint

TC 281AP Matrix Printer • 120 cps • employed with PROFFIT personal computer option:

41/30	850	15

286F Printer

Configuration • tabletop serial daisy-wheel printer • 960/1920/2560/3440/3564-character buffer • cluster printer for Telex 174/274C/276 and IBM 3274/3276.

Printer • 60-/80-cps bidirectional • 96-/127-character ASCII-B or EBCDIC character sets • 132/158 print positions at 10/12 cpi, respectively • 6/8 lpi • mono-/dual-case printing • friction-feed platen; 3- to 15-inch form width; 6-part forms:

$185/$165 mo	$5,750 prch	$50 maint

FC 84 Bidirectional Forms Tractor:

20/15	530	4

FC 85 Unidirectional Forms Tractor:

12/9	270	4

FC 97 Single-Sheet Feeder:

NA/NA	1,800	20

287D Printer

Configuration • tabletop serial matrix impact • 1920-character buffer standard, 1920 additional character extra-cost option • attaches to Telex 174/274C/276 or IBM 3274/3276.

Printer • 75/100/150-cps bidirectional • 7x8 dot matrix, 96 ASCII/EBCDIC character sets • 132 columns • 10 cpi, 6/8 lpi • 3- to 15-inch pinfeed forms tractor • 5-part forms:

$176/$155 mo	$5,000 prch	$40 maint

FC 47 Buffer Expansion • 1920-character expansion buffer:

4/3	105	NA

289C Line Printer

Configuration • pedestal-mounted character spinning-belt printer • 1920-character buffer standard; 1920 characters optional • cluster line printer attaches to Telex 174/274C/276 and IBM 3274/3276.

Printer • 340 lpm with 64-character belt; 280 lpm with 96-character belt • 64/96 ASCII/EBCDIC character set • up to 132 characters per line; 6/8 lpi; 10 cpi • 3- to 15-inch forms tractor • operator-selectable form length, line length, print density, mono-/dual-case printing, single/double spacing:

$440/$350 mo	$11,500 prch	$100 maint

FC 26 Buffer Expansion • 1920-character expansion buffer:

20/16	400	NA

387 Printer

Configuration • tabletop serial matrix impact • 960/1920/2560/3440/3564-character buffer • attaches to Telex 174/274C/276 and IBM 3274/3276.

Printer • 140/280/400-cps bidirectional • 8x7 dot matrix (280 and 400 cps) or 16x14 dot matrix (140 cps) • 96 ASCII/EBCDIC character sets; APL text • 136/163/204/227/233 print positions at 10/12/15/16.7/17.1 cpi, respectively • high-density bold print available in all cpi configurations • 3/4/6/8 lpi; 10/12/15/16.7/17.1 cpi • mono-/dual-case character printing • 3- to 16-inch pinfeed forms tractor • 6-part forms:

$240/$210 mo	$7,200 prch	$55 maint

• **END**

3M EMT Series Facsimile Transceivers
Models EMT 1000E, EMT 2000, EMT 2346, EMT 2700, EMT 9140, EMT 9145, EMT 9160 & EMT 9165

■ PROFILE

Function ● general-purpose digital/analog facsimile transceivers with high-quality half-tone transmission ● unattended operation via auto-dialer and polling on some products.

Type ● tabletop or floor-console transceivers.

CCITT Compatibility ● Group 2 only (EMT 1000E); Groups 1 and 2 (EMT 2346); Groups 2 and 3 (EMT 2000, 2700, 9140, 9145, and 9160); Groups 1, 2, and 3 (EMT 9165).

Maximum Scanning Width ● 8.5 inches for all models, except EMT 2000, 9160, and 9165 which are 10 inches.

Feeder ● single-sheet, manual (EMT 2346 and 9145); auto-feed 30 documents (EMT 1000E, 9140, 9145, and 9160); 50 documents (EMT 2000, 2700, 9165, and 9600).

Image Resolution ● 203x200/100 lpi (EMT 2000, 2700); 200x400/200/100 lpi (EMT 9165); 200x200/100 lpi (EMT 9160); 200x200 lpi (EMT 9145); 200x100 lpi (EMT 9136 and 9140); 96x144/96/64 lpi (EMT 1000E); 96x96 lpi (EMT 9160); 96x96/64 lpi (EMT 2346).

Half-Tone Support ● 16 shades of gray (EMT 1000E, 2000, 2346, and 9160).

Communications ● dedicated (leased) line or DDD network ● transmit/receive speeds of 9600/7200/4800/2400 on EMT 2700, 9160, 9165; 4800 bps on EMT 2000, 9145; 2400 bps on EMT 9140 ● polling offered on EMT 2000 and 9165 ● Group 1 and 2 transmission times are industry standard 6/3 minutes.

First Delivery ● 1981 (EMT 2700 and 9160); 1982 (EMT 1000E and 9140); 1984 (EMT 9145).

Units Installed ● unavailable.

PURCHASE PRICE RANGE

Hardware ▮▮▮

5-yr maint fee ☐☐☐

EMT 1000E
▮☐ $1.9K to $3.7K
EMT 2000
▮☐ $2.6K to $7.6K
EMT 2346
▮☐ $0.95K to $2.5K
EMT 2700
▮☐ $4K to $6.4K
EMT 9140
▮☐ $2.2K to $3.9K
EMT 9145
▮☐ $3.7K to $5.4K
EMT 9160
▮☐ $4.2K to $6.6K
EMT 9165
▮☐ $5.5K to $8K

| $4K | $8K | $12K | $16K | $20K | $24K |
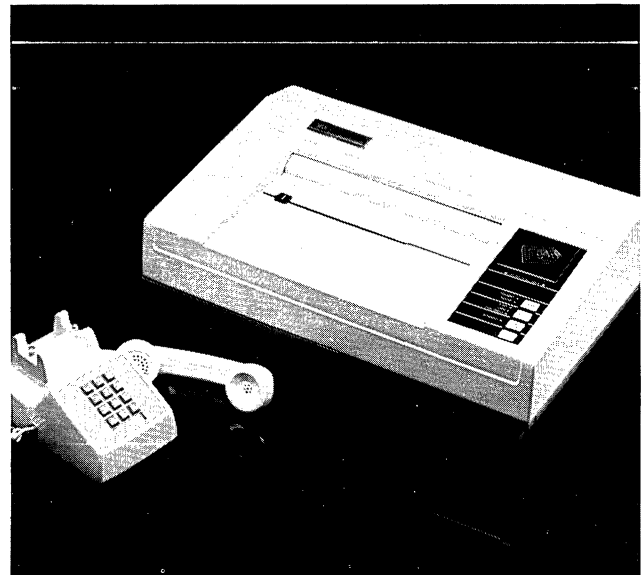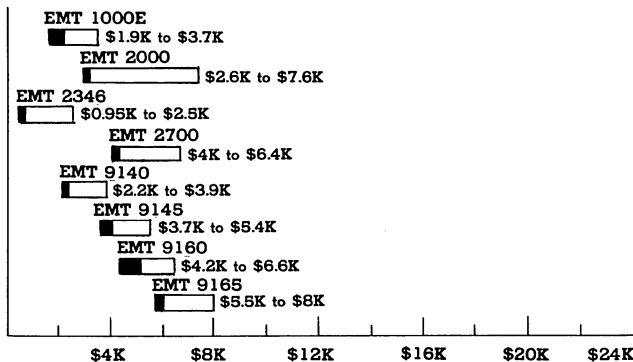
3M EMT FACSIMILE TERMINALS PURCHASE PRICING bar graph covers range between individual family members ● hardware costs are defined by solid bar; associated 5-year maintenance by open bar ● EMT 1000E is basic system plus auto-feed option ● EMT 2000 is basic system ● EMT 2346, EMT 2700, EMT 9140 are all basic systems ● EMT 9145 is basic system plus auto-dial and auto-feed options ● EMT 9160 is basic system plus auto-dial ● EMT 9165 is basic system. All prices are single-quantity purchase.

Comparable Systems ● Burroughs dex Series; Exxon Qwip 2210 and 2310; NEC System III SE: Pitney Bowes 8800; and Rapicom Models 3100, 3300, and R-5000.

Vendor ● 3M Company; 3M Center, St. Paul, MN 55144 ● 612-733-1110.

Distribution ● nationwide through 3M sales offices.

■ ANALYSIS

Since our last evaluation of the EMT series, 3M has adopted a strategy of price-positioning its product line at or below that of its competition. While price certainly is a major consideration in purchasing facsimile transceivers, we question the wisdom of ignoring the challenge posed by some of the more sophisticated machines on the market currently offered by Ricoh (formerly Rapicom), Pitney Bowes, Panafax, and NEC. These vendors offer page store-and-forward facilities, whereby a transceiver can receive pages from other units, store them on disk or in RAM, and forward them to other facsimile devices. Since the people at 3M certainly understand marketing, we guess they have their reasons—and they do. In fact, 3M is reading **quite a surprise** which we'll reveal at the end of this analysis.

If we discount the importance of such advanced facilities and concentrate on "standard" facsimile services, the EMT series is technically comparable with some of the leading transceivers and enjoys a price advantage over most.

The EMT series consists of 8 transceivers: EMT 1000E, 2000, 2346, 2700, 9140, 9145, 9160, and 9165. The 1000E is strictly a CCITT Group 2 (AM) machine with a 96x144/96/64 lpi resolution and the facility for handling half-tones with 16 shades of gray. Priced at $1,880 plus $150 for a 50-document auto-feeder, it's an outstanding machine for those who can live with transmission times between 80 seconds and 4.5 minutes. The

3M EMT Series Facsimile Transceivers
Models EMT 1000E, EMT 2000, EMT 2346, EMT 2700, EMT 9140, EMT 9145, EMT 9160 & EMT 9165

latter is needed for 96x144-lpi resolution.

The 2000, 2700, 9140, 9145, and 9160 are all Group 2 and 3 transceivers. These units differ in image resolution, half-tone support, data compression support, data transmission speeds and, of course, price. The 2000 is an outstanding buy. It is primarily a Group 3 machine with Group 2 optional, has a 203x200/100 lpi resolution, half-tone support (16 shades of gray), modified Huffman/Read data compression, an integral 9600/7200/4800/2400-bps modem, and polling support. Priced at $2,600, we aren't aware of anything on the market that even comes close to it.

The EMT 2700 has the same scan image resolution but no half-tone support or modified read. It does have Group 2 and 3 compatibility as standard and the same class of integral modem as the EMT 2000. With a price of $3,995, it's competetive with a number of products on the market but no where near the bargain the 2000 is.

The EMT 9140 also supports Group 2 and 3 as standard features and sports a 200x100 lpi scan resolution. It does have modified Huffman (but not modified read) compression, but no half-tone support. Its maximum transmission speed is 2400 bps. The 9140 also provides such useful services as time and date stamping, terminal identification, message receipt conformation, voice transmission, call-back message auto-dial and an ASCII TTY interface as standard equipment. At $2,211 it's an attractive buy, but would be even better with a faster transmit speed.

The EMT 9145 is virtually the same as the 9140, except its scan resolution is 200x200 lpi and it transmits at 4800 bps. Document auto-feed, however, is a $135 option (auto-feed is standard on the 9140) and a 10-number auto-dialer is available also for $135. The 9145 carries a $3,260 base price.

EMT 9160 has a scan resolution of 200x200 lpi (Group 3) and 96x96 lpi, and supports half-tone transmission with up to 16 shades of gray. It also provides, as a standard feature, modified Huffman/Read data compression, a 9600-bps transmit speed, auto-answer/disconnect and document reduction. A 10-number auto-dialer is a $395 option. Priced at $3,795, it's an excellent buy, prinicipally because of its advanced data compression and half-tone facilities.

The top-of-the-line EMT 9165 has just about everything except local page storage, auto-scan resolution, and advanced data compression. It is Groups 1, 2, and 3 compatible, has a 200x400/200/100 scan-image resolution, provides document auto-reduction, and has a 9600-bps integral modem. It also provides auto-answer, terminal identification, polling and turnaround polling, auto-dialing, delayed transmission, time and date stamping, voice communication, and an ASCII TTY interface. It does not offer half-tone support, however, and only employs modified Huffman compression (no modified read). Priced at $5,495, the EMT 9165 is also an excellent buy.

The final product in the line is the EMT 2346, a Group 1 and 2 transceiver with fairly typical characteristics. It employs a single-document manual feed input, with a roll-feed output; a 96x96/64 lpi scan image resolution; and auto-answer/disconnect. The 2346, however, does support half-tone transmission (16 shades of gray), and with a price of $950 it's one of the lowest cost units on the market.

In summary, 3M has done a fine job in price-positioning the EMT series in a marketplace that has become extremely price sensitive. The products themselves are also first rate, providing facilities at least as good as—and in some cases even better than—higher-priced competition.

The major limitation of the series is the lack of a page store-and-forward facility (see Limitations). Actually, it's surprising that this feature has not been added to the EMT 9165, since 3M demonstrated a disk-based page-storage facility early last year. According to our sources, the unit worked perfectly so the decision was not based on technical problems.

It could be that 3M has decided to curtail the facsimile-based store-and-forward strategy in favor of a **model centralized facsimile** approach. Data Decisions has learned that 3M is currently Beta-testing a facsimile-switching unit that will store up to 1000 pages on a Winchester disk, and **selectively** route pages over 8 different telephone links. The unit, named the **Fax Exchange**, is CCITT Groups 1, 2, and 3 compatible, and will offer mailbox services, full accounting, and code conversion. The latter will permit **normally incompatible** Groups 1, 2, and 3 units to exchange data by performing the necessary code conversion. For example, a Group 1 machine could transmit to a Group 3 with the analog-to-digital code conversion performed by the Fax Exchange. Also coming is an ASCII terminal interface that will accept data characters directly and convert them for facsimile transmission. In addition, 3M is developing an X.25 interface that will allow the Fax Exchange to employ the services of public data (packet) networks. The product has been tested on the Telenet network. Reliable sources say the Fax Exchange will be released during the first-quarter 1985 and will carry a $38,000 price tag. This will include the base unit with a 1000-page-capacity (35K-byte) Winchester disk and 2 communication ports. Additional dual-port units will cost around $7K.

☐ **Strengths**

If we discount the Fax Exchange—and since it's a separate unit, you should—the prinicipal strength of the EMT series is price-performance. All of the units offer first-class facsimile services, and their prices are among the lowest in the market.

For example, the $2,600 EMT 2000 provides Group 2 and 3 compatibility, a 50-document auto-feed, an outstanding 203x200 lpi scan image resolution, half-tone support and both modified Huffman/Read data compression. We can't find another unit on the market that can touch it at that price.

With its new price of $5,495, the EMT 9165 is about $1,000 cheaper than last year with no sacrifice in features. That unit, as we mentioned earlier, has about everything most organizations would need for typical facsimile transmission.

Another notable strength of the 9165 is the turnaround transmission facility. Sometimes called reverse polling, it permits a polled 9165 terminal to receive pages from the master, and immediately transfer pages back to it. This is accomplished on the same phone call, thus saving the time and expense of separate calls and connection procedures to send data in both directions. The optional auto-dialer allows the 9165 to interact with up to 30 different terminals.

The 9140, 9145, and 9165 can receive data directly from ASCII TTY terminals and word processors. Connection is made via an RS-232C port and transmit speed is 300 bps. This facility is extremely useful in distributed processing environments, and permits offices to enjoy a form of facsimile service without incurring the expense of a separate transceiver.

☐ **Limitations**

The major limitations of the entire EMT series are the lack of an automatic scan-image resolution facility, and no local page store-and-forward. Automatic-scan-image resolution automatically adjusts the scanning rate to meet the quality of the document being scanned. In cases where print quality varies, most users set the scan rate for worst case, which generally means fine scan. Such scanning is applied to the entire document whether it needs it or not, and results in larger scan and transmision times. Burroughs, NEC, and Teleautograph have solved this problem via automatic adjustments, so it can be done.

Until 1984, the only major vendor offering local page storage was Ricoh. Using the then-called Rapicom R-5000 with a SAF-PAK option, users stored up to 30 pages in RAM and transmitted them to 100 different transceivers. Panafax, Pitney-Bowes, and NEC all have demonstrated a similar facility using a Winchester disk as storage, which considerably increases the number of pages that can be stored. As mentioned, 3M has developed a disk-based local storage facility with the EMT 9165, but to date has not officially released it. If 3M is banking on the Fax Exchange to solely provide this service, its $38K price tag could be too high for a number of prospective customers, especially since the aforementioned competition is selling its products for between $5K and $10K. Admittedly, the Fax Exchange is far more

3M EMT Series Facsimile Transceivers
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sophisticated than anything the competition is offering, so the price could be justified if you need what's being offered. It remains to be seen how many do.

■ HARDWARE

□ Terms & Support

Terms • all products are available for purchase, or under a 1-,2-, or 3-year lease; lease prices shown in this report are for 3-year terms.

Support • vendor support is rendered through 3M local offices • maintenance is bundled into leased units, and priced separately for purchased units.

□ Overview

The 8 transceivers encompassing this family are all intended for general-purpose document transfer/receive applications. The product line includes an AM, digital, AM/FM, 5 AM/digital, and AM/FM/digital transceivers. The principal differences between products within the same classifications are the scan-image resolution, input document capacity, options, and price.

For example, the EMT 2000, 2700, 9140, 9145, and 9160 are all CCITT Group 2 and 3 compatible. The 2000 and 2700 offer the finest scan-image resolution at 203x200/100 lpi, and it is automatically selected to meet the quality of the input document. Both also have an auto-feed, 50-document capacity and contain an integral 9600/7200/4800/2400-bps modem. The 2700, however, does not support half-tone inputs or polling. The 2000 has both capabilities.

The 9140, 9145, and 9160 all have fairly comparable scan-image resolutions, but differ in data transmission rates, document feed capacity, and available options. The 9140, for example, runs at 2400 bps while the 9145 and 9160 transmit at 4800 and 9600 bps, respectively. Both the 9140 and 9160 include auto-feed, with 30-document capacity, while this facility is optional on the 9145. In addition, the 9160 supports half-tone documents while the other 2 do not. Both the 9140 and 9145 include auto-dial and the ASCII TTY facilities. While the 9160 cannot be equipped to handle ASCII TTY inputs, it does provide auto-answer/disconnect and document reduction as standard, while auto-dial is optional.

The EMT 1000E AM and EMT 2346 AM/FM transceivers offer basic services. The analog machines are notable in that all support half-tones with up to 16 shades of gray. This should be more than adequate for most business-level photographs.

The EMT 9165 is an AM/FM/digital transceiver with a scan resolution of 200x400/200/100 lpi in Group 3 mode, and 96x96 lpi for both analog modes. While this unit does not support half-tone transmission, it does perform data compression via the modified Huffman technique. This transceiver is the only one in the group to support turnaround polling.

□ EMT 1000E AM Transceiver

Tabletop unit measuring 8x20x15 (HxWxD) inches; 44 lbs • input document up to 8.75x23 inches; auto-feed, single document • output document roll-fed, 8.5x11 inches • thermal printing • flatbed, photodiode array scanning • switch-selectable resolution at 96x144/96/64 lpi • CCITT Group 2 compatible; also EMT 2000/2700 compatible • transmission time for 8.5x11-inch document is 80 seconds for 96x64 lpi; 3 minutes for 96x96 lpi; and 4.5 minutes for 96x144 lpi • 8.5-inch maximum scan width • half-tone, 16 shades of gray • communicates over DDD or leased line; integral DAA; auto-answer/disconnect standard:

$91 mo	**$1,880 prch**	**$29 maint**

Document Auto-feed • provides 50-document auto-feed capability:

NA	150	NA

□ EMT 2000 AM/Digital Transceiver

Floor-console unit measuring 34x22x35.4 (HxWxD) inches; 331 lbs • input document of 3.15 to 10x4.5 to 5.9 inches; auto-feed,

50-document capacity • output document roll-fed, 8.5 inches x length of original • electrostatic, dry toner printer • flatbed, CCD scanning • automatically selected resolution of 203x200/100 lpi • CCITT Group 3 compatible; Group 2 optional • transmission time for 8.5x11-inch document under Group 3 at 4800 bps at 203x100 lpi is 40 seconds; 80 seconds at 203x200 lpi; 3 minutes for Group 2 • 10-inch maximum scan width • half-tone, 16 shades of gray • modified Huffman/Read data compression • communicates over DDD or leased line; FCC registered, integral 9600/7200/4800/2400 half-/full-duplex modem; polling:

$168 mo	**$2,600 prch**	**$83 maint**

□ EMT 2346 AM/FM Transceiver

Tabletop unit measuring 4.5x21x14.5 (HxWxD) inches; 32 lbs • input document up to 8.5x11 inches; single sheet, manual feed • output document roll-fed, 8.5 inches x length of original • electrosensitive printing • flatbed, CCD scanning • switch-selectable resolution at 96x96/64 lpi • CCITT Group 1 and 2 compatible • transmission time for 8.5x11-inch document is 3 or 6 minutes at 96x96 lpi; 2 or 4 minutes for 96x64 lpi • 8.5-inch maximum scan width • half-tone, 16 shades of gray • communicates over DDD or dedicated line; FCC-registered interconnect; connects to USOC RJ 30X telephone jack; auto-answer/disconnect:

$57 mo	**$950 prch**	**$26 maint**

□ EMT 2700 AM/Digital Transceiver

Tabletop unit measuring 10x15.6x15.4 (HxWxD) inches; 66 lbs • input document of 3.2 to 10x4.5 to 5.9 inches; autofeed,· 50-document capacity • output document roll-fed, 8.5 inches x length of original; 330-foot roll • thermal printing • flatbed, CCD scaning • automatically selectable resolution at 203x200/100 lpi • CCITT Group 2 and 3 standard • transmission time for 8.5x11-inch document at 4800 bps under Group 3 is 40 seconds at 203x100 lpi; 80 seconds at 203x200 lpi; 3 minutes under Group 2 • 8.5-inch maximum scan width • no half-tone support • modified Huffman data compression • communicates over DDD or leased line; FCC-registered 9600/7200/4800/2400 modem with auto-fallback • local copy standard:

$171 mo	**$3,995 prch**	**$40 maint**

EMT 9140 AM/Digital Transceiver

Tabletop unit measuring 5x22x14 (HxWxD) inches; 33 lbs • input document up to 8.5x14 inches; auto-feed, 30-document capacity • output document, roll-fed, 8.5 inches x length of original; 115-foot roll • thermal printing • flatbed, CCD scanning • switch selectable resolution of 200x100 lpi (Group 3); 100x100 lpi (Group 2) • transmission time for 8.5x11-document at 2400 bps under Group 3 is less than 1 minute; 3 minutes under Group 2 • 8.5-inch maximum scan width • no half-tone support • modified Huffman data compression • communicates over DDD or leased line at 2400 bps, half-duplex • time and date stamp, terminal identification, message conformation, voice transmission, call-back message auto-dial and ASCII TTY input all standard:

$100 mo	**$2,211 prch**	**$29 maint**

EMT 9145 AM/Digital Transceiver

Tabletop unit measuring 5x22x14 (HxWxD) inches; 33 lbs • input document 8.5x11 inches; single-sheet manual feed standard; auto-feed optional • output document, roll-fed, 8.5 inches x length of original; 115-foot roll • flatbed, CCD scanner • switch-selectable resolution of 200x200 lpi (Group 3); 100x100 lpi (Group 2) • transmission time for 8.5x11-inch document at 4800 bps under Group 3 is less than 1 minute; 3 minutes for Group 2 • 8.5-inch maximum scan width • no half-tone support • time and date stamp, terminal identification, message conformation, voice

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MO: monthly charge under 3-year lease. PRCH: single-quantity purchase price. MAINT: monthly maintenance charge for purchased units. NA: not available. NC: no charge. All prices current as of January 1985.

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transmission, call-back message indicator all standard • ASCII TTY input standard:

$139 mo	$3,260 prch	$32 maint

Auto-dial • provides automatic dialing facility for 10 stored telephone numbers:

NA	135	NC

Auto-feed • provides 30-document automatic feeding operation:

NA	135	NA

EMT 9160 AM/Digital Transceiver

Tabletop unit measuring 9x21x17 (HxWxD) inches; 55 lbs • input document 7 to 10.5x5 to 8 inches; autofeed, 30-document capacity • output document, roll-fed, 8.5 inches x length of original; 350-foot roll • thermal printing • flatbed, CCD scanning • switch-selectable resolution of 200x200 lpi (Group 3); 96x96 lpi (Group 2) • transmission time for 8.5x11-inch document at 4800 bps under Group 3 is 35 seconds; 3 minutes under Group 2 • 10-inch maximum scan width • half-tone, 16 shades of gray • modified Huffman/Read data compression • communicates over DDD or leased line at 9600/7200/4800/2400 bps, half-duplex; auto-answer/disconnect and document reduction standard • auto-dial optional:

$161 mo	$3,795 prch	$40 maint

Auto-dial • provides automatic dialing facility for 10 stored telephone numbers:

NC	395	NC

EMT 9165 AM/FM/Digital Transceiver

Tabletop unit measuring 11.3x22.4x21.2 (HxWxD) inches; 55 lbs • input document 7 to 10x5 to 50 inches; autofeed, 50-document capacity • output document, roll-fed up to 10 inches x length of original • auto-reduction • switch-selectable resolution at 200x400/200/100 lpi (Group 3) and 96x96 lpi (Groups 1 and 2) • transmission time for 8.5x11-inch document at 9600 bps under Group 3 is less than 1 minute; 3 minutes for Group 2; 6 minutes for Group 1; and 35 seconds for Group 3 connected to EMT 9140, 9145, and 9160 • 10-inch maximum scan width • no half-tone support • modified Huffman data compression • communicates over DDD or leased line at 9600/7200/4800/2400 bps, half-duplex • auto-answer, terminal identification, polling, turnaround transmission, voice transmission, auto-disconnect, delayed transmission, time/date stand, auto-dialer, and ASCII TTY all standard:

$219 mo	$5,495 prch	$42 maint

Communications

All models communicate over leased lines or the DDD. The EMT 2000 and 9145 operate at 4800 bps. EMT 2700, 9160, 9165, and 9600 operate at 9600/7200/4800/2400 bps, while the EMT 9140 runs at 2400 bps. The EMT 9165 allows a polled 9165 to transmit documents to the polling unit during the same telephone call.

• END

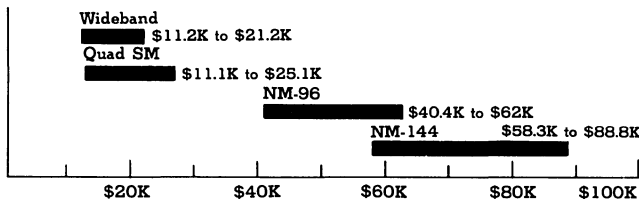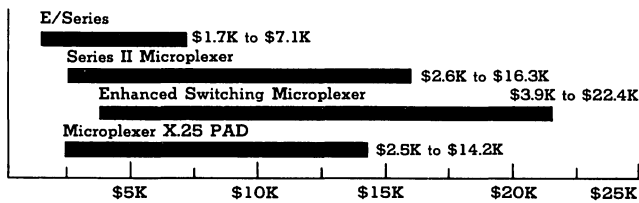# Timeplex Statistical Single- & Multi-Link & X.25 PAD Multiplexers

E/Series, Series II, Enhanced Switching, Quad Switching, Networking & X.25 PAD Microplexers

■ PROFILE

Function ● statistical multiplexers for point-to-point communication (E/Series/Series II Microplexer/Wideband Microplexer) ● multinode statistical multiplexers (Series II Microplexer/Enhanced Switching Microplexer/Quad Switching Microplexer/Networking Microplexer ● statistical multiplexer/

PURCHASE PRICE RANGE

hardware ▮▮▮▮

E/Series
▮▮▮▮ $1.7K to $7.1K

Series II Microplexer
▮▮▮▮▮▮▮▮▮▮▮▮ $2.6K to $16.3K

Enhanced Switching Microplexer
▮▮▮▮▮▮▮▮▮▮▮▮ $3.9K to $22.4K

Microplexer X.25 PAD
▮▮▮▮▮▮▮▮▮ $2.5K to $14.2K

$5K	$10K	$15K	$20K	$25K

Wideband
▮▮▮▮ $11.2K to $21.2K

Quad SM
▮▮▮▮▮ $11.1K to $25.1K

NM-96
▮▮▮▮▮ $40.4K to $62K

NM-144 $58.3K to $88.8K

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

TIMEPLEX PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for E/Series, Series II Microplexers, and Enhanced Switching Microplexers ● Timeplex provides no maintenance contract for its E/Series, which is available through distributors only ● maintenance contracts are available for all other models, but maintenance cost is not shown on this bar graph because cost depends on system configuration including options; Timeplex refused to supply maintenance costs ● **E/Series** small configuration is 4-channel async mux; large configuration consists of 16-channel async mux with single-channel bandsplitter and integral 9600-bps link modem ● **Series II small configuration** is M8C 8-channel async mux with 4 channels; large configuration consists of M48C 24-channel base unit with 24-channel expansion unit, 32 async channels, 16 async/sync channels, supervisory port, dual composite link, sync protocol for 16 channels, Auto-speed for 16 channels, network configurator, extended diagnostics, alarm driver, and TSO/TCAM handler ● **Enhanced Switching Microplexer small configuration** consists of SM851 8-channel unit with 4 async channels and single composite link; **SM4852 large** configuration consists of 24-channel base unit with 24-channel expansion unit, 32 async channels, 16 SDLC/async channels, supervisory port, dual composite link, sync protocol for 8 channels, Auto-speed for 12 channels, network configurator, extended diagnostics for all channels, and alarm driver ● **Microplexer X.25 PAD** small configuration consists of 4-channel unit with single composite link; large of 48-channel unit with dual composite link ● **Wideband Microplexer** small configuration consists of 16-channel unit with 8 async channe... ,4 with Auto-speed), 4 sync (includes sync protocol option) and 4 SDLC channels, network configurator, communicator, alarm driver, and extended diagnostics for all channels; **large WM** of 48-channel unit with 32 async channels (12 with Auto-speed) 4 sync (included sync protocol option) and 4 SDLC channels, network configurator, communicator, alarm driver, and extended diagnostics for all channels ● **Quad Switching Microplexer small configuration** consists of 12-channel unit with 8 async channels (4 with Auto-speed), and 4 sync channels (included sync protocol option), and extended diagnostics for all channels; **large QSM** of 48-channel unit with 32 async channels (12 with Auto-speed), 8 sync (includes sync protocol option), and 8 SDLC channels, alarm driver, and extended diagnostics for 48 channels ● **Networking Microplexer NM-96 small**
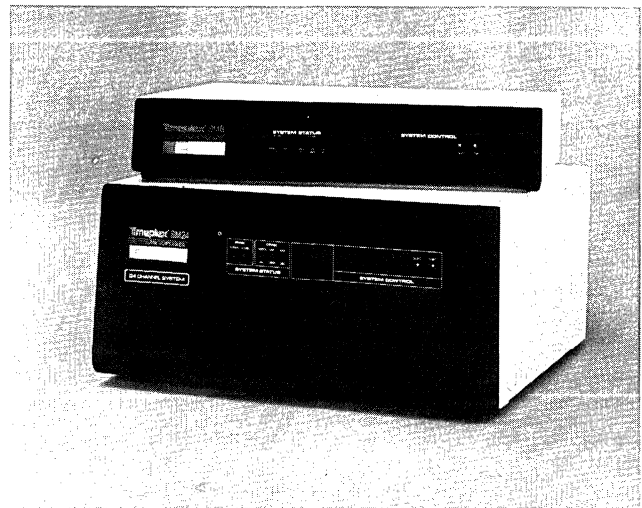
PAD for X.25 public or private, packet-switched networks (Microplexer X.25 PAD).

Communications/Networks ● E/Series supports 4 or 8 asynchronous plus synchronous bandsplitter channel ● M8C/SM8, M24C/SM24, and M48C/SM48 support up to 8/24/48 asynchronous/synchronous channels, respectively ● QSM and WM support up to 20/48 asynchronous/synchronous/ SDLC channels; NM supports up to 96/144 asynchronous/ synchronous/SDLC channels; Microplexer X.25 PAD supports up to 8/24/48 asynchronous channels ● maximum aggregate channel rate of 19.2K/76.8K/230.4K/460.8K bps (M4A/E/Series and M8C/SM8/M24C/M48C and SM48); 460.8K bps (WM and QSM); 921.6K bps/1.382M bps (NM 96/NM 144); 76.8K/230.4K/460.8K bps (MX.25 PAD Models MX8/MX24/MX48 ● E/Series WM support single composite link in point-to-point configurations; SM8, SM24, and SM48 support 1 or 2 composite links in point-to-point configurations; M8C, M24C, and M48C support 1 or 2 composite links in point-to-point traffic balancing or node bypass configurations ● QSM supports 4 and NM supports 6 composite links in multinode network

configuration consists of 32-channel unit with 24 async channels (8 with Auto-speed), 4 sync (includes sync protocol option), and 4 SDLC channels, alarm driver, extended diagnostics for 32 channels, network configurator, communicator, and network manager; **large NM-96** of 96-channel unit with 64 async channels (12 with Auto-speed), 24 sync (includes protocol option), and 8 SDLC channels, alarm driver, extended diagnostics for 96 channels, network configurator, communicator, and network manager ● **NM-144 small** configuration consists of 48-channel unit with 32 async channels (12 with Auto-speed), 12 sync (includes protocol option) and 8 SDLC channels, alarm driver, extended diagnostics for 144 channels, network configurator, communicator, and network manager; **large NM-144** of 144-channel unit with 96 async channels (32 with Auto-speed), 32 sync (includes protocol option), and 16 SDLC channels, alarm driver, extended diagnostics for 144 channels, network configurator, communicator, and network manager.

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configurations ● modified CCITT Level II link protocol MX.25 supports single or dual link; X.25 Level III protocol.

First Delivery ● November 1981 (E/Series); July 1979 (M8C); January 1980 (M24C); March 1981 (M48C); December 1981 (SM Series); 1982 (Wideband); 1983 (MX.25, ESM, QSM, and NM).

Systems Delivered ● unknown.

Comparable Systems ● principal competition for E/Series from Micom Micro 800/2 and Micro 8000 Concentrator Modem ● principal competition for Series II Microplexer M4A and M8C from Codex 660; CompreComm Data Express; DCA 105; Gandalf MX-8; GDC 140/1241; Infotron Supermux 480; Intertel SMX8000; Micom Micro 800/2 and Micro 800/2; Prentice SNP-1000; Racal-Milgo Omnimux 40/80; and Rixon DCX815 ● principal competition for M24C and M48C from Codex 6010; DCA 115; DCC CM 9100; Gandalf PIN 9103; GDC 1257/1258 Megamux; Infotron Supermux 780/790; Racal-Milgo Omnimux 320; and Rixon DCX 825/836 ● Principal competition for the Enhanced Switching Microplexer, Quad Switching Microplexer and Networking Microplexer from DCC SM 9200, DCA 335/355, Infotron 790, Paradyne DCX 840/850, and Rixon DCX 840/850 ● principal competition for Microplexer X.25/PAD from Amdahl 4400 series and Rixon X.25 PAD.

Vendor ● Timeplex Inc; 400 Chestnut Ridge Road, Woodcliff Lake, NJ 07675 ● 201-930-4600.

Distribution ● nationwide via local Timeplex direct sales/service offices; worldwide and E/Series accounts via Timeplex distributors ● Canada via Timeplex Canada, Inc, Toronto ● Great Britain via Timeplex Limited, Brentford/Leeds.

■ ANALYSIS

Timeplex has not introduced any new members to its microplexer families nor has it expanded to other versions of these microplexers over the past year. But it has introduced enhancements for its powerful Prophet Network Management system and its X.25 PAD. Prophet's software has been expanded to further extend network control and management from a central source and to provide directory information and network security through multiple levels of password protection. The X.25 PAD enhancements are ease-of-use, network security, and flexibility features satisfy user needs. These enhancements are standard features that Timeplex has added without increasing the PADs price.

Timeplex substantially strengthened its position in the networking market in 1983 with the introduction of several products, including the Quad Switching Microplexer, the Networking Microplexer, an enhanced version of its Switching Microplexer (which supercedes the original version) and the Microplexer X.25 PAD for packet network applications. Timeplex no longer produces its original Switching Multiplexer; however, it will field upgrade existing models to the enhanced version as requested to protect user investments. Timeplex also produces and markets the E/Series statistical multiplexers which focus on small-scale network requirements and the Series II Microplexer family which is targeted to small-to-medium scale single or multinode network applications.

The **E/Series** is primarily **targeted to minicomputer users** to satisfy their need to combine as many as 16 asynchronous lines or devices on a high-speed link, and is available with a bandsplitter option to accommodate a single synchronous channel, multiplexed with the unit's composite link.

A DMA (direct memory access) interface option is available for DEC users. The option interfaces the multiplexer with a single minicomputer port.

E/Series models are packaged 4-, 8-, 12-, or 16-channel units, field expandable to 16 channels. An integral modem option eliminates the need for an external link modem and is available for 2400-, 4800-, and 9600-bps composite link rates. Packaged configurations include basic models and models with all option combinations. Physically small, the standalone unit is available with a rackmount option.

The **Series II Microplexer** addresses small-to-medium scale,

point-to-point single and multinode network applications. Packaged configurations support a minimum of 4 or 8 asynchronous channels to a maximum of 48 asynchronous and synchronous channels in quad-channel increments.

Series II Microplexer Models M8, M24, and M48 support a maximum of 8, 24, and 48 channels, respectively, in 4-channel increments. The user can specify any mix of asynchronous and asynchronous/synchronous quad-channel adapters. The models can service a maximum of 64 nodes through dual composite links. The dual link models are configuration flexible and can satisfy load balancing over 2 links between 2 points and traffic bypassing through a node between 2 points. The load balancing configuration dynamically divides the point-to-point traffic load between 2 links, and it provides redundancy to prevent interruption of communication from single link failure. The user can permanently assign specific channels to either of the 2 data links as an alternative to traffic balancing; however, a link failure will interrupt communication between channels assigned to that link.

Users with only asynchronous transmission requirements can substantially reduce costs by employing asynchronous quad-channel adapters. Synchronous applications require the asynchronous/synchronous quad-channel adapter which statistically multiplexes synchronous and asynchronous channels. Each port of the adapter is parameter independent, which means any of the ports can be configured for asynchronous communication and the remainder for synchronous communication. Synchronous applications are protocol supported to compensate for extensive delays such as encountered with satellites. Prominent byte-oriented protocols are supported, each via a separate extra-cost PROM per asynchronous/synchronous quad adapter. Additional cost firmware is also required in the central control module. PROMs can be mixed according to user requirements to support different protocols.

Channel parameters are easily alterable to meet changing operating requirements on all Microplexer models through either front-panel thumbwheel switches and associated digital display, or through a colocated or remote supervisory console connected to any one node in the network. Any asynchronous ASCII display terminal can serve as a supervisory console. Supervisory console functions include channel parameter changes, channel-to-channel interconnection changes, diagnostic testing, system statistics, monitoring data from any selected channel, and transmitting messages to a selected channel or to all local and remote channels. Supervisory console support benefits multinode network configurations by centralizing network control.

The **Wideband Microplexer** addresses high-volume communication requirements within a small-to-medium scale point-to-point network, using wideband or digital communication facilities. A maximum of 48 channels in quad-channel increments are supported in any combination of asynchronous, synchronous, or SDLC channels to satisfy a variety of applications. The maximum link rate is 72K bps which makes its use applicable with AT&T's DDS at 56K bps. Channel routing (switching) is supported, and channels can be routed locally and remotely both on an individual basis or contiguous group basis according to user needs.

The **Enhanced Switching Multiplexer (ESM)** addresses the advantages of statistical multiplexing combined with the advantage of automatic or manual channel switching for both local and remote multiplexer channels. The family consists of 6 single- or dual-link models, with maximum channel capacities of 8, 24, and 48 channels. The user can configure a network with up to 64 nodes and over 1,000 switchable ports using any combination of models. Network control functions such as altering channel parameters, network reconfiguration through switching, status reporting, and diagnostic testing are performed through a colocated or remote supervisory console connected to the designated master node multiplexer for ease of use and operating convenience.

The ESM Series are identical in performance, function, and features to respective models of the Series II Microplexer family,

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except for the added switching functions. Series II Microplexers can be field upgraded to switching multiplexers. However, the families are transmission incompatible.

Channel-switching flexibility meets different user needs and changing operating requirements. User programmable channel assignments are alterable according to user need. The user can establish channel assignments as dedicated or switched. Dedicated channels form a permanent communication path until altered through the supervisory console. Switched channels provide operating flexibility to meet changing needs. The user can assign switched channels to contention or selection modes. The contention mode accommodates more terminals than computer ports for operating economy. Terminals connected to these channels contend for one of several available ports; if all are busy, the caller is notified and the system automatically retries to establish the connection every 10 seconds. The user should consider contention mode operation for terminals that are not busy simultaneously. Port selection allows the user to establish a connection between a selected channel and another selected channel or group of contention mode channels. Port selection gives users the flexibility to share network resources.

System security prevents channel or system supervisory port access by unauthorized users. The security feature is programmable and can include password access for added security.

The **Quad Switching Microplexer (QSM) and Networking Microplexer (NM)** are expanded versions of the Timeplex Switching Microplexer (SM) which Timeplex enhanced to support nodal intercommunication among the 3 products. These 3 products support a broad range of network traffic requirements and can be integrated into the same network to satisfy existing user needs as well as future needs to accommodate growth or changing user requirements. All 3 products provide configuration flexibility, link-to-link transmission compatibility, and support the same features and options. All support channel routing through user-assigned dedicated, switched, or contention channels. The products also support 8 Restricted Resource Groups to prevent unauthorized access of restricted resources (such as a specific database of a CPU).

Traffic balancing, traffic bypassing, and alternate routing is supported for all Timeplex Switching Microplexer products including the SM, Enhanced SM, QSM, and NM. Traffic balancing dynamically balances the traffic load between 2 points (nodes) over 2 links to increase throughput, and in the event of link failure, automatically routes all traffic over the remaining link to prevent loss of data. Traffic bypassing routes traffic through a node to a destination node to eliminate the need (and cost) for a direct link between each pair of nodes. However, a link failure will interrupt communication between the nodes unless remedial recovery is provided. Timeplex has resolved this problem through automatic alternate routing, which automatically reroutes traffic interrupted by a link failure over an alternate route, provided the user network configuration supports alternate paths. For example, ring or ring-with-hub network configurations provide the link connections necessary to reroute traffic in the event of link failure. The alternate routing feature can also be used to reroute traffic to circumvent traffic congestion, preventing throughput degradation.

The Quad Switching Microplexer addresses small-to-medium scale multinode network applications with as many as 48 asynchronous and synchronous channels (ports) and 4 composite links per unit (node) and more than 1,000 addressable network ports. It supports intercommunication with the Networking Microplexer and with the Enhanced Switching Microplexer. The data rate per composite link is 19.2K bps—double that of the Switching Microplexer. The QSM supports all the features of the SM but is transmission compatible only with the **Enhanced** SM.

The Networking Microplexer addresses medium-to-large scale **multinode networks** with 800 or more network ports. It supports the same quad channel cards and the same features as the Enhanced SM and the QSM and can intercommunicate node-to-node with these models. Available in 2 models that support a maximum of 96 or 144 local channels (ports), the

Networking Microplexer offers double or triple the maximum channel capacity of the Enhanced SM or QSM, and substantially increased networking capacity to support high-volume traffic over 6 model links at 72K bps between adjacent nodes (point-to-point) or 19.2K bps between nonadjacent nodes.

Timeplex has simplified network management through the introduction of its **Prophet Network Manager**, a "user-friendly" means for network manipulation. Consisting of an IBM PC/XT that runs a Timeplex proprietary software package, the menu-driven software accepts menu-selected functions or English-language user commands (mnemonics) to alter network configuration and parameters, monitor network port and link status, and conduct diagnostic tests. Prophet virtually eliminates the need to memorize or refer to network procedures in a reference manual. And a verification scheme eliminates inadvertent operator commands by aborting execution before the command can be processed. Prophet is a strong user benefit for large complex networks, composed of any combination of Enhanced Switching Microplexers, Quad Switching Microplexers, and Networking Microplexers. It is mandatory with the Networking Microplexer and optional for the Quad Switching and Enhanced Switching Microplexers. Timeplex Prophet software is available to users who do not need or want to purchase the IBM PC/XT.

The **Microplexer X.25 PAD** addresses the need to connect asynchronous terminals to an X.25 packet data network (PDN) such as GTE's Telenet, Tymnet, or Uninet. The unit combines a statistical multiplexer and an X.25 PAD (packet assembler/disassembler) and is certified for use on each of these PDNs. The user can define the window size up to 7 packets per channel. The unit is available in 3 models which support a maximum of 8, 24, or 48 asynchronous channels (ports) in quad-channel increments. Network configuration flexibility supports the use of tail-circuit connected or dial-up terminals in addition to locally attached terminals. An adaptive speed (auto-speed) option accommodates various terminals operating at different data rates and codes over dial-up lines. Single- or dual-link versions are available; dual-link models guard against link failure, when used for back-up. In the event of a link failure, all calls are routed over the remaining link. Dual-link models can also be used to support resources over 2 networks simultaneously. Users can assign channels to either of 2 networks according to needs, and network links can address any channel. Integral modems for channel tail circuits or composite link connected to an X.25-supported remote computer over a voice grade line are available at 2400/4800/9600-bps data rates.

Timeplex was formed in 1969, and has dedicated itself to the design, manufacturing, marketing, and servicing of data communication equipment, principally modems and multiplexers. The company produces TDMs as well as statistical multiplexers and has gained prominence as one of the largest multiplexer vendors in the industry. The company has a reputation for sound, reliable products.

☐ Strengths

The E/Series multiplexers are an economical alternative to multiple dedicated lines and modems for asynchronous terminal applications. The cost of extra lines and modems are eliminated, and an optional integral link modem eliminates the extra cost, service, and extra cables associated with separate modems. Integral modems are available at 2400, 4800, and 9600 bps to satisfy different needs. Users with a synchronous transmission requirement should consider the single-channel bandsplitter. The option is flexible to adapt to different requirements. The user can assign synchronous channel bandwidth according to communication requirements, or bandwidth can be assigned dynamically, which means synchronous channel bandwidth varies according to use. During nonuse periods, the full bandwidth is dedicated to other asynchronous channels.

Configuration modularity, ease of expansion, network configuration flexibility, ease of operation, supervisory control, and comprehensive diagnostic support are major attributes of the Series II Microplexer, the Wideband Microplexer, the Enhanced Switching Microplexer, the Quad SM, and the Networking

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Microplexer. The units can be configured according to user needs. Asynchronous and synchronous channels can be combined in any mix; channels can be expanded according to growth requirements. Principal byte-oriented protocols are supported for synchronous operation. Protocol support eliminates the effect of end-to-end delays, especially those encountered with satellites.

Multinode support, a strong user benefit, allows data to be exchanged between 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. Link transmission compatibility among all models of the Series II Microplexer, all models of the Enhanced Switching Microplexer, and among all models of the QSM, and NM is a powerful advantage. Any combination of models within each compatible set can be used in a multinode configuration to satisfy specific user requirements.

Dynamic traffic balancing is another valuable asset for high-volume and/or critical applications that require redundancy to recover from modem or line failures. Besides increased throughput over 2 14.4K bps composite links in a point-to-point configuration, dynamic traffic balancing shares the load between the 2 links; when 1 link fails, traffic on that link is automatically rerouted over the other link without loss of data.

Ease of operation is achieved through front-panel thumbwheel switches and an associated 4-digit display that scrolls through all possible parameter values, and can also display current operating parameters for any channel. Interactive prompting aids programming; programs are automatically downline loaded from master to slave.

Supervisory control is a key benefit to users with complex networks that frequently need to alter operating parameters to accommodate changing traffic requirements. Channel rerouting and parameter reconfiguration, the display of operating statistics or data on any channel, the transmission of messages to selected or to all channel-attached devices, and optional diagnostic testing can all be performed from the supervisory console—a user-supplied asynchronous ASCII display terminal. The user can locate the terminal at the master multiplexer site or remotely to satisfy operating convenience.

Comprehensive diagnostic testing performed from front-panel controls facilitate ease of failure isolation, eliminating finger-pointing and excessive downtime. As an option, diagnostics can be performed from the supervisory console for operating convenience. Users requiring assistance can request a Timeplex service engineer at Timeplex's field service headquarters to dial into their network anywhere in the U.S. and diagnose a failure. A network can be accessed through a multiplexer's supervisory channel.

Other useful features include local echoplex, flyback control, priority control, and adaptive auto-speed. All except the last are standard features. Echoplex is required by most asynchronous terminals for data verification, while flyback control is necessary to compensate for delays encountered with nonprint functions for unbuffered teleprinter terminals. Priority control is beneficial to service channels with critical traffic before those with noncritical traffic. The Series II Microplexers provide 3 levels of priority to respond to traffic demands. The extra-cost adaptive auto-speed option eliminates the need for dedicated lines or ports to support remote terminals with different data rates and code levels.

The principal benefit of the Enhanced Switching Microplexer, QSM, and NM is communication flexibility and connectivity. Data terminal equipment at any location can communicate with data terminal equipment at any other location. Communication paths between origination and destination can be changed according to user needs. Terminals can be added or deleted as needed. Resources can be shared. A local node can perform as a data PABX to support communication between locally attached devices. Port contention eliminates the need for each computer or front-end processor port to be dedicated to 1 terminal in a point-to-point link. Few ports can service many terminals, provided not all terminals are in constant use. The user has the flexibility to assign channels to dedicated, contention, or selection

mode operation and to alter assignments according to changing needs. System security prevents unauthorized users from gaining access to restricted channels or the supervisory channel.

Communication flexibility is augmented by transmission compatibility among all models of the Enhanced SM, QSM, and NM. Each of these models can intercommunicate within a multinode network configured according to user requirements. And the entire network can be controlled from a single source to establish operating parameters, alter channel assignments, run diagnostic tests, and monitor network performance.

The principal benefits of the Microplexer X.25 PAD are its configuration flexibility, ease of expansion, its large channel capacity, and link redundancy or dual-link communication with 2 networks simultaneously. Other strong benefits are its support of integral modems for channels or link, its flexibility to accommodate terminals connected through tail circuits or dial-up lines, and its high link rate of 19.2K bps for increased throughput.

☐ Limitations

The E/Series statistical multiplexers are limited to small-scale asynchronous applications that do not exceed the unit's 16-channel limit. The synchronous bandsplitter option is limited to a single channel. Users should exercise caution when assigning bandwidth to the synchronous channel so as not to cause intolerable delays for asynchronous channels or choke off asynchronous channel transmission. E/Series models are not available with automatic speed detection for dial-up lines, echoback, or flyback control—important features found on comparable models.

Series II Microplexer models M8 through M48 are limited to 2 composite links, which limits the practical size of a multinode network. Although a network can include several dual-link units connected in a ring configuration, considerable delays can be encountered when channels are bypassed through many units using the traffic bypass technique.

Traffic bypassing is subject to interrupted communications from link or modem failures unless all nodes are connected in a ring configuration. The user should also be aware that permanently assigned channels in a traffic balancing configuration are subject to interrupted communications from link or modem failure. Immediate remedial action would be necessary to switch from assigned channels to traffic balancing operation to recover from a failure. Traffic balancing automatically reroutes all channels on the failed link to the other link until the link failure is corrected.

Timeplex supports byte-oriented protocols on all Microplexer models; however, SDLC is supported only on the Enhanced Switching Microplexer, Quad Switching Microplexer, and Networking Microplexer. Other bit-oriented protocols such as HDLC are not supported. Synchronous communication requires an extra-cost PROM per quad-channel adapter, plus extra-cost firmware in the central control module.

Data compression is also absent from Timeplex models. Data compression yields increased throughput rates and more effectively utilizes the communication facility.

The Enhanced Switching Microplexer, Quad Switching Microplexer, and Networking Microplexer are transmission compatible (over the composite link) with one another, but are **not** transmission compatible with the older Switching Microplexer and Series II Microplexer, and cannot intercommunicate in a multinode network. However, installed Switching Microplexers can be field upgraded to Enhanced Switching Microplexers to support intercommunication with the multilink models in a multinode network.

Although integral modems are available for most models and can be used as tail-circuit modems or channel ports or composite link modems, each integral modem **displaces** a quad-channel card **reducing** the maximum number of channels within a system configuration.

Prospective users should be aware that channel/port switching is restricted to asynchronous ASCII ports; synchronous ports **cannot** be switched. This can be a crippling limitation for applications that require synchronous communication between

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remote terminals (such as 3270-type terminals) and more than 1 host computer.

■ HARDWARE

□ Terms & Support

Terms • all Timeplex statistical multiplexer products, except the E/Series, are available for purchase, or on a 1-, 2-, 3-, 4-, or 5-year lease • separate maintenance contract available for leased or purchased units • lease/purchase credit available • 1-year warranty for purchased/leased units; first-year maintenance free of charge • quantity discounts available • E/Series multiplexers are available for purchase or lease only from Timeplex distributors.

Support • installed by Timeplex or by user; installation discounts for multiple units (3 or more); installation free of charge with maintenance contract • maintenance available under contracts for leased or purchased equipment (priority service), on-call service, custom service, or factory repair; E/Series multiplexers serviced through factory swap-out arrangement • fixed-price maintenance performed under annual contract during prime shift hours 8:00 A.M. to 4:00 P.M. Monday through Friday; includes priority dispatching, extended warranties, discount Special Services, and free online diagnostics for equipment with supervisory port option • On-Call maintenance billed for time and materials plus transportation • Custom Services available include 24-hour service, network consultation, failure recovery (Hot Spare Programs), and other user-tailored plans • defective equipment under warranty and without contract maintenance may be returned to factory or repaired via on-call service (with attendant charges) at user's option • Special Services, including equipment reprogramming and relocation, and special equipment reconfiguration, is available for equipment under contract maintenance at $50 per hour, or $75 per hour nonprime time; noncontract users charged $75 per hour, or $100 per hour nonprime time • Contract Maintenance/On-Call Service outside 200-mile radius of a Timeplex Service Center incurs a $350 surcharge; all maintenance performed by Timeplex from 17 Service Center locations in major cities nationwide; factory repairs, including E/Series service, performed at Timeplex factory at 100 Commerce Way, Hackensack, NJ 07601.

□ Overview

Timeplex statistical multiplexer families are designed for point-to-point and multinode network configurations, with variations including integral modems and channel switching. A variety of packaged configurations are available that should satisfy requirements of small to medium-large networks. The E/Series is a family of expanded to 4- to 16-channel models targeted at minicomputer users, especially users with DEC, Data General, Perkin-Elmer, and IBM minicomputers, and are used in small point-to-point networks. E/Series Data Concentrator Systems can incorporate an optional integral modem and/or bandsplitter.

Series II Microplexers consist of point-to-point and multinode models to accommodate networks of up to 64 nodes. Various models in this model line can support "Traffic Balancing" or "Bypass Multinode Configuration."

Traffic Balancing is a point-to-point configuration using dual composite links to achieve transmission speeds up to 19.2K bps (9600 bps per link) with fallback to 9600 bps in case of a link failure. Bypass Multinode Configuration allows for alternate data routing upon link failure in a multinode network. Channel capacity is up to 48 asynchronous channels, with byte-oriented protocol options for synchronous data; both asynchronous and synchronous channels are statistically multiplexed. The Supervisory Port is a standalone alone feature for all Microplexers.

The Wideband Microplexer consists of a 20-channel standalone or rackmount base unit and a 28-channel rackmount expander unit for a maximum of 48 channels. Designed for point-to-point communication over a DDS or wideband facility, the multiplexer accommodates any combination of asynchronous, synchronous,

and SDLC channels in quad-channel increments, and supports channel switching on an individual or contiguous channel group basis.

Enhanced Switching Microplexers support both dedicated and switched channels in networks of up to 64 nodes. Single node networks are also feasible, where 1 Enhanced Switching Microplexer acts like a data PBX, precluding composite-link transmission and allowing terminal-to-terminal communications in a local area network environment. Data channels support either asynchronous or synchronous protocols, like the Series II.

The Quad Switching Microplexer (QSM) consists of a 20-channel standalone or rackmount base unit and a 28-channel rackmount expander unit for a maximum of 48 channels. Designed for multinode network communication, the QSM supports 4 composite links and accommodates any combination of asynchronous, synchronous, and SDLC channels in quad-channel increments. It also supports dedicated, contention, and switched channels user-assigned through the Supervisory Port or optional Network Manager, which can control more than 1,000 network ports.

The Networking Microplexer (NM) is available in 2 models, the NM 96 supports a maximum of 24 channels and the NM 144 accommodates a total of 36 channels. Both models support 6 composite links and are designed for multinode network communication. The NM accommodates any combination of asynchronous, synchronous, and SDLC channels in quad-channel increments. Channels can be assigned as dedicated, contention, or switched. Over 1,000 network ports can be controlled through the Supervisory Port or Network Manager.

The Microplexer X.25 PAD combines a microplexer with an X.25 PAD for direct attachment to an X.25 packet data network (Telenet, Tymnet, or Uninet) or communication with a host computer via X.25 communication support. It is available in 3 models that support a maximum of 8, 24, or 48 asynchronous channels, and in single- or dual-link versions. The dual-link version protects against link failure and routes all traffic over the remaining link. Integral modems are optional for tail-circuit connections and for the composite link.

Several levels of diagnostics and network control can be implemented with Timeplex statistical multiplexers. The usual complement of loopbacks and self-tests can be manually initiated on all models. Supervisory Port-equipped models can support extended diagnostics and channel or network reconfiguration via a user-supplied display terminal, and can display operating statistics. The Supervisory Port also supports Timeplex's Prophet Network Manager, Sentinel 424, and its Alpha Star network manager, a microcomputer-based system that monitors, controls, and reports statistics for up to 768 data channels over as many as 32 composite links. Users with a Supervisory Port and an AT&T 201C modem can also request Remote Dial-Up Diagnostics, a service conducted by Timeplex engineers remotely at a Timeplex Service Center.

The Sentinel 424 is a surveillance system that monitors any 4 leads (pins) of the EIA interface of locally attached multiplexer, modem, or device ports for abnormal conditions. Alarm conditions trigger an audible alarm and are listed on the screen of an attached asynchronous ASCII command terminal and logged on an attached printer. When and with Timeplex Microplexers, Sentinel connects the command terminal to the Supervisory port of the user-selected Microplexer and the user can exercise direct control including diagnostic testing, status report generation, and reconfiguration. Remote devices can be linked to Sentinel over a phone line with a pair of modems. Sentinel monitors any device that responds to ASCII control characters, which includes smoke and water detecting, intrusion alarm, and other devices. The Sentinel system can be expanded from a few ports to as many as 424.

E/Series Configuration • 4-, 8-, 12-, or 16-channel standalone or optional rackmount unit • models expandable to 16 channels • supports asynchronous channels at selectable rates to 9600 bps; 34.8K bps (4 channels); 76.8K bps (8 channels); 96K bps (12/16 channels); maximum aggregate channel rate • integral bandsplitter option accommodates single synchronous channel

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at selectable data rates of 0.125, 0.25, 0.50, 0.75, 0.875, or 1.0 times the composite link data rate ● single composite link; synchronous data rates to 9600 bps ● optional integral link modem for 2400-, 4800-, or 9600-bps data rate.

Series II Microplexer Configuration ● up to 8/24/48 channels; units expandable in 4-channel increments; standalone or rackmount standard ● supports asynchronous channels at selectable rates to 9600 bps; supports optional synchronous channels with data rates to 9600 bps ● 1 or 2 composite links; synchronous data rates to 9600 bps, each link.

Enhanced Switching Microplexer Configuration ● up to 8/24/48 channels; units expandable in 4-channel increments; standalone or rackmount standard ● supports asynchronous channels at selectable rates to 9600 bps; supports optional synchronous channels with data rates to 9600 bps ● switched or dedicated channels ● 1 or 2 composite links; synchronous data rates to 19,200 bps (single link) or 9600 bps (dual link) ● optional integral link and tail circuit modems.

Quad Switching Microplexer Configuration ● up to 20/48 channels; units expandable in 4-channel increments; standalone or rackmount up to 20 channels; rackmount up to 48 channels ● supports asynchronous channels at selectable rates to 9600 bps; supports optional synchronous channels at rates to 9600 bps ● switched or dedicated channels ● 4 composite links; synchronous data rates to 19.2K bps each ● optional integral link and tail circuit modems.

Networking Microplexer Configuration ● up to 96/144 channels; units expandable in 4-channel increments; rackmount only; single- (96 channels) or dual-bay 6-foot rack cabinet enclosure ● supports asynchronous channels at selectable rates to 9600 bps; supports optional synchronous channels at rates to 9600 bps ● switched or dedicated channels ● 6 composite links; synchronous data rates to 19.2K bps each ● optional integral link and tail circuit modems.

Microplexer X.25 PAD Configuration ● up to 8/24/48 channels; units expandable in 4-channel increments; standalone or rackmount ● supports asynchronous channels at selectable rates to 9600 bps ● switched or dedicated channels ● 1 or 2 composite links; synchronous data rates to 9600 bps; CCITT X.25 Level III LAPB ● optional integral link and tail circuit modems.

☐ **E/Series Data Concentrator System**

E/Series Central Control

Central control module contains central logic with 16K-byte RAM buffer, asynchronous channels, composite link module, and power supply ● available as 4-, 8-, 12-, and 16-channel packaged units with or without an integral single-channel synchronous bandsplitter and/or a 2400-bps, 4800-bps, or 9600-bps integral link modem ● expandable to include bandsplitter and/or modem options ● 12-/16-channel mainframe required to upgrade from 3-board 4- or 8-channel units to 12-/16-channel units ● single boards for basic 4-/8-channel unit, 4-/8-channel expander module, bandsplitter, and modem.

Model E0400 ● standard 4-channel standalone unit with 16K-byte RAM buffer; expandable to 8 channels:

NA mo	$1,650 prch	NA maint

Model E0402 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral single-channel synchronous bandsplitter; expandable to 8 channels:

NA	2,025	NA

Model E0420 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral 2400-bps synchronous modem; expandable to 8 channels:

NA	2,625	NA

Model E0422 ● standard 4-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 2400-bps synchronous modem; expandable to 8 channels:

NA	3,000	NA

Model E0440 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral 4800-bps synchronous modem; expandable to 8 channels:

NA	3,575	NA

Model E0422 ● standard 4-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 4800-bps synchronous modem; expandable to 8 channels:

NA	3,950	NA

Model E0490 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral 9600-bps synchronous modem; expandable to 8 channels:

NA	4,400	NA

Model E0492 ● standard 4-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 9600-bps synchronous modem; expandable to 8 channels:

NA	4,775	NA

Model E0404 ● standard 4-channel standalone unit with 16K-byte RAM buffer; expandable to 8, 12, or 16 channels:

NA	2,100	NA

Model E0406 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral single-channel synchronous bandsplitter; expandable to 8, 12, or 16 channels:

NA	2,475	NA

Model E0424 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral 2400-bps modem; expandable to 8, 12, or 16 channels:

NA	3,075	NA

Model E0426 ● standard 4-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 2400-bps synchronous modem; expandable to 8, 12, or 16 channels:

NA	3,450	NA

Model E0444 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral 4800-bps modem; expandable to 8, 12, or 16 channels:

NA	4,025	NA

Model E0446 ● standard 4-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 4800-bps synchronous modem; expandable to 8, 12, or 16 channels:

NA	4,400	NA

Model E0494 ● standard 4-channel standalone unit with 16K-byte RAM buffer and integral 9600-bps synchronous modem; expandable to 8, 12, or 16 channels:

NA	4,850	NA

Model E0496 ● standard 4-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 9600-bps synchronous modem; expandable to 8, 12, or 16 channels:

NA	5,225	NA

Model E0800 ● standard 8-channel standalone unit with 16K-byte RAM buffer:

NA	2,250	NA

Model E0802 ● standard 8-channel standalone unit with 16K-byte RAM buffer and integral single-channel synchronous bandsplitter:

NA	2,625	NA

Model E0820 ● standard 8-channel standalone unit with

MO: monthly lease charge. PRCH: purchase price. MAINT: monthly maintenance charge. NA: not available. NC: no charge. Prices effective as of October 1984.

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16K-byte RAM buffer and integral 2400-bps synchronous modem:

NA	3,225	NA

Model E0822 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 2400-bps synchronous modem:

NA	3,600	NA

Model E0840 • standard 8-channel standalone unit with 16K-byte RAM buffer and integral 4800-bps synchronous modem:

NA	4,175	NA

Model E0842 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 4800-bps synchronous modem:

NA	4,550	NA

Model E0890 • standard 8-channel standalone unit with 16K-byte RAM buffer and integral 9600-bps synchronous modem:

NA	5,000	NA

Model E0892 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 9600-bps synchronous modem:

NA	5,375	NA

Model E0804 • standard 8-channel standalone unit with 16K-byte RAM buffer; expandable to 12 or 16 channels:

NA	2,700	NA

Model E0806 • standard 8-channel standalone unit with 16K-byte RAM buffer and integral single-channel synchronous bandsplitter; expandable to 12 or 16 channels:

NA	3,075	NA

Model E0824 • standard 8-channel standalone unit with 16K-byte RAM buffer and integral 2400-bps synchronous modem; expandable to 12 or 16 channels:

NA	3,675	NA

Model E0826 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 2400-bps synchronous modem; expandable to 12 or 16 channels:

NA	4,050	NA

Model E0844 • standard 8-channel standalone unit with 16K-byte RAM buffer and integral 4800-bps synchronous modem; expandable to 12 or 16 channels:

NA	4,625	NA

Model E0846 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 4800-bps synchronous modem; expandable to 12 or 16 channels:

NA	5,000	NA

Model E0894 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral 9600-bps synchronous modem; expandable to 12 or 16 channels:

NA	5,450	NA

Model E0896 • standard 8-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 9600-bps synchronous modem; expandable to 12 or 16 channels:

NA	5,825	NA

Model E1200 • standard 12-channel standalone unit with 16K-byte RAM buffer; expandable to 16 channels:

NA	3,450	NA

Model E1202 • standard 12-channel standalone unit with 16K-byte buffer with integral single-channel synchronous bandsplitter; expandable to 16 channels:

NA	3,825	NA

Model E1220 • standard 12-channel standalone unit with 16K-byte RAM buffer and integral 2400-bps synchronous modem; expandable to 16 channels:

NA	4,425	NA

Model E1222 • standard 12-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 2400-bps synchronous modem; expandable to 16 channels:

NA	4,800	NA

Model E1240 • standard 12-channel standalone unit with 16K-byte RAM buffer and integral 4800-bps synchronous modem; expandable to 16 channels:

NA	5,375	NA

Model E1242 • standard 12-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 4800-bps synchronous modem; expandable to 16 channels:

NA	5,750	NA

Model E1290 • standard 12-channel standalone unit with 16K-byte RAM buffer and integral 9600-bps synchronous modem; expandable to 16 channels:

NA	6,200	NA

Model E1292 • standard 12-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 9600-bps synchronous modem; expandable to 16 channels:

NA	6,575	NA

Model E1600 • standard 16-channel standalone unit with 16K-byte RAM buffer:

NA	4,000	NA

Model E1602 • standard 16-channel standalone unit with 16K-byte RAM buffer and integral single-channel synchronous bandsplitter:

NA	4,375	NA

Model E1620 • standard 16-channel standalone unit with 16K-byte RAM buffer and integral 2400-bps synchronous modem:

NA	4,975	NA

Model E1622 • standard 16-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 2400-bps synchronous modem:

NA	5,350	NA

Model E1640 • standard 16-channel standalone unit with 16K-byte RAM buffer and integral 4800-bps synchronous modem:

NA	5,975	NA

Model E1642 • standard 16-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 4800-bps synchronous modem:

NA	6,350	NA

Model E1690 • standard 16-channel standalone unit with 16K-byte RAM buffer and integral 9600-bps synchronous modem:

NA	6,750	NA

Model E1692 • standard 16-channel standalone unit with 16K-byte RAM buffer, integral single-channel synchronous bandsplitter, and integral 9600-bps synchronous modem:

NA	7,125	NA

Downline Load • automatically downline loads channel configuration parameters from master to slave or master to master unit • standard feature:

NA	NA	NA

Rackmount • rackmount adapter for 19- or 24-inch rack:

NA	40	NA

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E/Series Expansion Modules

4-to-8 Channel Expansion • 4-channel models expandable to 8 channels by substituting an 8-channel asynchronous control module for 4-channel module:

	NA mo	$1,400 prch	NA maint

8-to-12 Channel Expansion • 8-channel models expandable to 12 channels by adding a 4-channel asynchronous expander module:

	NA	850	NA

12-to-16 Channel Expansion • 12-channel models expandable to 16 channels by substituting an 8-channel asynchronous expander module for 4-channel module:

	NA	1,300	NA

2400-bps Integral Modem • CCITT V.26 compatible with RS-232C interface:

	NA	975	NA

4800-bps Integral Modem • CCITT V.27 compatible with RS-232C interface:

	NA	1,925	NA

9600-bps Integral Modem • CCITT V.29 compatible with RS-232C interface:

	NA	2,750	NA

Integral Bandsplitter • single synchronous channel:

	NA	375	NA

E/Series Flow Control

Guards against multiplexer overflow and against buffer overflow at terminals resulting in loss of data • controls data flow from terminals at selected terminal ports by raising or lowering Clear-To-Send (CTS) or other control signals on RS-232C interface, out-of-band; or by generating XON/XOFF or other appropriate control character, in-band • flow suspension threshold at 87 percent total buffer utilization; flow resumption threshold at approximately 80 percent total buffer utilization • terminal equipment controls data flow via control characters recognized at channel port • standard feature included in package price.

E/Series Diagnostic Tests

Multiplexer Initiated Diagnostics • isolates failures in local/remote channels; local/remote loopback of data transmitted from data terminal equipment; checks integrity of local/remote terminals, modems, and composite link.

Modem Initiated Diagnostics • for models equipped with integral modems, provides local/remote loopbacks for both analog and digital interfaces; includes modem self-test.

E/Series Status Reporting

Multiplexer Status Reporting • LED status display indicates results of performance monitoring • standard LEDs indicate normal/fault modes; loss of synchronization • LEDs on optional synchronous multiplexer indicate normal/fault modes.

Modem Status Reporting • LED status display on integral modem-equipped models indicates results of performance monitoring • LEDs indicate EIA signal activity; data rate; normal/fault conditions; and loopback modes.

E/Series Channels

Central control module packaged with 4, 8, 12, or 16 channels; models can be field upgraded to 8, 12, or 16 channels by board substitution and/or addition • asynchronous switch-selectable channel rates of 50/75/110/134.5/150/300/600/1200/1800/2400/4800/7200/9600 bps • 8-channel parameter combinations selected via DIP switches located behind front panel; includes data rates, CR/LF/FF character delays (flyback buffering), stop bits, code selection, parity, channel loops (in or out), DTE/DCE selection, and flow control technique • 76.8K-bps

maximum aggregate input rate • 5, 7, or 8 data bits • RS-232C/CCITT V.24/V.28 electrical interface standard.

Synchronous Bandsplitter Option • combines asynchronous channels with synchronous on composite channel link • switch-selectable assigned or dynamic bandwidth or "off" mode for single synchronous channel • synchronous bandwidth assignments at 0.125, 0.25, 0.50, 0.75, or 1.0 times composite link rate • option cost included in packaged configurations, Models E0402, E0422, E0442, E0492, E0406, E0426, E0446, E0496, E0802, E0822, E0842, E0892, E0806, E0826, E0846, E0896, E1202, E1222, E1242, E1292, E1602, E1622, E1642, and E1692.

E/Series Composite Link

Models Without Integral Modem • central control module packaged link • up to 9600 bps full-duplex synchronous • external clock • X.25 level II protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • standard feature.

Integral Modem-Equipped Models • packaged with integral link modems that communicate over full-duplex synchronous 4-wire dedicated Type 3002 facilities.

Models E0420, E0422, E0424, E0426, E0820, E0822, E0824, E0826, E1220, E1222, E1620 & E1622 • includes integral CCITT V.26-compatible modem • switch-selectable data rates of 2400/1200 bps • PSK modulation • statistical (compromise) equalization • 8.3-/30-millisecond training time delays.

Models E0440, E0442, E0444, E0446, E0840, E0842, E0844, E0846, E1240, E1242, E1640 & E1642 • includes integral CCITT V.27 bis-compatible modem switch-selectable data rates of 4800/2400 bps • PSK modulation • adaptive equalization • 50-/708-millisecond training time delays.

Models E0490, E0492, E0494, E0496, E0890, E0892, E0894, E0896, E1290, E1292, E1690 & E1692 • includes integral CCITT V.29-compatible modem • switch-selectable data rates of 9600/7200/4800 bps • QAM modulation • adaptive equalization • 253-millisecond training time delay.

☐ Series II Microplexer Models M8C, M24C & M48C

Models with dual composite links can be used in traffic balancing, traffic bypassing, or alternate routing network configurations • traffic balancing equally divides the traffic load between 2 composite links in a point-to-point network; it also provides redundancy in case of a link outage; all traffic is routed over the remaining link until the failure is corrected; upon recovery, normal traffic balancing over both composite links is automatically resumed • any combination of channels can be permanently assigned to either link, but communication is interrupted for channels assigned to a link that fails; unassigned channels are routed by traffic balancing • traffic bypassing supports communications among 3 nodes using only 2 composite links, one to link each single-link remote node to a dual-link central node • channels communicating between remote nodes are bypassed through the central node • alternate routing adds a third composite link between dual-link remote nodes in a 3-node network to provide an alternate route through channel bypassing in event of link outage, and to eliminate delay time for channels bypassed through the central node; requires dual-link models for each node • nodes can be added in a ring configuration • each multiplexer node can store 3 routing tables, a primary and 2 secondary routes, programmed through either front-panel thumbwheel switches or through the optional supervisory channel; routing tables are automatically downline loaded to node multiplexers.

M8C Central Control

Central control module contains power supply, central logic, 16K-byte RAM buffer, and composite link module; provides 2 slots for 4-channel adapters; 8 channels maximum; 16K-byte RAM buffer per adapter.

M803 Microplexer • supports any combination of up to 8 asynchronous/synchronous/SDLC channels and contains

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19.2K-bps synchronous composite link:

NA mo	$1,625 prch	$50 maint	

M823 Microplexer • supports any combination of up to 8 asynchronous/synchronous/SDLC channels and contains 19.2K-bps synchronous composite link; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting and EIA signal monitoring • requires user-provided display console:

	NA	1,875	40

M808 Microplexer • supports any combination of up to 8 asynchronous/synchronous/SDLC channels in traffic bypassing or alternate routing configurations • contains dual synchronous 14.4K-bps composite links:

	NA	2,400	50

M828 Microplexer • supports any combination of up to 8 asynchronous/synchronous/SDLC channels in traffic bypassing or alternate routing configuration • contains dual 14.4K-bps synchronous composite links; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting and EIA signal monitoring • requires user-provided display console:

	NA	2,650	40

M809 Microplexer • supports any combination of up to 8 asynchronous/synchronous/SDLC channels in traffic balancing configuration • contains dual synchronous 9600-bps composite links:

	NA	2,140	50

M829 Microplexer • supports any combination of up to 8 asynchronous/synchronous/SDLC channels in traffic balancing configuration • contains dual 9600-bps synchronous composite links; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting and EIA signal monitoring • requires user-provided display console:

	NA	2,390	40

M24C Central Control

Central control module contains power supply, central logic, 16K-byte RAM buffer, and composite link module; provides 6 slots for 4-channel adapters; 24 channels maximum; 16K-byte RAM buffer per adapter; up to 112K bytes of RAM per system.

M2403 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels and contains 19.2K-bps synchronous composite link:

NA mo	$2,655 prch	$75 maint	

M2423 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels and contains 19.2K-bps synchronous composite link; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting, and EIA signal monitoring • requires user-provided display console:

	NA	2,905	50

M2408 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels in traffic bypassing or alternate routing configurations • contains dual 14.4K-bps (opt) synchronous composite links:

	NA	3,430	75

M2428 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels in traffic bypassing or alternate routing configuration • contains dual 14.4K-bps (opt) synchronous composite link; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting, and EIA signal monitoring • requires user-provided display console:

	NA	3,680	50

M2409 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels in traffic balancing configuration • contains dual 9600-bps synchronous composite links:

	NA	3,170	75

M2429 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels in traffic balancing configuration • contains dual 9600-bps synchronous composite link; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting and EIA signal monitoring • requires user-provided display console:

	NA	3,420	50

M48C Central Control

Central control unit contains power supply, central logic, 16K-byte RAM buffer, and composite link module • provides 6 slots for 4-channel adapters; 24 channels maximum • expander unit (card frame) with power supply provides 6 slots for additional 4-channel adapters; 24 channels maximum; 48-channel maximum expansion capacity • each 4-channel adapter (expander module) contains an integral 16K-byte RAM buffer memory, for a system maximum of 208K bytes.

M4823 Microplexer • supports any combination of 24 asynchronous/synchronous/SDLC channels and contains 19.2K-bps synchronous composite link; includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting, and EIA signal monitoring • requires user-provided display console:

NA mo	$3,375 prch	NA maint	

M4828 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels plus an additional 24 asynchronous/synchronous/SDLC channels via the M48C Expander Unit • contains dual 9600-bps synchronous composite links; supports traffic bypassing or alternate routing configuration • includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting, and EIA signal monitoring • requires user-provided display console:

	NA	4,150	50

M4829 Microplexer • supports any combination of up to 24 asynchronous/synchronous/SDLC channels plus an additional 24 asynchronous/synchronous/SDLC channels via the M48C Expander Unit • contains dual 9600-bps synchronous composite links; supports traffic balancing configuration • includes integral supervisory port for channel monitoring and reconfiguration, statistics reporting and EIA signal monitoring • requires user-provided display console:

	NA	3,890	50

M48C Expander Unit • supports any combination of up to 24 asynchronous/synchronous channels; connects to either M4828 or M4829 central control units via ribbon cables • rackmountable only:

	NA	1,000	50

Flow Control—Models M8C, M24C & M48C

Guards against multiplexer overflow and against buffer overflow at terminals resulting in loss of data • controls data flow from terminals at selected terminal ports by raising or lowering Clear-To-Send (CTS) or other signals on RS-232C interface, out-of-band; or by generating XON/XOFF or other appropriate control character, in-band • flow suspension threshold at 87 percent total buffer utilization; flow resumption threshold at approximately 80 percent total buffer utilization • terminal equipment controls data flow via control characters recognized at channel port • standard feature included in package price.

Diagnostic Tests—Models M8C, M24C & M48C

Diagnostic tests conducted through front-panel controls on local or remote multiplexers or by user-supplied terminal supported by Models M823, M828, and M829 with optional Supervisory Communications Support and Extended Diagnostics Option • test results presented via unit's digital System Display or at terminal • isolates failures in local/remote channels; local/remote loopback of composite link • conducts self-test of system hardware and firmware modules • includes FOX message generator to test any selected data channel • standard feature.

Extended Diagnostics Option • supports remote test pattern

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generation channel loopbacks and tail circuit modem loopbacks via Supervisory Communications Support and user provided display console • available for Models M823, M828, M829, M2423, M2428, M2429, M4823, M4828, and M4829 only; requires Network Configurator Option • one per Expander Module as required:

NA mo	$100 prch	NA maint

Remote Dial-Up Diagnostics • supports remote diagnostics performed by Timeplex engineers at a Timeplex Service Center via models equipped with Supervisory Communications Support • determines quality/status of end-to-end communication facilities; interrogates and analyzes any I/O channel data transmission; monitors channel activity content/validity; and verifies complete system • available to users with contract maintenance; requires AT&T 201C or equivalent modem.

Status Reporting—Models M8C, M24C & M48C

Monitors and accumulates statistics on operating performance • central control module status display indicates normal operating condition, test condition, hardware failure, loss of carrier between modems, loss of composite link between local and remote mux, and central logic or channel buffer overload condition • channel adapter (Expander Module) status display indicates normal operating condition, test condition, and hardware failure condition • 4-character display presents channel parameters and system test results • standard feature included in package price.

Channels—Models M8C, M24C & M48C

M8C central control module supports 2 4-channel adapters (Expander Modules). M24C and M48C central control modules support 6 4-channel adapters. M48C Expander Unit supports an additional 6 4-channel adapters.

Asynchronous/synchronous full-duplex channels • asynchronous data rates at 50/75/110/134.5/150/300/600/1200/1800/2000/2400/3600/4800/7200/9600 bps • synchronous communications require Synchronous Protocol Options; data rates protocol dependent • Model M8C maximum aggregate channel rate is 38.4K/76.8K bps, 4/8 channels • Model M24C maximum aggregate channel rate is 230.4K bps • Model M48C maximum aggregate channel rate is 460.8K bps • up to 14 asynchronous channel parameters selected via front-panel thumbwheel switch; including data rates, parity, CR/LF/FF character delays (flyback buffering), data bits, stop bits, and flow control; selectable synchronous parameters include internal/external clock selection, maximum block size, number of leading synchronous characters, DTE/DCE selection, data speed, buffer priority level, and character code • automatically downline loaded channel parameters, master-to-slave • 5 through 9 data bits, asynchronous • standard RS-232C/CCITT V.24/V.28 interface.

M-ISD Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • converts to synchronous communication via Synchronous Protocol Option (PROM module) • requires slot on central control module • not included in package price:

NA mo	$1,000 prch	NA maint

M-IAD Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • does not accommodate synchronous communications • requires slot on central control module • not included in package price:

NA	750	NA

M-ISDLC/2 Expander Module • 4-channel full-duplex channel adapter with 16K-byte RAM buffer • 2 SDLC channels and 2 asynchronous/synchronous channels • requires slot in central control module or QSM expander unit • not included in package price:

NA	1,450	NA

M-ISDLC/4 Expander Module • 4-channel full-duplex channel adapter with 16K-byte RAM buffer • 4 SDLC channels • requires slot in central control module or QSM expander unit • not included in package price:

NA	1,750	NA

M-DBS Expander Module • dynamic bandsplitter provides 3 synchronous channels:

NA	1,000	NA

Channel Features & Options—Series II & Wideband Microplexers

Synchronous Protocol Options • statistically multiplexes synchronous data formatted in various protocols; uses variable-length X.25 packets • supports synchronous communication for 1 to 4 data channels per channel expander; unused channels can be used for asynchronous data transmission • strips leading synchronization characters and multiplexes synchronous data with asynchronous channels; synchronization character reinsertion and block size selectable at 512/1024/2048/4096 bytes per block via front panel thumbwheel switch • consists of additional firmware in central control module and 1 PROM per specified M-ISD or M-ISDLC/2 Expander Module.

Synchronous Protocol Support • firmware required by central control module; handles synchronous protocols from individual Expander Modules:

NA mo	$50 prch	NA maint

CDC UT-200 Synchronous Protocol • PROM supports up to 4 synchronous channels in accordance with Control Data Corporation 200 User Terminal Reference Manual 82128000 • data rates to 4800 bps; timeout set to 5 seconds:

NA	100	NA

DEC DDCMP Protocol • PROM supports up to 4 synchronous channels in accordance with Digital Equipment (DEC) Publication AAD599A-TC • data rates to 4800 bps • ASCII code • 512/496 char block size • for DecNet applications:

NA	125	NA

Honeywell VIP Synchronous Protocol • PROM supports up to 4 synchronous channels in accordance with Honeywell VIP Users Manual, Chapter 3 • data rates to 4800 bps; time-out set to 5 seconds:

NA	100	NA

IBM Bisynchronous Protocol • PROM supports 1 9600 bps or 4 7200 bps bisynchronous channels; accommodates EBCDIC and ASCII codes:

NA	100	NA

ICL Synchronous Protocol • PROM supports 1 9600 or 4 7200-bps synchronous channels in accordance with ICL documents 111439 Data Transmission Control Procedures Extended Interactive Procedures, 827985 Engineering Specification for 7181/2 Video Terminals, and PF 502; 7020 Remote Terminals (System Specification):

NA	100	NA

Autospeed • Adaptive Speed option regulates local and/or remote asynchronous channel rate and code level to that of dial-up line • selectable on per channel basis and to 1 of 3 modes • standard mode regulates both local (initiating) channel and remote (terminating) channel parameters to those of transmission; ASCII or BCD codes • constant mode regulates local channel only; remote channel parameters are not altered; ASCII only • standard mode with answerback is identical to constant mode except channel sends acknowledgement (H) to initiating terminal • 110/150/300/600/1200-bps ASCII rates • 134.5-bps BCD • CR convention for ASCII; CTL D for BCD • optional feature.

Adaptive Speed for Central Control • 1 required:

NA	50	NA

Adaptive Speed for Channel Adapter (Expander Module) • 1 per Expander Module:

NA	50	NA

Echoplex • loops transmission received from data terminal equipment at channel port to port output • selectable on per channel basis • provides visual data verification at remote terminal connected through tail circuit • included in package price.

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Flyback Control ● delays transmission of data to data terminal equipment following transmitted carriage return, line feed, or form feed control characters ● compensates for time required for terminal to perform these control functions ● selectable on per channel basis ● included in package price.

Supervisory Communications Support ● dedicated port supports any user-provided colocated or remote asynchronous ASCII terminal for statistics reporting, traffic monitoring, supervisory message transmission, and EIA signal monitoring ● supports remotely reconfigured channel parameters via Network Configurator Option; supports remote diagnostic test pattern generation and loopbacks via Extended Diagnostics Option; supports remote alarms of local Microplexer via Alarm Driver Option ● standard feature included with package price for Series II Models 823, 828, 829, 2423, 2428, 2429, 4823, 4828, and 4829 and wideband microplexer.

Network Configurator Option ● PROM supports remotely reconfigured channel parameters on a per channel basis via user-provided display terminal attached to supervisory port; requires Supervisory Communications Support ● noninterfering with other data channels ● EPROM module attaches to Channel Expander module ● extra-cost option; one per unit:

NA	150	**NA**

Communicator ● supports message communication between supervisory port terminal and network ports; message entered at terminal can be selectively transmitted to specific network ports or broadcast to all ports ● network supervisor can also monitor transmissions at selective network ports ● optional feature:

NC	100	**NC**

Extended Diagnostics Option ● PROM provides remote diagnostics on a per channel basis; includes FOX test pattern generation, local and remote digital and analog loopbacks, and remote tail circuit loopback ● asynchronous and synchronous test patterns ● requires Network Configurator Option ● noninterfering with other data channels ● EPROM module attaches to Expander module, as required ● extra-cost option; 1 per Expander Module:

NA	100	**NA**

Alarm Driver Option ● provides alarm indications of buffer overflow, composite link errors, and hardware/firmware failures from local Microplexer to user-supplied display terminal via Supervisory Communications Support ● unit mounts over supervisory port interface ● extra-cost option; 1 per unit:

NA	165	**NA**

Priority Control ● dynamic buffer priority overrides proportional memory allocation to most active terminals; 1 of 3 priorities selectable on a per channel basis ● Priority A allows unlimited buffer access; Priority B provides equal buffer sharing; Priority C provides limited buffer access ● standard feature included in package price.

TSO/TCAM Asynchronous Handler Option ● PROM supports IBM TSO/TCAM communications with IBM 2741 terminals ● inserts character at end of normal break signal to compensate for remote terminal tendency to switch from receive to transmit function ● extra-cost option; one per unit:

NA	100	**NA**

EIA RS-423 Unbalanced Interface ● integral feature permits interconnection between balanced and unbalanced interfaces ● standard feature included in package price.

Composite Link—Models M8C, M24C & M48C

Central control module packaged link ● synchronous single-link data rates to 19.2K bps; to 9600 bps or 14.4K bps per link in dual-link models ● modified CCITT X.25 Level II link protocol ● internal or external clock source ● CRC 16 and ARQ error detection and correction ● standard RS-232C/CCITT V.24/V.28 interface standard feature included in package price.

EIA RS-423 Unbalanced Interface ● integral feature permits interconnection between balanced and unbalanced interfaces ● standard feature included in package price.

Modem Option ● integral full-duplex synchronous modem for operation over unconditioned 4-wire dedicated Type 3002 line ● 2400/4800/9600 bps ● compromise equalizer (2400-bps modem); adaptive digital transversal equalizer (4800-bps and 9600-bps modems) ● requires **Modem Carrier Module (MCM)**; MCM inserts in Expander Module slot (displaces Expander Module-4 channels) and is powered by multiplexer ● usable for **composite link** or **channel-attached tail circuits.**

Modem Carrier Module ● accommodates single integral modem; inserts in Expander Module slot; 1 required per modem:

NA mo	**$225 prch**	**NA maint**

A2410 Data Pump ● 2400-bps, CCITT V.26-compatible integral modem ● inserts in Modem Carrier Module (MCM):

NA	750	**NA**

A4810 Data Pump ● 4800-bps, CCITT V.27-compatible integral modem ● inserts in Modem Carrier Module (MCM):

NA	1,700	**NA**

A9610 Data Pump ● 9600-bps, CCITT V.29-compatible integral modem ● inserts in Modem Carrier Module (MCM):

NA	2,525	**NA**

☐ Wideband Microplexer

Central Control

Central logic, 32K-byte RAM buffer, and composite link module ● accommodates 5 4-channel adapters; 20 channels maximum ● expander unit (cardframe) with power supply provides 7 slots for additional 4-channel adapters; 28 channels maximum ● 48-channel maximum expansion capacity ● each 4-channel adapter (expander module) contains an integral 16K-byte RAM buffer memory, for a system maximum of 224K bytes; buffering is dynamically allocated according to data handling requirements; specific buffer priority can be specified on a per channel basis.

WM4823 Control Unit ● supports any combination of up to 20 asynchronous/synchronous/SDLC channels and contains single synchronous composite link; supports WM48 Expander Unit ● standalone or rackmount unit:

NA mo	**$6,025 prch**	**NA maint**

WM48 Expander Unit ● supports any combination of up to 28 additional asynchronous/synchronous/SDLC channels; connects to WM4823 Control Unit via 2 ribbon cables ● rackmountable only:

NA	1,250	**NA**

Flow Control

Guards against multiplexer overflow and against buffer overflow at terminals resulting in loss of data ● controls data flow from terminals at selected terminal ports by raising or lowering Clear-To-Send (CTS) or other control signals on RS-232C interface, out-of-band; or by generating XON/XOFF or other appropriate control character, in-band ● flow suspension threshold at 87 percent total buffer utilization; flow resumption threshold at approximately 80 percent total buffer utilization ● terminal equipment controls data flow via control characters recognized at channel port ● standard feature included in package price.

Diagnostic Tests

Diagnostic tests conducted through front-panel controls on local or remote multiplexers or by user-supplied terminal supported by Supervisory Communications Support and Extended Diagnostics Option ● test results presented via unit's digital System Display or at terminal ● isolates failures in local/remote channels; local/remote loopback of composite link ● conducts self-test of system hardware and firmware modules ● includes FOX message generator to test any selected data channel ● standard feature.

Extended Diagnostics Option ● supports remote test pattern generation channel loopbacks and tail circuit modem loopbacks via Supervisory Communications Support and user-provided display console ● requires Network Configurator Option ● 1 per Expander Module:

NA mo	**$100 prch**	**NA maint**

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Remote Dial-Up Diagnostics • supports remote diagnostics performed by Timeplex engineers at a Timeplex Service Center via models equipped with optional Supervisory Communications Support • determines quality/status of end-to-end communications facilities; interrogates and analyzes any I/O channel data transmission; monitors channel activity content/validity; and verifies complete system • available free of charge to users with contract maintenance; requires AT&T 201C or equivalent modem.

Status Reporting

Monitors and accumulates statistics on operating performance • central control module status display indicates normal operating condition, test condition, hardware failure, loss of carrier between modems, loss of composite link between local and remote mux, and central logic or channel buffer overload condition • channel adapter (Expander Module) status display indicates normal operating condition, test condition, and hardware failure condition • 4-character display presents channel parameters and system test results • standard feature included in package price.

Channels

Central control module provides 5 slots for 4-channel adapters (Expander Modules) Expander unit provides 7 slots for additional 4-channel adapters • maximum of 48 asynchronous, synchronous, and SDLC channels in any combination • asynchronous data rates at 50/75/110/134.5/150/300/500/1200/1800/2000/2400/3600/4800/7200/9600 bps • passes 4 full-duplex EIA control signals per channel (port) • synchronous communication requires Synchronous Protocol Options; data rates protocol dependent • maximum aggregate channel rate of 460.8K bps for 48 channels • up to 14 asynchronous channel parameters selected via front-panel thumbwheel switch; including data rates, parity, CR/LF/FF character delays (flyback buffering), data bits, stop bits, and flow control • selectable synchronous parameters include internal/external clock selection, maximum block size, number of leading synchronous characters, DTE/DCE selection, data speed, buffer priority level, and character code • automatically downline loaded channel parameters, master-to-slave 90-day battery backup prevents loss of operating parameters in event of power failure • 5 through 9 data bits, asynchronous • standard RS-232C/CCITT V.24/V.28; MIL-188C; MIL-188-114 unbalanced port interface.

M-ISD Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • converts to synchronous communication via Synchronous Protocol Option (PROM module) • requires slot on central control module • not included in package price:

NA mo	$1,000 prch	NA maint

M-IAD Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • does not accommodate synchronous communications • requires slot on central control module • not included in package price:

NA	750	NA

M-ISDLC/2 Expander Module • 4-channel full-duplex channel adapter supports 2 SDLC data channels and 2 asynchronous or synchronous (via Synchronous Protocol Option) channels • contains 16K-byte RAM buffer • requires slot on central control module • not included in package price:

NA	1,450	NA

M-ISDLC/4 Expander Module • 4-channel full-duplex channel adapter supports 4 SDLC data channels • contains 16K-byte RAM buffer • requires slot in central control module • not included in package price:

NA	1,750	NA

Channel Features & Options

See Channel Features & Options under Series II Microplexer on page 10 for details.

Composite Link

Central control module packaged link • synchronous single-link

data rates to 72K bps • modified CCITT X.25 Level II link protocol • internal or external clock source • CRC 16 and ARQ error detection and correction • standard RS-232C/CCITT V.24/V.28 interface standard feature included in package price.

CCITT V.35 Interface • link module interface:

NA mo	$200 prch	NA maint

MIL-STD-188-114 Unbalanced Interface • link module interface:

NA	40	NA

Modem Option • integral full-duplex synchronous modem for operation over unconditioned 4-wire dedicated Type 3002 line • 2400/4800/9600 bps • compromise equalizer (2400-bps modem); adaptive digital transversal equalizer (4800-bps and 9600-bps modems) • requires **Modem Carrier Module (MCM)**; MCM inserts in Expander Module slot (displaces Expander Module-4 channels) and is powered by multiplexer • usable for **channel-attached tail circuits**.

Modem Carrier Module • accommodates single integral modem; inserts in Expander Module slot; 1 required per modem:

NA	225	NA

A2410 Data Pump • 2400 bps, CCITT V.26-compatible integral modem • inserts in Modem Carrier Module (MCM):

NA	750	NA

A4810 Data Pump • 4800 bps, CCITT V.27-compatible integral modem • inserts in Modem Carrier Module (MCM):

NA	1,700	NA

A9610 Data Pump • 9600 bps, CCITT V.29-compatible integral modem • inserts in Modem Carrier Module (MCM):

NA	2,525	NA

☐ Enhanced Switching Microplexers

SM851/SM852 Central Control

Central control module contains power supply, central logic, 16K-byte RAM buffer, and single or dual composite link modules • includes supervisory port and network configurator for channel monitoring, switching, and reconfiguration • accommodates 2 4-channel adapters; 8 channels maximum; 16K-byte RAM buffer per 4-channel adapter.

SM851 Switching Microplexer • supports any combination of SM851 up to 8 asynchronous/synchronous channels and contains 19.2K-bps synchronous composite link:

NA mo	$2,520 prch	NA maint

SM852 Switching Microplexer • supports any combination of up to 8 asynchronous/synchronous channels and contains dual 19.2K-bps synchronous composite links:

NA	3,290	NA

SM2451/SM2452 Central Control

Central control module contains power supply, central logic, 16K-byte RAM buffer, and single or dual composite link modules • includes supervisory port and network configurator for channel monitoring, switching, and reconfiguration • accommodates 6 4-channel adapters; 24 channels maximum; 16K-byte RAM buffer per 4-channel adapter.

SM2451 Enhanced Switching Microplexer • supports any combination of up to 24 asynchronous/synchronous channels and contains 19.2K-bps synchronous composite link:

NA mo	$3,330 prch	NA maint

SM2452 Enhanced Switching Microplexer • supports any combination of up to 24 asynchronous/synchronous channels and contains dual 19.2K-bps synchronous composite links:

NA	4,100	NA

SM4851/SM4852 Central Control

Central control unit contains power supply, central logic, 16K-byte RAM buffer, and single or dual composite link modules • includes supervisory port and network configurator for channel

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monitoring, switching, and reconfiguration • accommodates 6 4-channel adapters; 24 channels maximum • expander unit (card frame) with power supply provides 6 slots for additional 4-channel adapters; 24 channels maximum • 48-channel maximum expansion capacity • each 4-channel adapter (expander module) contains an integral 16K-byte RAM buffer memory, for a system maximum of 208K bytes.

SM4851 Switching Microplexer • supports any combination of up to 24 asynchronous/synchronous channels and contains 19.2K-bps synchronous composite link; supports SM48 Expander Unit:

NA mo	$3,650 prch	NA maint

SM4852 Switching Microplexer • supports any combination of up to 24 asynchronous/synchronous channels and contains dual 19.2K-bps synchronous composite links; supports SM48 Expander Unit:

NA	4,420	NA

SM48 Expander Unit • supports any combination of up to 24 asynchronous/synchronous channels; connects to any SM48 central control unit via ribbon cables • rackmountable only:

NA	1,250	NA

Flow Control

Guards against multiplexer overflow and against buffer overflow at terminals resulting in loss of data • controls data flow from terminals at selected terminal ports by raising or lowering Clear-To-Send (CTS) or other control signals on RS-232C interface, out-of-band; or by generating XON/XOFF or other appropriate control character, in-band • flow suspension threshold at 87 percent total buffer utilization; flow resumption threshold at approximately 80 percent total buffer utilization • terminal equipment controls data flow via control characters recognized at channel port • standard feature included in package price.

Diagnostic Tests

Diagnostic tests conducted through front-panel controls on local or remote multiplexers or by user-supplied terminal with Supervisory Communication Support and Extended Diagnostics Option • test results presented via unit's 4-digit display panel or at terminal • isolates failures in local/remote channels; local/remote loopback of composite link • conducts self-test of system hardware and firmware modules • contains FOX message generator to test any selected data channel • standard feature.

Extended Diagnostics Option • supports remote test patern generation, channel loopbacks, and tail circuit modem loopbacks via user-provided display console:

NA mo	$100 prch	NA maint

Remote Dial-Up Diagnostics • supports remote diagnostics performed by Timeplex engineers at a Timeplex Service Center via equipped models with optional Supervisory Communications Support • determines quality/status of end-to-end communications facilities; interrogates and analyzes any I/O channel data transmission; monitors channel activity content/validity; and verifies integrity of complete system • available free of charge to users with contract maintenance; requires AT&T 201C or equivalent modem.

Status Reporting

Monitors and accumulates statistics on operating performance • central control module status display indicates normal operating condition, test condition, hardware failure, loss of carrier between modems, loss of composite link between local and remote mux, and central logic or channel buffer overload condition • channel adapter (Expander Module) status display indicates normal operating condition, test condition, and hardware failure condition • SM48 Expander Unit contains power supply display indicator for normal/alarm operating conditions • 4-character display presents channel parameters and system test results • standard feature included in package price.

Channels—Models SM8, SM24 & SM48

Models SM851 and SM852 central control module supports 2 4-channel adapters (Expander Modules). Models SM2451, SM2452, SM4851 and SM4852 central control modules support 6 4-channel adapters. SM48 Expander Unit supports an additional 6 4-channel adapters.

Asynchronous/synchronous full-duplex channels • asynchronous data rates at 50/75/110/134.5/150/300/600/ 1200/1800/2000/2400/3600/4800/7200/9600 bps • synchronous communications require Synchronous Protocol Options listed below; data rates are protocol dependent • Model SM8 maximum aggregate channel rate is 38.4K/76.8K bps, 4/8 channels • Model SM24 maximum aggregate channel rate is 230.4K bps • Model SM48 maximum aggregate channel rate is 460.8K bps • 14 asynchronous channel parameters selected via front-panel thumbwheel switch; including data rates, parity, CR/LF/FF character delays (flyback buffering), data bits, stop bits, and flow control; selectable synchronous parameters include internal/external clock selection, maximum block size, number of leading synchronous characters, DTE/DCE selection, data speed, buffer priority level, and character code • automatically downline loaded channel parameters, master-to-slave • 5 through 9 data bits, asynchronous • standard RS-232C/CCITT V.24/V.28 interface.

SM-QAS Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • converts to synchronous communication via Synchronous Protocol Option (PROM module) • requires slot in central control module • not included in package price:

NA mo	$1,350 prch	NA maint

SM-QA Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • does not accommodate synchronous communications • requires slot in central control module • not included in package price:

NA	1,100	NA

SM-QSDLC/2 Expander Module • 4-channel full-duplex channel adapter with 16K-byte RAM buffer • 2 SDLC channels and 2 asynchronous/synchronous channels • requires slot in central control module or SM48 Expander Unit • not included in package price:

NA	1,450	NA

SM-QSDLC/4 Expander Module • 4-channel full-duplex channel adapter with 16K-byte RAM buffer • 4 SDLC channels • requires slot in central control module or SM48 Expander Unit • not included in package price:

NA	1,750	NA

Channel Features & Options

See Channel Features & Options under Quad Switching & Networking Microplexers on page 15 for details.

Channel Routing

See Channel Routing under Quad Switching & Networking Microplexers on page 16 for details.

Composite Link

Central control module packaged link • synchronous data rates to 19.2K bps per link • point-to-point communication over single link; dual-link models required for master site in triple-node networks only, for communication with 2 remote nodes • modified CCITT X.25 Level II link protocol • internal or external clock source • CRC 16 and ARQ error detection and correction • standard RS-232C/CCITT V.24/V.28 interface standard feature included in package price.

EIA RS-423 Unbalanced Interface • integral feature permits interconnection between balanced and unbalanced interfaces • standard feature included in package price.

Modem Option • integral full-duplex synchronous modem for operation over unconditioned 4-wire dedicated Type 3002 line •

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2400/4800/9600 bps • compromise equalizer (2400-bps modem); adaptive digital transversal equalizer (4800-bps and 9600-bps modems) • requires **Modem Carrier Module (MCM)**; MCM inserts in Expander Module slot (displaces Expander Module-4 channels) and is powered by multiplexer • usable for **composite link** or **channel-attached tail circuits**.

Modem Carrier Module • accommodates single integral modem; inserts in Expander Module slot; 1 required per modem:

	NA mo	$225 prch	NA maint

A2410 Data Pump • 2400-bps, CCITT V.26-compatible integral modem • inserts in Modem Carrier Module (MCM):

	NA	750	NA

A4810 Data Pump • 4800-bps, CCITT V.27-compatible integral modem • inserts in Modem Carrier Module (MCM):

	NA	1,700	NA

A9610 Data Pump • 9600-bps, CCITT V.29-compatible integral modem • inserts in Modem Carrier Module (MCM):

	NA	2,525	NA

☐ Quad Switching & Networking Microplexers

QSM Central Control

Central control unit contains power supply, central logic, up to 224K bytes of RAM buffering and 4 composite link modules • accommodates 5 4-channel adapters; 20 channels maximum • expander unit (card frame) with power supply provides 7 slots for additional 4-channel adapters; 28 channels maximum • 48-channel maximum expansion capacity • each 4-channel adapter (expansion module) contains an integral 16K-byte RAM buffer memory, for a system maximum of 224K bytes.

QSM4854 Quad Switching Microplexer • supports any combination of up to 20 asynchronous/synchronous channels and contains 4 synchronous composite links; supports expander unit:

	NA mo	$6,950 prch	NA maint

QSM48 Expander Unit • supports any combination of up to 28 asynchronous/synchronous channels; connects to central control unit via ribbon cables • rackmount:

	NA	1,250	NA

NM Central Control

Central control unit contains power supply, central logic, up to 480K bytes of buffering for NM96 or 672K bytes of buffering for NM144, and 6 link modules • NM96 accommodates 24 4-channel adapters for total of 96 channels • NM144 accommodates 36 4-channel adapters for total of 144 channels • each 4-channel adapter contains an integral 16K-byte RAM buffer memory.

NM96 Networking Microplexer • supports any combination of up to 24 asynchronous/synchronous or SDLC channels and contains 6 synchronous composite links:

	NA mo	$19,650 prch	NA maint

NM144 Networking Microplexer • supports any combination of up to 36 asynchronous/synchronous or SDLC channels and contains 6 synchronous composite links:

	NA	30,200	NA

Flow Control—Models QSM & NM

Guards against multiplexer overflow and against buffer overflow at terminals resulting in loss of data • controls data flow from terminals at selected terminal ports by raising or lowering Clear-To-Send (CTS) or other control signals on RS-232C interface, out-of-band; or by generating XON/XOFF or other appropriate control character, in-band • flow suspension threshold at 87 percent total buffer utilization; flow resumption threshold at approximately 80 percent total buffer utilization • terminal equipment controls data flow via control characters recognized at channel port • standard feature included in package price.

Diagnostic Tests—Models QSM & NM

Diagnostic tests conducted through front-panel controls on local or remote multiplexers or by user-supplied terminal connected to Supervisory Port • Extended Diagnostics Option required • test results presented via unit's 4-digit display panel or at terminal • isolates failures in local/remote channels; local/remote loopback of composite link • conducts self-test of system hardware and firmware modules • contains FOX message generator to test any selected data channel • standard feature.

Extended Diagnostics Option • supports remote test pattern generation, channel loopbacks, and tail circuit modem loopbacks via user-provided display console • available for Models SM2433 and SM2438 only; 1 per Expander Module:

	NA mo	$100 prch	NA maint

Remote Dial-Up Diagnostics • supports remote diagnostics performed by Timeplex engineers at a Timeplex Service Center via models equipped with optional Supervisory Communications Support • determines quality/status of end-to-end communications facilities; interrogates and analyzes any I/O channel data transmission; monitors channel activity content/validity; and verifies integrity of complete system • available free of charge to users with contract maintenance; requires AT&T 201C or equivalent modem.

Status Reporting—Models QSM & NM

Monitors and accumulates statistics on operating performance • central control module status display indicates normal operating condition, test condition, hardware failure, loss of carrier between modems, loss of composite link between local and remote mux, and central logic or channel buffer overload condition • channel adapter (Expander Module) status display indicates normal operating condition, test condition, and hardware failure condition • 4-character display presents channel parameters and system test results • standard feature included in package price.

Network Control & Management—Models ESM, QSM & NM

Extensive network control and management is conducted through the Prophet Network Manager, an IBM Personal Computer Model XT that runs under Timeplex proprietary software • Prophet is a powerful aid to users of large and/or complex networks; it executes numerous network control and management tasks initiated by the user via menu selection or simple keyed commands • connects to supervisory port of microplexer at user-defined central location • user can define, validate, and establish operating parameters for any port or composite link within a multinode network; reroute communication paths; or retrieve operating parameters for any node and compare with stored set; descrepancies between the 2 sets are flagged; a printed copy of the comparison is available • user can establish port profiles that are full or partial combinations of async port parameter values that can be assigned as a group to 1 or more ports to simplify port programming • monitors network status and activity; displays status and error information (such as number of retransmissions) so user can take immediate action; also shows status of all data links for all nodes in single screen; collects port, port buffer, and data link usage statistics at user command or automatically at a specified time or time interval for traffic analysis • network topology directory lists physical data link interconnections between nodes; lists active/inactive status, data link name, speed, and modem type • can define and store directory for each network node; directory determines primary and alternate path connections between node and other nodes • port history, port module status, data link status, and level of 4 EIA interface signal functions for each port can be retrieved for each network node at user command or automatically at specified time or time interval through user-created command files; stores up to 15 user-defined diagnostic command files • multilevel password protection allows (1) viewing all screens without editing, (2) parameter changes through menu only, (3) issuing commands directly to any or each network node, (4) password changes (internally enabled) and addition, deletion, or changes of users.

Prophet System • accommodated by ESM, QSM, and NM includes IBM PC/XT with 384K-byte RAM, 360K-byte diskette

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storage (contains operating software), 10M bytes of fixed disk (file storage), and printer:

	NA mo	$9,690 prch	NA maint

Prophet System • proprietary Timeplex software for use with user-supplied IBM PC; contact vendor for quotation:

	NA	NA	NA

QSM & NM Channels

QSM central logic module supports 5 4-channel adapters (expander modules). QSM Expander Unit supports an additional 7 4-channel adapters for a total of 12 adapters (48 channels).

NM96 central logic module supports 24 4-channel adapters (expander modules) for a total of 96 channels.

NM144 central logic module supports 36 4-channel adapters (expander modules) for a total of 144 channels.

Optional integral modems support tail-circuit connections; 2400/4800/9600-bps data rates; each requires single slot and displaces quad-channel card; see Composite Link section for details and pricing.

Asynchronous/synchronous full-duplex channels • asynchronous data rates at 50/75/110/134.5/150/300/600/1200/1800/2000/2400/3600/4800/7200/9600 bps • synchronous communications require Synchronous Protocol Options listed below; data rates are protocol dependent • QSM maximum aggregate channel rate is 460.8K bps • NM96 maximum aggregate channel rate is 921.6K bps • NM144 maximum aggregate channel rate is 1.382M bps • 14 asynchronous channel parameters selected via front-panel thumbwheel switch; includes data rates, parity, CR/LF/FF character delays (flyback buffering), data bits, stop bits, and flow control; selectable synchronous parameters include internal/external clock selection, maximum block size, number of leading synchronous characters, DTE/DCE selection, data speed, buffer priority level, and character code • 90-day battery backup of configuration memory prevents loss of operating parameters from power failures • automatically downline loaded channel parameters, master-to-slave • 5 through 9 data bits, asynchronous • standard RS-232C/CCITT V.24/V.28 interface.

SM-QAS Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • converts to synchronous communication via Synchronous Protocol Option (PROM module) • requires slot in central control module • not included in package price:

	NA mo	$1,350 prch	NA maint

SM-QA Expander Module • 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM buffer • does not accommodate synchronous communications • requires slot in central control module • not included in package price:

	NA	1,100	NA

SM-SDLC/2 Expander Module • 4-channel full-duplex channel adapter with 16K-byte RAM buffer • 2 SDLC channels and 2 asynchronous/synchronous channels • requires slot in central control module or QSM expander unit • not included in package price:

	NA	1,450	NA

SM-SDLC/4 Expander Module • 4-channel full-duplex channel adapter with 16K-byte RAM buffer • 4 SDLC channels • requires slot in central control module or QSM expander unit • not included in package price:

	NA	1,750	NA

Channel Features & Options—Models ESM, QSM & NM

Synchronous Protocol Options • statistically multiplexes synchronous data formatted in various protocols; uses variable-length X.25 packets • supports synchronous communication for 1 to 4 data channels per channel expander, unused channels can be used for asynchronous data transmission • strips leading synchronization characters and multiplexes synchronous data with asynchronous channels;

synchronization character reinsertion and block size selectable at 512/1024/2048/4896 bytes per block via front panel thumbwheel switch • consists of additional firmware in central control module, and 1 PROM per specified SM-QAS or SM-SDLC/2 Expander Module.

Synchronous Protocol Support • firmware required by central control module; handles synchronous protocols from individual Expander Modules:

	NA mo	$50 prch	NA maint

CDC UT-200 Synchronous Protocol • PROM supports up to 4 synchronous channels in accordance with Control Data Corporation 200 User Terminal Reference Manual 82128000 • data rates to 4800 bps; time-out set to 5 seconds:

	NA	100	NA

DEC DDCMP Protocol • PROM supports up to 4 synchronous channels in accordance with Digital Equipment (DEC) Publication AAD599A-TC • data rates to 4800 bps • ASCII code • 512/496 char block size • for DECNet applications:

	NA	125	NA

Honeywell VIP Synchronous Protocol • PROM supports up to 4 synchronous channels in accordance with Honeywell VIP Users Manual, Chapter 3 • data rates to 4800 bps; time-out set to 5 seconds:

	NA	100	NA

IBM Bisynchronous Protocol • PROM supports 1 9600-bps or 4 7200-bps bisynchronous channels; accommodates EBCDIC and ASCII codes:

	NA	100	NA

ICL Synchronous Protocol • PROM supports 1 9600- or 4 7200-bps synchronous channels in accordance with ICL documents 111439 Data Transmission Control Procedures Extended Interactive Procedures, 827985 Engineering Specification for 7181/2 Video Terminals, and PF 502; 7020 Remote Terminals (System Specification):

	NA	100	NA

AutoSpeed • Adaptive Speed option regulates local and/or remote asynchronous channel rate and code level to that of dial-up line • selectable on per channel basis and to 1 of 3 modes • standard mode regulates both local (initiating) channel and remote (terminating) channel parameters to those of transmission; ASCII or BCD codes • constant mode regulates local channel only; remote channel parameters are not altered; ASCII only • standard mode with answerback is identical to constant mode except channel sends acknowledgement (H) to initiating terminal • 110/150/300/600/1200-bps ASCII rates • 134.5-bps BCD • CR convention for ASCII; CTL D for BCD • optional feature.

Adaptive Speed for Central Control • 1 required:

	NA	100	NA

Adaptive Speed for Channel Adapter (Expander Module) • 1 per Expander Module:

	NA	50	NA

Successive Dial-Up Requests • supports successive access of different network resources from dial-up users without call disconnection at completion of each network resource access • standard feature included in package price:

	NC	NC	NC

Interactive Terminal Interface issues menu of commands at user request for accessing network messages or directory, or for altering echoplex at specific user port • standard feature included in package price:

	NC	NC	NC

Echoplex • loops transmission received from data terminal equipment at channel port to port output • selectable on per channel basis • provides visual data verification at remote terminal connected through tail circuit • included in package price.

Flyback Control • delays transmission of data to data terminal

Timeplex Statistical Single- & Multi-Link & X.25 PAD Multiplexers
E/Series, Series II, Enhanced Switching, Quad Switching, Networking & X.25 PAD Microplexers

equipment following transmitted carriage return, line feed, or form feed control characters • compensates for time required for terminal to perform these control functions • selectable on per channel basis • included in package price.

Supervisory Communications Support • dedicated port supports Prophet Network Manager or any user-provided colocated or remote asychronous ASCII terminal for channel reconfiguration and switching, network reconfiguration, and connect status reporting • supports remote alarms of local Microplexer via Alarm Driver Option • standard feature included with package price:

	NC	NC	NC

Network Configurator • PROM supports remote reconfigured channel parameters on a per channel basis via user-provided display terminal attached to supervisory port; noninterfering with other data channels • EPROM module attaches to Expander module • standard feature included with package price:

	NC	NC	NC

Communicator • supports message communication between supervisory port terminal and network ports; message entered at terminal can be selectively transmitted to specific network ports or broadcast to all ports • network supervisor can also monitor transmissions at selective network ports • standard feature included in package price:

	NC	NC	NC

Alarm Driver Option • provides alarm indications of buffer overflow, composite link errors, and hardware/firmware failures from local Microplexer to user-supplied display terminal via Supervisory Communications Support • unit mounts over supervisory port interface • extra-cost option; 1 per unit:

	NA	165	NA

Priority Control • Dynamic Buffer Priority Override overrides proportional memory allocation to most active terminals; 1 of 3 priorities selectable on a per channel basis • Priority A allows unlimited buffer access, Priority B provides equal buffer sharing; Priority C provides limited buffer access • standard feature included in package price.

TSO/TCAM Asynchronous Handler Option • PROM supports IBM TSO/TCAM communications with IBM 2741 terminals • inserts character at end of normal break signal to compensate for remote terminal tendency to switch from receive to transmit function • extra-cost option; 1 per unit:

	NA	100	NA

EIA RS-423 Unbalanced Interface • integral feature permits interconnection between balanced and unbalanced interfaces • standard feature included in package price.

Channel Routing—Models ESM, QSM & NM

All channels can be assigned as either switched or dedicated. Networks comprised of Enhanced Switching Microplexer, Quad Switching Microplexers, or Networking Microplexers are configurable with any mix of models; master site and node designations selectable via internal DIP switch settings. One node in network (master site) must be equipped with an ASCII Supervisory terminal or Network Manager; users configure channel parameters and execute switching commands via this required extra-cost option.

Programmable channel assignments include contention channels, dedicated channels, and selection channels. Compatible types can be grouped into variable sizes, but channels within each group must be contiguous. Group sizes are limited only by the maximum number of channels at a given node. For security, 1 or 2 contiguous groups can be designated for restricted access, limiting access for certain channels only. For more comprehensive security, access to the Supervisory Port can also be restricted; added password protection restricts access to authorized users. The Restricted Resource Group feature standard on all models, provides up to 8 secure groups.

Channel switching allows connections to be programmed

dynamically, rather than using fixed routing tables. Terminal operators enter commands that automatically connect them to other terminals in the network, provided they are allowed access; possible routes are pre-programmed into firmware via internal DIP switches or by the Supervisory Port Quad Switching and Networking Microplexers also support terminal-to-terminal communication either remotely or locally within a single node, performing as a data PBX and bypassing composite link communications. Local networks can utilize a single Microplexer in this manner.

Channel Selection • initiate calls to any switched channel or contention group in the network, pending channel group or Restricted Resource Group restrictions • standard feature included in package price.

Contention Channels • do not initiate calls; accept calls on a first-come, first-serve basis • contiguous channels in a Contention group are not treated as specific ports, but as a collective group • contending channels initiate calls only to a specified contention group • if connection cannot be made with a Contention group, the system will automatically retry every 10 seconds • standard feature included in package price.

Dedicated Channels • fixed, nonswitched channels assigned to other non-switched channels; dedicated routing information can be changed by the Supervisory Port only • only channel type supporting synchronous data • standard feature included in package price.

QSM & NM Composite Link

Central control module packaged links. QSM supports 4 links at link rates to 19.2K bps. NM supports 6 links at link rates to 19.2K bps or 72K bps (optional) in point-to-point applications • point-to-point, multipoint, or multinode communication • modified CCITT X.25 Level II link protocol • internal or external clock source • CRC 16 and ARQ error detection and correction • standard RS-232C/CCITT V.24/V.28 interface • standard feature included in package price.

EIA RS-423 Unbalanced Interface • integral feature permits interconnection between balanced and unbalanced interfaces • standard feature included in package price.

Modem Option • integral full-duplex synchronous modem for operation over unconditioned 4-wire dedicated Type 3002 line • 2400/4800/9600 bps • compromise equalizer (2400-bps modem); adaptive digital transversal equalizer (4800-bps and 9600-bps modems) • requires **Modem Carrier Module (MCM)**; MCM inserts in Expander Module slot (displaces Expander Module-4 channels) and is powered by multiplexer • usable for **composite link** or **channel-attached tail circuits**.

Modem Carrier Module • accommodates single integral modem; inserts in Expander Module slot; 1 required per modem:

	NA mo	$225 prch	NA maint

A2410 Data Pump • 2400-bps, CCITT V.26-compatible integral modem; inserts in Modem Carrier Module (MCM):

	NA	750	NA

A4810 Data Pump • 4800-bps, CCITT V.27-compatible integral modem • inserts in Modem Carrier Module (MCM):

	NA	1,700	NA

A9610 Data Pump • 9600-bps, CCITT V.29-compatible integral modem • inserts in Modem Carrier Module (MCM):

	NA	2,525	NA

☐ Microplexer X.25 PAD Packet Network Data Concentrator

MX.25 PAD Central Control

Central control module contains power supply, central logic, up to 48K, 112K, or 208K bytes of memory depending on model, and 1 or 2 composite link modules depending on model • available in standalone or rackmount packaged 8, 24, or 48 channel configurations • supports window size up to 7 packets per channel.

Timeplex Statistical Single- & Multi-Link & X.25 PAD Multiplexers
E/Series, Series II, Enhanced Switching, Quad Switching, Networking & X.25 PAD Microplexers

MX81 8-Channel PAD ● supports 2 asynchronous 4-channel adapters and contains single 9600-bps link module:

	NA mo	$1,750 prch	NA maint

MX82 8-Channel PAD ● supports 2 asynchronous 4-channel adapters and contains 2 9600-bps link module:

	NA	2,265	NA

MX241 24-Channel PAD ● supports up to 6 asynchronous 4-channel adapters and contains single 9600-bps link module:

	NA	3,480	NA

MX242 24-Channel PAD ● supports up to 6 asynchronous 4-channel adapters and contains 2 9600-bps link modules:

	NA	3,995	NA

MX481 48-Channel PAD ● supports up to 6 asynchronous 4-channel adapters and contains single 9600-bps composite link module ● requires MX48 Expander Unit for additional 6 4-channel adapters for 48-channel maximum configuration:

	NA	3,650	NA

MX482 48-Channel PAD ● supports up to 6 asynchronous 4-channel adapters and contains 2 9600-bps composite link modules ● requires MX48 Expander Unit for additional 6 4-channel adapters for 48-channel maximum configuration:

	NA	4,165	NA

MX48 Expander Unit ● supports an additional 6 asynchronous 4-channel adapters (24 ports) ● required for MX481 or MX482 expansion beyond 24-channel limit to 48-channel maximum configuration:

	NA	1,000	NA

MX.25 PAD Channels

MX81/MX82 central control module supports 2 asynchronous 4-channel adapters ● MX241/MS242/MX481/MX482 central control modules each support up to 6 asynchronous 4-channel adapters ● MX48 expander unit supports up to an additional 6 asynchronous 4-channel adapters ● channel (port) parameters are configured via a terminal connected to the standard supervisory port, and are downline loaded to remote X.25 PAD; 90-day battery backup of configuration memory prevents loss of operating parameters from power failure ● channels can be assigned to a specific link either locally or remotely through individual channel (port) and link addresses ● however, a channel (port) can be connected to only one link at a time ● where both links connect to the same network or computer, traffic is distributed equally between links to prevent congestion; in the event that a link fails, all traffic is routed over the alternate link ● each link can also be connected to a different network or computer; each network or computer can "call" any channel (port) ● asynchronous channel rates at 50/75/110/134.5/150/300/600/1200/1800/2000/2400/3600/4800/7200/9600 bps; maximum aggregate input rate of 76.8K bps (MX81/MX82), 230.4K bps (MX241/MX242), or 460.8K bps (MX481/MX482) ● 5/6/7/8 bits per character plus parity; 1/1.5/2 stop bits ● RS-232C/CCITT V.24/V.28; MIL-188C; MIL-188-114 unbalance port electrical interface.

MX-IAD Expander Module ● 4-channel, full-duplex asynchronous channel adapter with 16K-byte RAM ● supports dial-up or tail-circuit connections; optional integral modems for tail circuit buffer ● requires slot in central control module or expander unit:

	NA mo	$750 prch	NA maint

Channel Features & Options

AutoSpeed ● Adaptive Speed option regulates local and/or remote asynchronous channel rate and code level to that of dial-up line ● selectable on per channel basis and to 1 of 3 modes ● standard mode regulates both local (initiating) channel and remote (terminating) channel parameters to those of transmission; ASCII or BCD codes ● constant mode regulates local channel only; remote channel parameters are not altered; ASCII only ● standard mode with answerback is identical to constant mode except channel sends acknowledgement (H) to initiating terminal

● 110/150/300/600/1200-bps ASCII rates ● 134.5-bps BCD ● CR convention for ASCII; CTL D for BCD ● optional feature.

Adaptive Speed for Central Control ● 1 required:

	NA	100	NA

Adaptive Speed for Channel Adapter (Expander Module) ● 1 per MX-IAD Expander Module:

	NA	50	NA

Echoplex ● loops transmission received from data terminal equipment at channel port to port output ● selectable on per channel basis ● provides visual data verification at remote terminal connected through tail circuit ● included in package price.

Flyback Control ● delays transmission of data to data terminal equipment following transmitted carriage return, line feed, or form feed control characters ● compensates for time required for terminal to perform these control functions ● selectable on per channel basis ● included in package price.

Supervisory Communications Support ● dedicated port supports any user-provided colocated or remote asynchronous ASCII terminal for statistics reporting, traffic monitoring, supervisory message transmission, and EIA signal monitoring ● supports remotely reconfigured channel parameters via Network Configurator Option; supports remote diagnostic test pattern generation and loopbacks via Extended Diagnostics Option; supports remote alarms of local Microplexer via Alarm Driver Option ● standard feature included with package price.

Network Configurator Option ● PROM supports remotely reconfigured channel parameters on a per channel basis via user-provided display terminal attached to supervisory port ● noninterfering with other data channels ● EPROM module attaches to Expander module ● pricing included with package price:

	NC	NC	NA

Extended Diagnostics Option ● PROM provides remote diagnostics on a per channel basis; includes FOX test pattern generation, local and remote digital and analog loopbacks, and remote tail circuit loopback ● asynchronous and synchronous test patterns ● requires Network Configurator Option ● noninterfering with other data channels ● EPROM module attaches to Expander module, as required ● extra-cost option; 1 per Expander Module:

	NA	100	NA

Alarm Driver Option ● provides alarm indications of buffer overflow, composite link errors, and hardware/firmware failures from local Microplexer to user-supplied display terminal via Supervisory Communications Support ● unit mounts over supervisory port interface ● extra-cost option; 1 per unit:

	NA	165	NA

Priority Control ● Dynamic Buffer Priority Override overrides proportional memory allocation to most active terminals; 1 of 3 priorities selectable on a per channel basis ● Priority A allows unlimited buffer access; Priority B provides equal buffer sharing; Priority C provides limited buffer access ● standard feature included in package price.

TSO/TCAM Asynchronous Handler Option ● PROM supports IBM TSO/TCAM communications with IBM 2741 terminals ● inserts character at end of normal break signal to compensate for remote terminal tendency to switch from receive to transmit function ● extra-cost option; 1 per unit:

	NA	100	NA

EIA RS-423 Unbalanced Interface ● integral feature permits interconnection between balanced and unbalanced interfaces ● standard feature included in package price.

Channel Routing

All channels (ports) can be assigned as either switched or dedicated. Channel assignments are established via a terminal connected to the standard supervisory port and are downline loaded to the remote X.25 PAD. Virtual connections (calls) are established using 1 of 2 methods depending on whether the channel is switchable or dedicated.

Timeplex Statistical Single- & Multi-Link & X.25 PAD Multiplexers
E/Series, Series II, Enhanced Switching, Quad Switching, Networking & X.25 PAD Microplexers

Mnemonic Calling • establishes a virtual connection for switched channels • terminal operator establishes connection by typing an easily remembered name, acronym, or word up to 15 digits; mnemonics are interchangeable with numerical addresses • standard feature included in package price.

Auto-Connect • establishes a virtual connection for dedicated channels • connection is automatically established when terminal raises DTR signal at electrical interface, or when operator sends carriage return • standard feature included in package price.

Auto-Disconnect • virtual connection is automatically broken at end of user-established idle period; e.g., dial-in call termination (hung up) or operator leaves terminal • standard feature included in package price.

Network Security

Password protection attempts to prevent unauthorized access to supervisory functions. Password protection can also be assigned to user ports on an individual basis to safeguard against unauthorized network access. As additional protection against unauthorized access, the PAD can require a password before accepting a call from the network. The password is contained in the user text area of an incoming call request packet. This feature bars against unauthorized computer access and also presents a "wrong number" from "busying out" a user port even temporarily. As a still further safeguard, a dial-in port configured for Auto-Connect can reach only one destination, preventing unauthorized exploration of network resources.

MX.25 PAD Composite Link

Central control module packaged link • synchronous full-duplex single link or dual links; rates to 9600 bps • CCITT X.25 Level III link access protocol balanced (LAPB) • X.25 Level II HDLC • CRC 16 and ARQ error detection and correction • CCITT X.21 bis electrical interface • composite link(s) included in purchase price:

NC mo	NC prch	NC maint

Modem Option • integral full-duplex synchronous modem for operation over unconditioned 4-wire dedicated Type 3002 line • 2400/4800/9600 bps • compromise equalizer (2400-bps modem); adaptive digital transversal equalizer (4800-bps and 9600-bps modems) • requires **Modem Carrier Module (MCM)**; MCM inserts in Expander Module slot (displaces Expander Module-4 channels) and is powered by multiplexer • usable for **composite link** or **channel-attached tail circuits**.

Modem Carrier Module • accommodates single integral modem; inserts in Expander Module slot; 1 required per modem:

NA	225	NA

A2410 Data Pump • 2400-bps, CCITT V.26-compatible integral modem; inserts in Modem Carrier Module (MCM):

NA	750	NA

A4810 Data Pump • 4800-bps, CCITT V.27-compatible integral modem • inserts in Modem Carrier Module (MCM):

NA	1,700	NA

A9610 Data Pump • 9600-bps, CCITT V.29-compatible integral modem • inserts in Modem Carrier Module (MCM):

NA	2,525	NA

• **END**

Timeplex Link/1
T1 Facilities Management System

■ PROFILE

Function ● character-interleaved TDM designed for T1 carrier facilities ● point-to-point, drop-and-insert, and multipoint applications; downline loading of remote multiplexer ● handles asynchronous, synchronous, and voice (digitized) data ● composite link speeds of 4800 bps to 1.544M bps or 2.048M bps; uses bipolar NRZ encoding.

Communications/Networks ● supports synchronous data channels of 75 bps to 256K bps ● asynchronous data accommodated via submultiplexer or synchronous channel oversampling: maximum data rate 19.2K bps ● channel interfaces are RS-232C/CCITT V.24, RS-422/CCITT V.11, CCITT V.35, RS-423, MIL-Std-188C and 188-114 (unbalanced) ● link interface is RS-422/CCITT V.11, DS1 ● up to 10 composite links (trunks) ● cascaded multiplexers handled on channel side.

First Delivery ● 1983.

Systems Delivered ● not disclosed.

Comparable Systems ● Amdahl Model 2211, Avanti-Ultra Mux, Bayly Omniplexer, Codex 6240, Datatel DCP 9100, DCA Netlink, General Data Comm Megamux Plus, Infotron Infostream, and Paradyne DCX-T1.

Vendor ● Timeplex Inc; 400 Chestnut Ridge Road, Woodcliff Lake, NJ 07675 ● 201-930-4600.
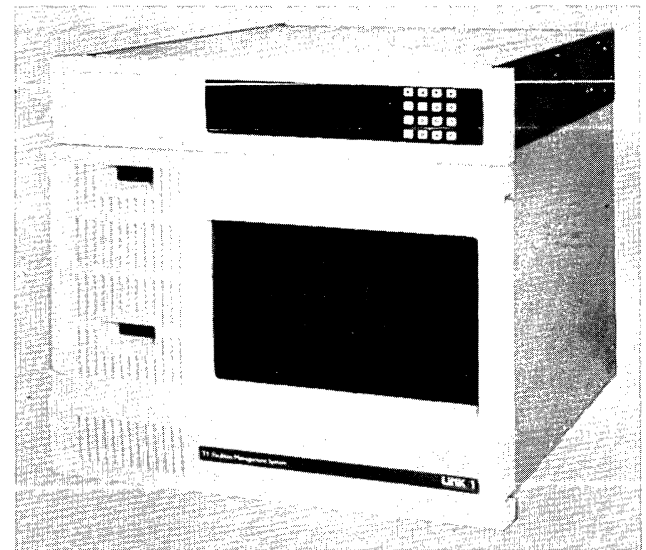
Distribution ● worldwide through direct sales forces and distributors.

■ ANALYSIS

The Link/1 multiplexer is a character (byte) interleaved time-division multiplexer designed specifically to combine a wide range of asynchronous and synchronous data paths on a single broadband link referred to as a T1 carrier.

T1 carrier facilities have been used by the telephone company since the early 1960s to carry digitized voice and data. Until early 1983, however, T1 was unavailable as a tariffed service to private users. Those who required it had to subscribe to independent carriers or had to install their own microwave links. Users can now order the service under AT&T Communications Accunet T1.5 Service.

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.

PURCHASE PRICE RANGE

Hardware ▬

Timeplex Link/1			$37K to $97K	

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

TIMEPLEX LINK/1 PURCHASE PRICING bar graph covers price range between "small" and "large" configurations of hardware (solid bar) ● **SMALL** configuration consists of basic chassis with network control module, interlink module, integrated modem, 5 data cards and 5 voice cards ● **LARGE** configuration consists of basic chassis with redundant control, interlink module, and integrated modules, and integrated modem, 12 data-channel and 12 voice-channel cards. All prices single-quantity purchase. Maintenance prices not available but should be typically 1 percent of purchase price per month for each component.
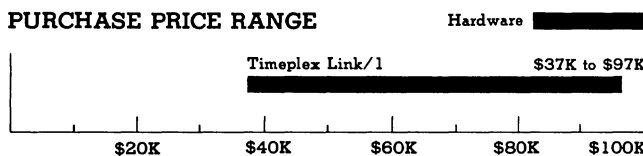
The problem with operating on 64K bps channel boundaries is that considerable bandwidth can be wasted if the channels are not efficiently "subslated." For example, a multiplexer that services inputs based on subslating multiples of 9600 bps will waste considerable bandwidth when lower speed channels are being serviced. A 300-bps input to a 9600-bps subslot wastes 9300 bps. A good number of T1 multiplexers—including Link/1—do not operate on these 64K-bps channel boundaries, and assign bandwidth in accordance with the needs of the input device. Thus, considerably more channels can be accommodated. In the case of Link/1, up to 208 channels can be handled.

The Link/1 can be configured to handle conventional TDM multiplexing applications whereby n-channels communicate with a like number of channels on a point-to-point basis; or the multiplexer can handle drop-and-insert applications. With drop/insert, certain channels originating at 1 multiplexer can be dropped at an intermediate multiplexer, while the remaining channels continue on to their utlimate destination. With data insert channels, data can be inserted into the message train at the same intermediate multiplexer where data is dropped.

Link/1 is a very simple, compact system. A single chassis contains the control logic, I/O channel cards (synchronous data and voice), and power supply. The control logic employs 2 cards to handle all functions of system control, test and monitoring, and an internal modem module provides the interface to the T1 link line and will transmit data over twisted-pair wires up to 1 mile. I/O channel card packaging is also compact. Four channel ports are contained on each synchronous data card and the voice card. By contrast, many Link/1 competitors employ dual-channel cards for data and voice.

Synchronous channels can be individually programmed to handle half-/full-duplex transmission at data rates from 75K bps to 256K bps. Up to 7 control signals (DTR, DSR, RTS, CTS, BO, RI, and CD) are transmitted end-to-end, and 4 additional control signals can be used for diagnostic purposes. Control signals can be selectively passed inband or out-of-band. Each channel also

Timeplex Link/1
T1 Facilities Management System

contains an I/O buffer which can be specified to be 2 to 16 bytes. This should be more than adequate to handle multidropped or dial-up terminals. In addition, Link/1 allows each channel to be assigned to priority number which is used by the system to assign time slots. This unique feature is a valuable asset to the user (see Strengths).

The voice channel employs Continuously Variable Slope Delta (CVSD) modulation for quantizing analog voice. CVSD divides the 4-KHz voice into 8-bit words and samples each bit 32,000 times a second. Only the direction and amount of the change (delta) in the slope between the current and previous sampling is transmitted. As a result, a CVSD channel only requires 32K bps to produce digitized voice output, half the bandwidth required for the popular alternative, Pulse Code Modulation (PCM).

Link/1 has no asynchronous data card, a drawback discussed under Limitations. Currently, a submultiplexer is required to handle asynchronous data or a synchronous channel card can be used provided that the sampling rate is 4 times the input data rate.

Link/1 is the only T1 multiplexer to date that supports multiple T1 links from the central control chassis. Other products (Avanti, Codex, and Bayly) permit individual links to be associated with each expansion channel chassis, but this scheme lacks the flexibility of Link/1 (see Strengths).

☐ Strengths

Link/1 is loaded with a number of beneficial facilities which makes it extremely attractive. Its redundant control logic and power supplies, for example, guarantees uninterrupted service should either or both of these vital primary components fail. It also features drop-and-insert and a multipoint communication facility, a multilink capability, and is totally controlled from a supervisor terminal.

With the addition of drop-and-insert, Link/1 joins the Bayly Omniplexer, Coastcom D/I Mux, and DCA Netlink in offering this advantageous capability. Drop-and-insert allows users to designate specific data/voice channels originating at one multiplexer to be dropped at an intermediate multiplexer (another Link/1) while the remaining channels continue to their ultimate destination. At the intermediate site, other channels are inserted into the composite data stream and are demultiplexed at their specific destinations. Link/1 performs drop-and-insert under software control, with channel assignments established at the supervisory terminals controlling each multiplexer in the network. Such control adds to the overall flexibility of the system by permitting the operator to change channel termination points throughout the network. When coupled with Link/1's multiple link option, dynamic channel routing is a potent networking tool.

The basic Link/1 is a single-link multiplexer intended for point-to-point/multipoint applications. With the addition of optional data link modules, users can add additional links which are controlled by the system's central logic. Link/1 can be configured with up to 10 independent links; 6 can be T1 links while the remainder can link to other facilities such as DDS and satellite channels. The link modules themselves insert into the central chassis or the expansion channel chassis; the only restriction is the remaining card-slot availability after the control logic is installed. The channels associated with each link needn't be physically located in the same chassis as the link module, as is the case with the Avanti, Bayly, and Codex products. Rather, users assign channels (via the supervisor console) to the links associated with the target destinations.

☐ Limitations

Since our last evaluation of Link/1, Timeplex has remedied the channel-capacity limitation (then 44; now 204) and added drop-and-insert. Still missing, however, is an asynchronous data channel card and a high-speed synchronous data-handling facility. In addition, Link/1 is currently **not compatible with AT&T's Digital Access and Crossconnect Service (DACS).**

The lack of an asynchronous data card requires the user to connect asynchronous channels to a submultiplexer such as Timeplex's Microplexer Statistical multiplexer and interface it with a Link/1 synchronous data channel; or interface the asynchronous channel directly to a synchronous channel. In the

latter case, the synchronous data sampling (clock) rate must be 4 times that of the asynchronous input data rate to reduce the chances of phase jitter. For organizations opting to use submultiplexers, be aware that these units operate in pairs and can be costly with oversampling a portion of the bandwidth is wasted.

The top data rate handled by a Link/1 synchronous channel is 256K bps, which should be adequate for most current applications. However, it is too slow to accommodate compressed video (a minimum of 450K bps) and very high-speed mainframe-to-mainframe file transfers (around 1M bytes per second). According to the vendor, a synchronous rate of 512K bps is coming, which should alleviate the limitation.

Link/1 does not employ the D4 or extended frame format (Fe) framing required to interface it with AT&T's DACS. DACS is a terminal-controlled system that allows the redistribution (switching) of individual DSO 64K-bps voice 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 time shared to identify both channel framing and signal framing.) A T1 multiplexer that does not employ this framing therefore, shouldn't be DACS compatible. Link/1 is not currently DACS compatible, but the vendor is working on it.

Two other minor points should be noted concerning Link/1 compatibility with current and future AT&T Communications Accunet facilities. Both points refer to the quantization technique employed to handle voice inputs. Link/1 employs the highly-efficient CVSD technique, thus allowing multiple channels to share each voice card. AT&T Communications Accunet facilities, however, currently recognize only PCM, which requires a separate 64K bps channel. The future voice-handling services of Accunet will recognize ADPCM. Like PCM, it also samples at 8,000 times a second but only sends a 4-bit change to represent a word. ADPCM therefore requires only 32K bps to handle voice inputs, which permits 2 voice channels to share a single 64k-bps channel. Timeplex, to date, has not announced an ADPCM capability.

■ HARDWARE

☐ Terms & Support

Terms ● standard components and options are available on a purchase or lease basis ● quantity discounts available.

Support ● all components are warranted for a 1-year period ● vendor offers on-site support/maintenance conducted by its own personnel.

☐ Overview

Link/1 is a character-interleaved time-division multiplexer designed for point-to-point and multipoint communication over T1 carrier facilities. Cascaded multiplexers are supported, and the unit can be configured as a multinode network. Drop-and-insert and data bypass are also supported. Link/1 time slot provides for a 9-bit character to be transmitted or received. For inband traffic control operation, the first 8 bits are data and the ninth designates that the character is a data byte or control function byte. In out-of-band operation, all 9 bits are allocated to data.

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The multiplexer handles synchronous data and digitized voice directly; asynchronous inputs, currently, must be interfaced via a submultiplexer such as Timeplex's Microplexer or they can be input to a synchronous channel provided the sampling rate is 4 times the data rate. The voice channel employs the Continuously Variable Slope Delta modulation technique, and produces digitized voice outputs at standard speeds from 16K to 64K bps.

The synchronous channel cards provide 4 I/O ports; each port can be configured to accept data inputs from 75K bps to 256K bps. Each channel also has an I/O buffer which can be specified to be 2 to 16 bytes. Channels can be configured DTE or DCE. Standard channel interfaces are RS-232C/CCITT V.24, RS-422/CCITT V.11, RS-423, and MIL-Std-188C or 188-114 has 4 ports, employs CVSD, and outputs at standard speeds from 16K to 64K bps.

Link/1 can be configured with up to 10 links, with channels dynamically assignable to individual links. Users can also assign communication priorities to channels, which determine the order in which channels are assigned to alternate T1 links should the primary route fail. Higher priority channels are rerouted before lower-priority units.

Link/1 can also be configured to handle drop-and-insert applications. Users can assign individual channels to be dropped at different locations within the network, while channels destined for other locations bypass these intermediate data links. Up to 200 channels can be handled in a drop-and-insert application. The Timeplex method for invoking drop-and-insert is implemented by software (no channel cabling) and allows users to reassign channels to different T1 links as they pass through the network to the ultimate destination. Channel reassignments are established via the Link/1 supervisor console.

The channel bypass scheme employed with drop-and-insert allows patching of dedicated virtual circuits through multinode configurations and across many data links with demultiplexing at bypassed nodes. Routing communications paths is on an individual basis. Each path can include up to 7 bypasses.

The multiplexer is extremely compact and very easy to use. Two cards handle all system functions such as channel configuring, system monitoring, testing, and multiplexing/demultiplexing. An integral modem module provides the interface to the T1 link line. The system is totally configured from a built-in control panel, or a separate supervisory terminal or supervisory computer can be used. Link/1 is menu driven.

All central logic cards, power supplies, and channel cards are contained in 1 chassis and 2 expansion nests. Up to 208 channels can be handled in a nonredundant configuration. Link/1 supports 10 composite links that run at speeds of 4800 bps up to 1.544M bps or 2.048M bps. The message framing technique conforms to the unframed DS1 format. This Link/1 may interface with AT&T's ACCUNET T1.5 service without the need for a Model 306 modem.

☐ **Link/1 Facilities Management System**

Link/1 consists of a single control-unit chassis containing 13 channel card slots, and up to 2 channel expansion nests each with 18 card slots. The system supports synchronous data and/or voice cards each with 4 I/O ports. A fully configured Link/1 provides up to 208 I/O ports and 10 independent links. The system can also be configured with redundant control logic and power supplies interlink module, and internal modem.

The central logic consists of 2 cards which handles all system functions and interaction between the data/voice channel and the data link. The Network Control Module, for example, contains the system PROM, RAM, microprocessor, test-message generator, and system interface circuits. The second card, called the Interlink Module, provides the interface between the data/voice I/O and the link modem. The actual interface between the link line and the multiplexer is handled by an internal modem module or an external modem.

Link/1 is a soft-configured system which employs an integral control panel to configure operating parameters, monitor operations, and perform system tests. As an alternative, users may employ an ASCII supervisory terminal or a supervisory computer, interfaced through separate ports, to perform the same functions. The supervisory port accommodates a remotely located terminal. All interaction between the user and the system is handled via menus and submenus; the instructions are very easy to learn.

For most operations, the control panel's capabilities should be adequate to handle system configuration, monitoring, and testing. There are, however, some functions which can be done only by the terminal or computer. A list of the supervisory port, control panel, and computer operations follows:

Function	Super-visory Port	Con-trol Panel	Com-puter Port
Monitoring			
Display channel parameters	●	●	●
Display data link parameters	●	●	●
Display data link statistics	●		●
Display connect status	●		●
Display computer port parameters	●	●	●
Display supervisory port parameters	●	●	●
Display system parameters	●		●
Display alarm table	●	●	●
Display functions/control signals	●	●	●
Display phasor error status	●	●	●
Display command file	●		
Display system status	●		●
Diagnostics			
Initiate channel loopback	●	●	●
Initiate data link loopbacks	●	●	●
Initiate relay test	●	●	●
Display start-up errors	●	●	●
Display errors during start-up tests		●	
Configuration Selections			
Define supervisory port parameters		●	●
Define gateway		●	
Define computer port parameters	●	●	●
Define system parameters	●	●	●
Define channel parameters	●	●	●
Define data link parameters	●	●	●
Define channel connection	●	●	●
Define alarm notification list	●	●	●
Define master system clock fallback list	●	●	●
Define station clock speeds	●	●	●

Link/1 incorporates a **channel processing priority** scheme whereby the user assigns each channel a numeric designation which the system uses in assigning bandwidth on the composite link. Should an alternate rerouting become necessary, the higher-priority channels receive precedence.

Link/1 can be configured with redundant critical components. These include the Network Control Module, Interlink Module, Internal Modem Module, and power supply. The redundant power supply operates continuously in conjunction with the primary supply, extending the life of both.

Central Control

L1325 Chassis ● contains 13 channel slots which support up to 44 data/voice channels in nonredundant configurations, or up to 36 data channels in redundant configurations ● includes a Network Control Module, an Interlink Module, and a power supply ● synchronous data cards are quad-channel units; voice cards are 4-channel/port units ● Network Control Module occupies a single card slot and contains system PROM, microprocessor, system RAM, test-message generator and detector circuits, control panel circuits, supervisory terminal port circuits, computer port circuits, system clock sources, and common bus interface ● Interlink Module provides the interface between the data/voice I/O ports and the internal modem module or external modem ● power supply is switching regulator

Timeplex Link/1
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type and incorporates control and logic circuits for load sharing when redundant power supply is employed:

$7,600 prch NA maint

L1825 Chassis ● expansion chassis for data/voice channel cards ● contains 18 channel slots; includes driver card for connection to L1325:

8,600 NA

NCM Redundant Network Control Module ● provides redundant network control functions; automatic switchover from primary:

1,750 NA

PS/L1 Redundant Power Supply ● provides redundant power supply; operates in tandem with primary power supply:

1,950 NA

Bypass Modules ● provide logic for handling drop-and-insert of up to 200 channels:

2,100 NA

Channels

Link/1 is offered with synchronous data and voice channel cards. Asynchronous data must be interfaced to synchronous channels via a submultiplexer such as the Timeplex Microplexer Statistical multiplexer or can be interfaced to a synchronous channel card provided that the sampling rate is 4 times the actual data rate.

The synchronous channel card contains 4 I/O ports, each of which can accommodate channel speeds ranging from 75 bps to 256K bps. Channel parameters are set either from the control panel, supervisory terminal, or supervisory computer. In a future release, Link/1 will allow users to program configuration changes to be automatically invoked at specific time periods.

Current programmable channel parameters consist of channel speed, connect priority, connect originator, control signal transmit mode, interface type (DTE or DCE), channel buffer size, and flow control activation.

The connect priority level allows the user to assign **processing priority** to specific channels. These priorities are used to determine the order in which channels are assigned to alternate T1 links should the primary path fail. Higher-priority channels have precedence over lower-priority channels.

The user has the option of sending control signals inband or out-of-band. Inband control signals are carried with the data stream; out-of-band signals are carried on separate paths and are handled at the interface. The interface can be configured as DTE or DCE. The DTE may provide internal send clock and accept external receive clock, or accept both external send and receive clocks. The channel buffer space (called phasors) can be 2 to 16 bytes for both input and output, and reset by local or remote carrier detect signals. The recognized flow-control signal is CTS, which can be programmed for a delay of 28, 65, 101, or 138 milliseconds following RTS.

PRCH: single-quantity purchase price. NA MAINT: maintenance prices were not available at this writing; typical fees should run about 1 percent of the purchase price per month. Prices current as of January 1985.

The voice channel card provides 4 I/O ports, and employs Continuously Variable Slope Delta (CVSD) modulation. Uses can select standard data rates from 16K to 64K bps for each channel. The voice interface is 2- or 4-wire E&M signaling.

The synchronous channel card contains LEDs indicating send/receive data activity on a per-channel basis. Since all system tests are initiated from the control panel or supervisory terminal, no other switches or indicators are necessary. The voice channel, at this writing, was just announced and no further information is currently available.

QSC Synchronous Channel Card ● accommodates 4 data channels ● half-/full-duplex mode ● soft-configured data rates of 75, 100, 150, 200, 300, 400, 600, 1200, 1800, 2000, 2400, 3200, 3600, 4800, 7200, 9600, 12,000, 14,400, 16,000, 16,800, 19,200, 32,000, 38,400, 40,800, 48,000, 50,000, 56,000, 64,000, 72,000, 128,000, 192,000, 230,400, 256,000 bps ● 2- to 16-byte buffer for input and output ● can be configured to interface with DTE/DCE equipment ● 16 levels of processing priority assignment ● RS-232C/CCITT V.24, RS-422/CCITT V.11, RS-423, and MIL-Std-188C or 188-114 (balanced and unbalanced) interfaces:

$2,350 prch NA maint

QVC Voice Channel Card ● accommodates 4 voice channels ● employs CVSD modulation to 64K bps ● 2- or 4-wire E&M signaling interface:

3,550 NA

Composite Link

The standard Link/1 supports a single composite link; up to 10 links are optional at extra cost; connection to a communication facility is established through the internal modem module or external modem. Data rates are 56K, 64K, 1.544M, and 2.048M bps using bipolar NRZ-encoded transmission. Standard link interfaces are RS-422/CCITT V.11 DS1, DSX-1, CCITT G.703, and MIL-std 188-114 unbalanced. Data link rates down to 4800 bps are possible with Link/1, but are not fully supported by Timeplex's technical staff.

ILC Redundant Interlink Module ● provides redundant interlink control functions; automatic switchover from primary:

$1,750 prch NA maint

DTU-1 T1 Internal Modem Module ● converts standard unipolar data signals to bipolar signals compatible with T1 service ● connects to AT&T channel service unit (CSU) or DSU or interface of digital radio facilities ● produces delay-modulated signals compatible with microwave or fiberoptics transmission facilities ● interfaces with data link via RS-422:

850 NA

DTU-2 Redundant T1 Internal Modem Module ● provides redundant internal modem module; all services same as primary modem:

1,200 NA

ILC Interlink Module ● connects single high-speed composite link to Internal Modem Module (MLD-1):

1,750 NA

● END

Tone Software Corporation TONE 3/TONE 4
TSO Replacement System

■ PROFILE

Function ● TONE 3 is an enhanced TSO package for OS/VS1 users; TONE 4 offers extended TSO facilities for MVS users.

Computers/Operating Systems Supported ● IBM System/370, 3000, 4300, and compatible computers; TONE 3 runs under OS/VS1, and TONE 4 runs under OS/VS2(MVS).

Networks & Protocols ● SNA; all IBM protocols supported under TSO.

TP & File Access Methods ● BTAM, VTAM, VSAM; all standard OS file structures.

Terminals ● ASCII devices, 3270 Model 2, 2740 Models 1 and 2, 2741, 3278, 3279, and equivalents.

Languages Supported ● COBOL, FORTRAN, PL/1, RPG, assembler, VSBASIC, and VSAPL.

Special Features ● Full Screen Mode (FSM) provides IBM SPF-like facilities for IBM 3270-class devices; TLIB, interactive LIBRARIAN command processor; TPAN, interactive PANVALET command processor; Tone PROCMAN CLIST compiler; and Tone TSPRINT Spool to 328X printer support.

Standalone/Associated Products ● Intersystem Spool Processor (ISP) for OS/VS1 and OS/MVS; Dynamic Allocation of SYSOLIT (PHASOR) for OS/VS1; Full Screen Output (FSO) for OS/VS1 and OS/MVS.

Logging/Accounting ● constant screen display with time-of-day, time-since-log-on, total CPU time used, identity of current user, and primary command name.

Current Version ● TONE 3: Release 3.3I; TONE 4: Release 5.
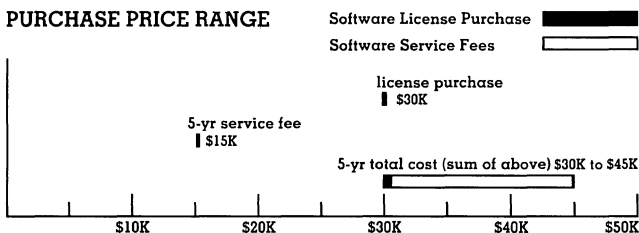
Installations ● TONE 3: 300; TONE 4: 50.

Comparable Products ● Applied Data Research ROSCOE; Boole & Babbage VAM/SPF; Pansophic O-W-L; and On-Line Business System WYLBUR.

Vendor ● Tone Software Corporation; 1735 South Brookhurst, Anaheim, CA 92804 ● 714-991-9460.

■ ANALYSIS

TONE is offered as a replacement for the IBM TSO (Time Sharing Option) program product. There are 2 versions: TONE 3 for the OS/VS1 user, and TONE 4 for users operating under MVS. The 2 versions provide logically identical features and facilities; the only

differences are in the facilities that address functions unique to each operating system. TONE provides extended capabilities for users of the 3270 display console, most of which are not available with TSO. For example, TONE can submit jobs directly to the JES job queue. It allows users to interactively execute system commands, programs, and utilities; and it permits direct inquiry into the system's status. All TONE commands are compatible with TSO.

In spite of the variety of changes that have occurred in the operating system environment, there have been no major enhancements or extensions to either TONE product. Accordingly, there has not been any price change either. On the other hand, IBM hasn't introduced any significant changes to TSO recently.

□ Strengths

TONE's most significant benefit is a considerable reduction in TSO overhead. This reduction is due primarily to the elimination of TSO user swapping and the replacement of TSO's TCAM communication modules with TONE's BTAM-written modules. Some of the quoted performance improvement figures show that active transaction service rates for TONE are as much as 50% greater than comparable figures for TSO. They also show that logical and physical swapping activity can be reduced by as much as 75%, and that overall CPU utilization per transaction can be decreased by as much as 35%. TONE users can also implement many batch operations that are impossible to implement with TSO. TONE makes provision for all TSO-like facilities to operate under VS/1, therefore users familiar with TSO should require no retraining.

Although many VS/1 users will be converting to MVS over the next few years, those who stay in their existing environment indefinitely or for a predetermined period of time will enjoy the benefits of an efficient conversational monitor, and when they make the move to MVS they can easily upgrade to TONE 4.

□ Limitations

An important, potentially limiting aspect of TONE, especially in VS/1 systems, is its heavy requirement for memory space. TONE 3 can support from 10 to 15 terminals in a single session with a partition work area of 1M bytes. TONE 4 can support up to 25 terminals in a 2M-byte partition. Add-on terminals beyond these limits require additional memory increments for each terminal added.

TONE users who also use the IBM SPF (System Productivity Facility) product require additional virtual storage to handle both. The paging overhead also increases sharply because SPF loads the entire data set into virtual storage to perform the editing functions. This limitation can be eliminated if the user converts to Tone's FSM (Full Screen Mode) facility, whose edit commands are very similar to those of SPF, but not as extensive as ISPF.

■ OVERVIEW

□ Terms & Support

Terms ● license available for purchase, 1-, 3-, or 5-year lease, or monthly rental; an extended payment plan for the ISP option is available; the FSO option can be acquired for use with some non-TONE monitors at a fixed price ● multisite discounts are 85% of listed price for second site usage, 80% for third site, and 75% for fourth and subsequent sites ● special features are included for term of initial contract.

Support ● license purchase include first-year maintenance; available annually thereafter at 12.4% of the then-current license purchase price; multisite maintenance discounts are available if

PURCHASE PRICE RANGE

Software License Purchase ■
Software Service Fees ▭

license purchase ▮ $30K

5-yr service fee ▮ $15K

5-yr total cost (sum of above) $30K to $45K ▭

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

TONE SOFTWARE TONE 3/TONE 4 PRICING ● solid bar shows single license purchase price, which includes the first year of service; open bar shows corresponding 5-year service fee schedule, but is calculated for 4 years (48 mos) because the first year of service is included in the purchase price ● license configuration includes all optional facilities, but does not include any of the standalone adjunct products that can be interfaced with TONE.

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performed through a central site; standard rates apply if each site is maintained separately; lease and rental plans include maintenance ● documentation is provided on the system tape in machine-reproducible format; all IBM-supported releases of OS/VS1 and all MVS releases through SP 1.3 are supported by Tone.

☐ Host Computers & Operating Systems

TONE can be installed on any IBM System/370, 3000, 4300, or compatible computer. TONE 3 is designed to operate in an OS/VS1 operating system environment; TONE 4 is a logically similar product specifically designed for the MVS operating system environment.

☐ Minimum Operational Configuration

TONE requires the BTAM or VTAM access modules. The virtual storage requirement is dependent upon the number of active TONE partitions and the modules selected for the Link Pack Area. Approximately 1M bytes are needed in the Link Pack Area for both TONE 3 and 4. In addition, a 1M-byte partition is necessary for each set of 12 started terminals with TONE 3; TONE 4 requires 1 to 2M bytes in each MVS address space to support 15 to 25 started terminals. If the TONE user is using the IBM SPF program product, additional storage may be required, depending on the desired functions.

Real storage utilization is dependent upon the activity of the system, the relative priority of the TONE partitions (address spaces), and the nature and frequency of user commands.

Nine operating system SVCs must be resident, for use under OS/VS1 and the Extended Timer Support modules are required if CPU time accounting is desired on an individual user basis.

The ISP option requires approximately 250 tracks on a shared DASD device to handle 1,000 pages of spooled data. Approximately 8K bytes of virtual storage are required within the "sending" system, and 2K bytes are needed in the CPU controlling the unit record peripherals.

☐ Protocols & Network Interfaces

All SNA conventions are supported. Besides support for the 3270 display console, TONE also supports ASCII devices, the 2740 Models 1 and 2 (station control and checking are necessary), the 2741, and the 3278/3279 console (all models). Where TSO uses TCAM for I/O operations, TONE uses BTAM. An interface to VTAM is also provided.

☐ Access Methods

All of the data sets used by TONE have standard OS file structure. Sequential or partitioned data sets of any record format, length, or block size are supported. VSAM data sets, providing they have been previously allocated, can be accessed via an interactive program. However, VSAM data sets cannot be created through the use of TONE commands, but may be created by running the IBM IDCAMS utility program interactively.

■ TSO REPLACEMENT FACILITIES

☐ Basic System

TONE is command compatible with IBM's TSO product. It utilizes BTAM I/O modules in place of TSO's TCAM modules to minimize system overhead and to eliminate user swapping, a form of round-robin job-stream multiplexing. Users' codes are queued in an online swap file and are then executed in queue order in a sequence of fixed-duration time slices. TONE takes full advantage of the host operating system's virtual memory management techniques. VTAM terminal support is also provided.

FSM (Full Screen Mode) is an integrated edit facility that enables 3270 users to perform a wide range of functions unavailable with TSO. These functions match facilities offered with the IBM SPF program product. FSM generally permits users to define a field to be edited, to position the cursor anywhere on the screen, and to execute the selected editing function. Some special functions are: full screen processing, which allows users to read and process an entire screen of new or modified data in one service cycle; logical

tab support; hexadecimal edit facilities, which permit users to create or modify data fields in hexadecimal; the capability to update NONUM data sets; and the capability to overtype existing data or to use character insertion and deletion to move or align data. FSM adds 26 additional commands to the basic TONE command vocabulary.

TLIB (Interactive LIBRARIAN Command Processor) and TPAN (Interactive PANVALET Command Processor) are no-cost selectable options available with TONE. They allow users of the source maintenance programs to operate in either TONE or TSO environments. They also allow TONE users to retrieve data from the respective master files for add/replace/delete tasks. Column and sequence number manipulation is supported. The indexes and control information maintained by TLIB and TPAN can be displayed on request.

The TSPRINT product, which is included with TONE 3 and TONE 4, allows the user to print any spooled output to a local or remote 328X, 3262, or ASCII printer using BTAM. A VTAM command package is included which allows any VTAM terminal to control the TSPRINT environment. TSPRINT is a JES external writer that will function with all currently supported releases of JES, JES2, and JES3. It includes full Universal Character Set support as well as simulated Forms Control Buffer (FCB) or Carriage Control Tape support. Print jobs can be selected to print through the use of standard CLASS, DESTINATION, and FORMS parameters on the SYSOUT JCL statement.

The PROCMAN CLIST compiler is also included with TONE 3 and TONE 4. It allows the user to compile CLISTs which show enhanced execution times and use less CPU resources. In addition, many commands have been added to the CLIST language which are not available in the standard IBM TSO CLIST processor. PROCMAN allows users to build their own built-in functions or define new control variables. A built-in security feature of PROCMAN allows the user to specify authorization requirements for any user of the CLIST. Users can be required to have ACCOUNT, JCL, MOUNT, or OPER authority, or any combination of these in order to execute the compiled CLIST.

TONE 3/4 ● TONE 3 for OS/VS1 systems; TONE 4 for OS/VS2(MVS) systems:

$29,900 lcns	$825/$1,700 mo	$309 serv

☐ Multiple System Spooling

ISP (Intersystem Spool Processor) ● a standalone product designed for use with multiple (up to 9) OS/VS1 and/or MVS systems; provides routing of job-created output between processors sharing the ISP function; uses shared DASD (Direct Access Storage Devices) and data compression techniques; displays the number of print lines in each data set; compresses redundant data before transmission to another CPU; performs hardware scheduling to allow pooling of I/O on one CPU ● provides for possible elimination of dedicated card readers and printers for spooling operations; supports all DASD units from 2314 through 3350, and the 3800 printer:

$11,500 lcns	NA/NA mo	$119 serv

■ USER INTERFACES

☐ Languages Supported

TONE supports data sets created with COBOL, FORTRAN, PL/1, RPG, assembler, VSBASIC, or VSAPL. TONE also contains its own terminal command language. TONE commands are completely compatible with IBM MVS Release 3.7 TSO commands. Any command processor written for use with TSO normally operates without modification under TONE.

LCNS: license purchase fee includes first-year maintenance. MO: first figure represents the monthly rate for a 3-year lease; second figure is the monthly rental charge. NA: lease or rental plans are not available for this product; however, a 12-month payout plan of $1,500 per month is available. SERV: ongoing monthly maintenance fee for fully paid licenses; based on annual rate of 12.4% times prevailing license fee. Prices effective as of September 1984.

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☐ **Data Set Editing**

The TONE data set editing functions supplement those available with TSO. Besides supporting data sets created by the aforementioned language processors, TONE also addresses DATA, TEXT, and CNTL data sets. DATA designates uppercase data files, TEXT designates upper- and lowercase files, and CNTL is used to identify job control stream data sets.

The editor dynamically allocates the file specified by the user, creates a copy of the file in a work file, and then invokes the subcommand processor to perform the desired function. Some of these subcommand processors are: Input, which places the system in a status to accept data into the work file; Verify, which displays the line(s) most recently acted upon; Find, to search for a specified sequence of characters; Change, to modify a sequence of characters; Delete, to remove one or more characters from the work file; List, to display one or more lines of the work file; Move, to move one or more records within the work file; Copy, to copy one or more records; Help, to obtain a display of the syntax and functions of all subcommands; Submit, to submit one or more batch jobs directly into the JES job queue; and Save, to retain the edited data set as a permanent cataloged data set.

PHASOR (VS1 Dynamic Allocation of SYSOUT) • another standalone product which provides dynamic allocation and release of SYSOUT data sets for early printing; similar to the MVS DYNALOC facility; allows dynamic class and destination designation from the console for output class, job name, destination user ID, output writer, number of copies, accounting information, output priority, and form type • added to operating system environment as a Type 3 or Type 4 SVC (Supervisor Call) • monthly rental and extended-lease monthly fees are identical:

$6,500 lcns	$225/$225 mo	$67 serv

☐ **Enhanced 3270 Support**

Users can perform full screen reads and writes utilizing all 1920 characters of the 3277 Model 2 or equivalent. A windowing feature can be activated through the use of a designated program function key (PFK), which directs the screen to display any selected 80 characters from the 133-character terminal buffer. In this manner, users can view segments of the data, such as SYSOUT, that are wider than the physical terminal screen can handle. Using the PFK facilities, a physical tab can be set. When the tab function is executed, the cursor skips along the input line and fills in the skipped area with blanks. Users can also define a character to be used as a logical tab indicator.

Program Attention (PA), as well as PF keys, are supported under the extended support facilities. Up to 27 keys can be manipulated to provide specific procedural functions. For users without PA/PF keys on their terminals, a simulation facility is provided. Most TONE functions are instantly interruptable from the 3277 because the device is always in ready status under TONE. TONE users can also retrieve lines and place a previously displayed line or part of a line in the input area.

FSO (Full-Screen Output) • this standalone adjunct allows 3270 Model 2 user to review spooled input and output without JCL modifications; allows spooling vertically and horizontally; can search for specified character strings and page forward and backward; permits reference point setting for return with delete or requeue operations for subsequent processing; provides status commands for display of information on active partition or job, for display of job queue status, and for display of outstanding requests • performs most functions of the IBM IEHPROGM utility online; can be used to display and alter system control information via special user exits • can be used with IBM TSO and CICS/VS, ADR ROSCOE, and Altergo Products SHADOW II TP monitors:

$6,000 lcns	$150/$333 mo	$62 serv

☐ **Queue Manager I/O Facility**

Using special output commands, terminal users can review spooled output immediately upon completion of a submitted job. Because the queue manager I/O commands interface directly with JES, the SYSMSG data set and all SYSOUT files can be read directly from the output queue. Other commands allow users to either requeue the output for later review, requeue the output into a print class destined for hard copy printing, save the output in an OS sequential or partitioned data set, or delete all spooled output from the queue.

☐ **Batch Processing**

Through the Interactive Program Execution facility, most programs can be called into execution under the user's terminal function and either made to interact with the user or simply run to completion with user notification. Normal batch data facilities are available to programs executing interactively. Interactive programs can receive data directly from the user's terminal, and the output from the program can be displayed directly on the terminal.

☐ **328X Support**

The 328X feature enables users to logically connect IBM 3270-type display stations to 328X-type printer devices. This provides the terminal user with the ability to have specified data printed on the connected hard-copy device. Some of the capabilities provided to the terminal user include the ability to connect the printer, skip to top of form, print the data currently on the screen, enter continuous print mode (print each line as it is directed to the terminal), enter page print mode (print only when directed), and disconnect the printer.

■ **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:

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● **END**

Tymnet Network Services
Packet-Switched Data Service (PSDS)

■ PROFILE

Function ● value-added, packet-switched carrier network services.

Facilities ● 400,000 miles of leased terrestrial lines, augmented with satellite links, interconnects over 1,800 intelligent processing nodes.

Services ● data/message nonvoice transmissions ● public and private dedicated networks ● error detection/correction, speed/protocol/code conversion; alternate routing ● supports interconnection of various host processors and asynchronous terminal types ● protocol support for SDLC, HDLC, X.3, X.25, X.75, X.27, X.28, X.29, 3270 Bisynch, and 3270 DSP, X.PC.

Access ● local dial-up from over 500 domestic and over 60 international metropolitan areas for asynchronous transmission at 300 to 1200 and 2400 bps; synchronous transmission at 2400 to 14.4K bps ● asynchronous access via public dial-up network ports or private ports using dial-up leased lines ● speeds to 56K bps under special arrangement ● WATS and Foreign Exchange access available.

First Available ● shared-user nonregulated network established in 1969; FCC-regulated common carrier in 1977; unregulated common carrier in 1984.

Number of Users ● over 1,500 host computers connected to network ● subscribers number over 500 organizations ● over 6,000 users currently supported simultaneously during peak hours.

Comparable Services ● AT&T Net 1000, Datapac (Canada), United Telecom's Uninet and GTE Telenet for value-added packet-switched services; Graphnet and GTE Telemail for electronic mail/message services.

Vendor ● Tymnet, The McDonnell Douglas Network Systems Company; 2710 Orchard Parkway, San Jose, CA 95134 ● 408-946-4900.

Canadian Headquarters ● none; contact vendor headquarters.

■ ANALYSIS

Tymshare Inc, the parent of Tymnet, was acquired by McDonnell Douglas Corporation in April 1984 for $307.5 million. It is now part of the McDonnell Douglas Information Systems Group along with McDonnell Douglas Automation (McAuto), the original centerpiece of McDonnell's computer business, Microdata Corporation, and Vitek Systems, Inc. Microdata produces and markets computer systems and application software for a variety of industries. Vitek produces automated laboratory test equipment for hospitals.

The Tymnet network has been substantially expanded to encompass over 1,800 processing nodes from 1,200 just a year ago, a 50 percent expansion. Local dial-up access has been increased to over 500 areas from 400 last year, a 25-percent increase. There are now 1,500 host computers connected to the Tymnet network as compared with 800 in early 1984. And the network now accommodates 6,000 users concurrently during peak hours, as compared with 5,000 a year ago.

For the most part, Tymnet's pricing has remained the same over the past year, which reflects pricing stability. Traffic charges have not been changed. However, public dial-up port access surcharges for medium- and low-density cities have been increased from 25 percent to as much as 80 percent over last year's charges. Private dial-up and leased access port charges have not changed, nor has the charges for dedicated network connections.

Tymnet Network Minimum Usage Costs

Configuration ● 1 customer host computer site connected to a Tymnet node via 2400-bps leased line ● 5000K-character-per-month traffic load ● customer account charge ● 2 user names excludes costs associated with user terminal equipment and user-site modems.

Minimum Start-Up Costs ● $250 total ● consists of basic installation charges for 2400-bps leased line within 50 miles of Tymnet node.

Minimum Monthly Operating Costs ● $658 per month total ● consists of $300 per month for X.25 Tymnet/host interface; $250 per month for traffic charges; $100 per month for customer account charge; and $8 per month for 2 user names.

Three new services have been added. Asynchronous Outdial Service is applicable to customers whose needs require the transfer of data from the Tymnet network to dial-up locations. The service provides an auto-dial modem at the network port that connects to the public-switched network, FX, or WATS service; however, the service is available **only** in high- and medium-density cities. Another new service, 3270 Public Multidrop Service, accommodates customers in geographically dispersed large cities who want to connect their IBM 3270 (or equivalent) clustered terminals to the Tymnet network to communicate with IBM hosts attached to the network. The service requires a Synchronous Terminal Interface and is priced on a graduated monthly traffic volume scale called a Service Level, which ranges from 3 million to 18 million characters in 3-million-character increments. During off-peak hours, each 1K characters are counted as 0.5K characters. How does this traffic scale relate to actual usage? Let's examine the low end of the scale in terms of screenfuls of data (typically 2K characters per screen). The 3-million-character level equates to 1,500 screens per month; about 75 per day (based on 20 working days per month) or about 9 per hour (1 every 6.6 minutes). This level is satisfactory for infrequent usage by several terminals, but is certainly not adequate for applications that require continuous usage in an interactive mode. At the high end, 18 million characters, 56 screens per hour (about 1 per minute) are supported. This should be adequate for high-volume traffic where many terminals are active concurrently. Should the customer exceed higher Service Level, an overflow charge of $0.09K characters is applied to the monthly charge. If the customer plans some transmission for off-peak hours (after 6 PM and before 7 AM) he gets a bonus since each 1,000 characters only count for half as many. In many cases, complete screens of data are not transmitted, which means these figures are modest. But don't forget, the traffic volume is measured for both received as well as transmitted data, so you will have to adjust these figures according to your own application (usage).

The third new service is the Transaction Services Billing option. This service is designed for customers with point-of-sale transaction applications, such as credit authorization. To qualify for this service, customers are limited to 40 seconds per session and 200 characters per transaction. Within these limits, the customer is not billed for connect time or characters transmitted, but where sessions exceed these limits, customers are billed according to standard connect time and character transmission rates. The service is based on large volumes of monthly transactions and can range from $12,000 for 100K monthly transactions to over $140,000 for over 2 million transactions.

Tymnet Network Services
Packet-Switched Data Service (PSDS)

Tymnet differs from many other public packet networks in that it is centrally controlled by a sophisticated computer system called the Supervisor. This central control provides a greater degree of security to users, and maximizes efficiency through the allocation of network resources such as bandwidth and virtual circuit building. Reliability is ensured by 4 additional Supervisors located in different parts of the country.

Each user name is assigned a specific host system, or systems, and is stored with the nonreversible lost-bit cipher of its corresponding password, so that it is secure within the storage media. When the user logs in, the Supervisor verifies the user's name and password and builds a virtual circuit, or fixed communication path for the length of the session, to the appropriate destination, automatically restricting the user's access to specific host systems.

Tymnet also differs from other networks because it is character-oriented rather than bit-oriented. Since each user's communication path is established for the duration of the session at login, each character the user enters can be immediately multiplexed in a packet with data from other users and transmitted, thereby reducing transmission time, improving security as well as response time for the user, and ensuring that each packet sent is full. Multiplexing user data in packets allows more effective use of network resources.

Tymnet offers higher integrity service than the switched DDD network of the telephone company. For long-distance leased-line data communication, it can, in many situations, offer significant cost savings because of its distance insensitivity. Costs to the user are based on traffic (characters) volume, access arrangements, and usage or connect time. In addition to charging according to actual usage, Tymnet offers low "off-peak" time rates attractive to providers of information services. Since the user pays only for actual characters transmitted, there is no need to pay premium charges for unused packet space.

For the future, Tymnet has plans to incorporate high-speed (up to 1.544M bps) packet- and circuit-switched services with its network, both to enhance and to complement existing services. Access technologies will reportedly include microwave, satellite, optical fiber, and wire-pair; a pilot deployment of high-speed services in the San Francisco Bay area will begin service early this year. Tymnet will also soon support domestic Telex traffic as a result of its recent acquisition of FTCC Communications; all Tymnet-connected terminals will be capable of message communication. In addition, the vendor expects to provide international credit card authorizations and travel services (in conjunction with parent Tymshare) through interconnection with networks in foreign countries.

☐ Strengths

Tymnet's major strengths are its strong position gained through the acquisition of Tymshare by McDonnell Douglas, a powerful industry leader, and its maturity and stability, acquired from over 15 years of pioneering experience in the management and design of the world's largest packet network. Local access is provided in over 560 domestic and foreign locations. Tymnet, in providing international access and services, has proven attractive to multinational organizations. Many of the international gateways to PTT networks are provided by Tymnet.

Data integrity, continuous network performance, and host availability are ensured by automatic error detection and retransmission, redundant network control capabilities, and alternate routing and host multitargeting techniques. Tymnet rate charges are distance insensitive, providing a cost savings for far-flung users.

A novel user name and password scheme, and the ability to limit access to or from customer specified nodes and/or hosts, offer a high degree of security.

Tymnet is an attractive alternative to a private network. The user is relieved of network management responsibilities; a significant consideration since it dispenses with the need to maintain an in-house staff of qualified and expensive personnel. Finally, as an ardent supporter of the important CCITT X.25 protocol, Tymnet has become a leading tester of X.25 interface products. Most major computer vendors have obtained Tymnet certification of

X.25-based equipment.

☐ Limitations

As with other packet networks, Tymnet has at least one drawback. The technology is not transparent to data flow, and it is unlikely that these facilities will be adapted to analog, or for that matter, digital voice transmission in the near future. Packet networks by their very nature destroy the time sensitivity and continuity so essential to intelligible voice traffic. Users who desire to share the same facility for both voice and data will have to remain content with nonpacket-switch network offerings for now.

A traffic-based service such as Tymnet is not ideal for transmitting bulk data such as 2780/3780 batch transmissions. Although Tymnet provides an extended-term discount plan with volume-based options, users must still weigh differences between Tymnet and other nontraffic-sensitive carrier services.

■ NETWORK

☐ Terms & Conditions

Billing Criteria ● customers typically pay for Tymnet services based on factors associated with access arrangements, usage or connect time, and data traffic ● as with most tariffed interstate services, billing is complex; access cities are categorized as high, medium, or low density for rate purposes; WATS access factored into rate charges ● public, private, dedicated, and polled access arrangements accommodate a wide range of user requirements.

Billing Conditions ● minimum service period on one-month basis; 30-day advance notice required for termination ● minimum charge based on fixed monthly charges during minimum service period plus installation and applicable usage charges ● extended term service plans offered ● advance payments and deposits may be required contingent on financial risk ● service established day following day Tymnet notifies customer of completion of installation and testing of network access channels and/or equipment ● charges due when billed; payable at Tymnet corporate office in San Jose ● proportionate fractional billing for service beginning or ending on other than first or last day of month ● interest at 1.5 percent per month accrues upon any unpaid amount commencing 30 days after bill rendition unless proscribed by law, in which event, highest allowable rate ● charges for special provision related to cost.

Other Conditions ● service subject to facility availability; right reserved to limit or refuse service when necessary ● not liable for unauthorized access to, or alteration, theft, or destruction of customer data, programs, procedures and other information ● services shall not be used for unlawful purposes ● services, rights, and obligations not transferrable without written consent of Tymnet ● ownership title to special facilities normally remains in Tymnet.

☐ Overview

A Tymnet network consists of a collection of minicomputers (nodes) interconnected by communication lines to allow information to travel along alternative paths between nodes in the network. The primary function of a node is to pass information. The nodes, typically, do little or no processing of application tasks. Nodes are buffered to hold data en route to another node or to a terminal or host port. Tymnet provides the flexibility of designing and building a network in a nearly infinite number of configurations. Customers may choose to configure the network to suit their particular needs.

In general, all nodes are switchers and contain basic routing and flow control. They may also contain one or more of these functions: terminal interface, host interface, gateway, or supervisor.

The Tymnet terminal interface is referred to as a Tymsat. The asynchronous Tymsat provides the interface to a large variety of ASCII asynchronous devices. This module exists both under ISIS and as a standalone node. ISIS, a network hardware/software system creates a multiprogrammed operating environment with multiple job slots at the node. ISIS nodes have special host-like characteristics. The asynchronous Tymsat can also provide control of a local line printer device operating as a high-speed

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ASCII output terminal with special host software support. An asynchronous Tymsat provides the control specific to the type of asynchronous device attached. It detects connect and disconnect of the device. It performs serialization/deserialization of the characters going to and coming from the device. It also echoes most of the characters it receives from the device. In some cases of full-duplex operation, the asynchronous Tymsat must defer to the host interface to determine how characters should be echoed.

The Tymnet host interfaces include asynchronous Tymcoms, X.25, X.75, 3270 BSC, 3270 SDLC, and RJE/HASP. The typical customer's configuration includes two types of host interfaces—asynchronous Tymcom and X.25. The asynchronous Tymcom appears to the host as a set of low-speed asynchronous modems. This module runs on the Tymnet Engine under ISIS. The Tymnet Engine is the standard communication processor used in the network.

The Tymnet X.25 interface serves as a network interface to a host, and provides access to a host on a Tymnet public network or a customer host in a private network. It allows terminals on the network to build circuits to the host computer, and it also allows the host computer to build circuits to other hosts on the network. Tymnet, incidentally, maintains an ongoing X.25 certification program for the testing of X.25 hardware, software, and firmware products offered by vendors.

Through Tymnet's 3270 Synchronous Terminal Interface connected to a user-site Tymnet engine, users can access asynchronous host applications (such as public databases) via user-transparent protocol conversion facilities inherent to the network. The Synchronous Terminal Interface also supports switched 3270 connections for multiple-host access. Users connected to a host equipped with Tymnet's Synchronous Host Interface software can obtain options allowing asynchronous terminals access to 3270 applications; this option is available for both character- and block-mode terminals for 3270 BSC applications, and for character-mode terminals for 3270 HDLC applications.

Tymnet's Display System Protocol (DSP) allows 3270 Bisynchronous devices to send and receive data across X.25 links and through X.75 gateways. This service includes a variety of features beyond the transport function, as well. Login menus are provided that allow the user to select a login string and, with the stroke of single key, perform the entire login sequence. Since such a device can be mapped and locked to a specific host address, security is considerably enhanced. The bisynchronous transparency option permits Tymnet to support 7-color IBM 3279 terminals, graphics packages for 3278s and 3279s, and any printer traffic requiring these features. A major enhancement recently released is Early Data Forwarding (EDF), which significantly reduces data packet transit time.

The 2780/3780 interface provides data communication for remote batch terminals to host computers with 2780, 3780, and 3770 series RJE terminal support through a Tymnet network.

Tymnet supports for access between SNA/SDLC protocol terminal and host interfaces using packet-switching data transmission services of the network to replace leased lines.

Supervisor nodes, which comprise the heart of the Tymnet network, perform a variety of control and data collection functions. A Supervisor node contains the Supervisor and Probe programs, a number of disk files, and several "slave" programs used to transfer data from the data files over network circuits to the Network Control Center. Supervisor nodes have disk storage capabilities because some of the files maintained are very large.

The primary task of the Supervisor is to build circuits in the network. All communication in the Tymnet network are performed over virtual circuits. For example, a port on a Tymsat node communicates with a port on a Tymcom node via a circuit set up by the Supervisor. A Tymsat port or a Tymcom port may request a circuit from the Supervisor. If the circuit requested is an auxiliary circuit, no password is required. Otherwise, when the request is made, the requestor sends the Supervisor a user name, an optional password, an optional destination host number, and a character indicating what type of terminal or pseudo-terminal is making the request. The Supervisor maintains tables which indicate the current network topology. This includes information

for each node indicating what its neighbor nodes are, what type and what speed lines connect it to its neighbors, whether or not any lines are in overloaded conditions, what hosts are connected to the node, etc. The Supervisor uses this information to build a circuit for the requestor through the network to the required destination. Once the circuit is built, data is sent through the network along this circuit without further Supervisor intervention.

The Supervisor also collects accounting information for each circuit which is built in the network and stores it onto a disk file on the Supervisor machine. In addition, it receives error messages from the various network nodes and interfaces and stores this information on a disk file.

A process called Probe exists on each Supervisor node. Probe allows a network operator to inquire about the condition of each node and host on the network, their associated circuits, if any, and provides commands to control access as required.

Since a Tymnet network is centrally directed, provisions must be made for backup if the network Supervisor malfunctions. (It should be noted that the Tymnet existing paths are not affected in the event of a Supervisor malfunction.) The solution to the Supervisor backup problem is to provide a hierarchy of several Supervisors. Up to 7 supervisor nodes may exist. Only 1 Supervisor is active at a time, and it keeps the others dormant by sending them messages called "sleeping pills." If the active Supervisor malfunctions, one of the dormant Supervisors will awaken without any human intervention and take control of the network. Although "sleep" times are staggered, it is possible to have 2 Supervisors trying to take control of the network simultaneously. This solution is handled gracefully by assigning the Supervisors with numbers indicating their priority. In the case of a Supervisor fight, the one with the lowest priority will put itself back to "sleep."

The basic unit of data is the character or byte of 8 bits. A circuit within a Tymnet network is a fixed path over which bytes are transferred in both directions in a first-in, first-out manner. The content of the data bytes is transparent to the network and is the responsibility of the interface at each end of the circuit. Because the sequence is maintained, the actual data need not really be in 8-bit quantities, but may instead be in quantities of anywhere from one bit to 1,000,000 bits or more. The only constraint is that the total transfer (including padding, if necessary) be a multiple of 8 bits.

Tymnet has developed its own internal node-to-node protocol for intranet data transfers. The protocol is a full-duplex, error checking, ACK-with-data design which is much like X.25 level II only highly tuned and more efficient. According to Tymnet, the probability of an undetected data error passing through the network is one bit in 4 billion. Data travels in the form of packets between network nodes. Each packet may contain data for several of the network circuits using the link. Each packet is checksummed with a 32-bit checksum. When a packet is received with a good checksum, a corresponding acknowledgement is sent along with data in the next packet transmitted back over the link. This tends to reduce the overhead of data packets by multiplexing data traveling in the same direction into single packets.

A packet can consist of several logical records relating to different users. The maximum length of the packet is 66 bytes and the fixed overhead is 6 bytes. Each user's data within a packet has a 2-byte header. The header is followed by the data. The packet can consist of at most 20 different users' data (one character per user). Several other different packet formats also exist.

Flow control in Tymnet is performed on a per-channel basis. Periodically, each node examines the buffers associated with each input process. If a buffer exceeds the threshold, the process is informed to stop inputting for that port until further notice. For the link control process, a passive flow control technique is used. Periodically, each node informs its neighbors on which channel it is permitted to transmit data. Each time permission is given, a fixed amount of data (based on the throughput class of this circuit) is allowed to be transmitted.

There are several levels of security within Tymnet. The security levels include network logon, packet multiplexing techniques, closed user groups, and the gateway.

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In order to login to Tymnet, a user must enter a user name which is valid on the network and a corresponding password. Only the user name is echoed to the terminal during logon on a full-duplex terminal. Additionally, the password is stored in the Master User Directory (MUD) on the Supervisor's disk in its encrypted form so someone having access to the MUD would find the password illegible. In the standard (prompted) login mode, the password is not echoed to full-duplex terminals and is masked for half-duplex terminals. In the optional (unprompted) login mode, the password is not masked on half-duplex terminals.

Packets sent over links between network nodes typically contain data for a number of circuits using that link. Also, packets typically have only a small number of characters for a given virtual circuit. This increases the difficulty of tracing data over any particular circuit.

One of the characteristic requirements of networks having large numbers of users is the ability to limit user access to only certain parts of the network. That is, it may be important to limit any given network user to access from a small set of entry nodes and to a small set of hosts. Tymnet provides this capability in the form of Closed User Groups. In the MUD entry for every user is an access profile which indicates the set of nodes from which the user may originate circuits and the set of hosts to which he may build circuits.

A gateway is a logical method of interconnecting 2 distinct networks. Within a network, the gateway appears as a host. Any and all security may be applied to its access as to any other host on the network. Logins received by the gateway from a foreign network are subject to all normal Tymsat login restrictions.

The Tymnet Engine is the standard communication processor used in the network. It is a high-performance, microcode driven processor with 16 sets of 16 registers. The internal cycle time is 125 nanoseconds. Each register is 32 bits wide. The processor has 3 I/O interrupt levels plus system interrupts and can contain up to a 1M byte of memory. The Tymnet Engine's modular design philosophy allows expedient replacement of the subassembly components, resulting in minimum repair time should a failure occur. According to Tymnet, when proper configuration guidelines are followed, the Tymnet Engine will provide the user with at least 98 percent system availability, excluding exterior communication components and environmental conditioning. Operational diagnostics are fully integrated with the software components which run in the Tymnet Engine to allow detection of problems and provide data for easy analysis prior to serious impact on user throughput or availability. A site documentation package including schematic diagrams is provided at each installation site.

☐ Traffic Charges

Tymnet users are billed on the volume of traffic forwarded over the network in addition to access, connection, and other charges. The unit of measure for such traffic is the character—a unit which represents 8 binary bits (byte). A **minimum session charge** of 6 kilocharacters is applied for all sessions originating from: private access ports, dedicated terminal interfaces, synchronous host interfaces, and synchronous polled terminal ports; public access ports are charged for a minimum of 2.5 minutes for high-density location and Leisure-Tyme calls, 2 minutes for medium-density calls, and 1.5 minutes for low-density and WATS calls. Asynchronous polled terminal ports require no minimum. The following traffic charges apply to all customer data originating or terminating in the U.S. except where specifically modified or excluded (see Public Access Ports, Leisure-Tyme Billing Option, and Dedicated Customer Facility Usage Options). Characters originating from different types of terminal and host interfaces are aggregated to determine monthly volume for billing. Prorated traffic charges for sessions that span peak and off-peak periods. Discounts are available through extended contracts and off-peak (nonprime-time) discounts (see Discount Structure).

Peak/Off-Peak Time Traffic Charges

Tymnet peak time extends from 7:00 AM to 6:00 PM on normal business days, Monday through Friday. Tymnet off-peak time extends from 6:00 PM to 7:00 AM on normal business days,

Monday through Friday; off-peak time also includes the full 24-hour period on Saturday, Sunday, and Tymnet Holidays. Tymnet Holidays are: New Year's Day, July 4, Labor Day, Thanksgiving, and Christmas.

Kilocharacters Per Month		Peak Time per Kchar	Off-Peak Time per Kchar
First	50,000	$0.05	$0.005
Next	50,000	0.03	0.005
Next	100,000	0.02	0.005
Over	200,000	0.01	0.005

Transaction Services

Tymnet's Transaction Services billing option is designed for large volumes of dial-up transaction-oriented traffic. Customer billing is based on sessions that do not exceed 40 seconds and is limited to 200 characters per session. Sessions that qualify for this service are not billed for connect time nor for the number of characters transmitted. Sessions that exceed either the connect time maximum stated above or the maximum number of characters transmitted are billed according to standard connect time and character transmission rates. There are no minimum session charges, but there is a minimum charge of $500 per month for this service. The rates are presented below.

Monthly Volume of Transactions		Net Charge per Transaction
First	100,000	$0.120
Next	100,000	0.110
Next	100,000	0.100
Next	200,000	0.095
Next	250,000	0.090
Next	250,000	0.085
Next	500,000	0.080
Next	500,000	0.075
Over	2,000,000	0.070

☐ Access Charges Within Continental U.S.

In addition to traffic charges, Tymnet customers pay monthly and/or hourly charges for host and terminal interfaces dependent on their application and network configuration requirements. Customers also pay monthly account and user name charges.

Public Dial-In Ports

Public access ports support asynchronous communication from 110 to 1200 bps, and at 2400 bps in over 55 cities. Hourly charge for access depends on time of access and number of public access port hours per month on a single Tymnet invoice. In addition, there are hourly surcharges for access from cities classified as medium and low density, and for WATS access. For substantial off-peak time usage, Leisure-Tyme Billing Option is available. Charges are $0.90 per Off-Peak hour for Public Dial-In port usage, excluding WATS access, service includes up to 100K characters per hour. Minimum charge is $5,000 per month; minimum service period is 3 months.

Extended Term Service plans are available for domestic peak time character transmission charges and public Dial-In Port connect time charges. Minimum session lengths apply as follows: high-density, 2.5 minutes; medium-density city, 2.0 minutes; low-density city, 1.5 minutes; WATS, 1.5 minutes; Leisure-Tyme Billing Option, 2.5 minutes.

The following hourly charges and surcharges apply to asynchronous access to Public Dial-In Ports based on peak or off-peak time usage and medium- or low-density locations or WATS access.

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Hours Per Month		Peak Time per hour	Off-Peak Time per hour
First	1000	$4.25	$1.50
Next	1000	3.25	1.50
Next	3000	2.50	1.50
Over	5000	2.00	1.50

Surcharges	Peak Time per hour	Off-Peak Time per hour
Medium Density Locations	$ 2.50	$ .75
Low Density Locations	7.00	2.25
WATS Access	18.75	15.00

Private Dial-In Access Ports

Private dial-in asynchronous ports are available at Tymnet locations in selected high- and medium-density cities. Charges are dependent on city classification and the dial-in facility. Service includes use of the asynchronous port, full period maintenance, a switched business line, and a modem at the Tymnet port. The customer must provide his own on-premise modem or circuit from Tymnet; see User Site Network Access Equipment. Data rates supported are 110 to 1200 bps and 2400 bps. Tymnet will provide an optional rotary charged on a per-port basis or a FX service connection at 115 percent of applicable common carrier rates. Discounts are available for groups of 8 or more private dial-in ports at a single Tymnet location. Access and installation charges per dial-in port are presented below.

Service	Installation	Monthly Rate
High-Density City, 110 to 1200 bps	$500	$250
High-Density City, 2400 bps	500	325
Medium-Density City, 110 to 1200 bps	500	400
Medium-Density City, 2400 bps	500	450
Rotary, per port	N/A	12

Private Leased Access Ports

Private leased-line asynchronous ports are available at Tymnet locations in selected high- and medium-density cities. Charges are dependent on city classification and the leased-line facility. Service includes use of the asynchronous port and full period maintenance. Tymnet will provide the leased line at 115 percent of the applicable common carrier rate. Modems at both customer and Tymnet premises will be provided by Tymnet at extra cost. An optional Permanent Virtual Circuit is available on a per port basis. It allows the connection to appear as a permanent physical circuit, but does not support port contention or selection. Access and installation charges per private leased line/port are presented below.

Service	Installation	Monthly Rate
High-Density City, 110 to 1200 bps	$500	$200
High-Density City, 2400 bps	500	250
Medium-Density City, 110 to 1200 bps	500	350
Medium-Density City, 2400 bps	500	375
1200-bps Modem	75	30
2400-bps Modem	100	75
Permanent Virtual Circuit, per port	250	50

Outdial Service Charges

Asynchronous outdial ports are available in high- and medium-density cities. Charges depend on city classification. Service includes use of the port, full period maintenance, and 1 auto-dial modem at the port. The customer is responsible for the installation cost and the monthly charges associated with the switched business line, FX, or WATS service and the modem at the remote end.

Service	Installation	Monthly Rate
High-Density City		
Initial Port	$500	$225
Additional Port	250	125
Medium-Density City		
Initial Port	500	275
Additional Port	250	125

TINET Asynchronous Polled Terminal Service

Ports for asynchronous polled terminals at data rates of 1200 and 2400 bps are available in selected high- and medium-density cities; see Access. Charges do not include modems or the necessary multidrop leased lines; Tymnet will provide leased lines at 115 percent of the applicable common carrier rates; see User Site Network Access Equipment for modem rentals available from Tymnet. Service includes full-period maintenance. No minimum session charges.

Service	Installation	Monthly Rate
High-Density City		
Initial Port	$600	$350
Additional Port, each	200	225
Medium-Density City		
Initial Port	600	550
Additional Port, each	200	425
Software Modification, per port	150	N/A
Asynchronous Modem, 1200 bps	75	30

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Synchronous Terminal Access

A 3270 Public Multidrop Service is available for terminal clusters in selected locations designated as **Primary Access Areas (PAAs)**. Terminal clusters outside PAAs will be assessed for mileage surcharge of $100 for 100 miles or less and $1.000 per mile over 100 miles. The user is charged for the service from a PAA according to the selected Service Level for each terminal cluster. An overflow charge of $0.09 per 1,000 characters is incurred for traffic exceeding the selected Service Level. Each 1,000 characters transmitted during off-peak hours is counted as 500 characters. This service includes the Synchronous Terminal Interface (STI), leased line facilities, synchronous modems, terminal addresses, and character transmission. Installation is priced at $1,050 per Service Level. Monthly Service Level charges are presented below:

Service Level		Monthly Rate
PMS-3	3,000 Kchar	$590
PMS-6	6,000 Kchar	645
PMS-9	9,000 Kchar	700
PMS-12	12,000 Kchar	765
PMS-15	15,000 Kchar	840
PMS-18	18,000 Kchar	925

Dedicated Network Connections

Dedicated connections for synchronous transmission at data rates of 2400/4800/9600/14.4K bps are available between customer sites and the nearest Tymnet node. Requires a rented/leased/purchased Tymnet engine and associated software, a Tymnet asynchronous terminal concentrator, or other Tymnet-certified connection equipment from another vendor.

Each network connection includes full-period maintenance, a pair of synchronous modems, and a leased line of up to 50 miles. An additional mileage surcharge is assessed for leased lines over 50 miles.

Optional dial-backup provides access to the Tymnet network in the event leased lines associated with a dedicated network connection become inoperative. Data rates are supported up to 9600 bps, full-duplex, however, data rates at 4800 bps or below are recommended for lower error rates. The customer is responsible for telephone message unit and toll charges.

Network Connections	Installation*	Monthly Rate**
Leased Line, 2400 bps	250/1000	800
Leased Line, 4800 bps	250/1000	900
Leased Line, 9600 bps	250/1000	1,200
Leased Line, 14.4K bps	250/1000	1,500
Dial Backup	750	200
Upgrades/Downgrades/Moves	250/500	NA

* Higher charge applies to installation charges not concurrent with installed customer premise equipment (CPE) or synchronous Host Interface.

** A mileage surcharge applies to all lines (any speed) over 50 U.S. miles. The surcharge is $2.25 per month per mile for miles 51 to 100; $1.10 per month per mile for miles 101 through 1,000; and $0.70 per month per mile for miles 1,001 and over.

Tym-Link Express Service ● provides an interim dial-in connection to Tymnet while customers wait for leased line service ● includes two 4800-bps modems and full-period maintenance ● customer responsible for providing business telephone line and message unit and toll charges ● installation plus monthly charge:

$300 instal	$164 mo

Dedicated Facilities Access Charges

Tymnet charges special rates for dedicated sessions that do not traverse public network connections; i.e., for sessions between service points from the same customer or Tymnet location, or between locations on the network dedicated to the customer. Two Dedicated Customer Facility billing options are available; character charges do not apply.

Billing Option 1 ● minimum charge per call plus charge per hour:

$0.083 call	$0.25 hr

Billing Option 2 ● for calls exceeding 24 hours ● charge per call plus charge per day:

0.25	0.25

☐ Discount Structure

Extended Term Service Plans

Customers can receive discounts based on connect time or traffic volume when they subscribe to the Extended Term Service Plans. Except for Option 4 in Table 1, which is based on a 2-year commitment, all plan options are based on an annual commitment. Table 1 presents the **Connect Time Discount Plan** and is divided into columns for each plan option detailing the monthly minimum commitment level in dollars for peak-hour traffic; the maximum discount allowable under the plan; the number of user traffic hours (and over) at which the maximum discount is credited; and the number of user traffic hours attributed to the "break even point," i.e., the number of hours above which the user would save money under the plan. Table 2 presents the **Transmission Discount Plan** and is divided into columns for each plan option detailing the monthly minimum commitment level in dollars for peak-hour traffic; the maximum discount allowable under the plan; the number of transmitted user characters (and over) at which the maximum discount is credited; and the number of transmitted characters attributed to the "break even point." No other discounts apply.

☐ Additional Network Charges

Customer Charge Account ● provides invoice for monthly network services ● detailed session records in printed form, if requested ● charge per month:

$100 mo

User Names ● charge for each valid user name obtained from Tymnet; discount offered for user names in quantities greater than 500 ● charge per month per name:

4

☐ Optional Network Service Features

Accounting Tape ● Tymnet will provide detailed accounting session records on magnetic tape, on request ● monthly charge per customer account (invoice):

$200 mo

Net Alert Service ● notifies customer online whenever network access might be affected by outages or planned maintenance; also notifies customer upon restoration of service ● allows users to report difficulties online ● requires a 300-bps auto-answer terminal with direct-dial access ● charge per month:

125

Net Patrol Service ● allows large customers with their own facilities or dedicated interfaces to monitor their own status ● requires a Private Access Port ● installation charge plus monthly charge, per terminal:

$150 instal	$75 mo

KCHAR: charge per 1,000 characters transmitted. HR: hourly charge. CALL: charge per call. MO: monthly charge. KSEG: charge per 1,000 64-character segments transmitted. KP: charge per 1,000 packets transmitted. INSTAL: installation charge associated with network feature or option. Prices effective as of November 1984; prices current as of March 1985.

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TABLE 1: CONNECT-TIME DISCOUNT PLAN

OPTION	MONTHLY MINIMUM COMMITMENT LEVEL	MAXIMUM DISCOUNT	TRAFFIC HOURS REQUIRED FOR MAXIMUM DISCOUNT	TRAFFIC HOURS BREAK-EVEN POINT
#1	$6,500	$1,000	2,000	1,692
2	10,000	2,500	4,000	3,000
3	20,000	5,000	10,000	7,500
4	35,000	10,000	20,000	15,000

TABLE 2: TRANSMISSION DISCOUNT PLAN

OPTION	MONTHLY MINIMUM COMMITMENT LEVEL	MAXIMUM DISCOUNT	TRANSMITTED CHARACTERS REQUIRED FOR MAXIMUM DISCOUNT	TRANSMITTED CHARACTERS BREAK-EVEN POINT
#1	$3,000	$1,000	100,000K Characters	66,666K Characters
2	4,000	2,000	200,000K Characters	100,000K Characters
3	5,000	4,000	500,000K Characters	150,000K Characters

☐ Traffic Charges Beyond Continental U.S.

Fractions of kilopackets transmitted during each virtual connection prorated and rounded to next higher cent.

Alaska

Access to Alaska is achieved either through the Alascom network X.75 gateway or via the Tymnet gateway; calls can be pre-paid or collect.

Alascom Access • charge per 1,000 segments; each segment contains up to 64 characters:

$4.00 Kseg

Tymnet Access • charge per 1,000 characters:

$0.10 Kchar

Canada

Datapac is the packet network service offered within Canada by Telecom Canada. Datapac 3000 access is accomplished using the X.25 protocol; Datapac 3101 access is accomplished using other Datapac-supported protocols. Rate bands are categorizations of Canadian Datapac access locations for rating purposes, as established by TCTS.

Datapac 3000 • X.25 protocol.

Rate Band 1 • charge per 1,000 packets:

$1.85 Kp

Rate Band 2 • charge per 1,000 packets:

2.10

Rate Band 3 • charge per 1,000 packets:

2.85

Rate Band 4 • charge per 1,000 packets:

4.35

Rate Band 5 • charge per 1,000 packets:

6.35

Datapac 3101 • non-X.25 protocols.

Rate Band 1 • charge per 1,000 packets:

4.20

Rate Band 2 • charge per 1,000 packets:

4.45

Rate Band 3 • charge per 1,000 packets:

5.20

Rate Band 4 • charge per 1,000 packets:

6.70

Rate Band 5 • charge per 1,000 packets:

8.70

Hawaii

International Record Carrier (IRC) Access • charge per 1,000 characters:

$0.20 Kchar

Tymnet Access • charge per 1,000 characters:

0.10

Mexico

Traffic Charges to/from Mexico • charge per 1,000 packets:

$7.00 Kp

Puerto Rico

Traffic Charges to/from Puerto Rico • charge per 1,000 characters:

$0.08 Kchar

☐ Access Charges Beyond Continental U.S.

Public Dial-In Ports

Charges billed for each minute or fraction thereof rounded to the next higher cent • minimum charge of 1 minute per virtual connection.

Dial-In Access to/from Alaska • charge per hour:

$6.50 hr

Dial-In Access to/from Canada • charge per hour:

4.50

Dial-In Access to/from Hawaii • International Record Carrier (IRC) or Tymnet access.

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IRC Access ● charge per hour:

3.00

Tymnet Access ● charge per hour:

6.00

Dial-In Access to/from Mexico ● charge per hour:

6.50

Dial-In Access to/from Puerto Rico ● charge per hour:

5.00

Dial-In Access to/from Other Countries & Areas ● charges vary with country or area; Tymnet should be consulted for particulars.

□ **User-Site Network Access Equipment**

Modems

Modems required at user sites for dial-in or dedicated access to Tymnet nodes ● most Tymnet cities accommodate AT&T 212A/103 or Vadic 3400 modems, but a few accommodate AT&T 103, 212A, or 202 units only; contact Tymnet for details ● 2400-bps full-duplex dial modems must be compatible with CCITT Recommendation V.22 bis ● users acquire their own modems or rent from Tymnet at the following rates.

AM-12D ● 1200-bps asynchronous dial-up modem ● installation plus monthly charge:

$100 instal	$45 mo

AM-12L ● 1200-bps asynchronous leased line modem ● installation plus monthly charge:

75	30

AM-24 ● 2400-bps asynchronous modem ● installation plus monthly charge:

100	75

SM-24 ● 2400-bps synchronous leased line modem ● installation plus monthly charge:

300	126

SM-48 ● 4800-bps synchronous leased line modem ● installation plus monthly charge:

300	164

SM-96 ● 9600-bps synchronous leased line modem ● installation plus monthly charge:

300	235

SM-144 ● 14.4K-bps synchronous leased line modem ● installation plus monthly charge:

300	350

On-Site Tymnet Engines

Tymnet engines provide a single interface for concentrating remote asynchronous or synchronous terminals, or provide asynchronous and synchronous host interfacing and concentration ● Micro-Engine supports network monitoring, virtual circuit paths, protocol/speed/code translation, and multiple host targeting; Mini-Engine in addition, supports multiple trunk links and network gateways; Standard Engine in addition, supports network supervision and control/security access control, network accounting information log, and electronic mail ● variable-length, multiuser packets ● users order software/port expansion boards separately depending on type of connections (AHI, STI, or SHI) and require synchronous connections to other Tymnet nodes and/or leased lines to other dedicated customer equipment ● users with small clusters of asynchronous terminals can obtain an asynchronous terminal concentrator or similar equipment at lower cost; other vendor equipment certified by Tymnet can also be used in lieu of Tymnet engines ● available on a rental, lease, or purchase basis; the following monthly rental rates include full-period maintenance.

Micro-Engine ● supports up to 16 asynchronous devices at rates from 50 to 4800 bps each, and/or 4 or 8 synchronous devices at rates up to 19.2K bps ● installation plus monthly charge:

$650 instal	$300 mo

Mini-Engine ● supports up to 64 asynchronous devices at rates fom 50 to 4800 bps each, and/or up to 32 synchronous devices at rates up to 19.2K bps ● installation plus monthly charge:

1,400	700

Standard Engine ● supports up to 256 asynchronous devices at rates from 50 to 4800 bps each, and/or up to 64 synchronous devices at rates up to 19.2K bps ● installation plus monthly charge:

1,400	700

Asynchronous Host Interfaces (AHI)

Called TYMCOMs, these AHIs can support one or more asynchronous host computers at the same site ● requires a Tymnet Engine listed above ● includes full-period maintenance.

AHI-8 ● supports up to 8 ports ● installation plus monthly charge:

$100 instal	$300 mo

AHI-16 ● supports up to 16 ports ● installation plus monthly charge:

200	600

AHI-32 ● supports up to 32 ports ● installation plus monthly charge:

300	1,100

AHI-48 ● supports up to 48 ports ● installation plus monthly charge:

350	1,250

AHI-64 ● supports up to 64 ports ● installation plus monthly charge:

400	1,400

AHI-80 ● supports up to 80 ports ● installation plus monthly charge:

450	1,550

AHI-96 ● supports up to 96 ports ● installation plus monthly charge:

500	1,700

AHI-112 ● supports up to 112 ports ● installation plus monthly charge:

550	1,850

AHI-128 ● supports up to 128 ports ● installation plus monthly charge:

600	2,000

Upgrades/Downgrades ● AHI upgrades and downgrades are charged at the same rates as the installation charges for the intended modification.

Asynchronous Terminal Interfaces (ATI)

Called TYMSATs, these ATIs support customer asynchronous terminal equipment ● requires a Tymnet Engine listed above ● includes full-period maintenance.

ATI-8 ● supports up to 8 ports ● installation plus monthly charge:

$100 instal	$150 mo

ATI-16 ● supports up to 16 ports ● installation plus monthly charge:

200	300

ATI-32 ● supports up to 32 ports ● installation plus monthly charge:

300	500

ATI-48 ● supports up to 48 ports ● installation plus monthly charge:

350	750

ATI-64 ● supports up to 64 ports ● installation plus monthly charge:

400	1,000

ATI-80 ● supports up to 80 ports ● installation plus monthly charge:

450	1,250

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ATI-96 ● supports up to 96 ports ● installation plus monthly charge:

500	1,500

ATI-112 ● supports up to 112 ports ● installation plus monthly charge:

550	1,750

ATI-128 ● supports up to 128 ports ● installation plus monthly charge:

600	2,000

Upgrades/Downgrades ● ATI upgrades and downgrades are charged at the same rates as the installation charges for the intended modification.

Synchronous Host Interfaces (SHI)

SHIs support a single synchronous protocol for a single customer from a single Tymnet location or a single piece of customer premise equipment ● SHIs are available for X.25, 3270 BSC, SNA/SDLC, RJE/HASP, and BSC protocols, as well as protocol conversion for block- and character-mode asynchronous terminals ● 3270 BSC support allows switching for multiple host access ● requires a Tymnet Engine listed above ● includes full-period maintenance.

SHI-X25B ● supports X.25 BSC protocol ● installation plus monthly charge:

$750 instal	$300 mo

SHI-X25H ● supports X.25 HDLC protocol ● installation plus monthly charge:

750	300

TEM-CMTX Option ● in conjunction with SHI-X25H, provides protocol conversion for asynchronous character-mode terminals to 3270 HDLC protocol ● supports all asynchronous devices connected to a user's host ● requires Display System Protocol (DSP) support in the host ● installation is priced at $750 if not installed concurrent with SHI ● installation plus monthly charge:

400	400

SHI-3270B ● supports 3270 BSC protocol ● installation plus monthly charge:

750	300

TEM-BLK Option ● in conjunction with SHI-3270B, provides protocol conversion for asynchronous block-mode terminals to 3270 BSC protocol ● supports all asynchronous devices connected to a user's host ● installation plus monthly charge:

NA	200

TEM-CMTB Option ● in conjunction with SHI-3270B, provides protocol conversion for asynchronous block- and character-mode terminals to 3270 BSC protocol ● supports all asynchronous devices connected to a user's host ● installation is priced at $750 if not installed concurrently with SHI ● installation plus monthly charge:

400	300

SHI-3270S ● supports 3270 SDLC protocol ● installation plus monthly charge:

750	300

SHI-SDLC ● supports IBM SDLC protocol ● installation plus monthly charge:

750	300

SHI-RJEB ● supports IBM RJE/HASP BSC protocol ● installation plus monthly charge:

750	300

SHI-BSC ● supports IBM BSC protocol ● installation plus monthly charge:

750	600

Upgrades/Downgrades ● SHI upgrades and downgrades are charged at the same rates as the installation charges for the intended modification.

Synchronous Terminal Interfaces (STI)

SHIs support a single synchronous protocol from a single Tymnet location or a single piece of customer equipment ● user terminals connected to High- and Medium-Density cities or to Tymnet Engines on customer premises ● STIs are available for 3270 BSC, SDLC, and RJE/HASP protocols ● IBM 3270 users can access asynchronous hosts (public databases) via automatic protocol conversion undertaken in transparent fashion within the Tymnet network ● STI options include dial backup, dedicated dial-up, and rotary access ● includes full-period maintenance.

STI-3270B ● supports 3270 BSC protocol ● installation plus monthly charge:

$750 instal	$300 mo

STI-3270S ● supports 3270 SDLC protocol ● installation plus monthly charge:

750	300

STI-SDLC ● supports IBM SDLC protocol ● installation plus monthly charge:

750	300

STI-RJEB ● supports IBM RJE/HASP BSC protocol ● installation plus monthly charge:

750	300

Asynchronous Terminal Concentrators (ATCs)

Tymnet asynchronous terminal concentrators multiplex remote asynchronous terminal clusters a single Tymnet synchronous link; ATCs are not PAD devices because they currently do not support CCITT Recommendations X.3, X.28, and X.29 ● bundled service provides hardware, software, a single 4800-bps link of up to 50 common carrier miles, maintenance, and associated modems ● additional charge per mile for leased connections over 50 miles: $2.25 per month, 51 through 100 miles, $1.10 per month, 101 through 1,000 miles, $0.70 per month, 1,001 miles and over ● connection to FX series is charged at 115 percent of applicable common carrier rates ● ATC options include dial backup, 9600-bps leased line connection, and rotary access.

ATC-4 ● supports up to 4 ports ● installation plus monthly charge:

$900 instal	$900 mo

ATC-8 ● supports up to 8 ports ● installation plus monthly charge:

900	1,000

ATC-12 ● supports up to 12 ports ● installation plus monthly charge:

900	1,200

ATC-16 ● supports up to 16 ports ● installation plus monthly charge:

900	1,300

ATC-HS ● 9600-bps leased line option ● installation plus monthly charge:

NA	250

DBU ● Dial Backup ● installation plus maintenance charge:

750	200

ROT ● Rotary, per port ● monthly charge only:

NA	12

Upgrades/Downgrades/Moves ● installation charge:

500	NA

☐ Access

U.S. Locations

Tymnet access locations in the U.S. have been classified, for rate purposes into high-, medium-, and low-density cities in addition to WATS. City density listings which follow are based on volume or density of network traffic ordinarily originating from them.

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High-Density Cities ● high-volume-density traffic.

Alabama ● Birmingham.

Arizona ● Phoenix.

California ● Anaheim; Belmont; Campbell; Cupertino; Garden Grove; Hayward; Irvine; Los Altos; Menlo Park; Mountain View; Newport Beach; Oakland; Palo Alto; Redwood City; Sacramento; San Francisco; San Carlos; San Jose; San Diego; Santa Ana; Santa Clara; Sunnyvale.

Colorado ● Boulder; Denver.

Connecticut ● Bloomfield; Darien; Hartford; Stamford.

Florida ● Miami.

Georgia ● Atlanta; Norcross.

Illinois ● Chicago.

Indiana ● Indianapolis.

Kansas ● Shawnee Mission.

Louisiana ● New Orleans.

Maryland ● Baltimore.

Massachusetts ● Boston; Cambridge.

Michigan ● Ann Arbor; Detroit.

Minnesota ● Minneapolis; St. Paul.

Missouri ● Kansas City; St. Louis.

New Jersey ● Lyndhurst; Newark; Piscataway; Princeton; Union.

New York ● New York; Rochester; White Plains.

North Carolina ● Charlotte.

Ohio ● Cincinnati; Cleveland; Columbus.

Oklahoma ● Oklahoma City; Tulsa.

Oregon ● Portland.

Pennsylvania ● Philadelphia; Pittsburgh.

Rhode Island ● Pawtucket; Providence.

Tennessee ● Nashville.

Texas ● Austin; Dallas; Houston; San Antonio.

Utah ● Salt Lake City.

Virginia ● Arlington; Fairfax.

Washington ● Seattle.

Wisconsin ● Brookfield; Milwaukee.

Medium-Density Cities ● medium-volume-density traffic ● at this time, Private Access Port Interfaces and Synchronous Polled Terminal Port Interfaces not available in cities marked with asterisk; other recently added cities may also be excluded, contact vendor for details.

Alabama ● Huntsville; Mobile.

Arizona ● Tuscon.

Arkansas ● Little Rock.

California ● Alhambra; Arcadia; Beverly Hills; Canoga Park; Colton; Covina; Diamond Bar; El Segundo; Escondido; Fremont; Long Beach; Mantea; Mission Hills; Northridge; Ontario; Oxnard; Pamona; Pasadena; San Pedro; San Fernando; San Bernadino; Santa Barbara; Santa Cruz; Sherman Oaks; Van Nuys; Ventura; Vista.

Colorado ● Colorado Springs.

Connecticut ● Bridgeport; Fairfield; New Haven; North Haven; West Haven; Westport.

Delaware ● Wilmington.

Florida ● Clearwater; Fort Lauderdale; Hollywood; Jacksonville; Longwood; Orlando; St. Petersburg; Tampa; West Palm Beach.

Idaho ● Boise.

Illinois ● Davenport; Downers Grove; Glen Ellyn; Rock Island; Rockford; Springfield; Wheaton.

Indiana ● South Bend.

Iowa ● Des Moines.

Kansas ● Wichita.

Kentucky ● Lexington; Louisville.

Louisiana ● Baton Rouge; Davenport.

Maryland ● Chevy Chase; Rockville.

Massachusetts ● Springfield.

Michigan ● Grand Rapids; Jackson; Kalamazoo; Lansing; Plymouth; Southfield.

Mississippi ● Jackson

Nebraska ● Omaha

Nevada ● Boulder City; Carson City; Las Vegas; Reno.

New Hampshire ● Nashua.

New Jersey ● Englewood Cliffs; Wayne.

New Mexico ● Albuquerque.

New York ● Albany, Hempstead; Melville; Syracuse.

North Carolina ● Durham; Greensboro; Salem; Winston.

Ohio ● Akron; Dayton; Toledo.

Pennsylvania ● Allentown; Bethlehem; Harrisburg; King of Prussia; Norristown; Valley Forge; York.

South Carolina ● Columbia; Greenville.

Tennessee ● Chatanooga; Knoxville; Memphis.

Texas ● Corpus Christi; El Paso; Fort Worth; Midland; Midlothian.

Virginia ● Newport News; Norwalk; Portsmouth; Richland; Riverside.

Washington ● Richmond; Spokane.

Wisconsin ● Madison.

Low-Density Cities ● low-volume density traffic.

Alabama ● Anniston; Montgomery; Tuscaloosa.

Arkansas ● Fort Smith; Hot Springs; Jonesboro; Springdale.

California ● Alvany; Antioch; Bakersfield; Burbank; Chico; Concord; Corona; Davis; Eureka; Fresno; Lancaster; Mar Vista; Marina Del Rey; Modesto; Napa; Norwalk; Palm Springs; Pleasant Hills; Pleaston; Rancho Bernardo; Redding; Salinas; San Bruno; San Clemente; San Luis Obispo; San Rafael; Santa Monica; Shreveport; South San Francisco; Stockton; Thousand Oaks; Vallejo; Visalia; Walnut Creek; West Covina; Woodland.

Colorado ● Danbury; Ft. Collins; Greeley; Pueblo.

Connecticut ● Meriden; New London; Norwich; Waterbury.

Delaware ● Dover.

Florida ● Boca Raton; Daytona Beach; Fort Myers; Fort Pierce; Gainesville; Lakeland; Macon; Melbourne; Merritt Island; Ocala; Panama City; Pensacola; Sarasota; Tallahassee; Winterhaven.

Georgia ● Athens; Augusta; Columbus; Marietta; Rome; Savannah.

Idaho ● Idaho Falls; Pocatello.

Illinois ● Aurora; Belleville; Champaign; Danville; Decatur; Forest Park; Freeport; Joliet; Lake Zurich; Peoria; River Forest; St. Charles; Urbana.

Indiana ● Anderson; Evansville; Fort Wayne; Gary; Hammond; Highland; Kokomo; Lafayette; Marion; Merrillville; Muncie; Terre Haute.

Iowa ● Cedar Rapids; Dubuque; Iowa City; Marshalltown; Sioux City; Waterloo.

Kansas ● Leavenworth; Manhattan; Salina; Topeka.

Kentucky ● Bowling Green; Owenboro.

Louisiana ● Alexandria; Monroe.

Maine ● Bangor; Brewer; Lewistown; Portland.

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Maryland ● Aberdeen; Columbia; Cumberland; Hagerstown; Joplin; Myersville.

Massachusetts ● Attleboro; Auburn; Brockton; Fall River; Fitchburg; Lawrence; Lowell; New Bedford; Pittsfield; Taunton; Woburn; Worcester.

Michigan ● Battle Creek; Benton Harbor; Cadillac; Freeland; Jefferson City; Manistee; Midland; Muskegon; Port Huron; Saginaw; St. Joseph; Traverse City.

Minnesota ● Duluth; Mankato; Rochester; St. Cloud.

Mississippi ● Pascagoula; Vicksburg.

Missouri ● Rolla; Springfield; St. Joseph.

Montana ● Billings; Bozeman; Great Falls; Mineola; Missoula.

Nebraska ● Lincoln.

New Hampshire ● Salem.

New Jersey ● Atlantic City; Cherry Hill; Eatontown; Jersey City; Manchester; Moorestown; Morristown; Pennsauken; Ridgewood; Trenton.

New Mexico ● Las Cruces; Santa Fe.

New York ● Binghamton; Corning; Elmira; Ithaca; Niagara Falls; Poughkeepsie; Utica.

North Carolina ● Asheville; Greenville; High Point; Raleigh; Wilmington.

North Dakota ● Bismark; Fargo; Grand Forks; Minot.

Ohio ● Canton; Cortland; Hamilton; Lima; Mansfield; Marysville; Warren; Youngstown.

Oklahoma ● Ardmore; Enid; Lawton.

Oregon ● Eugene; Medford; Salem.

Pennsylvania ● Altoona; Downington; Erie; Greensburg; Kingston; Lancaster; Latrobe; Levittown; New Castle; Scranton; State College; Wilkes Barre.

Rhode Island ● Newport; Woonsocket.

South Carolina ● Charleston; Fayetteville; Spartansburg.

South Dakota ● Rapid City.

Tennessee ● Jackson; Oak Ridge.

Texas ● Abilene; Amarillo; Baytown; Brownsville; Bryan; College Station; Denton; Killeen; Longview; McAllen; Nederland; Odessa; Port Arthur; Tyler; Waco; Wichita Falls.

Utah ● Ogden; Orem; Provo.

Vermont ● Burlington; Montpelier.

Virginia ● Charlottesville; Lynchburg; Petersburg; Roanoke; Williamsburg.

Washington ● Bellingham; Enumclaw; Olympia; Tacoma; Vancouver; Yakima.

West Virginia ● Huntington; Morgantown; Parkersburg.

Wisconsin ● Appleton; Beloit; Eau Claire; Green Bay; La Crosse; Neenah; Oshkosh; Racine; West Bend.

Wyoming ● Casper.

International Locations

Tymnet allows access to foreign or remote countries/areas by providing a gateway linking users to other packet-switched or message networks. Subscriptions, invoicing, and other details relating to foreign network service are handled by the communications administration for each country, which could include postal, telegraph, or telephone (PTT) authorities. Local service and related problems are also expedited by the individual foreign countries. Tymnet supports in-bound international Telex message traffic.

International locations are classified as either bidirectional or one-way only. Tymnet uses in the U.S. can either initiate a call to or accept a call from bidirectional locations; only the calling party is charged for service. All other locations provide one-way service, meaning U.S. subscribers can only receive calls from them. Bidirectional locations provide leased-line, dial-up, or both forms of access. Leased-line access locales support transmission rates of up to 9600 bps and sometimes 14.4K bps; dial-up locations support rates up to 1200 bps in most instances.

Bidirectional Locations ● Antigua; Argentina; Australia; Austria; Bahamas; Bahrain; Barbados; Belgium; Bermuda; Brazil; Canada; Cayman Islands; Chile; China; Columbia; Costa Rica; Denmark; Dominican Republic; Egypt; Finland; France; Gabon; Gambia; Greece; Guam; Guatemala; Hong Kong; Hungary; Indonesia; Ireland; Israel; Italy; Ivory Coast; Jamaica; Japan; Kuwait; La Guadeloupe; La Reunion; Luxembourg; Martinique; Mexico; Netherlands; New Zealand; Norway; Panama; Peru; Philippines; Portugal; Puerto Rico; Qatar; Saudi Arabia; Singapore; South Africa; South Korea; Spain; Sweden; Switzerland; Taiwan; Thailand; Trinidad; United Arab Emeritas; United Kingdom; U.S. Virgin Islands; West Germany.

Connections With International Carriers

Tymnet will provide, on behalf of a customer or authorized user, connection with and transmission of data to United States international common carriers, as specified below, at a gateway location of such carrier within the United States for transmission to locations outside the United States. Tymnet will also accept on behalf of a customer or authorized user, connection with and transmission of data from such United States international common carriers at the gateway locations. The rates for such services are the rates specified in the applicable tariff of the pertinent international common carrier.

Western Union International, Inc

ITT World Communications, Inc

RCA Global Communications, Inc

TRT Telecommunications Corporation

FTCC Communications, Inc

☐ Other Network Services

OnTyme-II Electronic Mail Services

Tymnet's parent, Tymshare, provides an electronic mail service called OnTyme-II for transmission of messages. The service offers good text editing facilities. The service also provides for network storage and multiple distribution of customer messages. The main service is available on a measured use basis.

A lower-cost bulk electronic mail service, offered on an unlimited use basis, is also available for very high-volume message transmission.

Private Networks

Tymnet provides specialized private network services to a number of organizations in the United States and overseas. Many U.S. and international corporations and financial institutions have installed their own private networks using Tymnet hardware and software. Private networks consisting of as many as 90 nodes are in place and provide the same range of networking services as the public network. In addition, some Tymnet network components are offered as separate products for incorporation into other networks; Tymsats, which connect terminals to the network; Tymcons, which connect host computers to the network; switches, which operate as network nodes; and software for network control, configuration, and accounting.

X.25 Interface Certification on Tymnet

Tymnet maintains an ongoing X.25 certification program for the testing of X.25 hardware, software, and firmware products offered by vendors. To date, X.25 products from over 50 vendors have been certified as compatible with Tymnet, and a great many more are either undergoing or awaiting testing.

Prominent vendors with Tymnet-certified products include Data General, Datapoint, Digital Communications Associates, Gandalf Data, Harris, Hewlett-Packard, Honeywell, IBM, NCR/COMTEN, Prime, Rixon, and Tandem. A complete and current list of all certified equipment can be obtained from Tymnet.

● END

Ungermann-Bass Net/One
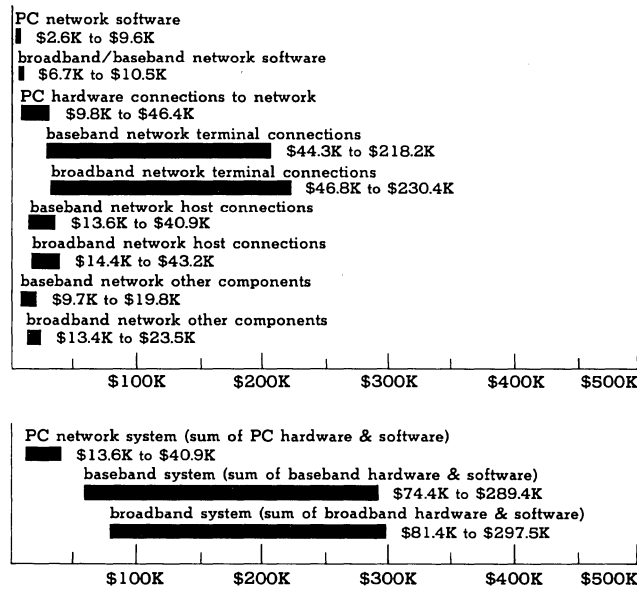## Baseband, Broadband & Fiber Optic LANs
With IBM PC Support

■ PROFILE

Architecture • Net/One Local Area Network (LAN).

Type • available in baseband and broadband versions • compatible with Ethernet specification • provides virtual circuit, datagram and name services.

PURCHASE PRICE RANGE   hardware & software ■■■■

PC network software
■ $2.6K to $9.6K

broadband/baseband network software
■ $6.7K to $10.5K

PC hardware connections to network
■■ $9.8K to $46.4K

baseband network terminal connections
■■■■■■ $44.3K to $218.2K

broadband network terminal connections
■■■■■■ $46.8K to $230.4K

baseband network host connections
■■ $13.6K to $40.9K

broadband network host connections
■■ $14.4K to $43.2K

baseband network other components
■■ $9.7K to $19.8K

broadband network other components
■ $13.4K to $23.5K

$100K	$200K	$300K	$400K	$500K

PC network system (sum of PC hardware & software)
■■ $13.6K to $40.9K

baseband system (sum of baseband hardware & software)
■■■■■■ $74.4K to $289.4K

broadband system (sum of broadband hardware & software)
■■■■■■ $81.4K to $297.5K

$100K	$200K	$300K	$400K	$500K

UNGERMANN-BASS NET/ONE PURCHASE PRICING • SMALL SYSTEM interconnects 100 terminals with 2 host computers; provides 16 ports per host computer and NMC for network management; the network management software is bundled with the NMC; shown for both baseband and broadband LANs • **small baseband Net/One** includes 17 NIU-180As, 18 NTR10 transceivers with 20-foot transceiver cables, NMC, OPS operating system and Virtual Circuit Service (VCS) software • **small broadband Net/One** includes 17 NIU-180Bs with RF modems, OPS operating system and VCS software, NMC with RF modem, CT-501 translator • **small PC Connection Net/One** connects 10 PCs to Net/One; includes 7 Personal NICs with transceivers, 3 Personal NIUs, 3 thin coax transceivers, and Printshare, Diskshare, and Mailshare software • **LARGE SYSTEM** interconnects 500 terminals with 4 hosts; provides 24 ports per host and NMC for network management; network management software is bundled with NMC • **large baseband Net/One** configuration includes 76 NIU-180As, 77 NTR10 transceivers with 20-foot cables, NMC, X.25 Gateway hardware and software, OPS operating system, and VCS software • **large broadband Net/One** configuration includes 76 NIU-180Bs with RF modems, CT-501 Translator, X.25 Gateway hardware and software, NMC with RF modem and network management software, OPS operating system and VCS software • **large PC connection Net/One** interconnects 50 PCs with 5 Print Servers and 5 Disk Servers; also runs Mailshare and CrossTalk Net/One Terminal Emulator • includes 38 Personal NICs with transceivers, 12 Personal NIUs, 12 thin coax transceivers, 5 Diskshare servers, 5 Printshare servers, Mailshare, and Crosstalk Net/One Terminal Emulator • networks do not include network cables and connectors • Ungermann-Bass provides maintenance contracts but the company has not released maintenance prices; thus these graphs do not include maintenance.

Transmission Speed • 10M bps for baseband; 5M bps per channel for 5 broadband channels.

Cable Length • 1,500 feet per segment for baseband; 2 extensions allow networks up to 4,500 feet; a remote repeater fiber optic link facility can extend cable length by 3,000 feet • 10 miles/50,000 feet for broadband • bridges can extend length even farther • for Fiber Optic Net/One, maximum end-to-end distance is 2.8 miles.

Applications • automated office, engineering shops, manufacturing plants, resource sharing through interconnection of personal computers.

Configurations • up to 100 taps for Network Interface Units (NIUs) can be placed on a baseband cable segment; NIUs can also serve as bridges to connect networks together • up to 300 NIUs can connect to each broadband channel; NIU models can support up to 24 user devices • see Figure 1 for typical baseband or broadband configuration • for Net/One Personal Connection PC network NIU is housed in PC • Personal NIU can connect to thin coaxial, fiber optic, Ethernet-compatible baseband or broadband cable • integrated networks can be configured as shown in Figure 2; Net/One Personal thin coax network connects to baseband Ethernet-compatible network through simple connector; baseband network connects to broadband network through a local bridge • Fiber Optic Net/One can implement complete standalone network or can function as a backbone network, interconnecting Ethernet-compatible cables located in separate buildings; standalone Fiber Optic Net/One can interconnect from 18 to 39 NIUs (432 to 936 user devices); when Fiber Optic Net/One is used as backbone network, it can interconnect up to 14 Ethernet-compatible Net/Ones or a total of 1,400 NIUs (up to 33,600 user devices) • Network Management Console (NMC) provides network manager with facilities to manage Net/One.

Interface • through Network Interface Units (NIUs).

Gateways • X.25 Gateway connects Net/One network to X.25 Public Data Network (PDN); can be used to connect 2 remote Net/Ones together or to connect Net/One to an X.25 interface on a host computer eliminating the need for multiple asynchronous RS-232C connections on host.

Support of Foreign Devices • RS-232C; IEEE-488; 8-, 16-, 32-bit parallel; RS-449; and V.35 physical interface support • IBM PCs.

Network Management • through Network Management Console Model 1 (NMC-1) based on an IBM PC/XT; provides NIU configuration, network download, and network debugging; planned facilities include network monitoring, access control, broadcast, collection of accounting data, dynamic port reconfiguration, port enable/disable, and network fault detection.

Protocols • software supports Async, BSC, HDLC/SDLC, DEC DDCMP, and DR-11B/W protocols.

Distributed Functions • some Network Interface Units (NIUs) are programmable and support data preprocessing, code conversion, protocol conversion, and attached resources management; multiple disk and print servers can reside on a single network • currently, program development can be done only on old NCF, not on NMC.

Support Software • software for loading NIUs; print and disk servers, and terminal emulator, runs under PC-DOS V.2.0 on IBM PC or IBM PC/XT (required by disk server) • some NIUs support multiple application processors.

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NIU: NETWORK INTERFACE UNIT

NMC: NETWORK MANAGEMENT

CONSOLE BASED ON IBM PC/XT BUNDLED WITH NIU & NETWORK MANAGEMENT SOFTWARE.

PERSONAL NIU: BOARD IN IBM PC.

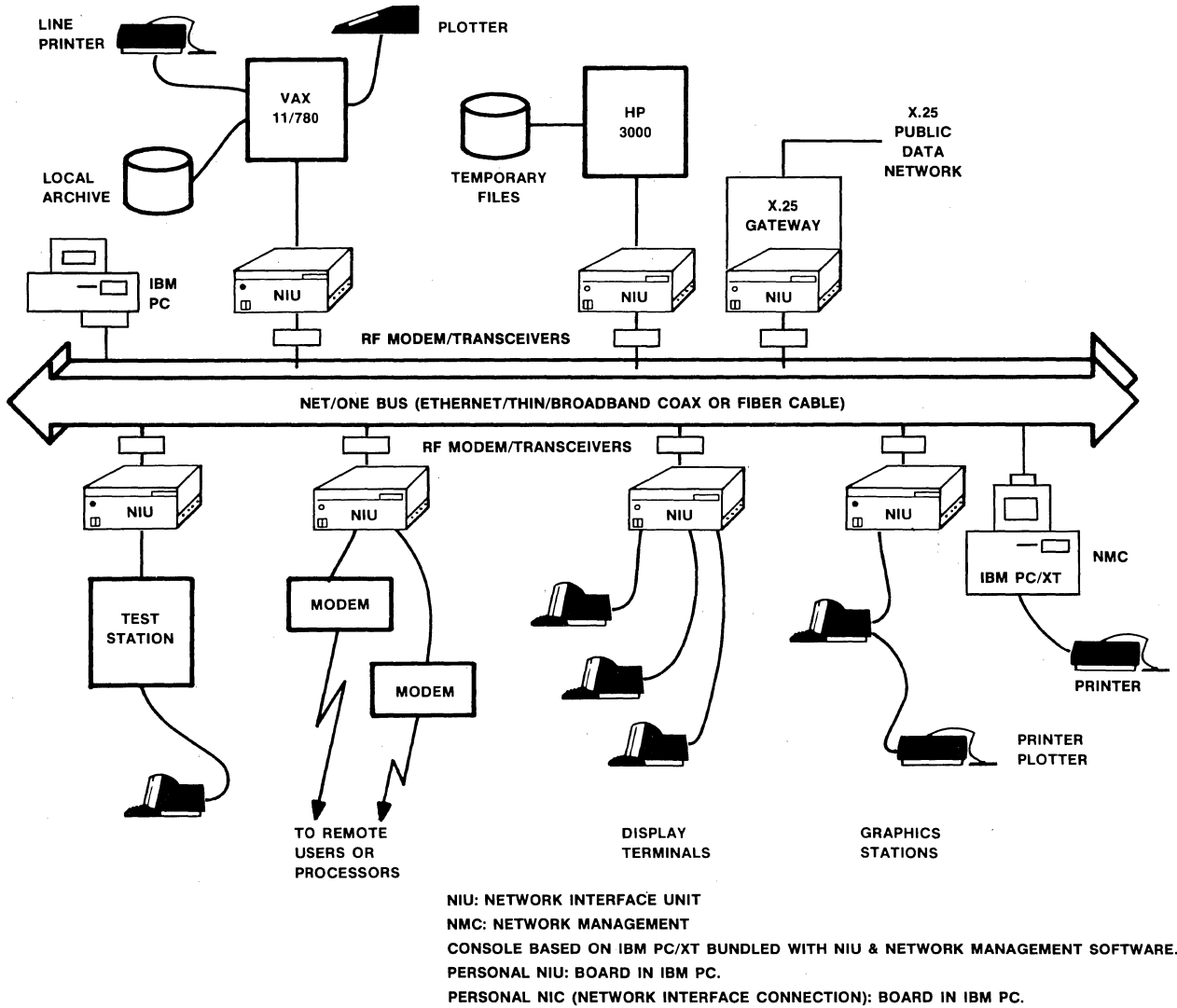PERSONAL NIC (NETWORK INTERFACE CONNECTION): BOARD IN IBM PC.

Figure 1 ● typical Net/One configuration.

First Delivery ● July 1980 for Net/One baseband; July 1981 for Ethernet-compatible Net/One baseband; July 1982 for Net/One broadband; 1983 for Fiber Optic LAN; January 1984 for Personal NIU.

Systems Delivered ● over 700 Net/One networks.

Comparable Systems ● Xerox Ethernet for Net/One baseband ● Net/One is compatible with Ethernet specifications, and Xerox uses the Ungermann-Bass Network Interface Unit on its Xerox 8000 networks ● Sytek's baseband LocalNet/20 is very different from the Net/One baseband network; transmission rate on each LocalNet/20 channel is 128K bps as compared to 10M bps on Net/One baseband ● LocalNet/20 channels are slow for file transfers between host computers.

Vendor ● Ungermann-Bass, Inc; 2560 Mission College Boulevard, Santa Clara, CA 95050 ● 408-496-0111.

Distribution ● through 12 Ungermann-Bass sales offices in the U.S., through distributors in Western Europe, Switzerland, Canada, United Kingdom, and Japan.

■ ANALYSIS

The Net/One baseband and broadband products are designed to complement one another. The Net/One baseband version is Ethernet-compatible and designed to interconnect word and data processing systems together within a building or location in a building. A bridge can interconnect Net/One broadband and baseband LANs as well as interconnect broadband channels. The Net/One Personal Connection interface units connect IBM PCs to either baseband or broadband Net/One or to the thin coaxial cable Net/One.

Ungermann-Bass has been supplying its Network Interface Units (NIUs) to Xerox for its Xerox 8000 Network System to interface devices to Ethernet since April 1981.

Net/One networks are supported by NIUs configured from Network Management Console (NMC) based on IBM PC/XT. The NMC can also function as a Workstation on Net/One.

Ungermann-Bass implements its Datagram and Virtual Circuit Services in software residing in the NIU. Users have complained

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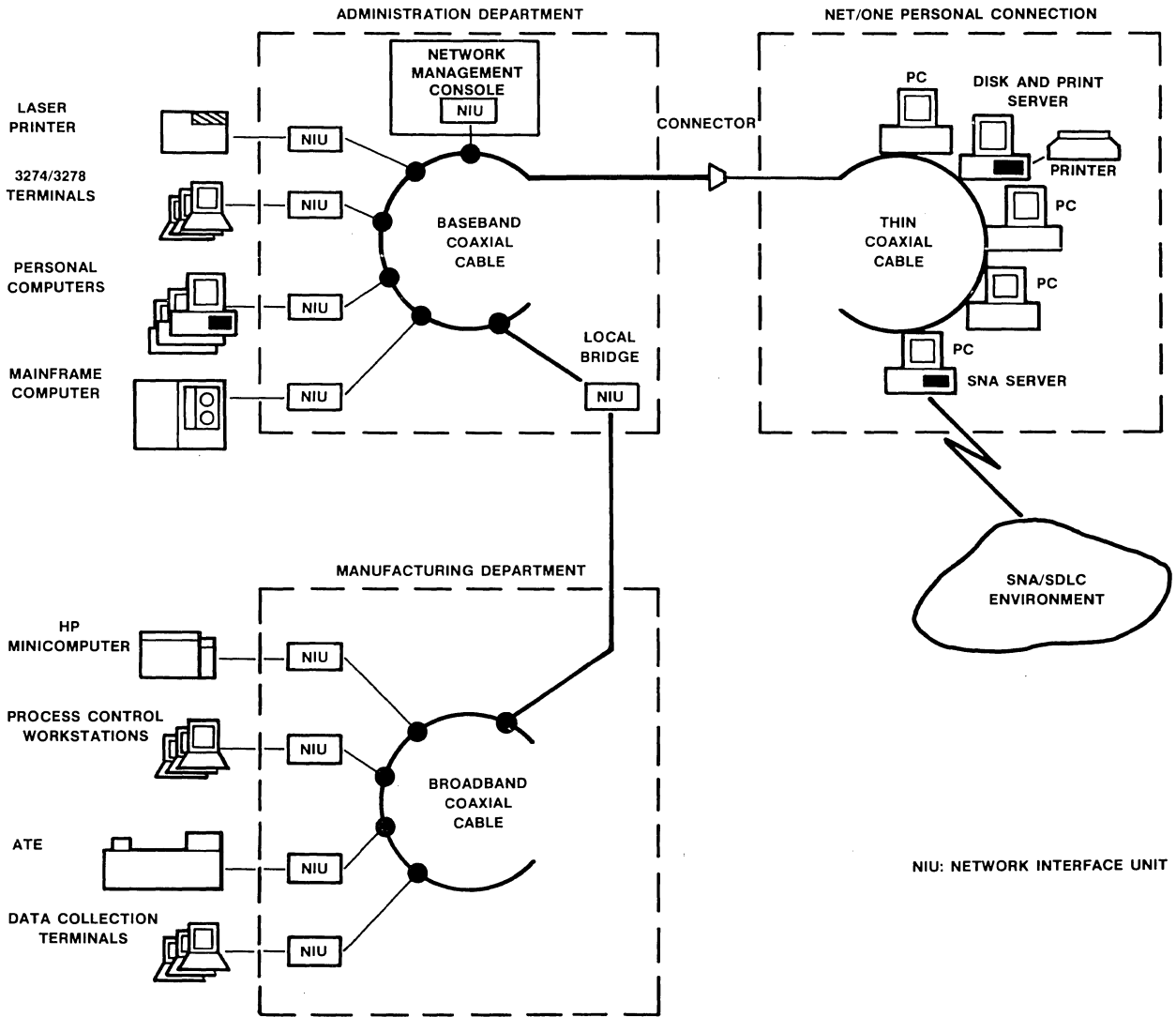
Figure 2 ● integrated Net/One configuration using Ethernet-compatible coax, Personal Connection thin coax, and broadband coax cable networks.

that LANs lack virtual circuit connection to accommodate terminals or other systems that communicate with only one other system, for example, terminals that communicate with one host computer. The Net/One virtual circuits are established by software when the system is configured, so the user can operate as if the user device is connected by a direct, dedicated to the remote device.

The Net/One Personal Connection with Printshare, Diskshare, and Mailshare software running on the IBM PC or IBM PC/XT allows PCs on Net/One to share resources.

Ungermann-Bass was founded in 1979 to design, develop, and market communication systems to use in Local Area Networks (LANs). The company delivered its first version of Net/One with a 4M-bps data rate in July 1980. The company's first Ethernet-compatible network with a 10M-bps data rate was announced in April 1981 and shipped in July 1981. The broadband version of Net/One was announced in February 1982 and first shipped in July 1982. The Personal Connection network was announced in

September 1983; first delivery was January 1984. Fiber Optic Net/Ones were first delivered in 1983. Ungermann-Bass has grown rapidly since it was founded in 1979. Revenues of $23M for first 6 months of 1984 were more than double that of 1983. The company has become the leading supplier of general purpose LANs.

☐ **Strengths**

Net/One is compatible with Ethernet, the most prominent LAN on the market today. Intel makes an Ethernet controller chip set. Fujitsu is producing LSI chips for both Net/One broadband and baseband LANs.

Net/One provides both broadband and baseband versions, as well as the Personal Connection baseband version. All use CSMA/CD for access control.

The ability to interconnect broadband and baseband Net/One networks extends the area over which Net/One can be used.

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Multiple bridge products can extend Net/One to almost any required length. The bridge can be configured on each end of a communication link for interconnecting remote networks.

Although a custom product, a fiber optic backbone network can be used to implement very large networks. The fiber optic cables with star nodes are used to interconnect up to 14 standard cable networks.

Net/One is vendor independent, thus it can be used to interconnect multiple vendors' products. The interfaces to user devices are industry standard. Another strong feature of Net/One is its support of both Datagram and Virtual Circuit Services, not available for some other LANs.

With the popularity of the IBM PCs, Net/One's ability to support them is a big plus. Ungermann-Bass has not just settled for the connection capability but is offering services to the PCs with the Printshare, Diskshare, Mailshare, and terminal emulation software.

☐ **Limitations**

Ungermann-Bass is still a small company although the products developed to date are impressive. So far, the Net/One product line includes no interfaces to IBM host systems except through ASCII terminal emulation. The company does have an X.25 Gateway. Ungermann-Bass announced an SNA gateway, which has not been delivered. The only special adapter available is the Digital Equipment DR11-W interface, a 32-bit DMA interface to the VAX-11.

■ **NETWORK SUMMARY**

Ungermann-Bass offers a complete line of products to construct baseband, broadband, personal computer, and fiber optic local area networks. The components of all networks are essentially the same except for the cable and the transceiver/RF modem interface. All networks use the same Network Interface Units (NIUs) with different boards to interface to the cable. The broadband system uses an RF modem tuned to the appropriate channel frequency. The Net/One Personal Connection can connect to either the baseband or broadband Net/One or to a special thin coaxial cable with a connection to a baseband Net/One for network management. The fiber optic network requires a fiber transceiver. In addition, it uses star node couplers to interconnect multiple fiber cables. Ungermann-Bass does not offer fiber optic Net/Ones as standard products. They must be ordered from the Network Design Group. Figure 3 shows single and multiple fiber optic cable configurations.

Net/One fiber optic, Ethernet-compatible, and thin coaxial cable baseband provide a single 10M-bps channel. Net/One broadband provides 5 5M-bps channels. All use CSMA/CD protocol for channel access. Net/One broadband uses standard CATV cable and fittings, and meets EIA guidelines for broadband LANs. RF modems are modulated using vestigial sideband amplitude modulation (VSB-AM) for compatibility with video transmissions over other channels.

The Net/One LAN design employs fiber optic cable to interconnect multiple baseband Net/Ones that serve individual buildings or locations within a building. A bridge interconnects Net/One baseband networks, Net/One broadband network channels, and broadband Net/One channels with Net/One baseband network. A simple "connector" to match different cable diameters connects the thin coaxial cable for PC networks to baseband Net/One.

Net/One uses a Network Interface Unit (NIU) to interface a user device to the LAN. The NIU is available in several versions: the NIU-150A/B uses the Fujitsu LSI chip set and is implemented on a single board. It is not expandable. The NIU-2A/B is a 3-board system based on the Z80A; it includes a transceiver interface and up to 4 optional application processors. The NIU-130A/B and NIU-180A/B use the Intel 80186 microprocessor to implement the CSMA/CD protocol. The Personal NIU is based on the 80186 microprocessor with 128K-byte memory. It is a single board that plugs directly into an IBM PC. A range of electrical interfaces can be connected to the Processor Boards on the NIU-2A/B. These

include the RS-232C, 8-bit TTL parallel, IEEE-488, 32-bit parallel with DMA, asynchronous, and high-speed serial interfaces. Interfaces to the other NIUs are RS-232C or V.35.

The NIU controls communication over the network. It performs CSMA/CD access control, provides self-diagnostics, and implements Datagram and Virtual Circuit Services for network users. The NIU is configurable through the Network Management Console (NMC), based on the IBM PC/XT running under MS-DOS. The NMC also includes an NIU to interface it to the network.

The NMC functions as a downline load server and network configuration device. The network management software is bundled with NMC.

Separate software packages implement Datagram or Virtual Circuit Services. The Datagram Service requires the user to specify the addressee of each packet that is transmitted. Packets can also be multicast to a list of devices or broadcast to all devices on the network. Net/One provides 3 types of Virtual Circuit Services: session-oriented, bound, and administrative.

Session-oriented circuits are established by direct commands from a user device to establish a circuit to any other specified device on the network. Command mode is available to both NIUs and the NMC. The virtual circuit is established only for the duration of the session.

Bound circuits are established in software at system initialization, and remain static or permanent in files stored in the NMC. The network administrator can change the bound circuits by reconfiguring the system.

Administrative circuits are established by the administrator with commands from the NMC.

Circuits can be established between 2 devices in the same NIU (internal circuits) or between devices connected to different NIUs (external circuits). Data is passed over external virtual circuits according to the packet-oriented Net/One Reliable Byte Stream Protocol (RBSP), which supports sequencing, retransmission, flow control, and error control.

RBSP allows many packets to be in transit on a connection at one time. It uses a sliding acknowledgement window to all packet acknowledgements to be grouped for maximum channel efficiency. RBSP uses standard flow control techniques, such as XON/XOFF character strategy and manipulation of RS-232C RTS/CTS or DSR/DTR signals.

Devices on Net/One can be designated command, data, or command/data devices. Command devices can establish virtual circuits. Terminals, computers, or any intelligent device can be designated as a command device if it has been programmed to generate the appropriate commands. Data devices cannot generate commands, thus they cannot establish virtual circuits. Data devices can operate as a target for a circuit request, and as an end point on a virtual circuit. Command/data devices can generate commands and operate as a target for circuit initiation. The administrator assigns device types at system initiation.

Net/One also offers an automatic local echo facility if a user desires characters echoed.

Devices on Net/One are addressed according to a hierarchical address format consisting of the NIU number to which the device is attached, the processor identification (for NIU 2A/B) within the NIU to which the device is attached, and the processor port number. Each processor has 6 I/O ports.

The administrator manages the network using a Network Management Console to examine or set parameters and to establish or break connections. Using commands, the administrator configures the network and loads each NIU with the appropriate software for the services available to each of its ports. Services provided by Ungermann-Bass include Virtual Circuits, Virtual Circuits with Administrative Command Parser, high-speed Datagram, multiport Datagram, SFT File Transfer, dual board system support board, dual board system user processor board, and nonstandard user-written module.

Virtual Circuit commands include CONNECT, LIST, SET, and

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QUIT. The Command Parser adds INTERCONNECT, EXAMINE, and DISCONNECT, commands used by a network administrator. High-speed Datagram service is designed for the 32-bit parallel I/O port and IEEE-488 I/O module. The multiport Datagram service is designed for the 6-channel serial and 4-channel serial/2-channel parallel I/O modules. The SFT file transfer service transfers user programs between computers.

The dual-board system support board supports user services residing on a user-programmable board. The dual-board system user processor board provides the appropriate interface to the supporting system board for the user services on the user processor board. The 6-channel initial diagnostics runs diagnostics each time the NIU is reset. The nonstandard load service is a user-written module in place of standard Net/One software modules.

The Net/One Personal Connection is a set of hardware/software products to connect IBM personal computers to Net/One. The Personal NIUs connect the IBM PCs to the network system and allow the PCs to access network services provided by network servers. So far, Ungermann-Bass supplies software to implement a printer network server, a disk network server, a mail network server, and a terminal emulation server.

The print network server can run on either the IBM PC or PC/XT; the disk network server runs only on the IBM PC/XT. Terminal emulation software provides for emulating a number of ASCII terminals. Mailshare provides for electronic mail.

The Personal NIU plugs into an expansion slot of the IBM PC or PC/XT. Two transceiver units are available for interfacing the Personal NIU to baseband networks, one for use with the standard Ethernet cable and the other for use with thin Ethernet cable. A Personal NIU modem is available to interface the Personal NIU to a broadband Net/One. A Personal Network Interface Connection (NIC) is also available to connect PCs to Ethernet. An NIC is cheaper than the NIU, but a PC acting as a server must be interfaced to the Net/One through an NIU. A Personal NIU is also available to connect PCs to broadband Net/One.

The IBM PCs can be loaded from a locally connected diskette or downline from a disk server. A network can implement multiple disk and print servers.

The IBM PCs can also use the same communication services as other devices connected to the Ethernet-compatible baseband and broadband networks. The Personal Connection network requires connection to an Ethernet-compatible baseband network to obtain the network management facilities provided by an NMC.

When a fiber optic network is operating as a backbone network to interconnect multiple Net/Ones located in separate buildings, Ungermann-Bass supplies Star Node-6 and Star Node-14 couplers. Star Node-6 can interconnect up to 6 networks and Star Node-14 up to 14 networks, see Figure 3.

■ SOFTWARE

□ Terms & Support

Terms ● available for one-time charge license fee; multiple copy discounts for some packages.

Support ● provided through home office.

□ Net/One Software Components

The Net/One System Software (NOSS) that runs on every NIU in the system has been repackaged to separate the Net/One Operating Software (OPS) from the Virtual Circuit Service (VCS). The Network Management Software; MS-DOS operating system, and a network interface unit (NIU) are bundled with the IBM PC/XT in the Network Management Console (NMC). NMC has replaced the Network Configuration Facility (NCF) for giving a network manager the tools to manage the network: adding, deleting, and configuring NIUs.

Part of the software running in an NIU is an "agent" that performs diagnostics and records NIU status. The manager can access the data collected by the "agent" from the centralized NMC.

Currently, NMC does not have an automatic network report generator.

Earlier program development for the network was done under CP/M on the NCF. So far, user program development facilities are not available from the NMC.

Other software provides for VCS, Datagram Service (DGS), System Control Software for BSC/SDLC/HDLC/DDCMP protocols, and support for the Local and Remote Bridges and the X.25 Gateway. See Figure 4.

Ungermann-Bass still supports the NCF with its software, but it is no longer actively marketed.

The Personal Connection Software to support IBM PCs on Net/One includes facilities to share resources and to emulate various terminals. Packages include Diskshare, Printshare, Mailshare, and Crosstalk Net/One Terminal Emulator.

7500A Net/One Operating Software ● provides software to support the connection of an NIU to a Net/One network; provides facilities for diagnostics and network management; supports features and line drivers ● price is per NMC:

$1,000 lcns	$100 yr

7510A Virtual Circuit Service (VCS) ● provides VCS among devices connected to Net/One.

For Network 1:

3,500	350

For Networks 2 to 5 ● per network:

2,500	250

For Networks 6 and above ● per network:

1,500	150

7520A Datagram Service (DGS) ● provides for DGS among devices connected to Net/One; per network:

2,000	200

7540A SCS I-Net/One Bisync ● option to support Bisync devices connected to Net/One, such as IBM 2770/2780/3270/3280 and HASP multileaving terminals; supports both EBCDIC and ASCII transmission codes, per network:

1,000	100

7541A SCS II-Net/One SDLC/HDLC ● option to support SDLC/HDLC devices connected to Net/One: 3770 Series and SDLC versions of 3270 Series Control Units:

1,000	100

7542A SCS III-DDCMP ● option to support DEC DDCMP devices; per network:

1,000	100

7550A Remote Bridge Software ● runs on an NIU configured as remote network bridge; makes bridge transparent to both networks; user on one network operates as if the device addressed were on the same network ● required on both ends of remote link, see Figure 4; per bridge:

1,750	175

7551A Local Bridge Software ● runs in an NIU configured as a local bridge between 2 baseband networks, between baseband network and broadband channel, or between 2 broadband channels, see Figure 4; per bridge:

1,000	100

**X.25 Gateway Software** ● supports connection to X.25 network (see Figure 4); per network:

2,500	250

LCNS: one-time license fee for each copy, sometimes per network and sometimes per unit. YR: yearly software update. NC: no charge. Prices are current as of January 1985.
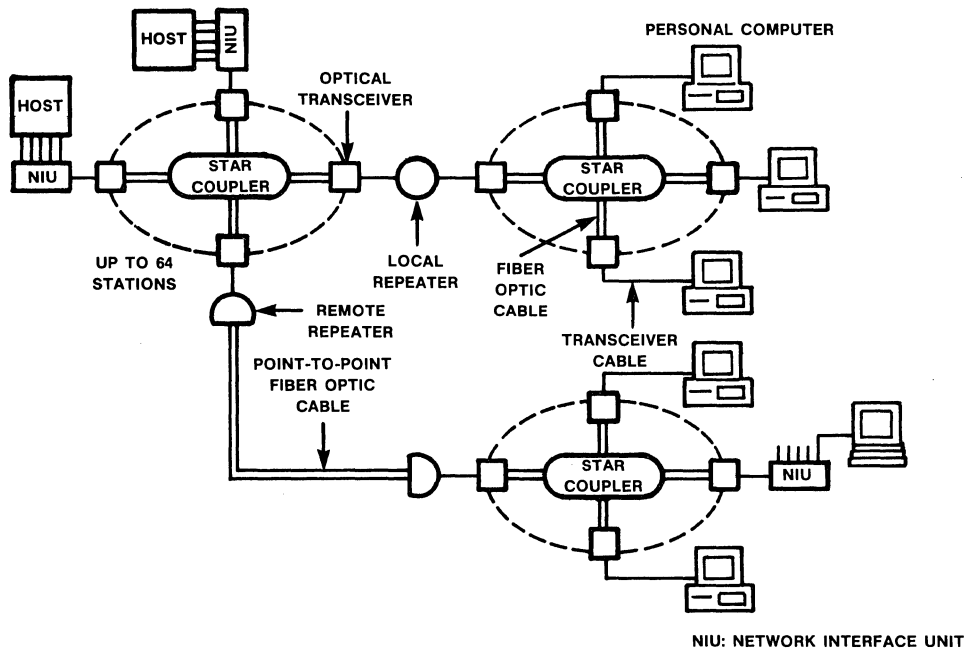

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SINGLE CABLE SYSTEM CONFIGURATION
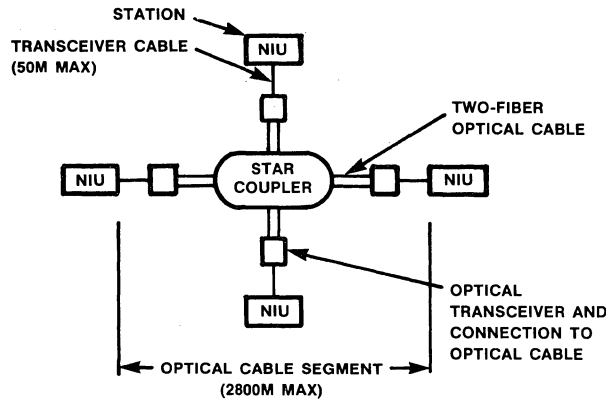
MULTIPLE CABLE SYSTEM CONFIGURATION

NIU: NETWORK INTERFACE UNIT

Figure 3 • Fiber Optic Cable Net/One configurations (available through special order from Network Design Group).

MS-DOS Operating System • bundled with Network Management Console (NMC):

	NC	NC

7411A Printshare Software • runs on an IBM PC network server to allow other IBM PCs on a network to share up to 2 printers connected to the network server; includes spooling to allow multiple users to access printer simultaneously; once the link is established, the data to be printed is sent to network server transparently • requires IBM PC with keyboard and display, 128K-byte memory, PC-DOS 2.0 licensed to run on the PC, one diskette drive, and Personal NIU; spooler requires at least one Diskshare network server • printer network server is free to run other applications • Printshare package includes software for the network servers and for the PCs using the server:

	500	50

7410A Diskshare Software • runs on an IBM PC/XT network server to provide shared access of other IBM PCs up to 3 hard disks connected to the server • disk volumes can be any size; public, private, or shared volume access supported; up to 10 workstations can share a network server; network server can downline load network and PC-DOS software throughout network; network server is free to run other applications; a network can be configured with multiple disk network servers • network security is through password protection; both read and write passwords can be assigned to volumes for protection • network management utility programs provide for creation,

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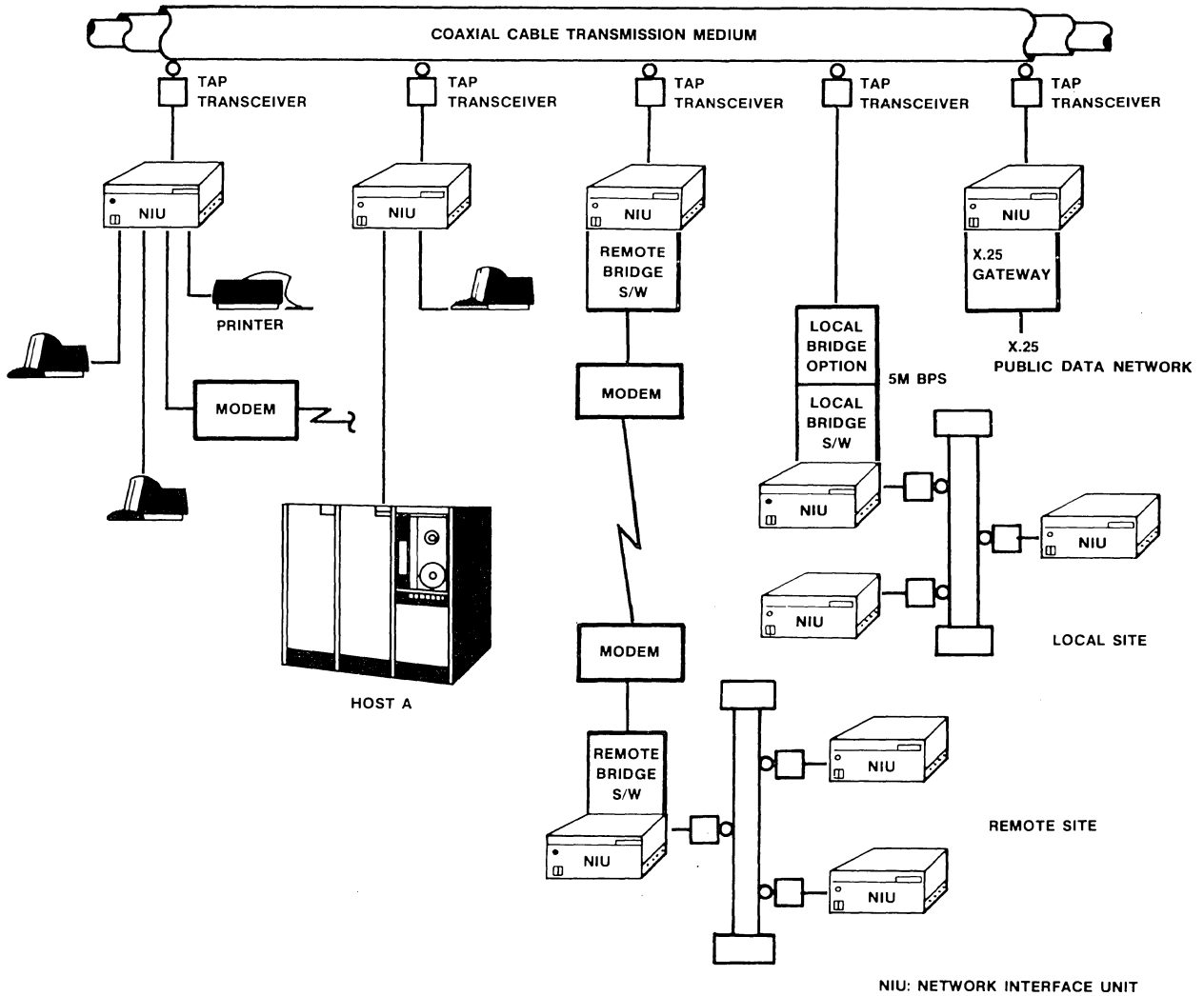
Figure 4 ● Net/One configuration with local and remote bridges and X.25 Gateway.

configuration, and deletion of network disk volumes, adding new users, setting password protection and types of access; moving files between volumes, and volumes between disks and consolidating free space ● IBM PCs that are downline loaded must include the Network IPL Facility ● requires IBM PC/XT with keyboard and display, 256K-byte memory, PC-DOS 2.0 licensed to run on PC, and Personal NIU ● includes network server software and user software needed to access the disk server; the user software contains the network software for the NIU and the Diskshare commands used to create links between volumes on the network servers and the logical drives specified by the IBM PC; once connection is established, the hard disk volumes appear local to PC-DOS and the application program; each PC workstation has 4 drive specifiers to link disk volumes:

	500	50

7412A Mailshare ● runs on PC/XT; allows network users to send memos, messages, letters, and associated data files to other users; mail can be sent to an individual, a list of individuals, or a predetermined distribution list; with proper ID and password, users can read their mail from a PC workstation on the network ● requires that Diskshare software be resident on at least 1 PC on

the network ● price is per network:

	750	75

7420A Crosstalk Net/One Terminal Emulator ● allow IBM PC and PC/XT Workstations on Net/One to emulate such popular ASCII terminals as DEC VT100 ADDS Viewpoint, IBM 3101, Televideo 910/920 Series, and Texas Instruments 940 ● also provides PC users with the ability to download/upload ASCII files (text and binary) from/to mainframe host; with use of Diskshare, mainframe files can be stored on a network disk server and shared by all PC workstation users ● can be loaded locally from diskette or across network from Diskshare server ● price is per network:

	650	65

■ HARDWARE

□ Terms & Support

Terms ● available for purchase only; volume discounts available under 2 discount schedules: Schedule A for NIU-2 products and Schedule B for NIU-1 products ● Schedule A discounts are $0K to

Ungermann-Bass Net/One
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$99K, no discount; $100K to $199K, 10 percent; $200K to $299K, 15 percent, $300K to $499K, 20 percent; $500K to $749K, 24 percent; $750K to $999K, 28 percent, $1M to $1.499M, 30 percent, and $1.5M and above, negotiable ● Schedule B discounts are approximately 5 percent less than the A discounts.

Support ● in April 1984, Ungermann-Bass signed a third-party maintenance agreement with the RCA Service Company for service of Ungermann-Bass customers nationwide with a guarantee of a 4-hour response ● Ungermann-Bass continues to service customers located within a 50-mile radius of Ungermann-Bass sales and technical support offices ● Ungermann-Bass has not released its maintenance prices; the customer signs a separate agreement for RCA maintenance ● a Systems Integration Group (formed August 1982) offers specialized networking solutions on an individual customer basis for site planning, system design, requirements analysis, and hardware/software support for both baseband and broadband Net/Ones ● a group in Lausanne, Switzerland supports European distributors and OEMs ● System Design Group offers custom fiber optic Net/Ones.

☐ Net/One Hardware

The Net/One hardware for all baseband and broadband networks differs only on the cable side of the interface. The user interface is identical for all networks. The broadband Network Interface Unit (NIU) differs from the baseband NIU only in that it requires an RF modem in place of the transmit/receiver board in the cable interface. The baseband NIUs differ in the transceiver used to connect to the network cable.

Network Interface Unit (NIU) Hardware

2221A NIU-2A ● operates at 10M bps as intelligent node on baseband Net/One; interfaces user devices to the network; provides passive, noncentralized network control; implements Datagram and Virtual Circuit Services; supports a range of electrical interfaces and device protocols; uses CSMA/CD protocol for access control; fully compatible with standard Ethernet 10M-bps networks; expandable; implemented on 3 boards and supports up to 3 application processor boards ● provides up to 24 user ports:

$4,325 prch

2321A NIU-2B ● operates at 5M bps as intelligent node on broadband Net/One; interfaces user devices to network; provides passive, noncentralized network control; implements Datagram and Virtual Circuit Services; supports a range of electrical interfaces ● device protocols; uses CSMA/CA protocol for access control expandable; supports up to 3 application processor boards for total of up to 24 user ports:

4,390

2241A NIU-130A ● baseband, provides up to 2 RS-232C synchronous or asynchronous user ports with data rates ranging from 50 to 19.2K bps; uses Intel 80186 microprocessor to implement network protocols; can operate as DTE or DCE device:

1,400

2341A NIU-130B ● broadband; provides up to 2 RS-232C synchronous or asynchronous user ports with data rates ranging from 50K to 19.2K bps; uses Intel 80186 microprocessor to implement network protocols; can operate as either a DTE or DCE device ● includes RF modem for single-cable broadband network:

1,600

2341B NIU-130B ● broadband, same as 234A except for dual-cable broadband network:

1,600

2231A NIU-150A ● on-board implementation of baseband Net/One NIU including Z80A processor, 64K-byte RAM and Fujitsu VLSI chip sets for interfacing to Ethernet ● nonexpandable; includes enclosure, power supply; transceiver controller, network processor, and 20-foot network transceiver cable ● user must specify I/O module for network application processor board ●

requires 5201B Network Transceiver Unit ● provides up to 6 user ports:

2,235

2331A NIU-150B ● nonexpandable 1-board model of broadband Net/One NIU based on VLSI Fujitsu Net/One chip set; includes enclosure, power supply, network modem controller, network processor, and 10-foot network modem cable ● provides up to 6 user ports:

2,300

2281A NIU-180A ● baseband, provides up to 8 RS-232C asynchronous user ports operating at data rates from 50K to 19.2K bps; based on Intel 80186 microprocessor:

2,950

2381A NIU-180B ● broadband; provides up to 8 RS-232C asynchronous ports operating at 50K to 19.2K bps; based on Intel 80186 microprocessor ● includes RF modem for single cable broadband network:

3,600

2381B NIU-180B ● broadband; same as 2381A but with RF modem for dual cable broadband network:

3,600

Personal NIU ● includes MS-DOS networking commands on diskette ● provides connection for IBM PCs to Net/One local area network systems; implemented on a single circuit board that plugs into expansion slot on IBM PC or IBM PC/XT giving the IBM PC access to all the resource sharing services of Net/One ● built around an 80186 microprocessor with 128K-byte memory; performs communication protocol processing ● can be used to connect IBM PC to all the available Net/One cables; Ethernet-compatible baseband standard or thin coaxial cable, broadband cable, or fiber optic cable ● all communication protocols used by Personal NIU follow the Xerox Network Systems (XNS) specifications ● PCs connected to Net/One through Personal NIU must be either IBM PC or IBM PC/XT with keyboard and display, single expansion slot available for Personal NIU, 128K-byte memory, PC-DOS 2.0 operating system, and single double-sided diskette drive or Network IPL Facility.

2261A Personal NIU ● baseband:

1,095

2361A Personal NIU ● broadband:

1,095

Personal Network Interface Controller (NIC) ● a plug-in controller board for the IBM PC, PC/XT, and compatibles; differs from Personal NIU in that NIU handles all protocol processing while NIC turns protocol processing over to the PC; includes 12K-byte receive and 4K-byte transmit buffers ● requires external transceiver and transceiver cable for connection to Ethernet or fiber optic cable; requires an RF modem for connection to broadband cable.

2271A Personal NIC ● baseband:

595

2272A Personal NIC ● baseband with on-board transceiver:

750

2371A Personal NIC ● broadband:

595

Network Storage Module (NSM)

Includes enclosure, power supply, diskette/disk storage, disk controller, IEEE-488 interface ● connects to either NIU-2A (baseband) or NIU-2B (broadband) system with 6602B Application Processor Board, Network Operating Software, and CP/M ● used to provide network management facility for networks without Network Management Console but with NCF.

PRCH: purchase price. No maintenance prices are available. Prices are current as of January 1985.

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3121A NSM-1 • includes 2 double-density, double-sided diskette units with 2M-byte storage capacity:

> $5,255 prch

Processor Boards for NIU-2

Each board requires a single NIU-2A or NIU-2B slot.

6600A Processor Board • PB without I/O:

> $1,100 prch

6601A Processor Board • PB with 4 serial asynchronous/2 parallel interfaces:

> 1,600

6601B Processor Board • PB with 4 serial synchronous interfaces for connection to DCEs:

> 1,600

6601C Processor Board • PB with 4 serial synchronous interfaces to DTEs:

> 1,600

6601G Processor Board • PB with 4 serial asynchronous ports; extended RS-232:

> 1,600

6601H Processor Board • PB with single asynchronous or parallel port for DTE:

> 1,600

6602A Processor Board • PB with IEEE-488 interface or 2 serial I/O ports:

> 1,695

6602B Processor Board • NCF processor with NSM interface:

> 1,695

6603A Processor Board • PB with 32-bit parallel interface:

> 2,400

6603B Processor Board • PB with 32-bit parallel interface; compatible with DEC DR11 port:

> 2,400

6605A Processor Board • PB high-speed serial synchronous port for Remote Bridge operation:

> 2,400

6606A Processor Board • PB with 6 serial asynchronous ports:

> 1,800

6607A Processor Board • PB with IEEE-488 interface:

> 1,695

6701A Processor Board • Motorola 68000, 8MHz processor with Memory Management Unit (MMU):

> 2,600

6702A Processor Board • Motorola 68000 12MHz processor without Memory Management Unit (MMU):

> 2,500

I/O Module Options for NIU-150

I/O modules provide the user device interface to Network Interface Unit.

6400A Null I/O Option • for NIU-150:

> $15 prch

6401A I/O Module • provides 4 serial/2 parallel ports:

> 500

6401B I/O Module • provides 4 serial synchronous interfaces to DCEs:

> 500

6401C I/O Module • provides 4 serial synchronous interfaces to DTEs:

> 500

6401G I/O Module • provides 4 serial asynchronous interfaces, extended RS-232:

> 500

6401H I/O Module • asynchronous/parallel port interface to DTE:

> 500

6403A I/O Module • provides general purpose 32-bit parallel interface:

> 1,300

6403B I/O Module • provides 32-bit parallel interface; compatible with DEC DR11-W/B:

> 1,300

6405A I/O Module • provides high-speed serial interface:

> 1,300

6406A I/O Module • for network processor board; provides 6 serial asynchronous ports:

> 700

6407A I/O Module • provides IEEE-488 interface:

> 595

Adapters

Adapter converts user interface to specific device requirements.

8403A Adapter • converts 6403 32-bit parallel I/O Module to DEC DR11-W/B interface DMA interface to VAX-11:

> $150 prch

8405A Adapter • for V.35 interface:

> 95

8407A DCE-to-DTE Null Modem • permits 6606A or 6406A 6-channel asynchronous ports to operate as DTEs:

> 65

8410A RS-232 DTE-to-DCE Sync Adapter • for RS-232C DTE interface:

> 65

8411A V.35 Adapter/DTE-to-DCE Sync Adapter • for V.35 DTE interface:

> 95

Gateways & Bridges

Ungermann-Bass supplies a Net/One X.25 Gateway for connection of a Net/One network to an X.25 interface. It can be used to connect Net/One to a Public Data Network or to an X.25 host, see Figure 5.

Local bridges are provided as options for the NIU-2 units. They can connect a baseband network to another baseband network or to a broadband channel or they can interconnect 2 broadband channels on a single network. Bridges extend the capability of Net/One, but are totally transparent to the user. The only traffic that passes over the bridge is that addressed to a unit on the other network. The NIU-2 must be configured with the Local Bridge Software.

Remote bridges can extend the length of Net/One to any distance by configuring NIUs at each end of a communication link with a communication high-speed serial interface and the Remote Bridge Software.

2701A Baseband-Baseband Local Bridge • for NIU-2, 10M bps:

> $9,850 prch

2711A Broadband-Broadband Local Bridge • for NIU-2, 5M bps:

> 9,850

2721A Baseband-Broadband Local Bridge • 10M bps to 5M bps:

> 9,850

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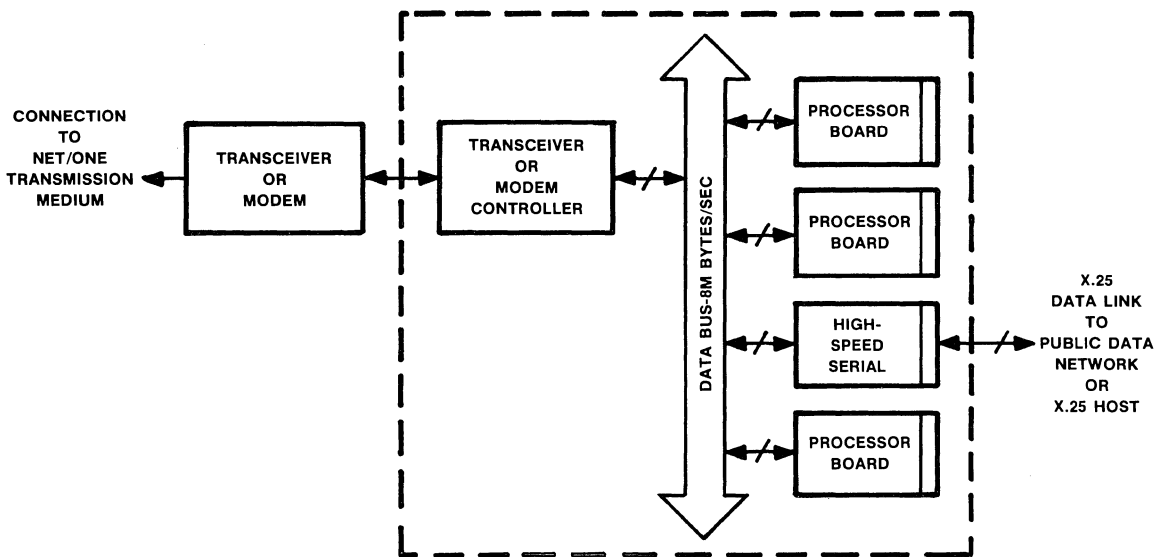## With IBM PC Support

Figure 5 • X.25 Gateway.

2731A Broadband-Baseband Local Bridge • 5M bps to 10M bps:

9,850

Net/One X.25 Gateway • allows a Net/One network to connect to X.25 host link, see Figure 5 • X.25 network can be used to connect 2 remote Net/One networks via Public Data Network (PDN) or to connect a host with X.25 interface to Net/One network, thus eliminating need for multiple asynchronous RS-232C connections on the host • includes multiple microprocessors: 3 function as managers of Net/One Virtual Circuits; a fourth is on a high-speed communication board providing X.25 data link control • hardware is communication media independent, thus it can operate on standard baseband (Ethernet coaxial, thin-coaxial, or optical fiber) cable or broadband cable • operates as Data Terminal Equipment (DTE) when it interfaces to a PDN or as Data Circuit Terminating Equipment (DCE) when connected to X.25 host • provides up to 32 Virtual Circuits per gateway; link speed of 64K bps; internal or external clocking; RS-232C, V.35, or RS-449 interface; DTE or DCE option; PAD parameters recall and data forwarding character in the gateway; other PAD parameters distributed to the terminal NIUs; half-step outgoing call connection, incoming call support; media independent • requires X.25 Gateway Software • see Figure 5.

2401 X.25 Gateway • baseband:

10,025

2411A X.25 Gateway • broadband:

10,090

Network Transceivers, Cables, Connectors, Terminators & Clamps

5201C Network Transceiver (NTRIO) • 10M bps • for Net/One baseband; includes coaxial cable clamp:

$395 prch

5211A Thin Coaxial Transceiver • for use with personal computer network using thin coaxial cable:

395

5216A Optical Transceiver • for use with optical fiber cable for extension of network or interconnection of networks:

1,500

8220A/8230A Network Transceiver Cable • 10-foot cable with lock ports/screws • 10M bps:

50

8221A/8231A Network Transceiver Cable • 20-foot cable with lock ports/screws • 10M bps:

65

8222A/8232A Network Transceiver Cable • 50-foot cable with lock ports/screws • 10M bps:

100

8223A/8233A Network Transceiver Cable • 80-foot cable with lock ports/screws • 10M bps:

140

8224A/8234A Network Transceiver Cable • 164-foot cable with lock ports/screws • 10M bps:

240

8270A Ethernet Cable • PVC, 10 meters:

150

8271 Ethernet Cable • PVC, 100 meters:

600

8272A Ethernet Cable • PVC, 250 meters:

1,350

8273A Ethernet Cable • PVC, 500 meters:

2,600

8280A Thin Coaxial Cable • 3 meters (10.8 feet):

25

8281A Thin Coaxial Cable • 10 meters (32.8 feet):

30

8282A Thin Coaxial Cable • 15 meters (49.2 feet):

45

8283A Thin Coaxial Cable • 30 meters (108.4 feet):

70

8284A Thin Coaxial Cable • 100 meters (328 feet):

170

8301A Coaxial Cable Connector • 2 required for each segment:

12

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8304A Coaxial Cable Terminator ● terminates 1 end; 2 required per network:

18

8307A Coaxial Cable Adapter ● allows connection of 2 cable segments; 1 required per connection:

9

8310A Coaxial Cable Clamp ● permits attachment of transceiver to cable:

10

8311A Coaxial Cable Clamp Plug ● prevents moisture penetration after removing transceiver:

7

8381A BNC Connector:

4

8382A BNC Barrel Connector:

3

8383A BNC Jack to N-Series Jack Adapter:

15

8384A BNC Terminator Pair:

10

8385A BNC T-Adapter:

10

Network Repeaters

5203A Local Network Repeater Unit (NRU-10) ● conforms to Ethernet Specification 1.0 for repeaters which prevent distortion of information when cable is extended beyond a 500-meter (1,500-foot) segment; 2 can be added to end-to-end path to extend Net/One baseband to maximum end-to-end length of 1500 meters (4,500 feet); 100 repeaters can be configured around 1 500-meter segment; operates at standard 10M-bps data rate; see Figure 6:

$1,475 prch

5211A Remote Network Repeater Unit (NRU-10) ○ complements local repeaters to extend cable length between any 2 baseband cable segments with 1,000 meters (3,000 feet) of fiber optic cable for a maximum end-to-end length of 2,500 meters (7,500 feet); 1 Remote NRU is required at each end of the fiber optic link; see Figure 6:

3,100

Broadband Modem & Translators

5311A NIU-150B Network Modem ● single cable system; 5M bps; includes 50-foot drop cable for connection to coaxial cable tap; receives power from NIU; provides 2 separate channels for receive and transmit; channel pairs are 2 and O, 3 and P, 4 and Q, 4A and R, and 5 and S:

$750 prch
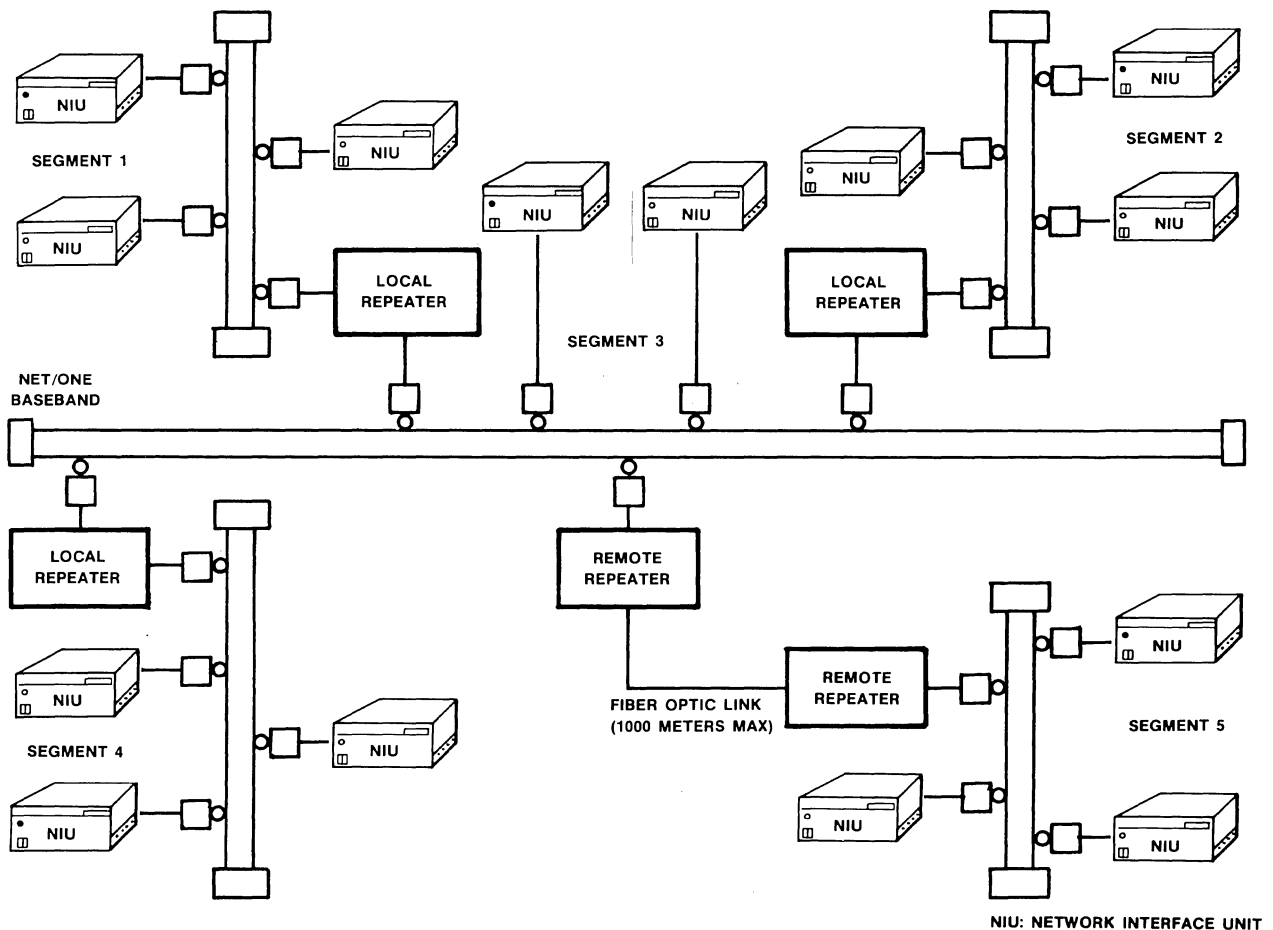
Figure 6 ● typical large-scale Net/One configuration using local and remote repeaters.

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5312A NIU-150B Modem ● same as 5311A except for dual cable system:

5312A NIU-150B Modem ● same as 5311A except for dual cable system: 750

5321A NIU-2B Modem ● same as 5311A except for NIU-2B: 950

5322A NIU-2B Modem ● same as 5321A except for dual cable system: 950

5331A PC NIU Modem ● same as 5311A except for PC NIU: 650

5332A PC NIU Modem ● same as 5331A except for dual cable broadband network: 650

Network Modem Cable ● single 50-foot length included with each NIU-1B or NIU-2B; additional cable available in other lengths.

8320A ● 10-foot modem interface cable; 5M bps: 70

8330A Modem Drop Cable ● 25-foot length: 20

8341A Broadband Cable ● starter kit: 200

5513A/5515A/5517A/5519A/5521A CT-501 Single-Channel Frequency Translators ● translate upstream frequency to downstream frequency for single channel pair: 3 to P, 4 to Q, 4A to R, 5 to S, 6 to T; offset is 192.25 MHz: 3,500

Fiber Optic Components

Ungermann-Bass supplies all the components for a fiber optic network through its Network Design Group. A fiber optic network is generally custom designed, and Ungermann-Bass does not stock fiber optic parts as standard components. The network is designed around star nodes. The company provides 6-port and 14-port Star Nodes for interconnecting fiber optic links from separate buildings or for building a multinode fiber optic Net/One. The star nodes can be used to construct very large networks with up to 1,400 NIUs (33,600 user devices). See Figure 3.

Spares

6210A Broadband/Baseband Transmitter Interface Board (TIB) ● operates at 10M-bps or 5M-bps data rate; used for spare unit: $1,000 prch

6220A Baseband/Receiver Interface Board (RIB) ● 10M bps; spare: 1,290

6225A Broadband/Receiver Interface Board ● 5M bps; spare: 1,290

Series 600 CATV Products

4111A NM-640 Modem ● tabletop version; single cable: $895 prch

4131A NM-640 Modem ● rackmountable version; single cable: 945

4121A NM-640 Modem ● tabletop version; dual cable: 895

4141A NM-640 Modem ● rackmountable version; dual cable: 945

4211A CT-603 Frequency Translator ● 3 channels: 4,000

4221A CT-609 Frequency Translator ● 9 channels: 5,775

4311A TSU-615 Translator Switchover Unit ● for back-up: 950

Rackmounts, Miscellaneous Items

8610A Upgrade Kit ● 4M-bps to 10M-bps data rate on baseband Net/One: $2,000 prch

8650 Baseband Installation Kit: 400

8651A Coring Tool: 20

8652A Tool ● foil shield remover tool: 25

8653A Insulation Piercing Tool: 30

8682A Wall Plate ● 10M bps: 8

8690A Rack Mounting Kit ● NIU-1: 175

8691A Rack Mounting Kit ● NIU-2, NSM-2: 175

8692A Rack Mounting Kit ● NSM-1: 175

8693A Rack Mounting Kit ● NIU-150: 110

8694A Rackmounting Bay ● for NM-640 or 670: 400

■ SPECIFICATION

Net/One is compatible with the Ethernet Specification as defined by Xerox, Intel, and Digital Equipment Corporation and available from Xerox.

Packet Format

Data packets range in size from 72 to 1526 bytes.

Format ● 8-byte preamble, 6-byte destination address, 6-byte source address, 2-byte type field, N-byte data field with 46 greater than or equal to M less than or equal to 1500, and 4-byte CRC ● preamble used for synchronization contains alternate 1s and 0s ending in 2 1s ● destination and source addresses are long to provide unique addresses when a local Ethernet network functions as a subnetwork in a larger global distributed network; type field also included for use in a larger network, not used by Ethernet ● minimum data field ensures that valid packets can be distinguished from collisions ● CRC (cyclic redundancy check) is calculated on the destination and source address, type, and data fields ● minimum spacing between packets is 9.6 microseconds ● any sequence of bits shorter than minimum packet size is discarded as collision fragment.

Transmission Characteristics

Channel Encoding ● uses Manchester encoding to ensure a transition for every bit position; transmits complement of the bit value in first half of bit time and true value in second half.

Data Rate ● 10M bps equals 100 nanoseconds per bit on Net/One baseband, and 5M bps or 200 nanoseconds per bit on each Net/One broadband channel.

Carrier ● signaled by presence of transitions on the cable; if no transition within 75 to 125 nanoseconds after last transition the carrier is lost, meaning the cable is free for another transmission.

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Control Procedures

Control procedures follow the CSMA/CD scheme to control accesses to the channel from the 1024 stations that can be connected to the cable. Only 1 station can transmit at a time, thus before transmission a station must determine if the channel is free. This is done by sensing the carrier on the line. During carrier absence, the station can transmit after waiting the minimum time between packets.

If a station starts to transmit, its data may collide with data from another station that also listened, determined no carrier was present, waited, then transmitted data. When this occurs, the collision is detected and each transmission is aborted. A jam of 4 to 6 bytes of arbitrary data is transmitted to make sure all stations detect the collision.

Each station then backs off and waits for a random retransmission time interval calculated using a backoff algorithm before trying to transmit again. A station will attempt to transmit its data 16 times. Further attempts are dependent on software control. The remote possibility of continued collisions that prevent delivery of a message makes Ethernet a datagram service.

Defer ● a station defers transmission until 9.6 microseconds after carrier is dropped.

Transmit ● when not deferring, a station can transmit until its message is complete or until it detects a collision.

Abort ● when collision is detected, the transmission is aborted and a jam sequence transmitted.

Retransmit ● after an abort, the station waits for a random length of time, then attempts to retransmit ● random number lies in range from 0 to 1023.

Backoff ● retransmission delay calculated using Truncated Binary Exponential Backoff Algorithm; calculates random number in range from 0 to 2 raised to the nth power minus 1 for n less than or equal to 10 where n is the retransmission attempt number; for attempts 11 to 15, 2 raised to the nth power is truncated to 1023 ● time interval before retransmission is 51.2 microseconds times random number generated.

Transmission Medium

Net/One baseband uses Ethernet coaxial cable with terminators at each end of the transmission medium. Impedance is 50 ohms. Cable segments can be up to 500 meters (1,500 feet) long. Standard pressure taps provide for connection to cable. All stations interface to cable through transceivers. Up to 255 transceivers can connect to 1 cable segment. Transceivers must be at least 2.5 meters apart. Net/One broadband uses standard 300-MHz coaxial cable and radio frequency (RF) transmission. Frequency division multiplexing (FDM) techniques produce 5 broadband channels on a single channel pair. Transmit bandwidth is 30 MHz. Transmit frequencies range from 53.75M to 83.75 MHz; receive frequencies range from 246M to 270 MHz. Transmit/receive frequency separation is 192.25 MHz. Channel spacing is 6 MHz. The system is designed using dual cable or midsplit cable technology with either a single channel or 5-channel (block) translator at the head-end. All devices connect to the cable through an RF modem tuned to a single channel pair for transmit and receive frequencies. Each Net/One broadband channel can accommodate a maximum of 255 devices.

The Personal Connection network can use the standard Ethernet-compatible baseband cable, broadband cable, fiber optic cable, or thin coaxial cable.

The NIU provides an intelligent interface to the cable for broadband, baseband, and Personal Connection Net/One networks.

Use

Net/One has been designed to interconnect data processing and word processing personal computer systems in an automated office environment. It can also be used to interconnect equipment in a factory or industrial plant.

To date, the only specific interface Ungermann-Bass has developed is an adapter for Digital Equipment's DR11-W interface. Other general-purpose interfaces include IEEE-488, RS-232, and 32-bit parallel. An IBM SNA interface/gateway is scheduled for April 1984.

● **END**

Universal Data Systems (UDS) Modems
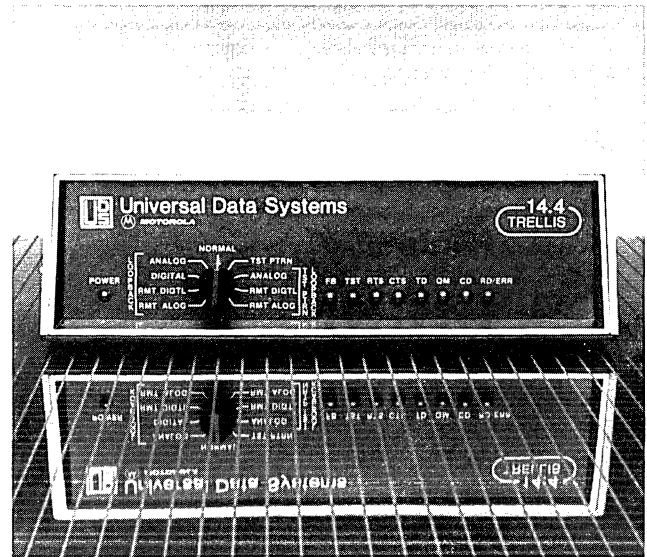## 103, 201, 202, 208, 224, 9600 & 14.4 Trellis Series

■ PROFILE

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

Communications/Networks • 300-bps AT&T 103/113 compatible for the DDD network; point-to-point or multipoint over unconditioned 2-wire dedicated Type 3002 facility • 1200-bps AT&T 202 compatible for the DDD network; 1200-bps AT&T 202 compatible and non-AT&T compatible point-to-point or multipoint over unconditioned 2- or 4-wire dedicated Type 3002 facility; 1800-bps AT&T 202 compatible point-to-point or multipoint over C2 conditioned or unconditioned 2- or 4-wire dedicated Type 3002 facility • 2400-bps AT&T 201 compatible for the DDD network; point-to-point or multipoint over unconditioned 2- or 4-wire dedicated Type 3002 facility • 2400-bps CCITT V.22 bis compatible for the DDD network; point-to-point over unconditioned 2-wire dedicated Type 3002 facility • 4800-bps AT&T 208A/B compatible for the DDD network; point-to-point or multipoint over C2 conditioned or unconditioned 2- or 4-wire dedicated Type 3002 facility ● 9600-bps CCITT V.29 compatible over unconditioned 4-wire dedicated Type 3002 facility; 9600 bps over DDD network • 14.4K-bps point-to-point operation over unconditioned 4-wire dedicated Type 3002 facility.

First Delivery • 1980 (103 O/A LP, 103J LP); 1981 (202LP, 202S LP, 201B, 201C, 208A/B); 1982 (113D, 103J, 202T, 202S, 202S/SS, 202S/5, 202S/150, 212LP, 212A, RM-113D LP); 1983 (9600 Series); 1984 (224); 1985 (202S/D, 9600FP, 14.4 Trellis).

Units Delivered • approximately 1,500,000 units, all models.

Comparable Systems • principal competition from Anderson Jacobson AJ1233, AJ1234, AJ1235, AJ1256, AJ1259; AT&T 103, 108, 113, 201, 202, 212A, 208A/B, and 209A; Concord Data CDS 224; General DataComm 103A3/J/J-L, 113BR2/C/D, 201C/C-M/-7R, 202S Type 21, 202S/T/9D/-9R, 212A, 2400 ASM, 4802E, 208A/B, and 9604; Paradyne LSI 2400/A/C, LSI

PURCHASE PRICE RANGE

hardware ■ ▬▬

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103 Series
■  $125 to $425
202/212 Series
■  $195 to $545
       201 Series
       ■  $685 to $1.3K
       208 Series
       ■  $1.4K to $2.1K
224 Series
■  $645 to $1.2K
       9600 Series
       ■  $1.7K to $2.6K
          14.4 Trellis
          ■  $2K
   |_____|_____|_____|_____|_____|
  $1K      $2K      $3K      $4K      $5K
```

UNIVERSAL DATA SYSTEMS MODEM PURCHASE PRICING bar graphs cover ranges between "small" and "large" standalone configurations ● **103** small configuration consists of 300-bps AT&T 103-compatible Model 1030/A LP modem; large of Model 103J modem ● **202** small configuration consists of 1200-bps AT&T 202-compatible Model 202LP modem; large of 300-/1200-bps AT&T 212A-compatible Model 212A/D ● **201** small configuration consists of 2400-bps AT&T 201-compatible Model 201B modem; large of 2400-bps AT&T 201-compatible Model 201C modem with optional auto-dialer ● **208** small configuration consists of 4800-bps AT&T 208A/B-compatible Model 208A/B; large of Model 208A/B modem with optional auto-dialer ● **224** small configuration consists of 2400-bps CCITT V.22 bis-compatible Model 224; large of Model 224 with optional auto-dialer ● **9600** small configuration consists of Model 9600; large of Model 9600A/B with optional auto-dialer ● **14.4 Trellis** standard configuration consists of Model 14.4 Trellis 14.4K-bps modem.

The 14.4 Trellis model utilizes trellis-coded modulation for improving transmission reliability at data rates of 14.4K bps.

48, and LSI 96; Penril 300/1200, 1800 DED, 2400 LSI, 4800 DCM, and 9629 LSI; Prentice P103/P113, P201C, P212A/C, P202A/T, P-V.27/4800; Racal-Milgo MPS 48/4801 and MPS 9601; Racal-Vadic VA300, VA1200, VA2400, and VA3400 Series; Case Rixon R2424, T103J, T108, T113C, T212A, TA201C, T202S/T, T208A/B, and T209A.

Vendor • Universal Data Systems, Inc (UDS), Subsidiary of Motorola, Inc; 5000 Bradford Drive, Huntsville, AL 35805 o 205-837-8100.

Canadian Distribution • Universal Data Systems Limited; 200 Consumers Road, Suite 200, Willowdale, ON M2J 4R4 ● 416-495-0008.

Distribution • worldwide via UDS representatives and stocking distributors.

GSA Schedule • listed.

■ ANALYSIS

Over the past year, Universal Data Systems has expanded its modem family by adding 3 new models and by releasing more compact versions of several existing models. The additions comprise the AT&T-compatible Model 202S/D, and non-AT&T-compatible high-end 9600 fast poll and 14.4 trellis-coded models. The 9600FP modem is a fast-training model which is designed for use on multipoint networks and boasts an 8-millisecond RTS/CTS delay. The new 14.4 Trellis modem joins the ranks of other sophisticated trellis-coded offerings from leading vendors such as Codex, Paradyne, and General DataComm by providing 14.4K-bps data transmission over unconditioned private lines. Aside from the new offerings, UDS has also introduced microprocessor-based, compact versions of AT&T-compatible Models 201B, 201C, 212A, and 212A/D. Intended to fit underneath a telephone base, the new UDS mini-box housing will

Universal Data Systems (UDS) Modems
103, 201, 202, 208, 224, 9600 & 14.4 Trellis Series

attract users with space savings considerations.

UDS has also unveiled its initial personal computer modem products during the past year. The new series of low-speed modems features Hayes compatibility and consists of Fastalk Models 300, 1200, and 1200PC. Designed for use with IBM PC, XT, and AT computers and compatibles, the Fastalk series includes a communication software package entitled SignOn, yet also functions with a variety of other software programs currently on the market. Priced at $345, Fastalk 300 is compatible with AT&T 103 modems and supports an assortment of functions encompassing automatic dial with auto-select of tone or pulse dialing modes; automatic answer; call progress detection; and a unique voice/data toggle capability that allows the user to switch from voice to data and back again without having to redial. Incorporating the aforementioned Fastalk 300 features, Fastalk models 1200 and 1200PC also provide automatic answer with automatic switching between 1200 and 300 bps. Both priced at $525, the Fastalk 1200 is a standalone modem whereas the Fastalk 1200PC is a plug-in card for the IBM PC. In response to the persistent influx of new modems in the marketplace, UDS has not only added to its current lineup but has slashed prices on selected models. As part of its competitive maneuvering over the past year, UDS has reduced pricing on its AT&T 212-compatible modems by 15 percent for the 212A/D and up to 33 percent for the 212LP. Pricing for Model 208A/B was also decreased by 17 percent. Further price reductions include a 25 percent decrease on Model 9600A/B, a 30 percent decrease on Model 9600, and a 35 percent decrease on Model 224.

The UDS family of modems support data rates up to 1200/1800 bps, 2400 bps, 4800 bps, 9600 bps, and 14.4K bps. Low- to medium-speed units provide end-to-end compatibility with AT&T 103/108/113, 201, 202, 212A, and 208A/B modems. UDS users have the benefit of increased flexibility and added features over equivalent AT&T modems; in addition, UDS models offer significant cost reductions over their AT&T counterparts. The 9600 Series offers economical, no-frills 9600-bps performance with CCITT V.29 compatibility for 4-wire operation; the 2-wire variant is compatible with itself and with Codex "E" Series modems, which are OEM versions of the UDS 9600s. The UDS 9600A/B is currently one of the fastest dial-up modems available, although it operates in half-duplex mode. Standalone packaging is standard for almost all UDS modems, and most models are available in rackmount versions for central-site installation. All models specifically designed for dial-up applications are FCC registered for direct connection to the DDD network.

UDS is a premier AT&T-compatible vendor with a reputation for high quality and innovation. In an industry segment where reliability is becoming the rule rather than the exception, UDS modems are extremely long-lived and consistently beat their competition in users' performance ratings. Line-powered (LP) models are an example of UDS attention to user needs, allowing the modem to derive operating power directly from the phone line.

UDS also markets a line of limited-distance modems, line drivers, and statistical multiplexers which the company OEMs from other manufacturers. Five limited-distance modems offer speeds and distances of up to 19.2K bps at up to 23 miles; 2 line drivers support data rates up to 100K bps at distances up to 1.5 miles. Four models of statistical multiplexers are available with 2 to 8 channels. These devices augment UDS' extensive line of long-haul modems, providing a single-vendor solution for a wide variety of user applications.

UDS sells modems directly through a network of nationwide representatives and stocking distributors. Faulty modems are usually returned to the factory in Huntsville, Alabama for repair, although some distributors offer maintenance contracts and/or leasing terms. The availability and cost of leasing and maintenance contracts vary among distributors offering such services.

☐ Strengths

UDS modems are designed to suit a variety of user needs. Part of its success is based on its ability to offer high-quality AT&T-compatible modems with added features and at substantial cost savings over equivalent AT&T models. The addition of new low-price 9600-bps models and the release of the new 14.4 Trellis model further reinforces this vendor's competitive stance. The 14.4 Trellis modem represents an emerging class of high-speed modems designed to provide reliable data transmission at rates above 9600 bps. Other leading-edge vendors including Paradyne, Codex, and General DataComm have already introduced new models that employ trellis-coded modulation for improving transmission accuracy at high speeds.

The fast poll capability of the 9600FP modem is an important consideration for multipoint networks. It significantly reduces the time lost to training time delays, which can be substantial where there are many drops per line. Users with heavy volume traffic conditions will appreciate the inclusion of the 9600FP into the UDS lineup.

Product reliability is exceptional, with newer models in the UDS stable demonstrating an estimated MTBF on the order of 80,000 to 100,000 hours; this equates to 9 to 11 years of continuous operation without a failure. On-going innovation promises to keep UDS near the top of the industry with breakthroughs such as line-powered modems, which delete the need for separate power cords and AC outlets. Another important plus is the integral anti-streaming option resident in Models 201B, 202T, 208A/B, 9600 A/B, and 9600FP; this feature enables a streaming modem to remove itself from the network, an important benefit for multipoint-polled communication.

☐ Limitations

There are no serious limitations to the UDS product line as it stands, although a point or two is worth noting. The 208A/B at 4800 bps does not permit fallback to a lower data rate, a maneuver which could relieve intolerable error rates on degrading or substandard communication lines. UDS does not provide an integral auto-dial option for most of its modems (the 212A/D is the only one that has it), which could be an inconvenience for some users. Model 224 can be equipped with front panel switch for leased line/dial-up selection, but this function is relegated to an internal strap when the modem is optioned for auto-answer. Another inconvenience is the lack of a rackmount card-modem version for the 9600A/B, a limitation for large-quantity modem users.

Although the 14.4 Trellis is a valuable addition to the diversified UDS lineup, it does lack several capabilities found on competing products such as multiport support, redundancy, and network diagnostic control. A primary benefit of alternative high-speed offerings from Paradyne, Codex, and General DataComm is the advantage of network control, which aids in the elimination of excessive downtime.

■ HARDWARE

☐ Terms & Support

Terms ● OEM purchase through Universal Data Systems' regional representatives; end-user purchase or lease only through UDS stocking distributors ● maintenance contracts not available from UDS ● 1-year warranty on all models ● quantity discounts for 10 or more purchased units.

Support ● all models installed by user ● modems under warranty repaired free of charge; out-of-warranty repair incurs a one-time equipment charge with faulty modem sent to the factory in Huntsville, Alabama; out-of-warranty repair for RM-17, RM-16, and RM-8 card nests charged on the basis of time, material, and shipping ● UDS maintains a spare parts bank; Federal Express service swaps user's defective unit for a working replacement within 12 to 24 hours; user charged for Federal Express only ● maintenance contracts available from some UDS stocking distributors ● 25 stocking distributors provide end-user sales, some with service, from approximately 300 different locations.

☐ Overview

UDS modems are aimed at the low end of the AT&T-compatible market, and the high-speed non-AT&T-compatible market. Only 1 low-speed model, the 202S/SS, is not an AT&T replacement. The 103, 202, 201, and 208 Series modems offer significant advantages over their AT&T counterparts. Additional features

Universal Data Systems (UDS) Modems
103, 201, 202, 208, 224, 9600 & 14.4 Trellis Series

include integral 5- and 150-bps secondary channels for Models 202S/5 and 202S/150, respectively, and line-powered models which delete the need for a separate power source.

Model 224 is a CCITT V.22 bis-compatible modem featuring 2400-bps full-duplex operation over dial-up networks or 2-wire dedicated circuits. It functions in a 1200-bps AT&T 212-compatible fallback mode, and automatically detects and adjusts itself to 212 operation when on the receiving end.

The new 9600 fast-poll modem is designed for use on multipoint networks requiring fast turnaround times. It features an 8-millisecond RTS/CTS delay, a fallback mode that allows the user to change data rate to 4800/7200 bps, an automatic adaptive line equalizer, and an antistreaming capability. A train-on-data feature permits the addition of tributary modems to a network without interrupting network operations.

The new 14.4 Trellis modem is the only UDS product to utilize trellis-coded modulation for reducing modem sensitivity to line distortion on unconditioned lines. Designed to support a maximum data rate of 14.4K bps, the 14.4 Trellis provides fallback rates of 12K bps and 9600 bps. At 9600 bps, the 14.4 Trellis is compatible with CCITT V.29 standard.

All models except the RM-113D LP and RM-113D are packaged as standalone versions, and most of these are available as rackmountable PC cards for central-site card nests. UDS offers an optional, separately packaged auto-dialer for all but the answer-only modems; auto-answer is a standard feature on appropriate models. Model 212A/D contains an integral auto-dialer. All 6 series include models for leased-line applications as well as direct-connect modems for the DDD network.

103 Series • point-to-point and multipoint AT&T 103-/113-compatible modems with data rates up to 300 bps.

202 Series • point-to-point and multipoint AT&T 202-/212-compatible and non-AT&T-compatible modems with data rates up to 1800 bps.

201 Series • point-to-point and multipoint AT&T 201-compatible modems with fixed data rates at 2400 bps.

208 Series • point-to-point and multipoint AT&T 208A-/208B-compatible modems with fixed data rate at 4800 bps.

224 Series • point-to-point 2-wire or dial modem with data rates at 2400 bps and 1200 bps, fallback.

9600 Series • point-to-point and multipoint 2-wire (CCITT V.29 compatible) and 4-wire modems with data rates at 9600 bps and 7200/4800 bps, fallback.

14.4 Trellis • point-to-point communication over 4-wire dedicated Type 3002 voice channel with data rates of 14.4K bps and fallback rates of 12K bps and 9600 bps.

☐ Packaged Modems

Standalone packaging standard for all models; models 103J, 202S LP, 202D, 202S, 202S/SS, 202S/5, 202S/150, 201B, 201C, 208A/B, and 9600 available in a modem card, rackmount version for central-site card nesting • central-site card nests fit standard 19-inch equipment rack.

103 Series AT&T 103-/113-Compatible Modems

Model 103 O/A LP • standard DDD direct-connect 300-bps standalone modem with manual originate and answer mode:

$125 prch	$35 maint

Model 103J LP • same as model 103 O/A LP except with automatic answer mode:

165	175

Model RM16-113D • standard 2-wire dedicated or DDD connect (via DAA) 300-bps rackmount modem with automatic answer-only mode • inserts in RM16 enclosure:

235	40

Model RM8-113D • same as Model RM16-113D except inserts into RM-8 enclosure:

260	40

Model 103J • standard 2-wire dedicated or DDD direct-connect 300-bps standalone modem with manual originate and automatic answer mode:

425	55

Model RM16-103J • same as Model 103J except contained on single PC card for rackmounting • inserts in RM16 enclosure:

275	40

Model RM8-103J • same as Model 103J except contained on single PC card for rackmounting • inserts in RM-8 enclosure:

300	55

Model 108 • standard 2- or 4-wire dedicated 300-bps standalone modem with manual originate or answer mode • AT&T 103 compatible:

295	55

Model RM16-108 • same as Model 108 except contained on single PC card for rackmounting • inserts in RM-16 enclosure:

195	55

202/212 Series Modems

Model 202LP • standard DDD direct-connect 1200-bps standalone modem with manual originate mode • AT&T 202 compatible:

$195 prch	$55 maint

Model 202S LP • same as Model 202SP except with automatic answer mode:

245	55

Model 202T • standard 2- or 4-wire dedicated 1800-bps standalone modem • AT&T 202 compatible:

425	55

Model RM16-202T • same as Model 202T except contained on single PC card for rackmounting • inserts in RM16 enclosure:

275	55

Model 202S • standard 2- or 4-wire dedicated or DDD direct-connect 1200-bps standalone modem with manual originate and automatic answer mode • AT&T 202 compatible:

475	55

Model 202S/D • standard 2-wire DDD direct-connect 1200-bps standalone modem with manual and automatic answer and automatic dialer modes • AT&T 202 compatible:

495	55

Model RM16-202S • same as Model 202S except contained on single PC card for rackmounting • inserts in RM16 enclosure:

325	40

Model RM8-202S • same as Model 202S except contained on single PC card for rackmounting • inserts in RM8 enclosure:

350	55

Model 202S/SS • standard 2- or 4-wire dedicated or DDD direct-connect 1200-bps asynchronous or 600-/1200-bps synchronous standalone modem • non-AT&T compatible:

550	55

Model 202S/5 • standard 2- or 4-wire dedicated or DDD direct-connect 1200-bps standalone modem with 5-bps secondary channel • AT&T 202 compatible:

550	55

Model 202S/150 • same as Model 202S/5 except includes 150-bps secondary channel:

620	55

Model 212LP • standard DDD direct-connect 1200-bps standalone modem with manual originate and answer modes •

PRCH: single-unit purchase price. MAINT: one-time factory repair charge for purchased units out-of-warranty. NC: no charge. NA: pricing not announced or not available to date. Prices are current as of August 1985.

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AT&T 212 compatible at 1200-bps data rate:

295	75

Model 212A ● standard 2-wire dedicated or DDD direct-connect 300-/1200-bps standalone modem ● AT&T 103/113/212 compatible:

495	75

Model RM8-212A ● same as Model 212A except contained on single PC card for rackmounting ● inserts in RM8 enclosure:

495	75

Model 212A/D ● same as Model 212A except includes integral automatic dialer and stores up to five 30-digit numbers or operatives entered from terminal keyboard; calls executed upon keyboard command:

545	75

201 Series AT&T 201-Compatible Modems

Model 201B ● standard 2- or 4-wire dedicated 2400-bps standalone modem ● AT&T 201B compatible with manual answer mode:

$685 prch	$55 maint

Model RM16-201B ● same as Model 201B except contained on single PC card for rackmounting ● inserts in RM16 enclosure:

545	40

Model RM8-201B ● same as Model 201B except contained on single PC card for rackmounting ● inserts in RM8 enclosure:

570	40

Model 201C ● standard 2- or 4-wire dedicated or DDD direct-connect 2400-bps standalone modem ● AT&T 201C compatible with automatic answer mode:

685	55

Model RM16-201C ● same as Model 201C except contained on single PC card for rackmounting ● inserts in RM16 enclosure:

595	40

Model RM8-201C ● same as Model 201C except contained on single PC card for rackmounting ● inserts in RM8 enclosure:

595	40

208 Series AT&T 208-Compatible Modem

Model 208A/B ● standard 2- or 4-wire dedicated or DDD direct-connect 4800-bps standalone modem ● AT&T 208 Series compatible with automatic answer mode:

$1,450 prch	$75 maint

Model RM8-208A/B ● same as Model 208A/B except contained on single PC card for rackmounting; inserts in RM-8 Enclosure only:

1,300	75

224 Series CCITT V.22 Bis-Compatible Modem

Model 224 ● standard 2-wire dedicated or DDD direct-connect 2400-bps modem with manual originate and manual/automatic answer modes ● CCITT V.22 bis compatible at 2400 bps; AT&T 212A-compatible fallback rate at 1200 bps ● standalone only:

$645 prch	$175 maint

9600 Series Modems

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

$1,658 prch	$175 maint

Model RM8-9600 ● same as Model 9600 except contained on single PC card for rackmounting ● inserts in RM8 enclosures:

1,550	175

Model 9600A/B ● standard 2- or 4-wire or DDD direct-connect 9600-bps modem ● CCITT V.29 compatible in 4-wire mode; automatic answer in 2-wire mode:

1,995	175

Model 9600FP ● standard 4-wire, dedicated 9600-bps fast-poll modem ● CCITT V.29 compatible in point-to-point mode:

1,995	175

14.4 Trellis

Model 14.4 Trellis ● standard 4-wire, dedicated 14.4K-bps modem ● CCITT V.29 compatible in 9600 mode:

$3,950 prch	NA maint

Modem Enclosures

Model RM-16 Multiple Modem Enclosure ● 16-slot card nest accommodates any combination of up to sixteen 103, 202, 201, and 208 Series PC card modems and/or automatic calling units (ACUs) ● requires 1 PS-16 power supply, or 2 PS-16s for dual redundancy backup ● fits standard 19-inch equipment cabinet:

$750 prch	NA maint

PS-16 ● power supply for RM-16 Enclosure:

250	50

Model RM-8 Multiple Modem Enclosure ● 9-slot card nest accommodates up to 8 103, 202, 201, 208, and 9600 Series modems; 1 slot dedicated for ACU use only, but unit can accommodate up to 9 ACUs ● requires 1 PS-8 power supply, or 2 PS-8s for dual redundancy backup ● fits standard 19-inch equipment cabinet:

1,500	NA

PS-8 ● power supply for RM-8 Enclosure:

500	95

Model RM-1 Rack Adapter ● adapts standalone modem models 103J, 202S, 208A/B, 201C, 9600, and 9600A/B for insertion in standard 19-inch equipment cabinets:

75	NA

Model RM1L Rack Adapter ● adapts standalone modem models 108, 201B, 202T, 212A, 212A/D, 224, and standalone models 801 and 701 for insertion in standard 19-inch equipment cabinets:

75	NA

☐ Application

103 Series

Models 103LP O/A, 103J LP & 113LP ● designed for operation over the DDD network.

Models 113D ● point-to-point and multipoint communication over unconditioned 2-wire dedicated Type 3002 voice channel, or over the DDD network with a data access arrangement (DAA).

Model 103J ● same as Models 113D, but includes FCC certification for direct connection to the DDD network without a DAA.

Model 108 ● point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel ● selectable 8.5/50/150-millisecond training time (CTS) delay.

202 Series

Models 202LP, 202S LP & 212LP ● designed for use on the DDD network.

Model 202T ● point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel, up to 1200 bps; C2 conditioning required at data rates to 1800 bps.

Models 202S, 202S/D, 202S/SS, 202S/5, 202S/150, 212A & 212A/D ● point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel, or over the DDD network.

201 Series

Model 201B ● point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel ● selectable 8.5-/150-millisecond training time (CTS) delay.

Model 201C ● same as Model 201B, but can also be used on the DDD network ● selectable 8.5/25/150-millisecond training time

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(CTS) delay.

208 Series

Model 208A/B • point-to-point and multipoint communication over unconditioned or C2 conditioned 2- or 4-wire dedicated Type 3002 voice channel, or over the DDD network • selectable 8.5/50/150-millisecond training time (CTS) delay.

224 Series

Model 224 • point-to-point communication over unconditioned 2-wire dedicated voice channel, or over the DDD network.

9600 Series

Model 9600 • point-to-point and multipoint communication over unconditioned 4-wire dedicated Type 3002 voice channel • 100-millisecond training time (CTS) delay.

Model 9600A/B • point-to-point and multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 voice channel or over the DDD network • training time (CTS) delay at 253 milliseconds, 4-wire mode; selectable 30/50/150 milliseconds, 2-wire mode.

Model 9600FP • multipoint communication over unconditioned 4-wire dedicated Type 3002 voice channel • training time (CTS) delay at 8 milliseconds; 253-millisecond training time delay in CCITT V.29 mode.

14.4 Trellis

Model 14.4 Trellis • point-to-point communication over 4-wire dedicated Type 3002 voice channel • training time delay at 253 milliseconds.

□ Operating Parameters

103 Series

All Models • asynchronous full-duplex at rates up to 300 bps • FSK modulation • compromise (statistical) equalization.

202/212 Series

Models 202LP & 202S LP • asynchronous half-duplex at rates up to 1200 bps • FSK modulation • compromise (statistical) equalization.

Models 202S, 202S/D, 202S/5 & 202S/150 • asynchronous half-/full-duplex at rates up to 1200 bps • FSK modulation • compromise (statistical) equalization.

Model 202T • asynchronous half-/full-duplex at rates up to 1800 bps • FSK modulation.

Model 202S/SS • asynchronous half-/full-duplex at 600/1200 bps, or synchronous half-/full-duplex at 1200 bps • FSK modulation • compromise (statistical) equalization.

Models 212A, 212A/D & 212LP • asynchronous full-duplex at rates up to 300 bps; FSK modulation • synchronous full-duplex at 1200 bps; PSK modulation (212A, 212A/D only) • compromise (statistical) equalization.

201 Series

201B & 201C • synchronous half-/full-duplex at 2400 bps • PSK modulation • compromise (statistical) equalization.

208 Series

Model 208A/B • synchronous half-/full-duplex at 4800 bps • PSK modulation • automatic adaptive equalization.

224 Series

Model 224 • asynchronous or synchronous full-duplex at 2400 bps, CCITT V.22-bis mode; asynchronous or synchronous full-duplex at 1200 bps, AT&T 212 mode • accepts 6- through 9-bit data codes with 1 start bit, 1 stop bit; parity transparent; data may include additional stop bits • 16-point QAM modulation at 2400 bps; 4-point QAM modulation at 1200 bps • automatic adaptive equalization at receiver; nonstrappable compromise equalization at transmitter.

9600 Series

Model 9600 • synchronous full-duplex at 9600/7200/4800 bps; rear-panel fallback rate switch • QAM modulation; 8 phase, 4 amplitude per CCITT V.29 • automatic adaptive equalization.

Model 9600A/B • synchronous half- or full-duplex (2- or 4-wire) at 9600/7200/4800 bps; rear-panel fallback rate switch • QAM modulation; 8 phase, 4 amplitude per CCITT V.29 • automatic adaptive equalization.

Model 9600FP • synchronous full-duplex (4-wire) at 9600/7200/4800 bps; rear panel fallback rate switch • QAM modulation; 8 phase, 4 amplitude per CCITT V.29 • automatic adaptive equalization.

14.4 Trellis

Model 14.4 Trellis • synchronous full-duplex (4-wire) at 14.4K/12K/9600 bps; rear panel fallback rate switch • trellis-coded modulation • automatic adaptive equalization.

□ Channel Functions

5-bps Reverse Channel • 0- to 5-bps half-duplex, amplitude-modulated channel • provides control path for supervisory control or line turnaround commands • operates independently of the primary channel • standard feature on Model 202S/5 only:

NC prch	NC maint

150-bps Reverse Channel • asynchronous 0- to 150-bps half-duplex, FSK modulated channel • provides control path for supervisory control or line turnaround commands • operates independently of the primary channel • standard feature on Model 202S/150 only:

NC	NC

210 A/S Asynchronous to Synchronous Converter • standalone unit converts asynchronous protocols into synchronous format; allows asynchronous terminals to operate with synchronous modems • accommodates 7- through 9-bit codes at 1200/2400/4800/9600-bps synchronous data rates • compatible with all terminals and modems:

250	NA

Local Copy • all UDS modems include strap-selectable local copy option; echoes data back to DTE for local print-out • standard feature included in package price:

NC	NC

Digital Interface • EIA RS-232C/CCITT V.24; 25-pin electrical connector • Models 103 O/A LP, and 103J LP also include 20-mA or 60-mA current-loop interface; 9-pin electrical connector.

□ Control Functions

Model 701 Modem Sharing Device • standalone unit allows up to 4 terminals to share a single modem, one at a time • asynchronous or synchronous, 0 to 9600 bps • front panel LEDs monitor channel activity (on/off) • internal buffering accommodates separate terminal and modem clocks • RS-232C electrical interface ports:

$475 prch	$55 maint

FCC-Registered Modems • all UDS modems specified for the DDD network are FCC registered for direct connection under FCC Rules Part 68 • does not require separate Data Access Arrangement (DAA) • standard feature included in modem pricing:

NC	NC

Data Access Arrangement (DAA) • FCC-certified wall-mounted units allow connection of UDS and other vendor equipment to the DDD network • required for non-FCC certified devices.

Model 1001F • DAA for auto-answer modems • requires 115 Volts-AC power source; includes transformer:

165	20

Model 1001D • DAA for auto-answer modems; requires 24 Volts-DC power source:

145	20

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Model 1000A • DAA for manual answer modems; receives power supply from TelCo line, eliminating the need for separate power source:

110	20

Line-Powered Modems • LP model modems derive power from TelCo telephone line; does not require separate power cord or power supply • standard feature on Models 103 O/A LP, 103J LP, RM-113LP, 202LP, 202S LP, and 212LP:

NC	NC

Alternate Voice/Data • all direct-connect and dedicated modems can be equipped for alternate voice/data by attaching TelCo telephone, Data Phone, or UDS 500 Series telephones • UDS 500 Series includes exclusion key for voice/data operation; can be colocated with modem, or located separately.

Model 501 • pulse dial telephone for use with direct-connect modems:

85	NA

Model 502 • pulse dial telephone for use with modems requiring DAA:

85	NA

Auto-Answer (Automatic Answer) • Models 103J LP, RM-113LP, RM-113D, 103J, 202S LP, 202S, 202S/SS, 212A, 212A/D, 201C, 208A/B, 224, and all rackmount (RM) variants of the preceding models include integral automatic answer function • standard feature:

NC	NC

EC100 Error Controller • standalone unit provides end-to-end error control by inserting a CRC-16 check character into the data stream; automatically retransmits errored blocks of data • accepts asynchronous terminal input at data rates from 150 to 9600 bps; 7 or 8 bits per data character, not including parity; supports asymmetrical data rates from terminal equipment at each end • transmits synchronously full-duplex at 1200 bps through AT&T 212A modem, or synchronously half-duplex at 2400/4800/9600 bps through half-duplex modems; simulates full-duplex operation • positive acknowledgement sliding window protocol allows multiple outstanding blocks; includes 4K-byte data buffer • XON/XOFF or CTS/pin 11 flow control • includes power on and retransmission status indicators • EC100 unit required at each end of transmission:

495	NA

Failure Recovery • provides immediate recovery from dedicated 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.

Model 720 Dual Dial Backup Unit • standalone unit switches dedicated line modem to 2 DDD line pairs automatically or manually upon dedicated line failure • battery-backed memory stores phone numbers for automatic dial operation • auto self-test upon power up:

695	NA

Auto-Dial (Automatic Originate) • all UDS models, excluding RM-113LP and 113D, can accommodate an external Model 801 automatic calling unit (ACU) • standalone or rackmount configuration for single or multiple lines; FCC certified • provides automatic dialing for CPU or terminal originated calls using pulse or tone dialing • supports tandem dialing • compatible with both direct-connect or non-FCC registered modems.

Model 212A/D Auto-Dial • Model 212A/D includes an integral automatic dialer with battery-backed memory; stores up to five 30-digit telephone numbers • displays menu of modem commands on operator terminal; single keystroke dialing; supports linked numbers for alternate dialing • continuous number dialing; automatic redial of last number • pulse or tone dialing • standard feature, Model 212A/D only:

NC	NC

Model 801A/C • standalone pulse dial (801A) or tone dial (801C) ACU with RS-366 parallel interface • AT&T 801 compatible:

620	40

Model 801AS or 801CS • standalone pulse dial (801AS) or tone dial (801CS) ACU with RS-232C serial interface • non-AT&T compatible:

550	40

Model RM16-801A or RM16-801C • single PC card ACU with pulse dial (RM801A) or tone dial (RM-801C) • RS-366 parallel interface • for insertion in RM-16 or RM-8 card nests; addresses up to 60 RM-16 card modems from 2 computer ports; each additional card nest, up to 4 maximum per rack, requires one RM-801A or RM-801C • AT&T 801 compatible:

400	40

Model RM8-801A or RM8-801C • same as above, except addresses up to 24 RM8 card modems from 2 computer ports • fits RM8 enclosure:

425	40

Model RM16-801AS or RM16-810CS • same as RM-810A or C but contains RS-232C serial interface; addresses up to 60 card modems from one computer port • non-AT&T compatible:

550	40

Model RM8-801AS or RM8-801C • same as above, except addresses up to 24 RM8 card modems from 2 computer ports • fits RM8 enclosure:

575	40

Model RM8-800 • rackmounted manual dialer with handset • provides manual selection and manual dialing for any modem in RM8 rack enclosure • pulse-dial only • occupies slot in RM8 enclosure:

425	NA

Model RM16-800 • same as RM8-800 except occupies slot in RM16 enclosure:

400	NA

Satellite Delay • integral strap-selectable option inserts 110- (normal), 200-, or 400-millisecond delay to inhibit RTS; enables activation of TelCo echo suppressors for use in satellite links or ground distances greater than 500 miles • standard feature on Models 202S and 201C only:

NC	NC

Anti-Streaming • integral strap-selectable option detects streaming condition; modem automatically disconnects itself from line • standard feature on Models 202T, 201B, 208A/B, and 9600A/B:

NC	NC

New Sync • integral strap-selectable option resynchronizes incoming calls • required in high-volume polling operations when intervals between calls are less than normal 7-millisecond carrier detect (CD) delay • standard feature on Model 208A/B only:

NC	NC

Clock Slaved Timing • integral strap-selectable option on 4-wire models locks received clock signal in phase with outgoing signal; slaves modem tail circuit to that of high-speed modem or multiplexer • standard feature on models 202T, 202S, 202S/SS, 202S/5, 202S/150, 201B, 201C, and 208A/B:

NC	NC

Automatic Disconnects • UDS modems designed for the DDD network, including LP models, contain integral strap-selectable timers that automatically disconnect call upon loss of carrier • models 113D and 103J can also disconnect when remote end fails to answer call • models in the 201, 202, 208 and 212 Series include additional levels of automatic disconnects:

NC	NC

☐ Diagnostic & Status Indicators

Loopback diagnostics isolate failures in local or remote modems, dedicated line, or data terminal equipment (DTE), depending on model • manual control of diagnostics through modem front panel, or from terminal console on models with remote loopback ability • visual indication of operating conditions; visual warning

Universal Data Systems (UDS) Modems
103, 201, 202, 208, 224, 9600 & 14.4 Trellis Series

of abnormal conditions ● line-powered (LP) models do not support loopback diagnostics.

Loopback Tests ● local analog and local/remote digital loopback, all models except LP type:

NC prch	NC maint

Test Pattern Generation ● integral bit pattern generator and error detector performs bit error rate tests ● integral feature on all models except LP-type modems:

NC	NC

Status Indicators ● test mode; circuit quality; EIA interface signal activity ● LP models indicate modem on/off only.

● **END**

Visual Technology Display Terminals
Models V60, V65, V102, V220, V240, V241, V300, V330, V500 & V550

■ PROFILE

Function ● general-purpose, nonprogrammable interactive keyboard-display ASCII terminals ● high-resolution and advanced graphics offered with Models V240, V241, V500, and V550.

Architectures Supported ● any architecture supporting an ASCII terminal; local/remote attachment.

Communications ● half-/full-duplex, asynchronous, 50 bps to 19.2K bps ● point-to-point ● character/block transmission modes ● RS-232C/20-mA current-loop interface.

Operating System ● none.

Database Management ● none; only in conjunction with host facilities.

Transaction Processing Management ● none; only in association with host processor.

Support Software ● third-party graphics software (Models V102, V240, V241, V500, and V550).

Processor ● display-oriented control and communication logic ● local/remote initiated printing.

Terminals/Workstations ● single-keyboard, 1920/2320/2640/3168/3828-character display ● RS-232C auxiliary printer port for local printer attachment.

First Delivery ● 1979.

Systems Delivered ● undisclosed.

Comparable Systems ● competitive with numerous ASCII display terminals including Anderson Jacobson 510/520, Beehive ATL Series, DEC VT100/200 Series, Esprit I and II, Lear Siegler ADM Series, ADDS Viewpoint Series, IBM 3101, and Televideo 900 Series.

Vendor ● Visual Technology Inc; 540 Main Street, Tewksbury, MA 01876 ● 617-851-5000.

Canadian Headquarters ● Ahearn & Soper; 100 Woodbine Downs, Rexdale, ON M9W 5S6 ● 416-675-3999.

Distribution ● sold through local Visual sales offices and distributors.

GSA Schedule ● listed.

■ ANALYSIS

Over the past year, Visual Technology has reacted to the stiff competition in the display terminal marketplace by slashing prices and releasing new DEC-compatible product offerings. Introduced at COMDEX/Fall'84, the V220, V240, and V241

PURCHASE PRICE RANGE   hardware ■■■■

Visual Terminal Series
■■■■■ $595 to $2.2K

| $1K | $2K | $3K | $4K | $5K |

VISUAL TECHNOLOGY DISPLAY TERMINALS PURCHASE PRICING bar graph covers price range between "small" and "large" configurations for hardware products ● maintenance is supported entirely through third parties and must be negotiated ● **SMALL** Model V60 consists of keyboard-display with auxiliary printer port ● **LARGE** Model V241 consists of keyboard-display with auxiliary printer port.

The Visual V240 Display Terminal is a direct replacement model for the DEC VT240 and features 15 programmable function keys, a 2,320-/3,828-character display at 29 lines x 80/132 characters, an 800x290 resolution in ReGIS mode, and a 768x293 resolution in Tektronix 4010/4014 mode.

terminals represent direct replacements for DEC VT200 Series terminals. These cost-effective alternatives are priced at least 30 percent below their DEC counterparts and offer additional capabilities not found on the DEC units. For instance, the Visual V220 terminal features a 14-inch tilt/swivel display and 30 user-programmable function keys as compared to the DEC offering which features a 12-inch tilt/swivel display and 15 user-programmable function keys. The Visual V240 terminal is more compact than the DEC 240 and supports both Tektronix 4010/4014 and ReGIS code sets with 800x290 pixels of resolution compared to DEC's 800x240 pixels. In addition, Visual Technology has released newer, more compact versions of the older V50 and V55 terminals. Dubbed Models V60 and V65, the new units are functionally equivalent to their predecessors but sport streamlined packaging and ergonomic features including a low-profile, detachable keyboard, and a nonglare, tilt/swivel display. Although a Televideo 925-compatible was slated to join this enhanced lineup, preliminary difficulties prevented it from reaching the manufacturing stage and all subsequent development plans have been dropped.

Visual Technology has also responded to the recent rash of display terminal price reductions by lowering prices on all models except for Model V102. Pricing for the remaining models of the Visual display terminal family have been reduced by 13 percent for the mid-range V300/V330 terminals and by 36 percent for the multifunctional V500/V550 terminals.

According to several articles published during the past year, Visual Technology attributed its consecutive quarter losses to poor sales and marketing cost increases of its Commuter portable computer. A company spokesman has indicated that the problems encountered with the Commuter computer has caused
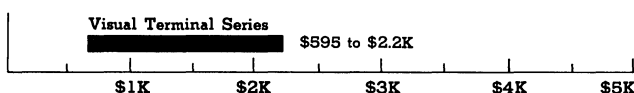
Visual Technology Display Terminals
Models V60, V65, V102, V220, V240, V241, V300, V330, V500 & V550

the firm to strengthen its commitment to the display terminal products.

Finally, Visual Technology signed a preliminary agreement in November which detailed its acquisition by Lee Data Corporation in an exchange for stock valued at $16.8 million. However, the acquisition which would have provided Visual with additional financial and marketing resources, never took place. With a renewed emphasis on enhancing its display terminals, Visual has opted to go it alone.

The Visual Technology family ranges from rudimentary terminals such as Models V60 and V65; to terminals with extended features including Models V300 and V330; to the multifunctional Models V102, V220, V240, V241, V500, and V550 terminals. Models V60 and V65 are the most elementary offerings. Both display 1,920 characters in a standard screen format; the V60 does not permit split-screen layout nor line lock, all scrolling is destructive, and there are few user-programmable function keys; the V65 does have user programmable function keys and split-screen capability. The lack of a split-screen/line-lock facility means that the V60 cannot be used in applications that require comparing different types of data. Such applications generally take the form of establishing a fixed body of data in the screen, and then having the host insert and scroll data in a variable screen area. User-programmable function keys are beneficial to users that want to associate action-triggering codes with individual keys. Repetitive processes such as accessing records, changing screen formats, and updating and restoring specific records or fields are typical applications made easier by programmable keys. Some terminals provide function keys with associated functions established at time of delivery. Others allow the user to change the associated key function; hence the term user programmable. Model V60 contains 3 function keys; Model V65 has 12 user-programmable function keys, and also supports split-screen and line-lock operations.

The Visual V102, which replaces the older V100 models, accommodates a Tektronix 4010-/4014-compatible graphics upgrade option.

Models V300 and V330 have the **potential** for being sophisticated devices. Options support local storage and display of pages. The option allows users to display data, roll it from the screen to a page buffer within the terminal, and then retrieve it when needed. Without this facility, users would have to store/retrieve via the host processor facilities which expands its resource and increases communication costs. Model V300 is available with an 8-page buffer option. No buffer option is available with Model V330.

Other notable features of the V300 and V330 are split screen/line lock, 12 user-programmable function keys, block graphics, and character/block mode transmission.

Models V500 and V550 are dual-function terminals which support normal display/editing applications but also support the use of advanced graphics software. As a conventional terminal, both display 1,920- or 2,640-character screens and provide 12 user-programmable function keys (the 2,640-character screen format extends the number of displayable lines to 33; line length remains 80 characters). Both also operate in character/block modes. The principal functional difference between these terminals is that the V550 supports split-screen format and the V500 does not. The graphics capability is derived from third-party software consisting of Plot 10, DISSPLA, TELL-A-GRAF, SAS/GRAPH, and DI 3000/GRAFMAKER.

☐ Strengths

Visual Technology's expanded terminal family provides prospective users with a variety of cost-effective product alternatives. At the present moment, the Visual offerings are among the lowest-priced terminals on the market. However, terminal prices continue to plummet as leading vendors including DEC, TeleVideo, Qume, Esprit, and Wyse lower prices in an attempt to gain competitive ground. Aside from low cost, Visual Technology has incorporated several beneficial capabilities into its products. For example, split-screen operation and a line-lock facility are available on all models except for the low-end Model V60. Split-screen operation is typically used to

compare different types of data, thus allowing a segment of information to be retained on the screen while another segment of data is scrolled by it. Line lock assists users by allowing them to lock or retain a line of data and scroll information under it. Another strong asset is the smooth scrolling facility supported by all models. With smooth scrolling, users can vary the speed at which data is received from the host and displayed on the screen. Conventional jump (incremental) scrolling utilizes a fixed data rate. Many users find that normal speeds associated with jump scrolling are too fast to read comfortably.

Ergonomic design considerations have remained a Visual Technology priority. Standard nonglare screens, tilt and swivel monitors, low-profile keyboards, 60-Hz refresh rate for flicker reduction, and plain-language set-up menus are featured on all models to enhance performance and facilitate operator ease of use. Another significant performance boost is offered by the bidirectional auxiliary port for interfacing the terminal with a printer. This beneficial feature allows the host processor to directly transmit data to the printer without interfering with normal terminal activity such as data entry.

It should be noted that the ability of Models V240, V241, V500, and V550 to run advanced graphics is a distinct advantage to users needing both alphanumerics and graphics. Many terminals in this class lack this important facility. Furthermore, the Visual V241 terminal includes a color-selectable display in the same price range as many monochrome terminals. Representing Visual's first entry into the color graphics arena, the V241 terminal offers a selection of up to 16 simultaneous colors from a choice of 64, as compared to a maximum of 4 colors from a selection of 16 offered on the DEC VT241. The addition of color can improve operator productivity by highlighting screen areas so that the operator can easily differentiate between contrasting types of information. The addition of advanced business graphics on both Models V240 and V241 enables the user to display numerical data in the form of charts and graphs which is generally considered a better way to convey information.

☐ Limitations

None of the Visual Technology terminals with the exception of the Model V300 offers a scrolling buffer. All scrolling is destructive which prevents the user from creating and storing multiple-screen pages for later use. Many of Visual's competitors, including TeleVideo and DEC, provide this facility. Only Models V102, V300, and V550 support ANSI X3.64 compatibility. The remaining models can only communicate with each other or the terminals they emulate. For companies with a multiple-vendor environment, this limitation might prove unacceptable. Another significant drawback is the lack of upgradability across the entire product line. Major competitor DEC does provide an upgrade provision for its VT100 terminal which is an advantage for users with growing requirements. Although DEC's prices are high, users can buy with the knowledge that they need only purchase an upgrade kit as their needs change. In addition, DEC-replacement Models V220, V240, and V241 offer several capabilities not found on their DEC counterparts but **do not** support block mode transmission. Block mode transmission is not supported on the DEC equivalents either; however, the newly released TeleVideo 922 DEC-replacement model incorporates block mode transmission as a standard feature. Additional items included on the DEC terminal but absent from the Visual Technology offerings include Selective Erase and Screen Saver features along with an integral modem/auto-dialer option for dialing a host computer directly from the keyboard. In recent months, DEC has also added an upgrade kit for its VT240 and VT241 terminals which provides color graphics printed output and polygon fill capabilities as well as replacement character sets to conform with foreign languages. According to DEC, the upgrade also adds Tektronix 4010/4014 graphics protocol support with a text registration mode for positioning text and graphics.

■ COMMUNICATIONS FACILITIES OVERVIEW

All members operate as general-purpose, half-/full-duplex ASCII display terminals at rates of 50 bps to 19.2K bps. Online nodes are point-to-point; keyboard-to-line/display; line-to-display; line-to-printer/display buffer (optional). Terminals are equipped

Visual Technology Display Terminals
Models V60, V65, V102, V220, V240, V241, V300, V330, V500 & V550

with an RS-232C/20-mA current-loop interface; 20-mA current loop available as an option on some models. The auxiliary port interface is RS-232C; buffered bidirectional is optional on some models.

■ SOFTWARE

Third-party graphics software usable on Models V240, V241, V500, and V550.

☐ Operating System

None.

■ HARDWARE

☐ Terms & Support

Terms ● terminal models offered on purchase basis only ● quantity discounts available.

Support ● third-party maintenance contracts negotiated through Sorbus ● depot and factory exchange agreements offered on quote basis.

☐ Overview

The Visual Technology family consists of 10 ASCII keyboard-display terminals designed to operate at speeds of 50 bps to 19.2K bps. All models except Model V102 support a 128-character ASCII set. Model V102 supports 95 ASCII characters. Foreign character sets are optional on Model V300.

Full data editing is provided on Models V60, V65, V300, V330, V500, and V550. Insert/delete lines not offered on Model V102; and insert/delete character is not offered on Models V60, V65, and V102. Character-only transmission mode is provided on Models V102, V220, V240, and V241. All other models operate in character/block modes.

None of the terminals provides scroll buffer storage as a standard feature. Model V300 however, offers it as an option. Split-screen/line-lock formatting is provided on all terminals except Models V50, V200, and V500. All scrolling is destructive, except on models with optional scroll buffers.

All members of the Visual Technology family are soft-configured either through displayed menus or bit-prompting.

Model Packages

V60 Display Terminal ● keyboard-display ASCII terminal ● detached typewriter-style keyboard with separate numeric keycluster ● 12-inch CRT; tilt and swivel ● displays 1,920 characters at 24 lines x 80 characters plus 25th line ● 7x9 dot matrix ● 128-character ASCII set plus 31-character line drawing set; foreign characters optional ● 3 nonprogrammable function keys; no split screen ● destructive smooth/jump scrolling ● character/block mode ● plain-language menu set-up ● local mode operation ● programmable answerback ● half-/full-duplex, asynchronous at 50 bps to 19.2K bps ● RS-232C/20-mA current-loop interface ● bidirectional auxiliary port ● compatible with DEC VT52, Lear Siegler ADM3A, Esprit, and ADDS Viewpoint:

$595 prch	**NA maint**	

V65 Display Terminal ● same as V60 except has 12 programmable function keys, features split-screen operation and character insert/delete, and is equipped with a RS-232C interface:

695	NA

20-mA Current-Loop Interface:

100	NA

V102 Display Terminal ● keyboard-display ASCII terminal ● detached typewriter-style keyboard with separate numeric keypad and 16 programmable function keys ● 14-inch CRT; tilt and swivel ● displays 1,920/3,168 characters at 24 lines x 80/132 characters ● 7x11 dot matrix; double-size characters ● 96-character ASCII set plus 32-character line graphics ● split screen; line lock ● destructive smooth/jump scrolling ● plain-language menu set-up ● local mode operation ● character

mode transmission; local echo ● programmable answerback, bit-prompt configuration ● full-duplex, asynchronous at 50 bps to 19.2K bps ● RS-232C/20-mA current-loop interface ● bidirectional auxiliary port; separate programmable port speed ● compatible with DEC VT100 and VT52; TTY and ANSI X3.64 mode:

1,095	NA

Buffered Printer Interface ● bidirectional RS-232C interface for auxiliary printer:

NC	NA

Graphics Card ● plug-in module provides Tektronix 4010-/4014-compatible graphics capability:

895	NA

V220 Display Terminal ● keyboard-display ASCII terminal ● detached, low-profile, typewriter-style keyboard with separate numeric keypad and 30 programmable function keys ● 14-inch CRT; tilt and swivel ● displays 1,920/3,168 characters at 24 lines x 80/132 characters; 25th status line ● 7x9 character matrix in a 10x12 cell; double-size characters ● 128-character ASCII set plus line character graphics; 2 downline-loadable character sets ● split screen; line lock ● destructive smooth/jump scrolling ● plain-language menu set-up ● local mode operation ● character mode transmission; local echo ● programmable answerback and time-of-day clock ● full-duplex, asynchronous at 50 bps to 19.2K bps ● RS-232C/20-mA current-loop interface ● bidirectional auxiliary port; separate programmable port speed ● compatible with DEC VT52/100/102/220:

795	NA

Optional 20-mA Current-Loop Interface:

100	NA

Second Programmable Character Set:

100	NA

Foreign Character Set:

25	NA

V240 Display/Graphics Terminal ● keyboard-display ASCII terminal with monochrome graphics capability ● detached, low-profile, typewriter-style keyboard with separate numeric keypad and 15 programmable function keys ● 14-inch CRT; tilt and swivel ● displays 2,320/3,828 characters at 29 lines x 80/132 characters; 30th status line ● 8x10 dot matrix in a 10x10 cell; double-size characters ● 128-character ASCII set with line graphics ● graphics features 96 upper-/lowercase ASCII characters; character size X1, X2, X3, X4; crosshair, 8-direction, 2-speed cursor; vector draw, point plot, rectangle draw primitives; 8 types resident, 3 user-defined line styles and rectangular fill styles; selectable erase, write complement control; 800x290-pixel ReGIS mode; 768x293-pixel resolution in Tektronix 4010/4014 mode; 4 resolution gray shades out of a palette of 64 can be displayed simultaneously; in optionally 16 gray shades out of a palette of 64 can be displayed ● split screen; line lock ● destructive smooth/jump scrolling ● character mode transmission ● local echo and local mode ● programmable answerback ● plain-language menu set-up ● full-duplex, asynchronous at 50 bps to 19.2K bps ● RS-232C/20-mA current-loop interface ● bidirectional auxiliary port; separate programmable port speed ● supports DECgraph, DECslide, and Tektronix Plot 10 independent software packages ● compatible with DEC VT52/100/102/240:

1,695	NA

Optional 20-mA Current-Loop Interface:

100	NA

Foreign Character Set:

25	NA

PRCH: single-unit purchase price. MAINT: maintenance pricing (third-party maintenance available through Sorbus Service). NA: not applicable/available. NC: no charge. Pricing current as of May 1985.

Visual Technology Display Terminals
Models V60, V65, V102, V220, V240, V241, V300, V330, V500 & V550

V241 Display/Graphics Terminal • same as V240 except supports the simultaneous display of 4 colors out of a palette of 64; optionally supports the simultaneous display of 16 colors out of a palette of 64:

	2,195	NA

Optional 20-mA Current-Loop Interface:

	100	NA

Foreign Character Set:

	25	NA

V300 Display Terminal • keyboard-display ASCII terminal • detached typewriter-style keyboard with separate numeric keypad and 12 programmable function keys • 12-inch CRT (14-inch optional); tilt and swivel • displays 1,920 characters at 24 lines x 80 characters plus 25th line • 7x9 dot matrix; no double-size characters • 128-character ASCII set plus 16 line drawing characters • split screen; line lock • smooth/jump scrolling • 8-page display buffer optional • character/block mode transmission • local echo and local mode • programmable answerback • plain-language menu set-up • half-/full-duplex, asynchronous at 50 bps to 19.2K bps • RS-232C/20-mA current-loop interface • optional bidirectional auxiliary port; separate programmable port speed • compatible with DEC VT100, TTY, and ANSI X3.64:

	995	NA

Foreign Character Set:

	25	NA

14-inch Green Phosphor (P31) CRT:

	75	NA

V330 Display Terminal • same as V300 except has no provision for display buffer storage • compatible with Data General D200:

	995	NA

Foreign Character Set:

	25	NA

14-inch Green Phosphor (P31) CRT:

	75	NA

Buffered Printer Interface • bidirectional RS-232C interface for auxiliary printer:

	75	NA

Foreign Character Set:

	25	NA

14-inch Green Phosphor (P31) CRT:

	75	NA

V500 Display/Graphics Terminal • keyboard-display ASCII terminal with monochromatic graphics capability • detachable typewriter-style keyboard with separate numeric keypad and 12 programmable function keys • 14-inch CRT; tilt and swivel • displays 2,640 characters at 33 lines x 80 characters; 34th status line • 7x11 dot matrix; double-size characters • 128-character ASCII set with line graphics • graphics features 96 upper-/lowercase ASCII characters; character size X1, X2, X3, X4; crosshair, 8-direction, 2-speed cursor; vector draw, point plot, rectangle draw primitives; 8 types resident, 3 user-defined line styles; 8 types resident, 2 user-defined patterns; rectangle fill; selectable erase, write complement control; 768x585 lines of resolution • no split screen; line lock • destructive smooth/jump scrolling • character/block mode transmission • local echo and local mode • programmable answerback • plain-language menu set-up • half-/full-duplex, asynchronous at 50 bps to 19.2K bps • RS-232C/20-mA current-loop interface • bidirectional auxiliary port; separate programmable port speed • supports Plot 10, DISSPLA, TELL-A-GRAF, SAS/GRAPH, and DI3000/GRAFMAKER graphic software:

	1,595	NA

V550 Display/Graphics Terminal • same as V500, except supports split screen • only emulates DEC VT100 and TEK 4010 • ANSI X3.64 mode operation:

	1,595	NA

□ CPU & Memory

All terminals are microprocessor controlled. Firmware control terminal functions. None of the terminal models provide screen page storage (scroll buffer) as standard equipment. However, Model V300 offers the capability as an option.

8-Page Display Buffer • stores up to 192 lines on Model V300:

	$225 prch	NA maint

I/O & Communications

All members of the Visual family support point-to-point asynchronous ASCII communication. Transmission rates are 50 bps to 19.2K bps over switched or dedicated lines in half-/full-duplex on all models. All terminals support local echo for interactive (character) mode operation. Message framing can include 7 or 8 data bits per character; odd, even, or no parity or mark/space; and 1 start and 1 or 2 stop bits.

All models support soft-configured operating parameters. A menu is employed by all models. The soft-configured terminals employ the keyboard to enter operating parameters which in turn are held in nonvolatile storage.

The DTE interface can be RS-232C or 20-mA current loop. The auxiliary port used for interfacing a printer is also RS-232C.

□ Disk

No disk/diskette is supported.

□ Terminals/Workstations

The family of terminals are similar in the number of characters/lines displayed, editing and formatting features, split-screen/line-lock operation, and modes of operation.

Split-screen operation horizontally divides the screen into 2 separate regions, and is used primarily for comparing data. Line lock allows the user to lock 2 or more lines on the screen and scroll data under them. This feature is also used for data comparison.

Configuration • tabletop keyboard-display with typewriter-style keyboard and separate numeric keypad/keycluster • each terminal can accommodate a separate local serial printer.

Display • 12-inch CRT for Models V60, V65, V300, and V330; 14-inch CRT for Models V102, V220, V240, V241, V500, and V550 • displays 1,920 characters on all models; 2,640 characters (Models V500/V550); 3,168 characters (Models V102/V220) • 96 ASCII characters on Model V102; 128 ASCII characters on all models • line graphics on all models; high-resolution graphics on Models V102/V240/V241/V500/V550 • foreign language character sets optional • amber phosphor displays are available on Models V60, V65, V102, V220, and V240.

Edit & Format Features • common features for all terminals include cursor up, down, left, right, home • blink, underline, bold cursor • line feed and autowrap • tab forward/backward; tab column • n-key rollover and typomatic key functions • clear character, EOL and EOP • reverse and blank cursor on Models V60, V65, V220, V240, V241, V300, V330, V500, and V550 • tab field on all models except V102 • insert/delete line on all models except Model V102 • insert/delete character on all models except Models V60, V65, and V102 • protected fields on all models except Model V102 • split screen/line lock and horizontal scrolling on all models except Models V60, V65, and V500.

Peripherals • RS-232C and bidirectional interface support local printer attachment • input from terminal or host processor.

□ Printers

Visual Technology does not offer a printer for any member of its terminal family, but does provide an RS-232C and bidirectional

Visual Technology Display Terminals
Models V60, V65, V102, V220, V240, V241, V300, V330, V500 & V550

buffered printer port which accommodates any printer with an RS-232C interface. With the bidirectional feature, data transmitted from the host processor to the attached printer bypasses the screen so that users can continue to key data for transmission during a print operation. This is quite a performance

boost, as we mentioned under Strengths.

• **END**

Wang Laboratories WangNet
Broadband Local Area Network

■ PROFILE

Architecture ● WangNet/FastLAN.

Type ● broadband local area network (LAN) composed of 5 services: Interconnect Band with 3 classes of channels, 2 for 80 dedicated frequency channels, and 1 for 256 switched frequency channels; Wang Band with 1 channel for communication among Wang OIS, VS, and Alliance systems; Peripheral Band with 19 channels to extend distance between a CPU and its peripherals; Professional Computer (PC) Service with 4 channels for up to 255 Wang PCs each; and Utility Band with 7 channels for video transmissions, see Figure 1 ● FastLAN is a modular WangNet LAN to interconnect from 4 to 640 transmit/receive ports; provides same services as WangNet; can operate standalone or can connect to WangNet operating as backbone network.

Transmission Speed ● Interconnect Band has 16 dedicated frequency channels for communication at 64K bps, 64 dedicated frequency channels for communication at 9600 bps, and 256 switched channels for communication at 9600 bps; Wang Band operates at 10M bps over virtual circuits; Peripheral Band has 9 channels for communication at 427M bps; PC band has 4 channels that operate at 2.5M bps; and Utility Band has 7 channels, each channel can handle 1 composite audio/video device.

Cable Length ● WangNet hardline cable limited to 4 cable miles; 2 miles actually, because cable is folded back on itself to form separate transmit and receive cables; Wang uses no frequency translation at head end, thus receive frequency is identical to transmit frequency, see Figure 2 ● FastLAN limited to 220-foot Teflon cable or 280-foot PRC cable; FastLAN can also connect to WangNet hardline cable; see Figure 3.

Applications ● primarily office automation applications that include text, data, electronic mail, facsimile, and video communication ● operates as multiplexer for connecting up to 32

PURCHASE PRICE RANGE

hardware & software ▬▬▬▬
5-yr maint/serv fee ☐─────☐

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software
| $7.5K
computer interfaces to Wang Band
■▌ $7.6K to $25.0K
   terminal & computer interfaces to Peripheral Band
   ▬▬▬▬▭ $35.4K to $254.1K
   |     |     |     |     |     |     |     |
 $100K  $200K  $300K  $400K  $500K

   total system (sum of above)
   ▬▬▬▬▭ $50.5K to $286.6K
   |     |     |     |     |     |     |     |
 $100K  $200K  $300K  $400K  $500K
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WANGNET PURCHASE PRICING bar graph shows price range from a small configuration with 2 Wang computers and 100 terminals to a large configuration with 4 Wang computers and 500 terminals; pricing does not include cables, fittings, user outlets, and other components in backbone networks; also pricing does not include computers or terminals ● **SMALL CONFIGURATION** includes CIU for OIS master and CIU for VS system on Wang Band with 4 Polling Master Boards (1 for OIS master and 3 for VS system), for connection of computer to Peripheral Band and Net Mux connections for 100 workstations to Peripheral Band ● **LARGE CONFIGURATION** includes 4 CIUs for VS systems on Wang Band with 16 Polling Master Boards to connect VS systems to Peripheral Band and Net Mux connections for up to 500 workstations to Peripheral Band ● all software, except Technical Control and Management System (TCMS) is bundled with hardware ● PC Band connections are $800 each; PCs cannot connect to Wang Band.

IBM 3270s to IBM 3274 controller.

Configuration ● includes transmit/receive cable with fittings and connectors, head end composed of 2 amplifiers and power supply, Cable Interface Units for systems connected to Wang Band, interface boards for peripherals and communication controller for master on each channel on Peripheral Band, and Fixed Frequency and Frequency Agile Modems for Interconnect Band ● up to 16K devices can connect to Wang Band and up to 32 serial devices can communicate with each CPU on each Peripheral Band channel; 1 video/audio device can connect to each of the 6 Utility Band channels.

Interface ● Interconnect Band requires RS-232C/V.24 connector to fixed frequency modem (FFM) for 32 dedicated 9600-bps channels; RS-449/422/V.35 connector to FFM for 16 dedicated 64K-bps channels; and RS-232C/V.24 connector to frequency agile modem (FAM) for 256 switched channels ● Wang Band requires Cable Interface Unit (CIU) ● Peripheral Band requires interface imbedded in "W" models of Wang Ergo III workstation or a network multiplexer to connect up to 8 Wang peripherals, and a controlling master VS, OIS, or Alliance System ● standard television modulator on video channels ● PC Modem for PC Band.

Gateways ● to be provided through a Wang VS, OIS, 2200, or Alliance Computer System on Wang Band ● X.25 gateway on VS system ○ a Wang computer can interface to Wang Band, Peripheral Band, and Interconnect Band simultaneously, thus bridge product is not required to cross from one network to another.

Support of Foreign Devices ● RS-232C devices to 9600-bps dedicated and switched channels and RS-449 devices to 64K-bps dedicated channels on Interconnect Band.

Communications Management ● Technical Control and Management System (TCMS) provides network monitoring.

Protocols ● CSMA/CD for access to Wang Band ● implementation of lower 5 layers of Open Systems Interconnection (OSI) model recommendation to International Standards Organization (ISO) in CIU nodes on Wang Band (Link, Transport, Network, Session and Presentation layer protocols) ● Interconnect Band is protocol transparent ● Peripheral Band implements Wang I/O protocol ● PC Band uses token-passing protocol for network access.

Distributed Functions ● control distributed among CIU nodes on Wang Band ● system peripherals can be located anywhere on WangNet cable, but they belong exclusively to system operating as master controller of Peripheral Band channel ● distributed application functions depend on devices connected to WangNet and are not part of WangNet.

Support Software ● in CIU node for Wang Band ● in operating system on master controller system for Peripheral Band ● in DataSwitch for switched channels on Interconnect Band ● TCMS for network control.

First Delivery ● January 1983.

Systems Delivered ● 180 currently installed.

Comparable Systems ● none ● Wang provides more services than broadband competitors; Wang implements 5 services.

Vendor ● Wang Laboratories, Inc; One Industrial Avenue, Lowell, MA 01851 ● 617-459-5000.

Distribution ● through over 140 sales offices in the United States and through international sales offices and sales representatives abroad.

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DEDICATED INTERCONNECT SERVICES	PROFESSIONAL COMPUTER SERVICES	SWITCHED INTERCONNECT SERVICE	PERIPHERAL ATTACHMENT SERVICE	UTILITY SERVICE	WANG SYSTEMS SERVICE	PERIPHERAL ATTACHMENT SERVICE
(INTERCONNECT BAND)	(PC BAND)	(INTERCONNECT BAND)	(PERIPHERALS BAND)	(UTILITY BAND)	(WANG BAND)	(PERIPHERALS BAND)

9.12-MHZ PILOT

| 9600-BPS & 64,000-BPS DEDICATED CHANNELS | | | 9600-BPS SWITCHED CHANNELS (VIDEO) | 4.27M-BPS 6 CHANNELS | | GENERAL PURPOSE CHANNELS (VIDEO) | 10M-BPS CSMA/CD BAND | 4.27M BPS 13 CHANNELS |

10.0   21.1   29.6   44.0   49.6   81.6   97.5   145.5   174.0   216.0   243.0   253.0   349.0

Figure 1 ● WangNet services bandwidth allocation.

Figure 2 ● WangNet user outlet attachment.

■ ANALYSIS

WangNet as announced June 23, 1981, included the Wang, Interconnect, and Utility Bands. The Peripheral Band was added in 1982. The Wang Band service is similar to Ethernet and other comparable systems. Wang offers no products for the Utility Band but reserves it for user-developed teleconferencing, security monitoring, and CATV types of applications. No other vendor offers services quite comparable to the Peripheral Band. Datapoint allows systems to share laser printers, disks, and facsimile transmission systems residing on ARC, but the Peripheral Band simply operates as an extension of a system's I/O lines. Peripherals are dedicated to a system and are indirectly shared. The WangNet Interconnect Band provides services similar to those offered by other vendors on its dedicated channels, which appear as data communication lines to the interconnected devices. The 256-channel Interconnect Band that utilizes frequency agile modems and Wang's DataSwitch provides full-duplex, transparent, multipoint, or point-to-point communication using circuit switching techniques.

Wang designed its system differently than other broadband LAN vendors. Wang does not use a frequency translator at the head end. Devices receive and transmit on the same frequency, thus Wang essentially doubles the capacity of its cable using half of the available capacity for each channel, by comparison to other vendors. The head end contains amplifiers and a power supply, but no frequency translator.

Wang has been slow in introducing products for WangNet, but enough products to build WangNets have been available since 1983. Gateways to X.25 are available for VS systems. A network control center for Wang Band is also now available.

Wang Laboratories, in the first 20 years after its inception in 1951, was a small struggling company that sold calculators. Gross revenues in 1971 were $36.7 million. The Wang 2200 with a firmware Basic compiler was introduced in the early 1970s. It became the company's first system to attain significant success. It became popular with OEMs who developed software packages for it to implement specific applications, such as automobile agency financial accounting or real estate office transactions. The Wang 2200 was inexpensive and easy to use; also, it could support a number of workstations for small business applications.

Wang's growth from 1971 to 1973 was relatively modest, but from 1973 to the present, the growth rate has been sustained at 50

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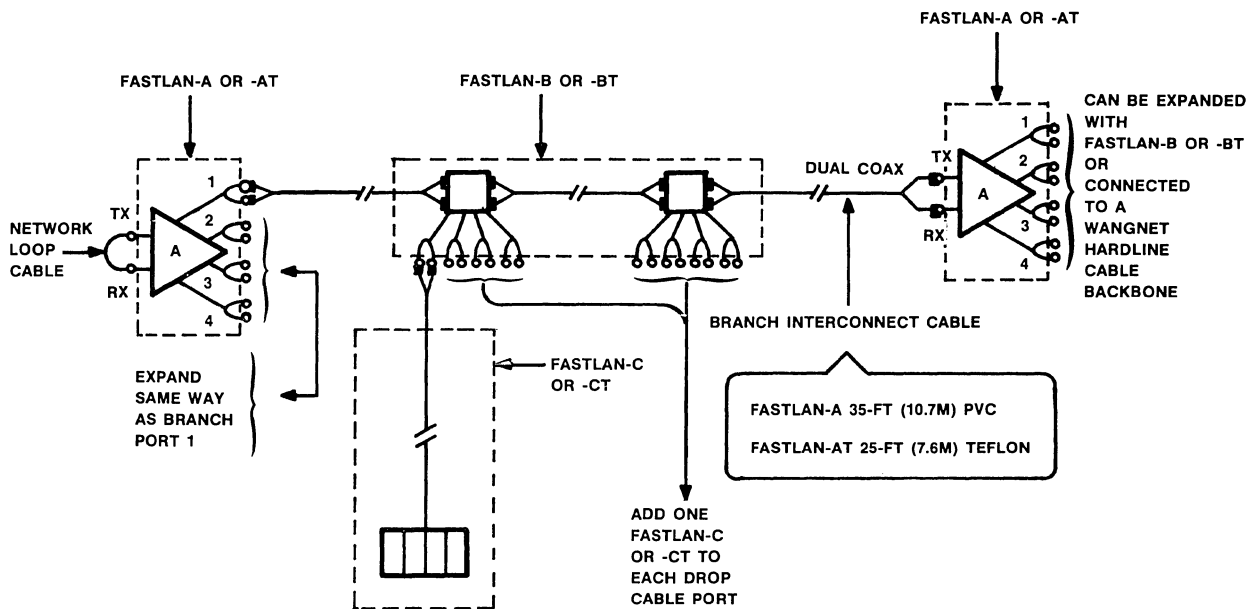
Figure 3 ● FastLAN configuration possibilities.

percent per year. Gross revenues for fiscal year ending June 30, 1982 were $1.2 billion making Wang one of the computer industry's leading corporations. Gross revenues as of June 30, 1983 exceeded $1.5 billion for a growth of 32%. The goal set for 1984 is for 30 percent growth in revenues.

Wang's growth has followed the company's increasing dedication to the office automation marketplace, one of the fastest growing applications for computers. In 1980, Wang announced its strategy for developing office automation products that would encompass 6 technologies, including data processing, word processing, image processing, audio processing, networking and human factors. According to Wang, networking is the key technology for making office automation a reality.

Prior to the introduction of WangNet, which ties all of Wang's products together, Wang used the WISE (Wang Inter-System Exchange) to interconnect its data processing and word processing systems. WISE is a bus system with a hardware/software- controller to interconnect 4 systems, which can be located 2,000 feet from the WISE unit. Workstations can be located 2,000 feet from the master computer systems. Thus, using WISE, computer systems can be located up to 4,000 feet apart, and workstations up to 8,000 feet apart. Multiple WISE systems can be used to interconnect more systems.

Remote Wang Systems Networking is not really part of WangNet. It allows a VS system acting as a host to link to remote OIS, Wang 2200, and other VS systems over point-to-point or multipoint communication lines at 2400/9600 bps. The VS system supports interactive processing and file exchanges with the remote system. A VS host can support up to 6 remote systems with up to 20 workstations per system.

☐ Strengths

WangNet is a well-conceived system providing support for Wang's office automation products as well as for other vendor's products through its Interconnect Band. The Interconnect Band is transparent and appears as a data communication link to the interconnected devices. Therefore, any device can communicate with any other devices as long as the 2 devices are transmission compatible. The Interconnect Band does not provide data rate matching or code conversion.

Wang has not followed the conventional wisdom in its network design, but developed its own system using standard CATV

components. Using the same frequency for transmit and receive doubles the usable capacity of the CATV Band over mid-split, subsplit, and dual cable topologies. Wang essentially uses a cable folded back on itself with no split at the head end. WangNet uses only 266 MHz of the 390-MHz CATV bandwidth, 124 MHz remains available for future expansion.

The Wang Band interconnects OIS, VS, and Alliance systems. These systems can also connect to a channel on the Peripheral Band to allow communication with workstations connected to different computer systems. Wang has made some very large sales of WangNets, so it will continue to be developed as an important product.

☐ Limitations

Workstations cannot connect directly to the Wang Band. They can connect to a VS, OIS, or Alliance system through a channel on the Peripheral Band. The path to connect to a different host system on Wang Band is always indirect through another system.

WangNet is designed to connect Wang products together. It is not designed to allow Wang products to interface to foreign systems.

The Wang Professional Computers can connect only to the PC Band, thus they can communicate only with each other. They cannot communicate with other Wang Computers connected to other bands on WangNet such as Wang Band. Furthermore, the connection is expensive although it does include the software as well as hardware.

■ NETWORK SUMMARY

WangNet is a broadband local area network (LAN) composed of standard CATV components and Wang-designed components. WangNet provides 5 services, 1 per band, and uses only 266 MHz of the 390-MHz CATV bandwidth that ranges from 10 MHz to 400 MHz. The remaining unused CATV bandwidth of 124 MHz is available for future development of additional services.

All services reside on the same cable. FDM (frequency division multiplexing) divides the total bandwidth into channels for the supported services. TDM (time division multiplexing) supports multiple devices on a channel. Channel access to Wang Band is through the CSMA/CD protocol. Access to the Peripheral Bands is established by polling. The Utility Band is provided for audio and video devices, only one device can connect to a channel. Interconnect Band is protocol transparent.

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WangNet uses a main trunk cable folded back on itself at the head end, the transmit/receive crossover point that Wang calls the Network Loop. The transmit and receive trunks are mirror images of each other. Data flow is unidirectional, down the transmit trunk through the Network Loop and back to the attached devices through the receive trunk. All devices connect to both trunks through dual coaxial cables.

Signal splitters divide the trunks into identical branches; receive-cable components are physically adjacent and parallel to transmit-cable components. User outlets connect to branches through dual drop cables; one cable is attached to the transmit line and the other to the receive line.

The Wang user outlet is usually wall mounted and provides a connection to the WangNet for user devices. The outlet contains separate receive and transmit connectors that correspond to WangNet receive and transmit cables. The threads are reversed on the transmit and receive connectors to prevent reversing cables. This topology physically separates the transmit and receive signals. Thus a signal passed through the transmit connector on a user outlet propagates down the transmit tree to the Network Loop and back through the receive tree to the receive connector on every user outlet.

WangNet can be implemented with either an active or passive design. Both designs use the same CATV signal splitters and cable taps, but the active design adds in-line CATV-type amplifiers, powered by 30 VAC. Power supplies for the amplifiers are provided as needed. Typically, the passive-design head end includes 1 or 2 pilot frequency-standard generators and the Network Loop. The active-design head end also includes 2 amplifiers, an amplifier power supply, transmit and receive line ammeters, and various network test points.

WangNets are designed with provision for expansion. At least 1 point in each cable tap is reserved for expansion to accommodate an additional user outlet.

The length of a WangNet depends partly on the number of passive cable components and the number of amplifiers. In an active WangNet, up to 32 amplifiers can be cascaded end-to-end in any cable circuit. Each Diplexer also counts as an amplifier. Up to 568 amplifiers can reside on a WangNet: 283 in the transmit-line tree, 283 in the receive-line tree, and 2 in the head end.

FastLAN is a modular WangNet that can be established fast. It does not require an extensive study and estimation of future requirements or installation of a backbone cabling system. FastLAN consists of 3 modules that can be interconnected to provide a WangNet that can support up to 640 transmit-receive ports.

FastLAN-A is an amplifier module that can support up to 4 FastLAN-B network branch modules. Each FastLAN-B includes 2 coupler boxes and each coupler box can attach up to 4 FastLAN-C multiuser (4-port) outlet boxes for a total of 128 ports. A second LAN-A amplifier can be attached to each FastLAN-B module, and it can be expanded with FastLAN-B and -C modules to provide an additional 128 ports each for a total of 640 ports.

Alternatively, the loop on FastLAN-A amplifier can be removed and replaced with a dual coaxial cable to a connection on a WangNet hardline cable backbone network.

The end-to-end length of FastLAN varies depending on whether Teflon or PVC dual cable is used. Teflon cable segments on the FastLAN-B units are 25 feet, while PVC cable segments are 35 feet. The drop cable length to FastLAN-C outlets is 60 feet. Thus, maximum end-to-end length of a standalone FastLAN network is 400 feet for PVC cable and 340 feet for Teflon cable.

The Wang Band Service provides a general-purpose LAN on a single 10M-bps channel to interconnect Wang VS (virtual system) central processors, OIS (Office Information System) Master Units, and Alliance systems. Any system with attached workstations can use Wang Band to connect to another Wang system to access information, to perform application processing, to exchange electronic mail, or to transfer files or documents. The workstations can attach to a host system through a channel on the Peripheral Band.

All systems connect to Wang Band through a Cable Interface Unit (CIU). The CIU includes an RF (Radio Frequency) modem to connect to the WangNet user outlet on the cable through dual coaxial cable.

The CIU runs the Systems Service networking software and supports up to 24 virtual circuits; the gating factor is the operating system running on the attached VS CPU, OIS Master, or Alliance system. The CIU implements the lower 5 levels of the Open Systems Interconnection (OSI) model: data link, network, transport, session, and presentation levels. Information is transmitted over the cable in packets using HDLC protocol. The CIU also contains the hardware and software to handle the CSMA/CD contention protocol for cable access, see figure 4.

The Peripheral Band provides the Peripheral Attachment Service. It consists of 19 channels; each channel operates at 4.27M bps and can connect up to 32 serial devices to a VS CPU, OIS Master, or Alliance System. A Wang computer must contain a system-specific Peripherals Band Polling Card to communicate with devices on a Peripherals Band channel. The unit connects to the WangNet user outlet on the cable through dual coaxial cables. The Band Polling card is located on 1 board and allows the computer to operate as the master polling unit on a Peripheral Band channel.

WANGNET CABLES
RECEIVE LINE
TRANSMIT LINE
TAPS
DROP
CABLES
USER OUTLET (WALL-MOUNTED)
COAXIAL CABLE
CABLE INTERFACE UNIT
COAXIAL CABLE
CPU-TO-CIU INTERFACE (MASTER DATA LINK)
WANG VS CPU OR OIS/ALLIANCE MASTER

LEGEND
- ▬▬ RECEIVE LINE
- ═══ TRANSMIT LINE
- ⨅⨅⨅⨅ BASEBAND CABLE CONNECTION
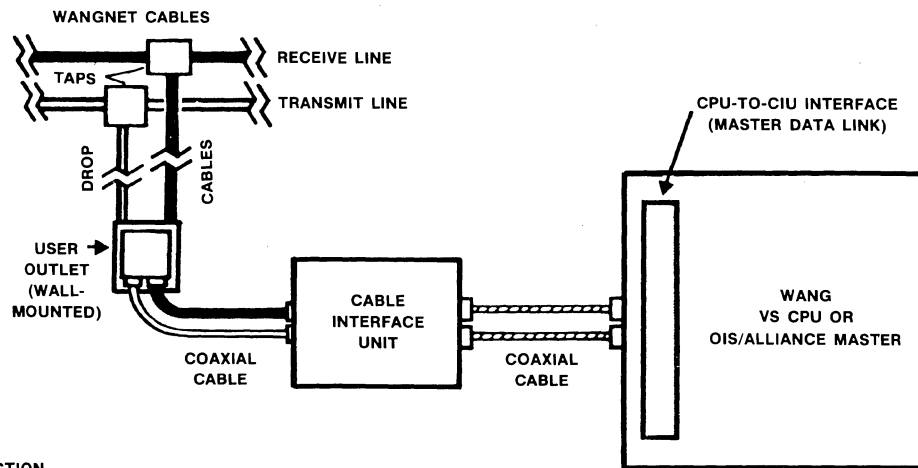
Figure 4 • WangNet cable interface unit and CPU-to-CIU interface.

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Peripherals can connect to the Peripheral Band through either a Wang Netmux or a WangNet connection option. The Wang Netmux contains an RF modem and can connect up to 8 standard Wang peripherals to a WangNet user outlet, thus to a Wang computer. Wang Ergo-IIIW workstations contain an RF modem to connect directly to a WangNet user outlet, see Figure 5.

Software support for a Peripheral Band channel resides in the operating system of the attached computer.

WangNet can contain more than 1 Peripheral Band of up to 19 channels. A Diplexer provides a connection between transmit and receive lines and establishes a separate Peripheral Band subnet. Only Peripheral Band channels are looped through the Diplexers; other service bands pass through the Diplexer without interference. WangNet can be segmented into several Peripheral Band subnets using Diplexers, however, each subnet is isolated from all the others. The total number of subnets that can be established within the WangNet is limited by the maximum number of Diplexers that WangNet can accommodate. Each Diplexer counts as an amplifier in the system, and a single cable circuit is restricted to 32 amplifiers. Multiple Peripheral Bands restrict the distance a peripheral device can be located away from its master computer; both must reside on channels within the loop formed by a Diplexer, see Figure 6.

The Interconnect Band implements 3 services: a 64K-bps Dedicated Interconnect Service, a 9600-bps Dedicated Interconnect Service, and a 9600-bps Switched Interconnect Service.

The Dedicated Interconnect Band provides 16 channels for the 64K-bps service and 64 channels for the 9600-bps service. The Switched Interconnect Band provides 256 channels for the 9600-bps service.

The Dedicated Interconnect Service channels connect to a WangNet User Outlet through a dual coaxial cable attached to a Fixed Frequency Modem (FFM). Each channel supports half-/full-duplex, point-to-point, or multipoint links between compatible data terminal equipment (DTE). The DTE equipment can be Wang or non-Wang devices as long as they conform to the appropriate interface standard: EIA RS-449 or CCITT V.35 for the 64K-bps service and EIA RS-232C or CCITT V.24 for the

9600-bps service. Wang terminals normally attach directly to Wang hosts/masters. The FFM for the 64K-bps service can be set at 0 to 64K-bps. The FFM for the 9600-bps service can be set at 0 to 9600 bps, see Figure 7.

Switched Interconnect Service channels connect to WangNet through dual coaxial cables attached to a Frequency Agile Modem (FAM). It allows dial-up communication between Wang or non-Wang DTE devices conforming to RS-232C or V.24 standards. Each channel supports a half-/full-duplex, point-to-point link. The FAMs can be set for synchronous/asynchronous operation. The FAM support DTE automatic dialing and automatic answer features.

The Switched Interconnect Service requires a WangNet DataSwitch to control the 256 connection pairs that can be supported simultaneously between 512 DTE devices. Addresses of the attached FAMs are specified to the switch at initialization time. The DataSwitch broadcasts a polling sequence over supervisory channels and services connection requests. Aggregate throughput of the DataSwitch is 4.9M bps, see Figure 8.

The Utility Band accommodates user-defined video communication services, such as teleconferencing, security monitoring, or electronic bulletin board. Wang does not sell video equipment, but devices used on the utility channels must be acceptable to Wang for connection to WangNet. The band can also be used for nonvideo devices supplied by the user. Such devices must also be acceptable to Wang for connection to WangNet.

Wang now offers the CMUX-3270 to connect up to 32 IBM 3270 terminals to an IBM 3274 controller over WangNet. Although the IBM 3270 devices use WangNet, they cannot communicate with Wang devices.

The first network control facility for WangNet is now available. The current Technical Control and Management System (TCMS) monitors and manages the devices on Wang Band, Interconnect Band, and Peripherals Band. Future modules added to the system will provide monitoring and control facilities for the other WangNet bands.
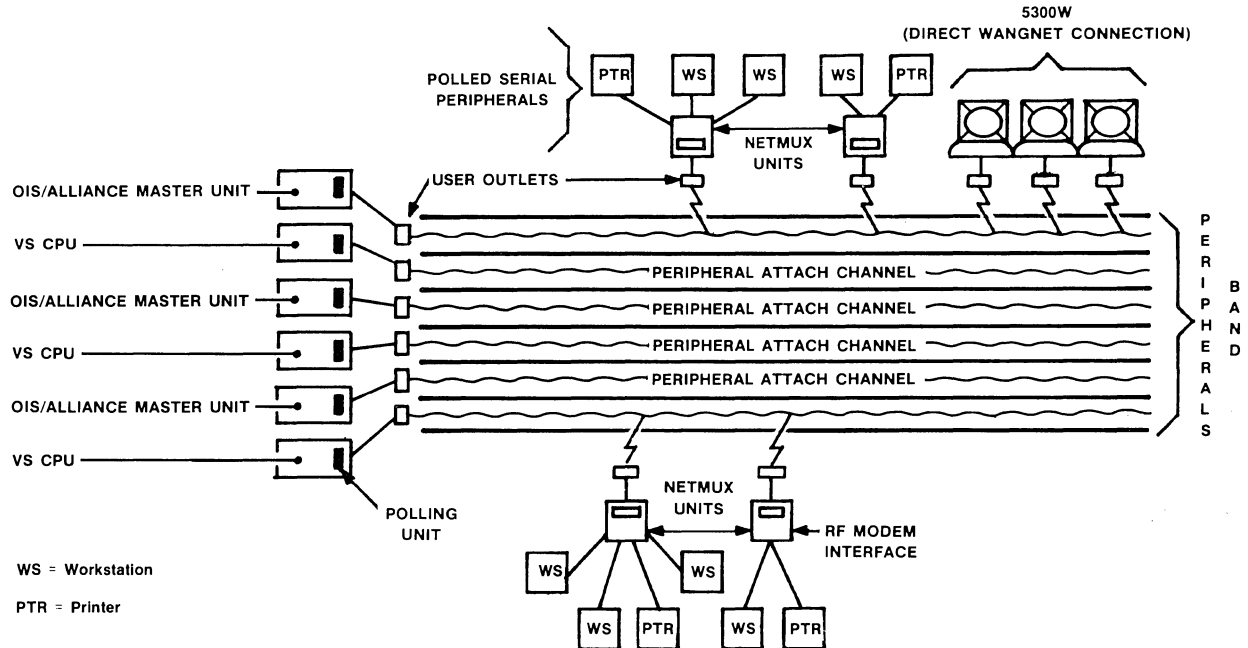
Figure 5 • peripheral attachment service.

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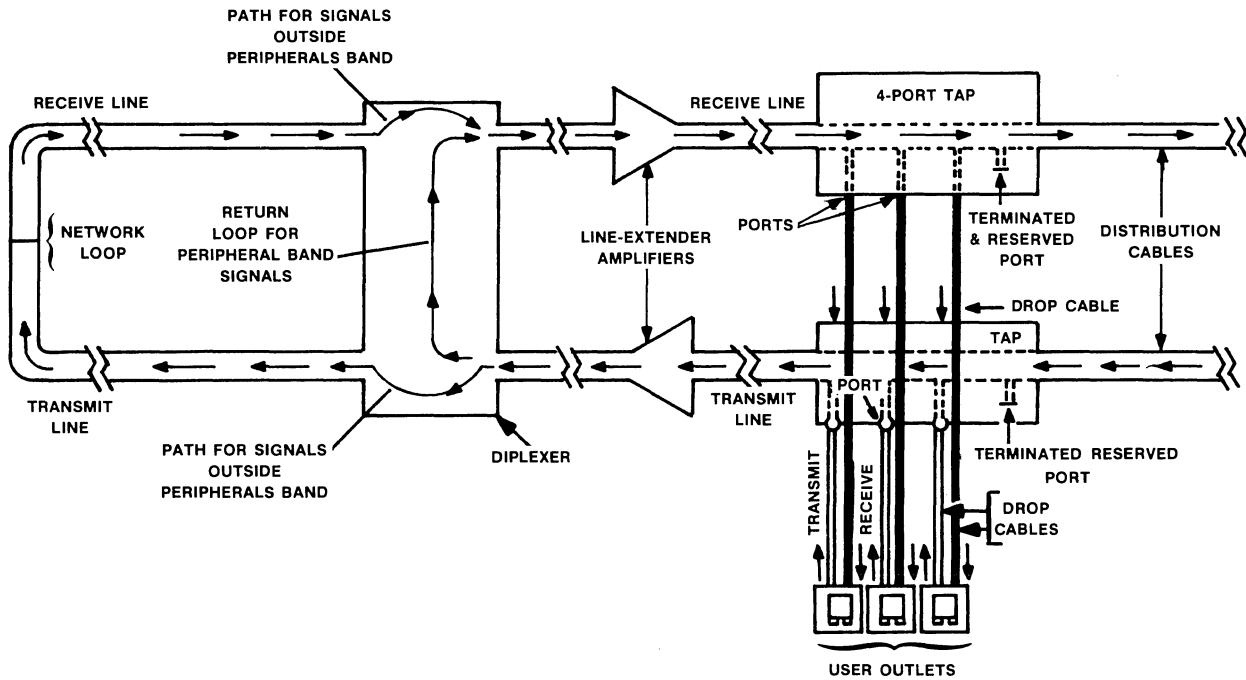
Figure 6 • WangNet Diplexer.
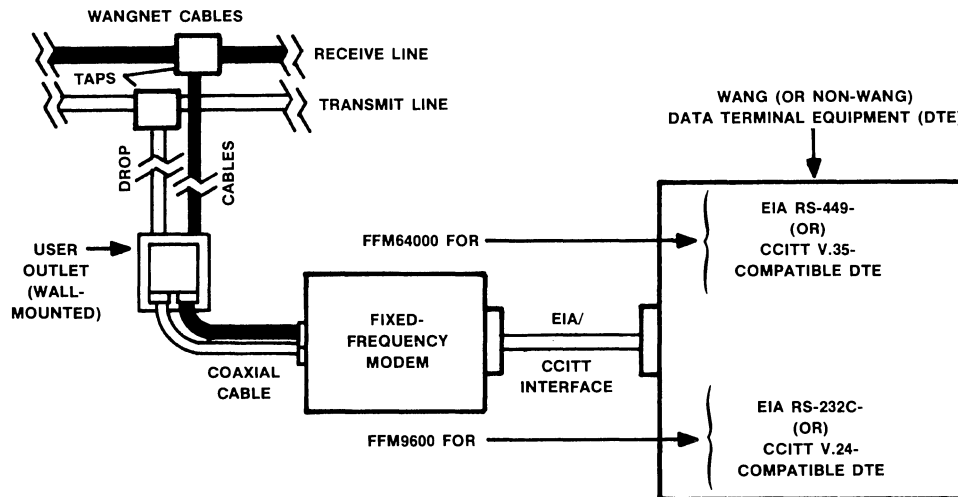
Figure 7 • WangNet FFM interconnections.

■ SOFTWARE

The software required to run WangNet is distributed among the various connected devices.

The control software for Wang Band services resides in the Cable Interface Unit (CIU). It implements the CSMA/CD contention scheme for cable access and the 5 lower layers of the OSI model: physical link, data link, network, transport, and session. The CIU can handle 24 virtual circuits simultaneously. The upper presentation and application OSI layers reside in the VS, OSI, or Alliance system.

The software to control the Peripheral Band resides in the operating system of the VS CPU or OIS or Alliance Master that operates as the master controller to WangNet attached workstations.

Software support for the Dedicated Interconnect Band channels resides in the DTE units. The channels appear as a data communication link and the only requirement is that the DTE

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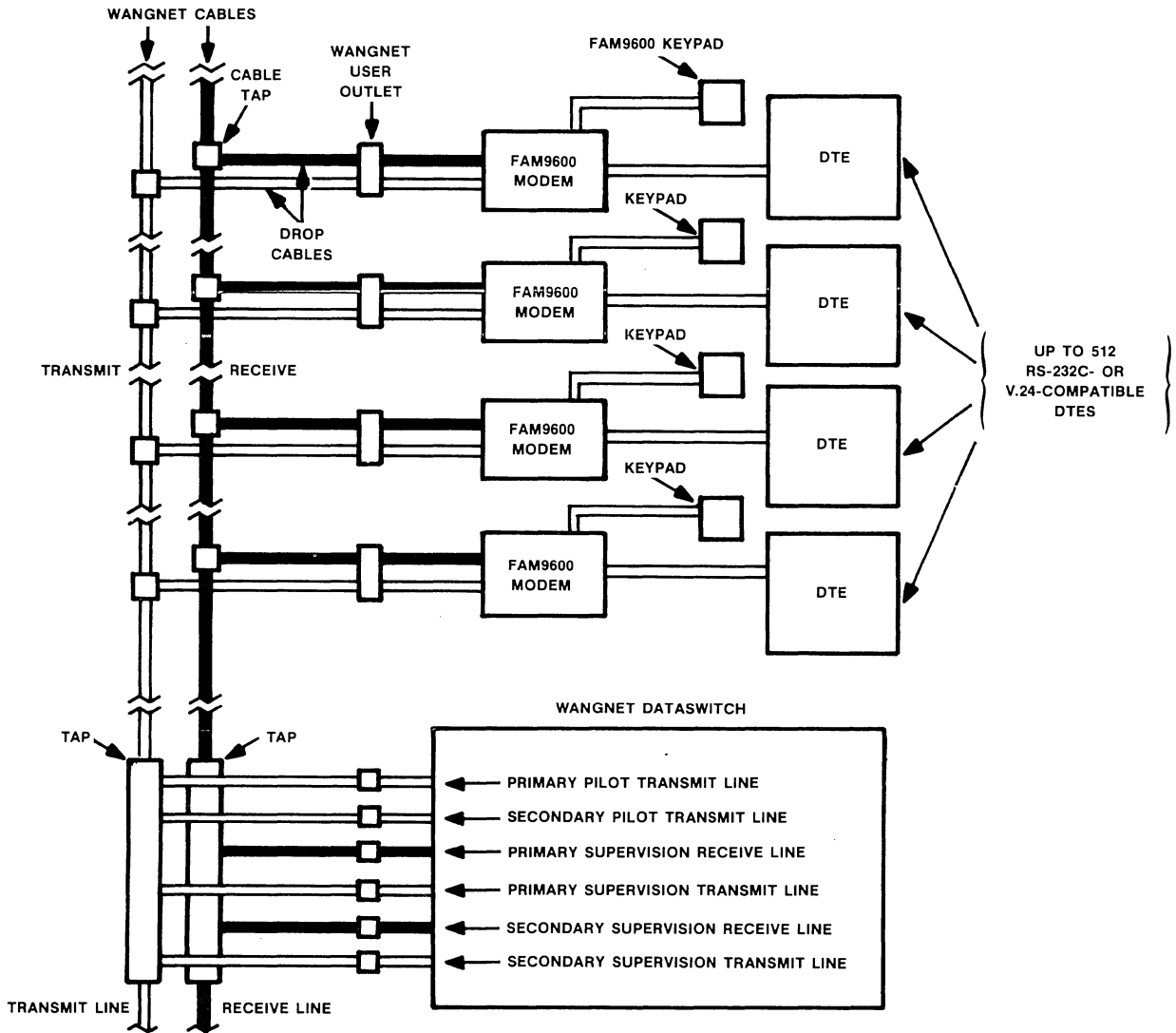
Figure 8 ● Wangnet DataSwitch.

units at each end of the link be transmission compatible with one another.

Software support for the Switched Interconnect Band channels resides in DataSwitch, which includes a 2200SVP processor. The DataSwitch appears as a switched connection line to the attached DTE units. Thus, the only requirement is that the units at each end of a link be transmission compatible with one another.

The WangNet Technical Control and Management System (TCMS) is a software and hardware package that requires a VS system.

WangNet Technical Control & Management System (TCMS) ● operates on a VS system; compiles information on location, status, and performance of components on Wang Band; measures traffic and quality of network service ● consists of TCMS monitor and WangNet Information Management System; monitor compiles performance statistics and generates reports on channel-wide status, unit status, and circuit status; WangNet Information Management System is interactive, online DBMS that combines monitor data with management information to provide network

manager with formatted displays, reports, and archives ● future releases will provide for managing interconnect, peripheral attachment, and utility bands:

$7,500 lcns

■ **HARDWARE**

☐ **Terms & Support**

Terms ● Wang will provide a WangNet site survey for $1,800; a site survey for an additional building in conjunction with an initial site survey is $650; prices for WangNet cable design and cable certification are based on the labor hours for a particular site; standard labor price is $95 per hour ● Wang also supplies various sized cable kits for small WangNets ● WangNet components are available for purchase as well as for rent under 1/2/3/5-year contracts.

LCNS: is one-time license fee; includes standard entitlement services. Prices effective as of October 1984.

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Support • provided through Wang's sales and service centers; monthly maintenance is for standard on-call service, 5 days per week, 9 hours per day.

Wang produces WangNet to meet user's specific requirements. The backbone network includes the cable, head-end, amplifiers, signal splitters, drop cables, Diplexers, and user outlets. Other hardware components include Cable Interface Units (CIUs), WangNet connection options, Netmux multiplexers, fixed frequency modems (FFMs), frequency agile modems (FAMs), a DataSwitch unit, and PC modems.

Cable Interface Unit (CIU) • connects a Wang VS CPU or OIS/Alliance Master Unit to Wang Band • implements CSMA/CD contention scheme for cable access and 5 lower-level protocols of OSI model • includes RF modem to interface transmit and receive lines of WangNet.

CIU-A • for OIS/Alliance Master Units:

$247/$168/$152 mo	$3,800 prch	$41 maint

CIU-B • for VS CPUs:

247/168/152	3,800	41

CIU-C • for Alliance Master Units:

247/168/152	3,800	41

WangNet Connection • no longer offered as option, Wang Ergo-IIIW model workstations now offered with interface to WangNet Peripheral Band; workstation includes RF modem for direct connection to WangNet.

WN2 • for Ergo-II workstation; no longer offered.

WN3 • for Ergo-III workstation; no longer offered.

5300W/PS Proportional Space Workstation Electronics • includes WangNet interface (Peripheral Band); with 64K-byte memory; OIS/Alliance workstations:

212/185/168	4,400	24

5300W Alliance Workstation Electronics • includes WangNet interface (Peripheral Band); VS workstation:

198/154/140	3,650	20

5300W/AUD Alliance Workstation Electronics • 64K-byte audio with WangNet interface (Peripheral Band):

240/185/168	4,400	37

5300W/AUD-PS Alliance Workstation Electronics • 64K-byte audio, proportional space, with WangNet interface (Peripheral Band):

254/207/188	4,900	41

PC-PM075 PC WangNet Service Option • includes WangNet Option Card and Professional Computer Interconnect Software; packet size is 1 to 508 bytes:

52/39/NA	800	8

Polling Master Board • interfaces controlling Alliance, OIS, or VS Master to Peripheral Band; provides polling for up to 24/32 devices on a WangNet channel • includes RF modem • incorporated directly into the OIS, VS, or Alliance system.

22V57W VS-80 IOP • master data link to drive up to 32 terminals; provides 4 ports for 4 serial devices and 1 port to WangNet Peripheral Band:

193/181/164	4,100	50

22V67 VS-90/100 IOP • master data link drives up to 32 terminals; provides 4 ports for serial devices and 1 port to WangNet Peripheral Band:

193/181/164	4,100	50

22V67W-A Additional VS-90/100 IOP • second master data link drives up to 32 terminals on VS 90/100 system; provides 4 ports for serial devices and 1 port to WangNet Peripheral Band:

208/180/163	4,075	50

6540-3W OIS 140 Model 3 Master • includes OIS 140 Model 3, 80.4M-byte disk, single diskette, and WangNet interface (Peripheral Band):

1,490/1,175/1,068	26,700	276

6545W OIS 145A Master • includes OIS 145, 275M-byte disk, single diskette, and WangNet interface (Peripheral Band):

1,819/1,703/1,548	38,700	393

6750-1W Alliance 250-1 Master • includes 128K-byte memory, 32 ports, new Alliance operating system software, 80.4M-byte fixed/removable disk, and WangNet interface (Peripheral Band):

1,819/1,484/1,348	33,700	368

6750-2W Alliance 250-2 Master • includes 128K-byte memory, 32 ports, new Alliance operating system software, 275M-byte removable disk, and WangNet interface (Peripheral Band):

2,524/1,791/1,628	40,700	401

Wang Netmux • connects up to 8 standard Wang serial devices to a Peripheral Band channel • includes RF modem:

104/71/64	1,600	10

Diplexer • segments WangNet into 2 or more 6-channel Peripheral Band loops; 1 additional loop per Diplexer; maximum number of Diplexers per WangNet restricted to 32 minus number of amplifiers on a WangNet cable; installed as part of backbone network:

NA/NA/NA	1,291	39

CMUX-3270 Cable Multiplexer • connects up to 32 IBM 3270 terminals to IBM 3274 controller over WangNet Peripheral Band; basic unit includes 8 ports:

220/149/135	3,375	33

CMUX-3270/Device Support Module (DSM) • provides 8 additional ports for CMUX:

25/17/16	376	4

Fixed Frequency Modem (FFM) • RF modem connects industry standard DTE devices to channels on the Interconnect Band • modem tunable to required frequency.

FFM 64000 • connects RS-449/V.35-compatible user devices to 64K-bps Dedicated Interconnect Band channel:

78/53/48	1,200	14

FFM 9600 • connects RS-232C/V.24-compatible devices to a 9600-bps Dedicated Interconnect Band channel:

56/38/34	850	9

PFG912 Pilot Frequency Generator • 9.12 MHz; required for WangNet cable kits with attached FFM 9600s:

51/35/31	775	5

PFG48 Pilot Frequency Generator • 9.12 MHz; required for WangNet cable kits with attached FFM 64000s except those with DataSwitches:

52/36/32	800	5

FAM 9600 Frequency-Agile Modem (FAM) • connects an RS-232C/V.24-compatible user device to a 9600-bps Switched Interconnect Band channel • required for each device connected to Switched Interconnect Band • maximum of 512 per WangNet:

82/55/50	1,250	14

DataSwitch • controls polling and switching on Switched Interconnect Band; supports up to 256 connections simultaneously between 512 devices; runs control software and diagnostics for attached FAMs:

780/528/480	12,000	130

FastLAN-A Amplifier Unit • with a 5-inch network loop cable and a 35-foot PVC Branch Interconnect Cable:

NA/NA/NA	995	20

FastLAN-AT Amplifier Unit • same as FastLAN-A except with 25-foot Teflon in place of 35-foot PVC Branch Interconnect Cable:

NA/NA/NA	1,300	20

MO: 1/3/5-year monthly rental charges including maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for purchased units. NA: not available/applicable. Prices effective as of October 1984.

Wang Laboratories WangNet
Broadband Local Area Network

FastLAN-B Distribution Leg ● includes a coupler Box 1, a coupler Box 2, a 35-foot PVC Network Branch Cable 1, and a 70-foot PVC Network Branch Cable 2:

NA/NA/NA	350	6

FastLAN-BTD Distribution Cable ● same as FastLAN-B except 25-foot Teflon instead of 35-foot PVC Network Branch Cable 1 and 55-foot Teflon instead of 70-foot PVC Network Branch Cable 2:

NA/NA/NA	800	6

FastLAN-C Drop Cable ● with multiuser (4-port) outlet and a 60-foot PVC drop cable:

NA/NA/NA	120	NA

FastLAN-CT Drop Cable ● same as FastLAN-C except with 60-foot Teflon instead of 60-foot PVC drop cable:

NA/NA/NA	180	NA

FastLAN-ENC Office Enclosure ● optional cabinet for FastLAN-A or -AT amplifier:

NA/NA/NA	640	NA

120-2307 WangNet Interconnect Cable ● 25-foot; to interface device to outlet:

NA/NA/NA	15	NA

220-0294 WangNet Interconnect Cable ● 10-foot; to interface device to outlet:

NA/NA/NA	10	NA

■ SPECIFICATION

Wang proprietary. Wang Band follows the OSI model recommendation and implements the data link, network, transport, session, and presentation layers.

Packet Format

Wang Band uses HDLC protocol as specified in the OSI model recommendation.

Format ● Wang Band divides data link packet into 3 parts: Header, Information Field, and Trailer ● Header contains 1-byte Flag, 2-byte Destination address, 2-byte Source address, and 1-byte Control Field ● Information Field includes variable-length Packet Header, 3-byte Transport Layer Header, variable-length Presentation Service Header, and variable-length Application Data ● Trailer contains 2-byte CRC-CCITT check data and 1-byte Flag.

Transmission Characteristics

WangNet uses Radio Frequency (RF) transmission.

Channel Encoding ● Wang proprietary.

Data Rate ● 10M bps for Wang Band; 4.27M bps for Peripheral Band; 64K bps and 9600 bps for Dedicated Interconnect Band; 9600 bps for Switched Interconnect Band; Utility Band not defined; 2.5M bps for PC Band.

Carrier ● frequency varies from channel to channel depending on assigned frequency of RF modems.

Control Procedures

WangNet implements network control on each channel for all services. Because of the nature of the Switched Interconnect Band service, the DataSwitch controls all 256 channels. Currently, control is distributed on Wang Band. Control can be through TCMS, from a terminal/workstation connected to a dedicated system connected to Wang Band through a CIU. Control of the Peripheral Band is from the VS, OIS, or Alliance system operating as the master on a channel. Control of the Dedicated Interconnect Band channels is through the connected devices.

CSMA/CD access control for Wang Band is implemented in each CIU connected to the channel. The algorithms for its implementation are Wang proprietary. The PC Band uses token-passing protocol for network access.

Transmission Medium

Wang uses standard CATV cable.

Use

Wang developed WangNet to interconnect its broad line of Office Automation products.

● END

Western Union (WU) Satellite Transmission Services

■ PROFILE

Function • voice-grade and wideband service, dedicated voice service (SpaceTel), transponder services, experimental and special services, video channel service, and audio program channel service.

Facilities • satellite microwave, and land-line network comprising Western Union-owned earth stations • terrestrial channels extend access to major metropolitan areas.

Services • switched and leased network services for video data, facsimile, and voice communication • television and radio program transmission services • satellite transponder leasing services • customer-owned earth station services.

Access • voice-grade channel access to network via W&R (wire & repeater) rooms in 30 major metropolitan areas • extended local access arrangements via other common carriers • wideband services available in 7 major metropolitan areas.

First Available • 1974.

Number of Users • over 8,000 individual customers.

Comparable Services • American Satellite Corporation for on-site dedicated channel services; GTE Telenet and RCA Americom for switched data channels; AT&T DDD, MCI, and GTE SPRINT for switched voice services.

Vendor • The Western Union Telegraph Company, Westar Satellite Systems & Services; One Lake Street, Upper Saddle River, NJ 07458 • 201-825-5000.

Canadian Distribution • none.

FCC Tariff • No. 261.

■ ANALYSIS

Western Union's Satellite Transmission Services serve a broad spectrum of business communication applications. Services support voice, data, facsimile, and video transmission. Subscribers can lease voice-grade or wideband (48 KHz or 240 KHz) analog channels, audio and video channels, dedicated telephone channels, and whole transponders on Westar satellites. Channel services are supported by a combination of Western Union's terrestrial microwave network and its satellites. Service is terminated at WU's central offices, but can be extended to customer locations. Customers are offered 2 types each of protected and unprotected satellite transponder services, which are dedicated to a customer's full-time use. Customers with long-term usage requirements can lease the transponder for 2-year intervals; those with short-term requirements can use the service on a month-to-month basis. However, monthly customers cannot obtain full transponder protection via a reserved replacement transponder, but are protected on an as-available basis when a transponder is not in use by other protected customers. Western Union's transponder services are flexible, allowing the use of customer-owned or operated earth stations, WU-owned earth stations, or a combination of each arrangement. Western Union also offers other transponder arrangements which include multitransponder service for customers with volume transmission requirements.

These satellite services are offered only on a domestic basis and apply to interstate service between points within the contiguous U.S., and service extensions to points in Alaska, Hawaii, U.S. Possessions, Puerto Rico, and foreign countries. Customers with international communication requirements should contact Western Union for information about international services.

As a traditional domestic common carrier, Western Union is well

> **WESTERN UNION SATELLITE SERVICE MINIMUM USAGE COST**
>
> **Configuration** • single leased voice-grade channel • customer stations (2) located in Houston and Boston, (approximately 1601 miles) • rental period of 12 months • alternate voice/data application • echo cancellers and channel conditioning not required.
>
> **Minimum Start-Up Costs** • $180.00 total • consists of $60.00 for installation of channel and $120.00 (2x$60.00) for station terminal installations in Houston and Boston.
>
> **Minimum Monthly Operating Costs** • $807.50 per month total • consists of $615.00 per month channel charge for Category V city pair for 12-month period; $192.50 a month for 2 alternate voice/data station terminals • monthly station terminal charges include facility termination charge ($60 per terminal) and a local facility charge ($36.25 per line).

established. Its organizational infra-structure is widely dispersed throughout the United States and is well equipped to provide its customers with a constant level of high-quality service. In addition to its solid offerings in the rapidly emerging field of satellite communication, Western Union is a leading supplier of leased-line channels, as well as private switched networks, multiplexing arrangements, and Easylink Instant Mail Service. Its Telex/TWX network is a dominant force in domestic record transmission.

Quite early in the space program, Western Union grasped the long-range potential of satellite communications, and in 1974, launched the first wholly corporate-owned communications satellite (Westar I). With Westar IV and Westar V, transponder capacity has been doubled from 12 to 24; and the increased transponder transmitting power density promises to make transmissions less susceptible to interference. Westar VI was unsuccessfully launched in February 1985 and never became operational. Given its dominant position in the satellite technology race, and its massive terrestrial network which includes 10,000 miles of microwave links, Western Union is in a good position to establish itself as a dominant force in satellite communication services. For the short term at least, the Western Union satellite offering would be most appealing to large users with several geographically separated (1000+ miles) cluster facilities and with a high-volume intraorganizational communication requirement.

□ Strengths

Western Union is an experienced communication company with an established record for service and support. Its facilities are ubiquitous, reaching into practically every important metropolitan area in the United States. The company's terrestrial network, which includes over 10,000 miles of microwave links, is second in size only to the facilities of AT&T. The Western Union Westar satellite system is a full-service satellite facility. Thousands of customer-owned earth stations interact with Westar satellites on a periodic basis.

The Westar service can prove most attractive to users with interstate long-haul high-capacity traffic, particularly if the end-point customer stations are concentrated and in reasonably close proximity to 1 of Western Union's wire and repeater room facilities located in 26 major metropolitan areas. Dependent upon the specific set of circumstances, it can provide an economic alternative to traditional long-distance and private-line routing. In some cases, the Western Union satellite service can replace

Western Union (WU) Satellite Transmission Services

existing WATS lines with resulting savings inasmuch as a Westar channel is a 2-way circuit, whereas a WATS line is either an inward or outward line.

In voice service via satellite, the most noticeable feature is the remarkable clarity, even on the longer routes such as New York to Los Angeles, since the length of the transmission path via satellite is virtually independent of ground distance between earth stations. In effect, signals transmitted via satellite pass through one repeater station in space, from earth station to earth station. In landline transmission, a coast-to-coast voice channel may pass through 100 or more relay points, each of which causes a slight degradation in quality of the signal. Also, communication via satellite is less susceptible to man-made interference. In data transmission via satellite, the principal advantage is the improved error rate. A typical Western Union landline error rate is between 1 error in 100,000 bits and 1 error in 10 million bits. Via satellite, the error rate is between 1 in a million and 1 in a 100 million.

☐ Limitations

Applications involving low traffic volumes and a scattering of small facilities located at considerable distances from a Western Union wire and repeater (W&R) room might not prove economically adaptable to satellite service; the cost of linking each site to a W&R service point via common carrier extension channels could escalate to a prohibitive sum. Also, the inherent propagation delay in the satellite circuit can sometimes be a problem. When a speaker at 1 earth station says hello and waits for a reply, it requires at least a half-second for the person at the other earth station to receive the greeting and return a "hello" to the other end. This delay can cause interference if 2 people interrupt each other frequently during a conversation. However, a moderate amount of self-discipline can alleviate the interference. In some data communication applications, the propagation delay may require some modification in the system's hardware or software to adapt the system to this response-time delay.

■ NETWORK

Terms & Conditions

Billing Criteria • customers pay for Western Union-leased voice-grade satellite services based on factors associated with categories of city-pair access channels, and station terminal requirements • 48 KHz and 240 KHz wideband channel charges are based upon bandwidth and categories of city-pair access combinations.

Billing Conditions • leased voice-grade and wideband channel service is 2-point, 7 days per week, 24 hours per day • minimum 1-month service; for voice-grade and wideband channels; 30-day advance notice required for termination • Western Union responsible for end-to-end connection; access line arranged by Western Union, although it may be provided by another common carrier • all terminal equipment and network facilities provided remain the property of Western Union • for leased-grade service, customer must specify number of channels, city-pair interconnect combinations, station terminal functions, and period of service, as well as echo canceller and channel conditioning that might be required • reduced monthly rental offered for Category 1 through Category 5 city-pair leased voice-grade channels if customer contracts for 12 months of sustained usage • a 15-percent discount applies to customer utilization of 5 or more 48-KHz channels or 1 or more 48-KHz channels in addition to a 240-KHz channel.

Other Conditions • services offered subject to availability of facilities and necessary legal permits to operate • Western Union assumes no liability for damage or unauthorized use of customer facilities, or for communication privacy/security breaches that may result from customer use of Western Union service.

☐ Overview

Western Union Satellite Transmission Services encompass a variety of transmission services including voice grade and wideband channel services, transponder services, video and audio program channel services, a telephone channel (SpaceTel) service, remote area channel service, and experimental and special services.

Voice-grade analog channels are offered on a full-duplex point-to-point basis between satellite city pairs. A channel, nominally 4 KHz, can be used for voice, data at speeds up to 9600 bps, or for both voice and data on an alternate basis. Conditioning and echo cancellers are available. Customers may subdivide and devise additional channels from the provided channels. Western Union will provide terminal equipment for the transmission of voice, data, or for the derivation of additional channels upon customer request. Service termination points may be established at the customer stations at respective satellite cities or at Western Union central offices. Western Union offers this service on a month-to-month or fixed-term basis. Fixed-Term service is available on a 12-month or 24-consecutive month basis; month-to-month service is offered for a minimum period of 1 month.

Wideband Channel Service offers 48-KHz or 240-KHz analog channels on a point-to-point basis between satellite access cities. Service is terminated at Western Union central offices, but the customer can extend the service termination point at additional expense. Western Union offers a 15 percent discount for customer utilization of 5 or more 48-KHz channels or 1 or more 48-KHz channels in addition to a 240-KHz channel. The channels can be utilized in a single route or distributed over several routes. The service is provided on a month-to-month basis.

Transponder Service provides a customer with the exclusive use of a Westar satellite transponder on a month-to-month or fixed-term (2-year) basis at lower cost. The fixed-term period is extendable in 2-year increments. In either case, the service is available with or without protection. Protected service provides a backup transponder in the event of a primary transponder failure or interruption.

There are 2 types of protected services for Fixed-Term customers. Dedicated protection, available only for Fixed-Term customers, reserves a replacement transponder which may be either unassigned or 1 subject to service interruption provided for unprotected service. The reserved transponder may be in the same satellite or a different satellite. Designated protection, available for Fixed-Term or Month-to-Month does not reserve a specific replacement transponder, but instead, it reserves a transponder or traveling wave tube amplifier for each 4 (or less) primary transponders in the event of a primary transponder failure. Under this arrangement, only the customer with the initial failure is protected; customers who experience failures following the initial failure will either be protected with another transponder, if available, or will be reclassified to an unprotected status.

Western Union offers 2 types of unprotected transponder services. Unprotected service dose not reserve a replacement transponder. A transponder failure may interrupt service for an indefinite period of time, during which Western Union will attempt to restore service via another transponder on the same or different satellite. Unprotected-uninterruptible service in addition to being an unprotected service is subject to interruption to meet Western Union's requirements to restore protected service. These 4 categories of service are priced according to their value in descending order beginning with dedicated protection.

Western Union also offers a variant of Transponder Service it calls Multitransponder Term Service. This service provides a group of transponders on Westar V, which initially includes 1 unprotected- and 8 protected-interruptible transponders dedicated to full-time customer usage over 3 years. The customer has the option to renew for 2 consecutive 3-year terms and to convert to Month-to-Month service thereafter. A variation of this service offers 3 unprotected-interruptible transponders on Westar IV for a 3-year period commencing in 1985. This service allows conversion without penalty from Unprotected-Interruptible Fixed-Term Transponder Service.

Western Union also offers a protection service for customer-owned transponders. The service designates a replacement transponder or traveling wave tube amplifier to recover from transponder failure. However, should the designated replacement be assigned to restore service to another protected customer, and another transponder is not available, the customer-owned transponder loses protection and monthly charges are terminated.

Video channels are available under the terms and conditions of

Western Union (WU) Satellite Transmission Services

Fixed-Term Transponder Service (FTTS). The service provides a video channel with associated audio in a protected transponder for full-time use. The form of protection is Protected-Designated.

Video Channel Service is offered for transmission, in 1 direction only, of standard monochrome and NTSC (National Television Systems Committee) color signals with accompanying audio channel. The service is available 3 ways according to Western Union and/or customer facility usage, and is priced accordingly. Video channel service utilizes transponder capacity that may be required for the restoral of other satellite services, and may be interrupted if service must be switched to another channel for restoral.

SpaceTel Channel Service is a metered-usage service that provides a point-to-point voice-grade channel and terminal equipment so that a customer can communicate directly between a station on his premises and a station in his or his correspondent's premises in another city through a combination of satellite facilities. The service can connect 2 PBX systems, a PBX and telephone handset terminal, and 2 telephone handset terminals. The customer can also utilize existing telephones and switchboard facilities which connect to SpaceTel facilities. A station at either end of the intercity service can be connected to extension stations on the customer's premises in the same building. The service is available 24 hours, 7 days per week for a minimum of 1 month and is supported between major U.S. cities.

Other services offered by Western Union under its Satellite Services include Audio Program Channel Service which supports low- or medium-fidelity audio transmission, and experimental and special services some of which are run by the U.S. federal government agencies and The Associated Press.

When Westar V reached operational orbit on June 11, 1982, Western Union became the first company to have 5 communication satellites in orbit, another pioneering milestone in a long string of satellite program accomplishments. Westar 1, now retired, launched in 1974 was the first operational satellite wholly owned by a domestic common carrier. Westar V, like its slightly older orbiting brother, Westar IV, is a 24-transponder spacecraft designed for data, video, voice, and facsimile transmission. Both of these powerful satellites were designed to have a minimum operational life of 10 years. Westar VI was launched on February 3, 1984 but failed to achieve its correct operating orbit, and could not be used as a communication satellite.

At present, there are 8 Western Union earth stations strategically located to serve the major population centers in the 48 continguous states. Each earth station is connected via a microwave beam link to a Western Union W&R (wire and repeater) room in the city it serves. Traffic designated for transmission via satellite is collected from many originating points at these W&R rooms, channelized, then sent to the earth stations over the microwave link. When these signals are received at an earth station, they are used to modulate the signals transmitted to the satellite. The number of transmitters used at an earth station depends upon the number of transponders to which the station must transmit. If some or all of the channels in 1 of the bandwidths carry the traffic intended for an earth station, that station is equipped with a receiver which demodulates the carrier, extracts the channels intended for it and ignores the others. Each earth station is equipped with a monitor, control, alarm, and test (MCAT) subsystem designed to restore service automatically in the remote event of any equipment malfunction in less than 100 milliseconds, in most cases. Each earth station is connected to the city it serves by a microwave radio beam link terminated in a W&R room.

The backbone of Western Union's terrestrial communication network is a coast-to-coast 10,000 mile microwave radio beam installation. Radio frequencies in the microwave range (above 1000 MHz) travel in a straight line and are not reflected back to earth by the inosphere (a part of the earth's upper atmosphere) as are radio frequencies in the commercial broadcasting range. Microwave transmission is therefore limited to line-of-sight communication. In the Western Union's coast-to-coast microwave network, repeater stations every 30 miles or so are provided to receive signals from 1 station and retransmit them to another station. At each station, the received signals are modified (either demodulated or converted to an intermediate lower microwave

frequency), then amplified and used to modulate another signal which is transmitted to the next microwave relay station.

With the Port Authority of New York and Merrill Lynch & Co, Inc, Western Union is constructing and will operate the Teleport, the world's first satellite communications center/office park, on a 350-acre site on Staten Island in New York Harbor. Teleport will have 17 earth stations with direct access to domestic, and international communications satellites. Western Union will connect this "antenna farm" with Manhattan, Brooklyn, Queens, and nearby New Jersey through a network of fiber optic cable. Teleport will enable many businesses that require rapid transmission of data or video signals to gain access to satellites without having to establish a private satellite network.

□ Voice-Grade Channel Service

Service is available on a month-to-month or fixed-term basis. Month-to-Month service is available for a minimum period of one month. Customers can convert to Fixed-Term service upon 30 days written notice. Fixed-Term service is available for 12 or 24 consecutive months, and is automatically renewed for an additional same period unless the customer terminates the service through written notice 90 days prior to the expiration date of the existing service period. Customer cancellations prior to the end of a 12-month service period are billed for the difference between Month-to-Month and Fixed-Term service for the number of months the channel is in service. For a 2-year Fixed-Term early cancellation, the customer is liable for the difference between the Month-to-Month rate and the 2-year service period rate for the number of months service was provided if the cancellation occurs during the first 12 months; if cancellation occurs after the initial 12-month period, customer liability is for the difference between the 12- and 24-month service rate times the number of months the channel was in service.

Service termination points may be either at WU's central offices or at customer stations at respective satellite cities. Service is provided only between the satellite access cities presented in **Table 1.**

Access Charge

Pricing structure is based upon monthly charges for leased voice-grade channels between 6 categories of city-pair combinations presented in **Table 1**, and for monthly station terminal charges. Rates for Categories I, II, or III include 2 facility terminations. Echo cancellers, where applicable, are provided at no additional charge. Nonrecurring installation charges for channels, facility terminations and, where applicable, echo cancellers are applied separately. Customers ordering a minimum of 48 channels, from Categories I, II, or III for a minimum service period of 2 years for voice applications only will be entitled to a discount of 15 percent on their monthly charges. Data use is not guaranteed due to likely use of compandored facilities. Charges can be found in **Table 2.**

Channel Installation & Move/Reconfiguration Charges • nonrecurring charges are applied for installation, move, or reconfiguration of a channel.

Installation • per channel:
$60

Move/Reconfiguration • per channel end:
30

Move/Reconfiguration • per station terminal within same premises:
30

MO: monthly charge. INSTAL: installation charge. NA: not available/applicable. MOVE CHRG: one-time charge for move/reconfiguration of channel equipment. EA 30 MIN: charge per specified period. EA ADD'L HR: charge per specified period. 0.5 HR: charge per specified period. 0.25 HR: charge per specified period.

Western Union (WU) Satellite Transmission Services

TABLE 1 • Voice-Grade Channel City-Pair Service Category

	Atlanta	Boston	Chicago	Dallas	El Paso	Fort Worth	Houston	Kansas City	Los Angeles	Lubbock	Milwaukee	Minneapolis	New York	Philadelphia	Phoenix	San Antonio	San Francisco	St. Louis	Seattle	Washington
Baltimore	VI	—	VI	V	—	V	V	—	VI	—	VI	—	—	—	—	—	IV	VI	—	—
Boston	VI	—	—	V	—	V	V	V	IV	—	—	V	—	—	—	—	—	IV	—	IV
Bridgeton, MO	—	—	—	—	—	—	—	—	V	—	—	—	—	—	—	—	—	—	—	—
Buffalo	—	—	—	V	—	V	—	—	IV	—	—	—	—	—	—	—	IV	—	IV	—
Chicago	III	VI	—	—	VI	—	—	—	—	VI	—	—	—	—	V	VI	—	—	V	—
Cincinnati	—	VI	—	VI	—	VI	VI	—	IV	—	—	—	—	—	—	—	IV	—	—	—
Cleveland	VI	—	—	VI	—	VI	V	—	IV	—	—	—	—	—	—	—	IV	—	IV	—
Columbus	—	VI	—	VI	—	VI	V	—	IV	—	—	—	VI	—	—	—	IV	—	—	—
Dallas	III	—	III	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	V	—
Dayton	—	VI	—	VI	—	VI	V	—	IV	—	—	—	VI	—	—	—	IV	—	—	—
Detroit	VI	—	—	VI	—	VI	V	—	IV	—	—	—	—	—	—	—	IV	—	IV	—
Fort Worth	III	—	III	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Houston	VI	—	VI	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Indianapolis	VI	VI	—	VI	—	VI	VI	—	V	—	—	—	—	VI	—	—	V	—	—	VI
Kansas City	VI	—	—	—	—	—	—	—	—	—	—	—	—	VI	—	—	—	—	V	—
Los Angeles	I	—	II	II	V	II	V	V	—	V	—	—	—	—	—	V	—	—	VI	—
Milwaukee	VI	VI	—	VI	—	VI	VI	—	V	—	—	—	—	—	—	—	V	—	V	—
Minneapolis	VI	—	—	VI	—	VI	VI	—	V	—	—	—	—	—	—	—	V	—	V	VI
New York	III	—	III	II	V	II	V	V	I	V	VI	—	—	—	—	V	—	VI	IV	—
Philadelphia	VI	—	VI	V	—	V	V	—	IV	—	VI	—	—	—	—	—	IV	—	IV	—
Phoenix	—	—	—	—	—	—	—	—	—	—	—	—	—	—	IV	—	—	—	—	—
Pittsburgh	—	—	—	VI	—	VI	V	—	IV	—	—	—	—	—	—	—	IV	—	IV	—
St. Louis	—	VI	—	VI	—	VI	VI	—	V	—	—	—	—	—	—	—	V	—	V	—
San Francisco	I	—	II	II	V	II	V	V	—	V	—	—	I	—	—	V	—	—	VI	—
Seattle	—	—	—	—	—	V	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Washington, DC	VI	—	VI	V	—	V	V	—	IV	—	VI	—	—	—	—	—	IV	VI	IV	—
Wilmington	VI	—	VI	—	—	—	V	—	IV	—	—	—	—	—	—	—	IV	VI	—	—

TABLE 2 • Voice-Grade Channel Access Charges

Monthly Charges Per Channel

Service Category	Month-to-Month	Fixed Term
Category I	$965	$695
Category II	750	535
Category III	700	535
Category IV	925	825
Category V	695	615
Category VI	580	580

Move/Reconfiguration • per station terminal moved to different premises:

60

Station Terminal Charges • includes facility termination charge and local facility charge • for the first station on a premises and for each additional station connected by separate facilities a monthly facility termination charge and an installation charge applies • for each additional station on the same premises as another station on the same service and connected at that premises to the same local facilities of such other station, an installation and monthly charge applies.

Voice Only:

$60 mo	$60 instal

Data Only:

60	60

Voice, Data, Alternate Voice/Data Additional Station:

6	60

Local Facility Charge • per access line provided by local telco:

36.25

Echo Canceller • applies to each city end-point of a channel for Categories IV, V, and VI • with/without Tone Disabler and Signal Frequency (S/F) Bypass:

40	25

Channel Conditioning • monthly charges applied to each city end-point of a channel.

Type C1 Conditioning:

5	NA

Type C2 Conditioning:

19	NA

Type C3 Conditioning:

30	NA

Voice-Grade Channel Service Access Locations

Locations from which customers can access this service:

Arizona • Phoenix.

California • Los Angeles; San Francisco.

Delaware • Wilmington.

District of Columbia • Washington.

Georgia • Atlanta.

Illinois • Chicago.

Indiana • Indianapolis.

Maryland • Baltimore.

Massachusetts • Boston.

Michigan • Detroit.

Western Union (WU) Satellite Transmission Services

Minnesota • Minneapolis.

Missouri • Bridgeton; Kansas City; St. Louis.

New York • Buffalo; New York City.

Ohio • Cincinnati; Cleveland; Columbus; Dayton.

Pennsylvania • Philadelphia; Pittsburgh.

Texas • Dallas; El Paso; Fort Worth; Houston; Lubbock; San Antonio.

Washington • Seattle.

Wisconsin • Milwaukee.

☐ **Wideband Channel Service**

Wideband channels are available in bandwidths of 48 KHz and 240 KHz. Service is provided between Western Union central offices located in major U.S. cities. Extension Service between a WU Central Office and customer termination point is available through special arrangement.

Access Charges

Pricing structure is based upon monthly charges for leased 48-KHz or 240-KHz wideband channels between specified city-pair combinations. When a customer utilizes 5 or more 48-KHz channels or when a customer is provided one or more 48-KHz channels in addition to a 240-KHz channel and such channels are either provided over a single route or are distributed over a number of different routes, the charges for such 48-KHz channels will be 85 percent of the rates presented in **Table 3**.

TABLE 3 • Wideband Channel Access Charges

City-Pairs	Rate Per Month Per Channel 48 KHz	240 KHz
New York-Los Angeles	$9,900	$40,300
New York-San Francisco	9,900	40,300
Atlanta-Los Angeles	9,900	40,300
Atlanta-San Francisco	9,900	40,300
Chicago-Los Angeles	7,400	30,050
Chicago-San Francisco	7,400	30,050
Dallas-New York	7,400	30,050
Dallas-Los Angeles	7,400	30,050
Dallas-San Francisco	7,400	30,050
Chicago-Dallas	4,950	20,150
Chicago-New York	4,950	20,150
Atlanta-New York	4,950	20,150
Atlanta-Dallas	4,950	20,150
Atlanta-Chicago	4,950	20,150

Channel Installation & Move/Reconfiguration Charges • nonrecurring charges are applied for installation, move, or reconfiguration of a channel.

Per 48 KHz or 240 KHz:

$50 move chrg	$100 instal

Wideband Channel Service Access Locations

Locations from which customers can access this service:

California • Los Angeles; San Francisco.

Georgia • Atlanta.

Illinois • Chicago.

New York • New York City.

Texas • Dallas; Fort Worth.

☐ **Transponder Services**

Transponder services are available under a Fixed-Term or Month-to-Month contract. Under either arrangement a transponder is made available for a customer's full-time use, 24 hours per day, 7 days per week. Fixed-Term Transponder Service is provided for a fixed initial period of 2 years and can be extended for additional 2-year periods • it is offered as follows:

Protected-Dedicated • Western Union will reserve a specific replacement transponder, consisting of an unassigned transponder or a transponder subject to interruption in a separate satellite or, if requested by a customer at the time the service is ordered, in the same satellite, for use in the event of the failure of the primary transponder being used by the customer.

Protected-Designated • Western Union will not reserve a specific replacement transponder, but instead, for each 4 primary transponders (or less), will reserve a transponder or Traveling Wave Tube Amplifier (TWTA) for use in the event of failure of one of the 4 primary transponders • the first customer whose primary transponder fails will have use of the replacement transponder or TWTA, and the customers, who were previously protected by the transponder or TWTA now being used in a primary manner, will be assigned another protection transponder if available, or will be reclassified to an Unprotected status.

Unprotected • Western Union does not reserve any replacement transponder; if the assigned transponder fails, service provided on this basis may be interrupted for an indefinite period; in the event of any such interruption Western Union will, subject to availability at the time of the interruption, attempt to restore service on another transponder either in the same or a different satellite • the customer will pay the rate applicable to the type of restored service provided; if the restored service is other than that originally ordered, the customer may cancel service without any liability other than to pay for the service taken, provided notice of such cancellation is given to Western Union within 30 days after restoral.

Unprotected-Interruptible • the provisions of unprotected service apply, but in addition this service may be subject to interruption to meet requirements of Western Union to restore protected services, including but not limited to the use of transponder as a replacement transponder when service is being provided to another customer on a Protected-Dedicated or Protected-Designated basis.

Transponder Service is provided through customer-owned and/or operated earth station, or a combination of Western Union earth stations, and compatible customer-owned and/or operated earth stations.

Video Channel Transmission Service is available under Fixed-Term Transponder Service. This service provides a video channel with associated audio in a protected Transponder for the customer's full-time use. The form of protection is defined as Protected-Designated.

Month-to-Month Transponder Service is available under 1 of the following designations defined under Fixed-Term service.

• Protected-Designated
• Unprotected
• Unprotected-Interruptible

Multitransponder

Term Service consists of the provision of a group of transponders on the Westar V satellite which initially includes 1 unprotected and 8 protected-interruptible transponders dedicated to a customer's full-time use (24 hours per day, 7 days per week) for an initial period of 3 years, together with the option to renew for 2 additional 3-year terms and to take service on a month-to-month basis thereafter.

The definitions of "unprotected" and "unprotected-interruptible" transponders are those defined in the Fixed-Term Transponder Service classification. With respect to transponders provided on an unprotected-interruptible basis, Western Union shall designate the particular protected transponder(s) which the unprotected-interruptible transponder(s) protect and shall not otherwise interrupt service.

Access Charges

Pricing is based upon monthly charges for Fixed-Term, Month-to-Month, Video Channel, or Multitransponder service on a

Western Union (WU) Satellite Transmission Services

protected or unprotected basis and can be either dedicated, designated, or interruptible. Charges for Month-to-Month, Fixed, and Multitransponder service can be found in **Table 4**.

TABLE 4 • Transponder Service Access Charges
Monthly Charge Per Transponder

Transponder Service	Month-to-Month	Fixed	Multi-Transponder *
Protected-Dedicated	NA	$172,000	NA
Protected-Designated	$150,000	130,000	NA
Unprotected	130,000	96,000	$91,850
Unprotected-Interruptible	110,000	75,900	66,667

The monthly charges for Multitransponder service will be maintained for unprotected service for the first year after start of service, thereafter it may be increased in 10-percent increments from 110 to 180 percent for the second through ninth years, respectively.

Also, the monthly charge for unprotected-interruptible service will be maintained for 6 years after the start of service. Thereafter, it may be increased in 10-percent increments from 110 to 130 percent for years 7, 8, and 9.

Video Channel Charges • based on a monthly fee; charge per video channel:

$110,000 mo

Protection Service for Customer-Owned Transponders

Western Union offers to designate a transponder or TWTA (Traveling Wave Tube Amplifier) as a replacement in the event a customer-owned transponder on a satellite fails. This service is offered under the same conditions as Protected Designated FTTS; however, if the designated replacement transponder or TWTA has been assigned to restore service to another protected customer, and Western Union is unable to designate another transponder for protection, the customer-owned transponder loses its protection and payment if charges cease. Once a transponder owner gains access to the replacement transponder or TWTA, he will be classified as a Fixed-Term Transponder Service customer and will be committed to the standard FTTS terms and charges.

Customer-Owned Transponder Protection Service • monthly charge per protected Transponder or TWTA:

$34,000 mo

Multiple Transponder Service 1985-1988

This service provides the use of 3 unprotected-interruptible transponders on the Westar IV satellite for a 3-year period from 1985 through 1988. A subscriber to unprotected-interruptible Fixed-Term Transponder Service (FTTS) may, without penalty, convert that subscription to this service. The converting customer shall subscribe to 3 unprotected-interruptible transponders on Westar IV. If a person subscribing to this service is, at the start of the 3-year term, also a subscriber to protected or unprotected FTTS, he may, without penalty, cancel his subscription to 1 FTTS transponder effective January 1, 1986, by providing at least 90 days advance written notice. If the customer chooses not to cancel the FTTS subscription, he shall be obligated to complete the balance of the FTTS term. This service is renewable for an additional 3-year term by written notice at least 6 months prior to the end of the service term.

Westar IV Transponder • provided on an unprotected-interruptible basis:

$65,000 mo

☐ SpaceTel Channel Service

SpaceTel Channel Service provides the requisite voice channel facilities and terminal equipment to allow a customer to communicate directly between a station on his premises in a city and a station on his or his correspondent's premises in another city through a combination of satellite and terrestrial facilities. The service is available 24 hours per day, 7 days per week and is provided on a minimum period of 1 month.

Access Charges

Charges are based on a fixed monthly charge for the first 900 minutes of use, the type of connection, and the designated zone in which the city-pair is classified, located in **Table 5**. Channel

TABLE 5 • SpaceTel City-Pair Zones

	Atlanta	Baltimore	Boston	Chicago	Cincinnati	Cleveland	Columbus	Dallas	Dayton	Detroit	Houston	Indianapolis	Kansas City	Los Angeles	Milwaukee	New York	Philadelphia	Pittsburgh	St. Louis	Washington
Baltimore	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boston	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chicago	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cincinnati	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Cleveland	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Columbus	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dallas	1	2	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dayton	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Detroit	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Houston	1	2	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Indianapolis	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kansas City	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Los Angeles	3	3	3	2	3	3	3	2	3	3	2	2	2	—	—	3	—	3	—	3
Milwaukee	1	—	1	—	—	—	—	1	—	—	—	—	—	2	—	—	—	—	—	—
New York	1	—	—	1	—	—	1	2	1	—	2	1	2	—	1	—	—	—	—	—
Philadelphia	1	—	—	1	—	—	—	2	—	—	2	—	—	3	1	—	—	—	—	—
Pittsburgh	—	—	—	—	—	—	—	1	—	—	—	—	—	2	—	1	—	—	—	—
St. Louis	—	—	1	—	—	—	—	1	—	—	—	—	—	—	2	—	1	—	—	—
San Francisco	3	3	3	2	3	3	3	2	3	3	—	2	—	—	2	3	3	3	2	3
Washington, DC	1	—	—	1	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—

Western Union (WU) Satellite Transmission Services

Service charges can be found in **Table 6.** Additional charges are made for additional service station equipment.

TABLE 6 • SpaceTel Channel Service Charges

Service	Intercity Channel Charges Zone 1	Zone 2	Zone 3
Between PBX Terminals or PBX Terminal and Handset	$475 mo	$500 mo	$565 mo
Between Telephone Handsets	450 mo	475 mo	540 mo
Per Minute over 900 Minutes	0.22	0.22	0.22
Installation	125	125	125

Additional Station Equipment	Monthly Charge	Installation
Extension Station	5	40
Master Instrument	5.50	80
Busy Lamp	0.30	25
Ring Transfer Key	0.30	25

☐ **Audio Program Channel Service**

Audio Program Channel Service furnishes channels for 1 or 2-way point-to-point transmission with 1-way transmission to additional multiple points, also available for the transmission of audio. Full-time, 24-hour, 7-day-per-week service is provided. The service is offered as Type I or Type II Audio Program Channels. Type I supports a frequency range of 300 to 3600 Hz; Type II, 50 to 7500 Hz. Channel conditioning is available on request. The service can be distributed to 2 or more locations within a local area. Local channels between the Western Union operating center and the customer site where the locations are in the same satellite access city may be provided by the customer or Western Union.

Access Charges

Monthly channel rates are between city pairs and are based on Type I or Type II, 1-way, 2-way, or multipoint. Basic service is provided for a minimum period of 1 month. Rates for basic service can be found in **Table 7.** Fixed term is provided for a minimum period of 6 months; the rates are determined by multiplying the basic rates by 0.9.

Basic Extension Service is available to additional cities by extension from specifically designated service points as outlined in Basic Service for minimum periods of 30 days. Charges can be found in **Table 8.**

Audio Program Channel Service is also offered on an occasional basis; rates are based on first half hour and each additional half hour in either peak or off-peak hours. Rates can be found in **Table 9**

TABLE 7 • Basic Audio Program Monthly Channel Rates

Service Route	Type I Channels One-Way	Two-Way	Multipoint	Type II Channels One-Way	Two-Way	Multipoint
Atlanta-Chicago	$520	$ 715	$488	$1,690	$2,340	$1,105
Atlanta-Dallas	520	715	488	1,690	2,340	1,105
Atlanta-Los Angeles	975	1,365	488	2,210	3,120	1,105
Atlanta-New York	520	715	488	1,690	2,340	1,105
Atlanta-San Francisco	975	1,365	488	2,210	3,120	1,105
Chicago-Dallas	520	715	488	1,690	2,340	1,105
Chicago-Los Angeles	715	1,040	488	1,950	2,730	1,105
Chicago-New York	520	715	488	1,690	2,340	1,105
Chicago-San Francisco	715	1,040	488	1,950	2,730	1,105
Dallas-Los Angeles	715	1,040	488	1,950	2,730	1,105
Dallas-New York	715	1,040	488	1,950	2,370	1,105
Dallas-San Francisco	715	1,040	488	1,950	2,370	1,105
New York-Los Angeles	975	1,365	488	2,210	3,120	1,105
New York-San Francisco	975	1,365	488	2,210	3,120	1,105

TABLE 8 • Basic Audio Program Channel Extension Service Charges

Western Union Service Point	Customer Service Location	Monthly Channel Rates Type I Channels One-Way	Two-Way	Type II Channels One-Way	Two-Way
Chicago	Cincinnati	$255	$360	$800	$1,090
Chicago	Cleveland	255	360	800	1,090
Chicago	Denver	255	360	800	1,090
Chicago	Detroit	255	360	800	1,090
Chicago	Kansas City	255	360	800	1,090
Chicago	St. Louis	255	360	800	1,090
New York	Boston	255	360	800	1,090
New York	Buffalo	255	360	800	1,090
Dallas	Houston	255	360	800	1,090
New York	Washington, DC	255	360	800	1,090
Los Angeles	Denver	255	360	800	1,090
Los Angeles	San Francisco	255	360	800	1,090

Western Union (WU) Satellite Transmission Services

TABLE 9 • Occasional Audio Program Channel Service Charges

	Peak Time	Off-Peak Time
First Hour	$150	$100
Additional Half Hour	75	50

☐ Video Channel Service

Video channels are furnished for transmission in 1 direction only of single U.S. standard monochrome and NTSC (National Television System Committee) color signals with accompanying video channel. The nominal video signal bandwidth is approximately 4.3 MHz; the audio channel, 15 KHz. Service can be provided either entirely over Western Union facilities or through a mix of customer-provided and Western Union facilities. Western Union uplink and downlink facilities are available in satellite access cities of Chicago, Dallas, Los Angeles, New York, San Francisco, and Seattle; extension service is available between Seattle and Portland, OR. Service can be extended beyond satellite access cities through Western Union or other means.

Service is categorized as Type 1, 2, or 3. Type 1 service is provided by Western Union's Television Operating Centers (TOC), and include the TOC, a terrestrial transmission link to the earth station, and earth station equipment. Type 2 service is provided at Western Union's earth station using its equipment and requires the customer to deliver the signal to that point. Type 3 service is furnished for customer-provided equipment and facilities.

Access Charges

Rates are based on per half hour, plus each additional half hour in an uplink or downlink channel depending on Type 1, 2, or 3; or space segment in either prime or nonprime (earlybird) time.

Prime time is the time period between 4:00 PM and 2:00 AM Mondays through Fridays and between 1:00 PM and 2:00 AM on Saturdays, Sundays, and national holidays, including Thanksgiving Day, Election Day, Christmas Day, New Year's Day, July 4, Easter Sunday, Labor Day, and Memorial Day. Earlybird time is the time period between 2:00 AM and 4:00 PM Mondays through Fridays and between 2:00 AM and 1:00 PM on Saturdays, Sundays, and the same national holidays as stated above. All time periods are for Eastern time zone. Charges are presented in **Table 10.** Service is offered on a long-term commitment, where service is provided for a minimum of 12 consecutive months or occasional use service, where service is subject to the availability of facilities and equipment.

Alternative Space Segment Rates • discounted space segment rates apply to customers who commit to a cumulative amount of at least $400K during any 12-month period for Video Channel Service • alternative rates also apply to customers who are subscribers to one or more transponders for a fixed-term and continue to apply to subscribers who purchase a transponder from Western Union during, or at the end of the service term • these rates are presented in **Table 10.**

Switching Service • applies for each connection or disconnection of a facility to or from another facility:

$10 conn/disconn

Monitoring Service • provides for the availability of facilities and personnel on a scheduled or standby basis to switch video channels leased by Western Union to the customer • applies for each 30 minutes, or fraction thereof, of standby time required • this must be indicated at the time service is requested:

$25 ea 30 min

Uplink/Downlink Extension • charges apply when a company-provided uplink or downlink is extended between Seattle, WA and Portland, OR depending on first hour or each additional hour:

$195 initl hr	$155 ea add'l hr

Multiple Audio Channel Service • charges apply for a 15-KHz audio channel added to an individual video transmit or an individual video receive channel for first half hour (or fraction) and each 15 minutes thereafter, and for each hour (or fraction) thereafter.

Audio Transmit Channel:

$60 initl 0.5 hr	$20 ea add'l 0.25 hr

Audio Receive Channel:

$25 ea hr

Remote Area Channel Service

A monthly charge applies for each voice grade channel between a Western Union office in the satellite access city of Dallas, TX and the customer's station remote area:

$3,000 mo

☐ Other Network Service

Experimental & Special Services

This service is provided in various bandwidths subject to availability of facilities and is available in 7 different services.

Experimental Channel Service is provided for limited time periods with fixed expiration dates for the purpose of conducting experiments relative to the testing of transmission techniques, system design concepts, equipment, and other customer facilities.

Multiple-Access Special Channel Service is available upon prior arrangement with Western Union. One or more channels, having frequency bandwidth and power levels prescribed by Western Union, are assigned. These channels are to be operated within the prescribed technical parameters. Service is provided on month-to-month, fixed-term, or long-term basis.

A 1.544M-bps Digital Data Service is provided to other carriers for use by the Defense Communications Agency. It includes facilities for 1.544M-bps digital data channels for voice and/or data use between specified locations.

Experimental Integrated Switched Network (EISN) provides for the furnishing to the Defense Communications Agency (DCA) of a satellite space segment and fixed aperture earth stations for

TABLE 10 • Video Channel Service Charges Per Channel

Channel	Prime Time		Earlybird Time	
	First Half Hour	Ea Add'l Quarter Hour	First Half Hour	Ea Add'l Half Hour
Uplink Type 1	$60	$30	$48	$48
Uplink Type 2	38	19	28	28
Uplink Type 3	20	NA	15	NC
Space Segment	325/250*	163/125*	175/140*	175/140*
Downlink Type 1	50	25	35	35
Donwlink Type 2	23	11.50	18.50	18.50

* Alternative space segment rates.

Western Union (WU) Satellite Transmission Services

use by the DCA in an experimental 3.088M-bps packet-switching, data, and digital voice transmission network.

A 230.4K-bps Digital Channel is provided to the Associated Press who has a requirement for a protected terrestrial 230.4K-bps transmit only digital channel connecting a transmit station in New York, NY to Western Union's earth station in Glenwood, NJ. The customer may provide the QPSK modulation equipment at Glenwood provided he operates within the parameters required for inter-connection with Western Union-provided equipment.

Terminal Link Service Arrangement essentially provides for maintenance and operations functions, is provided to Citicorp Satellite Communications Services (CSCS) between customer-provided earth stations which are proximate to Western Union's earth stations at Steele Valley, (Los Angeles) CA and Sky Valley, (San Francisco) CA and the Technical Control Centers at Los Angeles and San Francisco.

Department of Energy (DOE) Telecommunicatons Network provided for the furnishing to DOE 4 communications nodes located at Germantown, MD; Albuquerque, NM; Kansas City, MO; and Livermore, CA as part of a satellite network. Each node consists of an earth station, Time Division Multiple Access (TDMA) terminal equipment, commercial incryption devices and site main-

tenance, and is provided for use in the transmission and reception of digital data in the 4 and 6 GHz frequency bands.

Customer-Owned Earth Stations

Customers may provide their own earth stations and lease from Western Union only a transponder or a portion of a transponder. Use of customer-owned earth stations is particularly attractive to oil companies which operate off-shore drilling rigs and wish to communicate with on-shore offices or installations via satellite. In this case, the land station may be either a Western Union earth station or customer owned, with the customer providing his own off-shore station. A special modulation technique called ·VCPC (voice channel per carrier) is used in this service. Each voice channel is carried on a separate carrier frequency.

Another area where a combination is attractive to a user is in the broadcasting field. For example, television broadcasts originating in any 1 or 2 of the video transmitting cities (Chicago, Dallas, Los Angeles, and New York) could be broadcast via Western Union's earth stations throughout the U.S. At the present time, more than 2,000 customer-owned earth stations communicate through Westar satellites.

• END

Westinghouse Electric Corporation WESTI
TP Monitor System

■ PROFILE

Function ● medium-scale TP monitor; multitasking, multientry with I/O overlap.

Computers/Operating Systems Supported ● IBM System/370, 3000, 4300, and compatible computers; DOS/VS, DOS/VSE, and most replacement independent operating systems.

Networks & Protocols ● SNA; all asynchronous and bisynchronous IBM-standard protocols.

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

DBMS Interfaces ● general DBMS interface facility; specific interfaces available for Nixdorf DBMS, Cullinet IDMS, and Software AG ADABAS.

TP & File Access Methods ● BTAM, EXCP; all IBM sequential, index sequential, direct, and VSAM access methods.

Terminals ● all system-supported console devices; local and remote 3270s; TTY 33 and 35; most other asynchronous and bisynchronous terminals.

Special Features ● CPU-to-CPU communications; Function Trace; Diskwork Auditor; CICS-to-WESTI bridge.

Security ● enqueuing facility; read/write file access authorization; password validation and terminal lockout at sign-on.

Logging/Accounting ● log entries activated by application program entries.

Failure/Recovery ● transaction restore from log; warm restart.

Current Version ● 6.1.

Installations ● over 600.

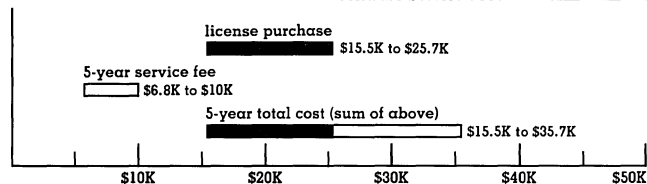**Comparable Product** ● Mathematica ATLAS; IBM CICS/DOS/VS(E).

Vendor ● Westinghouse Electric Corporation; 777 Penn Center Boulevard, Pittsburgh, PA 15235 ● 412-825-7000.

■ ANALYSIS

Much of WESTI's success stems from the excellent vendor support that has always been responsive to the need of its user base. Each release of WESTI has included significant enhancement features, and along with the pricing structure and excellent documentation, has managed to remain highly competitive in the medium-scale TP marketplace.

PURCHASE PRICE RANGE

Software License Purchase ■■■■■■■

Software Service Fees ▭

license purchase
■■■■■ $15.5K to $25.7K

5-year service fee
▭ $6.8K to $10K

5-year total cost (sum of above)
■■■■▭ $15.5K to $35.7K

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

WESTINGHOUSE WESTI 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 WESTI, Local Version ● **MAXIMUM CONFIGURATION** is WESTI, Local/Remote Version, with SCEPTER and memory queueing.

WESTI is one of those products that just seems to go on and on. Perhaps the reason can be traced to the fact that the product has been designed by end users to meet their needs, and subsequently, others find that it meets their needs as well. This well-known, comprehensive, medium-scale TP monitor provides most of the facilities that any other full-function communications control system can offer. It not only supports a multientry and multitasking environment, but it also contains a multicopy facility which, in conjunction with the roll-out-in methodology and full I/O overlap functions, provides the user with effective multithreading capabilities.

WESTI comes with a full range of sophisticated queue management and overall manipulatory technologies; many beyond what one would expect in a "small system" monitor. The macro-generative nature of the product provides the user with a highly flexible system, easily tailored to the network being installed and supported. WESTI is a highly modular, which means that the user can configure a system most suited to his/her needs, and do it without having to lay out any more money than it costs for the basic system. In fact, the only "option" that can be incorporated in with the WESTI system is SCEPTER, the Westinghouse program development facility. Actually, SCEPTER is a standalone product that can be retrofitted into the WESTI system to provide the user with an added capability.

Although WESTI was never designed to directly support any one particular DBMS, the vendors were farsighted enough to realize that the need would be there, so they have made available interfaces to some of the more popular DBMS systems. Recently, the developers went a step further and provided WESTI with a bridge software facility that allows the CICS/VS user to run his/her command-level applications under WESTI without having to make modifications to the CICS application program. Could it be that there is a TP monitor vendor who has not conceded defeat to IBM's CICS/VS, and, in fact, is showing the user of that highly complex system a "better way?"

□ Strengths

WESTI is probably one of the easiest to use, straightforward, DOS-oriented TP monitors on the market. WESTI uses BTAM I/O modules to handle all remote terminal communications and is noted for its low overhead and speed of performance. WESTI's command and macro structure is well described in the supporting documentation which helps to make the system easily usable right from the start. WESTI's modularity is another excellent overhead saving feature because users can generate only the elements required for a given installation. Screen format creation is also very simple and flexible and includes a menu-type operation for extensive prompting. Finally, WESTI supports a broad range of IBM-compatible terminals.

□ Limitations

WESTI is directly oriented to the user application and allows each application to control terminal-device allocations. This means that one program could inadvertently tie up the CPU and/or terminal(s) for long periods of time, preventing other work from getting done. This possibility requires the system architect to make certain that all application programs are fully aware of system status during operations and that enough safeguards are inserted into each application program to prevent lockouts. These requirements are minor inconveniences to users who develop their own applications software, providing they are constantly aware of the potential problem, but could become major problems for users who purchase packaged programs.

Westinghouse Electric Corporation WESTI
TP Monitor System

Selected DBMSs are supported with existing interfaces (supplied by the DBMS vendors), and most other DBMSs can also be supported at the record level if the DBMS vendor is willing to supply an interface module. Users who have or are considering an unsupported DBMS must either plan to design their own interface or scratch the DBMS from their shopping list.

■ OVERVIEW

☐ Terms & Support

Terms • there are 2 versions of the system: local or local and remote; license available purchase, lease or rental plans; full payout options are available.

Support • no charge for first-year maintenance; ongoing annual maintenance fee is fixed; training classes available in Pittsburgh every 6 weeks; cost is $375 per person; in-house training supplied on request; regional classes and consulting are available.

☐ Component Summary

All the individual elements of the WESTI system can be tailored to meet specific user requirements through the macro-oriented system generation process. Two versions of the WESTI system can be purchased: a local-only version or a local/remote version. Some of the system features are nonselectable (basic system elements), while others are optional. Among the basic elements are the dispatching and network control functions. Selectable modules include the AUTOSTART facility, which permits users to preset initialization parameters; the DBMS/File Interface facility; the Roll-In-Out facility, which allows several application programs to share a common execution area; a Screen Management facility for the IBM 3270 terminals; a data entry disk management facility; the Wait-On-User-Defined-Event (WOUDE) facility, which is the basis for program communication with asynchronous subtasks with wait time accumulation; remote support for 3270s and TTY devices; a logging facility; an enqueuing facility; and system, terminal, and printer control options.

☐ Host Computers & Operating Systems

WESTI can be installed on any IBM System/370, 3000, 4300, or compatible computer capable of supporting the IBM DOS/VS(E) operating system or a compatible replacement system.

☐ Minimum Operational Configuration

WESTI requires that BTAM be resident in the operating system environment. The monitor requires 12K bytes to 36K bytes of main memory storage depending on the options generated into the system. In addition, a minimum of 36K bytes for the Free-Core-Pool facility must be added to the required partition space for the application program. All system-supported disk units (including the 3310 and 3370) are handled by WESTI. Both 2260 and 3270 terminals are supported for local processing (3270s can also be used in remote environments).

☐ TP Monitor Facilities

WESTI Kernel

The nucleus of WESTI consists of the dispatcher task which schedules all activities in WESTI. Many dispatcher functions emulate operating system functions, but control is given up to the operating system only when there are no dispatchable tasks in the system. Other elements of the basic system code include the network management facility, terminal-to-application device assignment logic, resource allocation, application program scheduling, and memory management. The monitor kernel is also responsible for all terminal I/O operations.

In the latest release of WESTI, 2 new features were incorporated into the Kernel: the Function Trace facility, which is an online diagnostic aid that traces the logical flow of WESTI application programs; and the DISKWORK Auditor, a batch application that can be used to diagnose DISKWORK initialization errors by checking for mismatches in allocation unit counts, and attached tracks or block groups.

User applications can be written in COBOL, PL/1, assembly language, or RPG II. A WESTI application can run in multientry mode, where several terminals are handled asynchronously by a single program; in single-entry mode, where an application program handles one terminal at a time; or in single-entry/multicopy mode, where the monitor provides each terminal with its own dynamically created copy of an application. In addition, applications can be memory resident or can share a common roll-in/roll-out execution area.

WESTI • local version:

	$15,500 lcns	$500 mo	$1,705 serv
WESTI • local/remote version:	19,500	575	1,950

☐ User-Selectable TP Monitor Features

AUTOSTART Facility

This facility permits redefined responses to WESTI initialization messages to be constructed. Manual intervention by the operator is thus eliminated, and the possibility of human error is reduced. This process can be used only when initialization procedures are fixed. AUTOSTART also permits the initial application program to receive direct control of the system after initialization.

Database & File Interface

The Database Interface permits the application program running under WESTI to communicate directly with a DBMS at the record level. WESTI can be linked with the DBMS in a single partition, or the DBMS can operate in a separate partition in Central Mode. The DBMS vendor is responsible for supplying the actual interface coding. The standard DBMS interfaces are to Cullinet IDMS, Software AG ADABAS, Nixdorf DBMS, and Cincom TOTAL.

A second method of record access is the Access Method Controller (AMC) facility. AMC provides a common facility for performing read/write operations on direct access (DAM), index sequential (ISAM), sequential (SAM), and virtual storage (VSAM) files. PSAM files may also be accessed if this product from Universal Software is being used in-house as an access method. AMC eliminates the need for an application programmer to be concerned with deblocking, disk device type considerations, update protection, and return codes. Each application program interacts only with data at the record level. Changes can be made to file structures without impacting application programs. All wait time accumulated by the AMC facility is returned to the monitor to allow for terminal overlap access.

Roll-In-Out (RIO) Facility

This optional feature helps to reduce storage requirements and paging activity by permitting multiple application programs to share a common execution area. Any application program can share the area under control of the monitor regardless of program structure or code. At system initialization time, WESTI loads each program to be executed into the RIO area and then writes the programs onto a special disk file formatted in full track blocks. Programs are accessed through the RIO instead of the core image library, unless a fresh copy is required by a particular program.

System performance is enhanced by minimizing the time required to complete a roll-out/roll-in cycle. This enhancement is realized by using direct disk addressing, full track blocking, rolling in or out only the actual length of the application program involved, and breaking the RIO process into single track operations to lessen the impact of paging operations in a system with small page pools. The user is also given the option of designating certain programs as READ-ONLY, which guarantees that the program does not get rolled out and is only rolled in when required.

Screen Management Facility

This facility supports the creation of screen display formats and stores the resulting data streams in a system-managed disk data

Westinghouse Electric Corporation WESTI
TP Monitor System

set. It also provides for retrieval of requested display formats by relative record number identification. It adds required information through mapping overlays, and unstrings terminal reply streams into defined data areas to ease processing requirements. Records on the SCREENS file can be created, updated, and accessed. The user defines the maximum size of the record to be stored in the file. All tracks in the file are then preformatted to the defined record length with a 2-byte key, which designates the actual length of the data recorded in each record position. This arrangement permits relative record addressing and temporary storage of variable-length data.

DISKWORK Facility

This facility provides data management capabilities in support of data entry applications or as a temporary data storage media. It permits an application program to create, access, and update data records without concern for enqueuing schemes for data integrity in a multiterminal environment. It keeps records unique within a DISKWORK file by not allowing multiple tasks to own or share the data sets concurrently. The DISKWORK facility dynamically allocates and deallocates space to each task as required, which frees the application programmer from the need to allocate a fixed space for terminal input. As processed data strings or temporary data sets are no longer needed, the file space is released to the common track pool and is made available for subsequent reuse by the system.

Each data set created by a terminal attached to a DISKWORK application program is entry sequenced. Once a program gains access to a DISKWORK data set, the application can be moved freely within the string by a set of positioning commands. Applications can be moved forward or backward one record at a time to the beginning or end of the string. Data record strings that have been created by a WESTI online application program can be unloaded to an off-line environment using the batch DISKWORK module. This module communicates with the active WESTI system across partition boundaries to protect the integrity of the data structure if both the batch and online versions of DISKWORK attempt to access the data structure at the same time. The DISKWORK facility also has an automatic warm-start initialization capability.

Wait-On-User-Defined-Event (WOUDE) Facility

This module allows users' application programs to communicate with asynchronous subtasks in a manner such that any wait time accrued from use of the subtask is available to WESTI. When multiple applications or terminals attempt to use the same subtask, the monitor queues the requests in priority sequence. Both multiple-entry and single-entry subtasks can be accommodated. In single-entry mode, all processing of a WOUDE request must be completed before the subtask can signal for another request. In multientry mode, the subtask can signal for another request before the previous request is completed. Only terminals requesting subtask facilities are put into the wait state; all other system functions proceed to execute.

The WOUDE facility can be used to construct out-of-line error correction routines and to create unique data management facilities to meet special installation requirements. This facility permits almost any database management system to be interfaced with WESTI.

Remote Support

IBM 3270-type terminals, system-supported printers on leased multipoint lines, and TTY 33 and 35 (or equivalent) terminals on switched lines can be supported by the Remote Support feature. This facility handles all network management functions such as message-framing character control, polling selection, and incoming message segment blocking. ASCII code translation is handled automatically by this facility, and multientry applications can simultaneously service any mix of local and/or remote devices or printers. All remote writes to display units and printers are disk buffered, and switched line terminals are memory buffered.

Also available, as an optional add-on for remote users, is a memory queuing feature. With memory queuing, all remote terminal

I/Os are queued in memory as opposed to the DISKQ file. The result is lower system overhead and a faster response time for both remote and local terminals. The option can be acquired for a one-time price of $1,200, with maintenance included as part of the annual system maintenance fee.

Logging Facility

Two disk logging data sets must be allocated to the logging facility. One is always assigned to the active logging task, and the other is available for backup when the first is full. The application program is responsible for initiating the logging action, and it is also responsible for defining the contents of the logged transaction(s). The main purpose of the file is to provide a means for backing up or recreating a transaction when a system-connected failure occurs or when a terminal malfunctions. The log file can be restored with a warm restart profile in case of system initialization.

Enqueuing Facility

This facility allows application programs to schedule serial resources to prevent multiple terminals from attempting to use the same resource or to simultaneously access the same data file or record for a write operation. Resource ownership can be shared as long as a requesting terminal does not require exclusive control. Resources are released when an application program issues the DEQUEUE function call. They are also released any time a terminal signs off in normal mode. A resource can be retained after sign-off, but the possibility of a deadly embrace is prevented by a circular lock check feature that releases all resources locked up by an inactive terminal.

Terminal Control

Terminal control is given to the application program when it is loaded for execution. When a program terminates, the program transfers the terminal to another program or to a system task designed to hold the device. The initial program assigned to the terminal is defined at WESTI generation time. When the application program does not pass control of the terminal to another application program, the WESTI's MENU program takes control and allows the operator to designate the activity for the terminal. This control facility also contains the logic for sign-on and sign-off actions and for password and read/write authorization validations.

Printer Control

WESTI's control facilities provide application programmers with a set of options that permit printers to be acquired for exclusive or shared use, that allow printer output to be serialized by either hardware features or control characters, and that provide the ability to assign a group printer to a terminal. All printer write requests are staged to an intermediate disk buffer to release the terminal network from the slow speed printer device. Other options provide for data validation and compression.

System Control

WESTI control functions are incorporated in the control application program supplied with the system. The control functions are selectable and are designed to support the tailored environment of each installation. WESTI control applications provide the ability to activate or deactivate any local terminal or printer or any remote line, control unit, terminal, or printer; to deactivate or request a fresh copy load of any application program; to change the priority of any terminal or application or enable/disable priority scheduling within the WESTI; to cause all or parts of WESTI, memory-resident applications, or the RIO area to be page fixed or freed in virtual storage systems; to display the status of any line, control unit, terminal, printer, application, DISKWORK file, AMC file, or various other components of WESTI; to change the READ-ONLY and/or ENTRY attributes of application programs; to activate an orderly system shutdown process or initiate rapid system shutdown procedures; to activate or deactivate system logging procedures or initiate an active logging file; and to open, close, or change the accessability attributes of files managed by the AMC. WESTI also provides a system monitor control appli-

Westinghouse Electric Corporation WESTI
TP Monitor System

cation function for users who want to construct their own system control applications.

CICS-to-WESTI Bridge

This newly announced software interface enhancement is an extra-cost option that has been designed by Westinghouse to allow WESTI users to run CICS command-level applications under the WESTI monitor. This means, that the WESTI user can go out and acquire an application that has been designed to function under CICS and install it under WESTI without having to change anything in the CICS application program. According to the vendor, early tests have shown that the application runs faster in this conversion environment than it does in the native CICS environment. The bridge can be used in 2 ways: to allow the WESTI user to go out and purchase existing CICS applications software (or utilize existing CICS programs) and run it in the WESTI system, or to actually prepare for a conversion to WESTI from the CICS environment.

CICS-to-WESTI Bridge:

| | $10,000 lcns | $250 mo | $1,200 serv |

■ USER INTERFACES

Many discrete user interfaces are incorporated into the user-selectable TP monitor features that permit users to tailor WESTI to the requirements of each installation. These interfaces consist of optional command sets, procedures, and operating techniques and are determined wholly by the end configuration selected by each user.

□ Languages Supported

WESTI supports COBOL, PL/1, RPG II, and IBM assembler languages.

□ Program Development

SCEPTER ● display-oriented, command-driven source program development tool; operates as an application program in a WESTI system and can be interfaced with most DOS-oriented spooling systems; provides job entry facilities and queue management control; provides commands, subcommands, and PF (Program Function) keys to display up to 80 characters of source data on the CRT screen; supports source module updating and permits forward or backward spacing by line or by screen; also supports screen refresh, line addition/deletion/duplication, and line reversal or swapping; enqueuing facility provided by WESTI is the basis for SCEPTER's library sharing security ● SCEPTER modules can be updated either in batch mode, in which the update job stream is submitted directly from a SCEPTER work file to the batch partition where the update job stream is executed, or in an online mode, in which the source code is copied from its library into the work file where the update is applied directly; user exits are provided to allow users to generate and implement unique editing functions, to implement special sign-on/sign-off control, and to support a generalized batch library system interface for users who do not store all their source programs in a system or private library ● SCEPTER requires WESTI; a separate standalone version of SCEPTER, called SCEPTER/PLUS, is also available; it contains its own built-in monitor and does not require WESTI:

| | $5,000 lcns | $225 mo | $600 serv |

■ 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. Gary Brewer
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● Mr. Earl Hull
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● Mr. James L. Smith
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 Graber Plaza
 Middleton, WI 53562
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● END

Winterhalter DataTalker Family Protocol Converters
Models DataTalker/PC, /PC+, /II & /Coax

■ PROFILE

Function ● emulates IBM 3271/3274/3275/3276 local and remote controllers and 3277/3278/3279/3284/3287 terminals/printers ● substitutes asynchronous personal computers and ASCII printers for emulated IBM units ● provides IBM 2780/3780 RJE workstation emulation ● permits file uploading and downloading operations.

Packaging ● printed-circuit card (DataTalker/PC/PC+/Coax); standalone tabletop unit (DataTalker II).

Communications ● DataTalker/PC/PC+/II emulate IBM 3271/3274/3275/3276 controllers attached to IBM 3705/3725 communications processors or Integrated Communications Adapter ● single link, point-to-point or multipoint transmission at speeds from 110 to 19.2K bps half-/full-duplex, SNA/SDLC or BSC; RS-232C DTE/DCE interface ● DataTalker/Coax attaches directly to IBM 3274/3276 controller via coaxial interface ● X.25 interface (PAD) offered for DataTalker/PC+ and DataTalker/II.

First Delivery ● 1984.

Systems Delivered ● about 2,000 (all versions).

Comparable Systems ● ABM Computer Systems SC-Series, AST Research AST-PCOX/SNA/BSC/3780/5251, Avatar PA100 and PA 100 Turbo, CXI Inc CXI 3278/3279, Forte Data Systems FORTEPJ/3270-PC, DCA Irma, Micro-Integration Coax/Micro/BIS family, Pathway Design PC Path, Persyst Products Coax/3278 and PC/3270/3280/HASP, and Techland Systems Bluelynx Series.

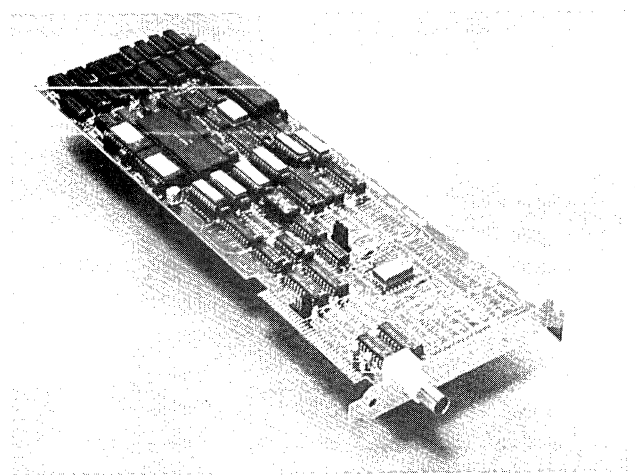**Vendor** ● Winterhalter Incorporated; 3853 Research Drive, Ann Arbor, MI 48104 ● 313-662-2002.

Canada ● none; Canadian distributor.

Distribution ● sold through direct sales staff, manufacturer's representatives, distributors, and retail sales outlets ● distributed in Canada by Electronics Supply, Inc; 306 Rexdale Boulevard, Rexdale, ON M9W 1R6 ● 416-741-4000.

GSA Schedule ● unlisted.

■ ANALYSIS

The members of the DataTalker family, officially classified as "protocol converters" allow incompatible terminals and printers to communicate with IBM mainframes. Like so many products in this growing marketplace, the DataTalker units are actually

PURCHASE PRICE RANGE   hardware ▆▆▆▆▆

DataTalker/PC
▮ $0.7K
          DataTalker/PC+
          ▆▆▆ $1.1K to $1.5K
          DataTalker/II
          ▆▆▆ $1.1K to $1.5K
          DataTalker/Coax
          ▮ $1.1K

      $1K $2K $3K $4K $5K

WINTERHALTER DATATALKER SERIES PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations ● DataTalker/PC is basic system ● small DataTalker/PC+ is for basic system large adds an X.25 PAD ● small Datatalker/II is for basic system; large adds an X.25 PAD ● DataTalker/Coax is for basic system ● all prices are single-quantity purchase ● maintenance is negotiable.

emulators that make the attached terminals/printers appear to be IBM 3270 controllers, printers, and/or terminals. In addition to emulator services, DataTalker also supports file transfers between IBM host mainframes and, in this case, personal computers. That's the **real** strength of the product line.

DataTalker members include 4 primary units: DataTalker/PC, DataTalker/PC+, DataTalker/II, and DataTalker/Coax. All except DataTalker/II are printed circuit cards that plug into a card slot in an IBM PC, PC/XT, PC/AT, or compatible products, causing them to emulate a 3270 controller and/or 3277/3278/3279/3284/3286/3287 terminal/printer. Device emulation varies with the DataTalker model and the selected protocol support. In addition, certain DataTalker products will also emulate the IBM 2780/3780 RJE Workstation.

The DataTalker/PC, /PC+, and /II are all capable of emulating remote versions of the 3270 cluster controller line. All are offered in versions supporting SNA/SDLC, BSC, or 2780/3780. In SNA/SDLC mode, the IBM 3274-51C, or 3276-12 controllers are emulated; under BSC, the 3271-2, 3275-2, or 3276-2 are emulated. The attached personal computers are made to emulate the 3277/3278/3279 terminals. For those DataTalker units attaching printers, serial ASCII printers can be substituted for IBM units.

While Winterhalter emphasizes the remote terminal market, it services the local-connect segment with its DataTalker/Coax product. That unit is also a printed circuit card that plugs into a personal computer, but relies on an IBM 3274 or 3276 controller for communication services. Connection to the IBM device is via a coaxial cable. DataTalker/Coax's emulation service is limited to making the personal computer appear to be a 3278/3279.

The DataTalker/II is the only standalone product in the family. This unit also provides 3270 controller emulation, thereby "technically" qualifying it as a cluster controller replacement. However, the Winterhalter unit only contains 3 RS-232C ports for attaching terminals/printers.

While the DataTalker line is no match for the 3270 when it comes to the number of terminals and printers handled, it far outstrips Big Blue and its imitators by providing **file-transfer utilities**. Unsupported by the 3270 or compatible products, Winterhalter's
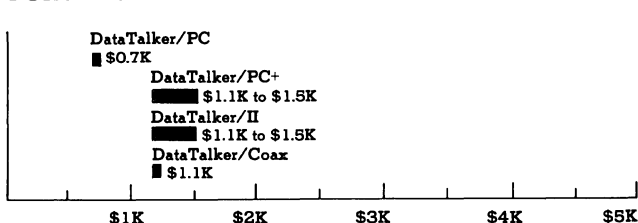
Winterhalter DataTalker Family Protocol Converters
Models DataTalker/PC, /PC+, /II & /Coax

products can upload and download files between the host and personal computers. On the DataTalker/Coax, file transfers are handled by sophisticated utilities much like IBM's TSO and CICS software. On the rest of the line, file transfer is handled by the 2780/3780 emulator.

The sophisticated TSO and CICS utilities are called Quick File and CICS File Transfer, respectively. Quick file employs TSO macros to transfer binary and text files between the personal computer and host, but bypasses the TSO editor in the process. This substantially decreases the time required to carry out the file transfer operation (see Strengths). The CICS utility interfaces with the IBM CICS monitor at the host, and takes advantage of the database management and efficient transfer services provided by that very popular system.

It is perplexing that Winterhalter has elected to support the local unit with the most sophisticated file transfer services. While local connect may be a large portion of the marketplace, remote users need access to file data for immediate operation. The 2780/3780 RJE file transfer does a commendable job, but it's intended for large batch transfers where the receiving device is a printer (or printer substitute). Thus, the data is not immediately available to the end user. More on this under Limitations.

The method employed for implementing protocol emulation is also worth noting. While the DataTalker boards are offered in versions that emulate SNA/SDLC, BSC, and 2780/3780, the emulation itself is executed in **software** loaded from a diskette into the personal computer's RAM and (except for DataTalker/PC) into the printed circuit board's RAM. Thus, to change protocol emulators, **only the diskette** need be changed—not the DataTalker board.

In summary, the DataTalker product line is really nothing special if you need emulation services. In fact, products from Black Box, Datastream ICOT, Infotron, Local Data, Micom, and Innovative Electronics (to name a few) can do the same job and support multiple terminals and printers (see survey report 737 for details). Most of those products are standalone boxes, however, which require space on an already crowded disk. In addition, some of them support the file transfer facilities. Remember, sophisticated file transfer capabilities, such as offered with DataTalker CICS, are **not for the novice**. They require knowledge of database organization (file, record, and field organizations), normally the turf of a systems programmer or database administrator. For those who can live with less power and flexibility, the Quick File software is much easier to use.

□ Strengths

The principal strength of the DataTalker line is its ability to emulate an IBM 3270 controller, not just terminals and printers as is the case with a number of competitive products. In addition, the file transfer programs provide a further degree of operating autonomy and flexibility not available in native-mode 3270 operation.

A good number of "protocol" converters on the market emulate only the terminals/printers of the 3270. For controller services, they rely on an IBM 3271/3274/3275/3276 (or compatible) product which, of course, costs anywhere from $4,885 for an IBM 3274-51C to $5,535 for a 3276-12. While some IBM replacement products are priced slightly less, their prices are still in the same ballpark. With the DataTalker line (except the Coax product), controller and terminal emulation is executed in a combination of firmware and software. No connection to an IBM 3270 controller is necessary. With a top price of $1,095, the DataTalker line offers not only end-to-end emulation but a price one-quarter of what IBM charges.

Of course, the 51C supports 8 terminals, while DataTalker supports no more than 3. While this is true, we question how many remote sites really need an 8-terminal facility. Besides, Winterhalter is targeting personal computer users while IBM is not.

DataTalker also employs software to execute the emulation services. While this technique is probably slightly slower than a total firmware approach, it is far more flexible. For example, firmware generally requires PROM chips that must be physically swapped to change emulation or to implement updates. Our experience has shown that nontechnical users are quite reluctant to even change a cable, let alone a chip. However, none will resist swapping a diskette to change emulation nodes or to incorporate a new release. Of course, software emulation does use the personal computer's RAM—typically 64K for DataTalker products—but given the price—flexibility tradeoff, we think it's worth it.

The file transfer facilities offered consists of the 2780/3780 emulation software and the advanced Quick File and CICS utility provided as part of the DataTalker/Coax package. The best that can be said about the 2780/3780 is that it allows file transfer where none would normally be available. Otherwise, as we discuss under Limitations, we don't like it for applications other than using the personal computer as a data concentrator.

QuickFile and CICS are a different story. Both are efficient and fast, and CICS provides fairly good data extraction capabilities when used in conjunction with IBM's host-resident CICS. QuickFile is a mainframe file transfer program that employs TSO macros and works in conjunction with IBM's TSO operating under CMS/MVS/VMS. QuickFile, however, **bypasses** the TSO editor that verifies each line of data sent to the host. This verification process causes the personal computer to wait between lines, thus slowing the entire file-transfer process.

The Winterhalter CICS application handles text and binary files. It uses full-screen record blocking with record lengths of up to 255 bytes. This application also allows the user to specify host-resident CICS file field selection from multiple files to create a new file. While this database manipulation provides considerable power to the personal computer, the operation itself is best suited to data processing professionals.

Another strength of DataTalker is concurrent operation. Users can initiate a file transfer to be performed in the background mode, while the personal computer continues to operate on foreground jobs. Concurrent operation with DataTalker is possible because each board, except DataTalker/PC, contains its own Z80A and RAM to handle personal computer and mainframe operations.

□ Limitations

The DataTalker line has a major drawback and several minor ones. The major limitation is that file-transfer to remote units is restricted to 2780/3780 emulation. The IBM 2780 and 3780 are RJE workstations designed to transfer large blocks of data. Further, it makes the personal computer appear to be a card-image reader or printer. Batch file transfers such as these do not allow the data to be used in real time, unless a programmer links batch execution with the data destination. This is **not** supported by Winterhalter. If you're planning to run the remote personal computer as a data concentrator and are familiar with RJE and JCL, then 2780/3780 is okay. Otherwise, we'd recommend QuickFile and CICS. This message hasn't been lost in Winterhalter; it is currently implementing those utilities for remote DataTalker.

Among the minor drawbacks are no multiple windowing facilities; no display characteristics beyond 80 columns; and no remote dial-in support to the DataTalker/II. The multiwindowing facility would allow several jobs to be concurrently displayed like the way IBM's 3270 PC handles it. The vendor claims this is under development.

All DataTalker products emulate the Model 2 display characteristics of the IBM 3278/3279, which simply means that the screen is restricted to 1920 characters displayed in an 80-column x 24-line format. For spreadsheets, a 132-column line is conducive (e.g., such as provided by the IBM 3180 and 3278-5). This is also under consideration by the vendor.

DataTalker/II is a standalone remote cluster controller with 3 terminal ports. None of the ports, however, can be programmed to handle a dial-in operation which would accommodate an occasional user. Dial-in is provided by a good number of Winterhalter competitors and it would be wise to offer it also.

■ SOFTWARE

□ Terms & Support

Terms ● emulation software applications offered on purchase-basis only ● firmware bundled into basic system price.

Winterhalter DataTalker Family Protocol Converters
Models DataTalker/PC, /PC+, /II & /Coax

Support ● provided by vendor and/or seller ● telephone consulting free-of-charge.

☐ Utilities

Winterhalter offers several utilities that provide device and protocol emulation of IBM 3270 components operating under SNA/SDLC and BSC. A program is also available for emulating the IBM 2780/3780 RJE Workstation. All emulators are diskette resident and work in conjunction with DataTalker boards and the IBM PC, PC/XT, PC/AT, and compatible devices.

Also available are diskette-resident advanced file-transfer programs for uploading and downloading binary and text files between the mainframe and microcomputers. Called QuickFile and CICS File Transfer Utility, they run only on a personal computer equipped with a DataTalker/Coax board.

To employ these advanced file-transfer programs, the host processor must also contain Winterhalter-supplied interface software to handle QuickFile and CICS File Transfer operations such as opening host-resident files.

QuickFile transfers binary or text data between the personal computer and host, and employs TSO macros. QuickFile, however, bypasses the TSO editor that normally verifies each line of data transferred. This verification results in some very unacceptable delays when transferring large files (see Strengths). Thus, file transfers under QuickFile involve large blocks of data transferred without the verification process. Users invoke file transfers by entering the source and distinction file names. QuickFile assigns the transfer destination that contains the file's record format, code table, and transfer mode. Both text and binary files are handled. The QuickFile utility runs in the personal computer as an application program, and requires 128K bytes of RAM.

The CICS File Transfer utility also runs on the personal computer and requires the same amount of RAM. The CICS utility handles binary- and text-file transfers between the host mainframe running CICS and the microcomputer. With the CICS File Transfer utility record definition, users designate the fields to be extracted from a file on the mainframe for transfer to the personal computer. Users create a single mainframe file consisting of only selected fields.

QuickFile Transfer Utility ● diskette-resident software application running on IBM PC, PC/XT, PC/AT, and compatible products ● interfaces via DataTalker/Coax and 3274/3276 controller to IBM mainframes running under VMS/MVS/CMS/TSO ● support sequential and partitioned data sets with fixed and variable formats ● transfers text and binary files to a selected host SYSOUT Class (e.g., host printer) ● file transfer initiated by entering source and destination filenames:

NC prch	NA maint

CICS File Transfer Utility ● diskette-resident software application running on IBM PC, PC/XT, PC/AT, and compatible products ● interfaces via DataTalker/Coax and 3274/3276 controller to IBM mainframes running under DOS/VSE with CICS, MVS with CICS, or OS/VS1 with CICS ● field types supported include alpha, alpha left justified ● zoned numeric, zoned numeric left and right justified, and packed decimal ● EBCDIC/ASCII conversion ● VSAM Entry Sequence, VSAM Key Sequence, Transient Data Sets supported ● supports field selection from multiple files to create new file; variable record lengths (up to 255 bytes) ● allows selection of files/records for transfer; multiple record formats from same file:

NC	NA

SNA/SDLC Emulation ● diskette-resident package emulating the IBM 3274-51C, 3276-12, 3278, 3279, and 3287 ● provides SNA/SDLC protocol ● requires 128K bytes of RAM ● offered for all products except DataTalker/Coax:

495	NA

BSC Emulation ● diskette-resident package emulating the IBM 3271-2, 3275-2, 3276-2, 3277, 3284, 3286, and 3287 ● provides BSC protocol ● requires 128K bytes of RAM ● offered on all products except DataTalker/Coax:

495	NA

2780/3780 Emulation ● diskette-resident package emulating the IBM 2780/3780 RJE Workstation ● provides BSC protocol ● requires 128K bytes of RAM ● offered on all products except DataTalker/Coax:

495	NA

■ HARDWARE

☐ Terms & Support

Terms ● all hardware components offered on purchase-basis only ● 30-day, money-back guarantee.

Support ● 12-month parts and labor warranty; factory repair and replacement within 2 business days ● service also available from third-party sellers.

☐ Overview

The DataTalker series consists of 4 hardware/software products designed to allow an IBM PC, PC/XT, PC/AT, and compatible products to function as members of the IBM 3270 clustered-terminal controller family. A version of the DataTalker line also allows the personal computer to emulate the IBM 2780/3780 RJE workstation.

The DataTalker line is composed of the DataTalker/PC, DataTalker/PC+, DataTalker/II, and DataTalker/Coax. With the exception of the DataTalker/II, all models are printed circuit boards that fit into a card slot in the personal computer. DataTalker/II is a standalone cluster controller that accommodates 3 personal computers or printers and provides the emulation and communication services for host interaction.

With the exception of DataTalker/Coax, all products are offered in versions that emulate the IBM 3270 operating under SNA/SDLC or BSC, or emulate the IBM 2780/3780. Since the software needed to perform emulation is on diskette, users can switch emulation modes **without** changing DataTalker cards (see Software). The emulation software requires 128K bytes of RAM, 64K of which runs on the DataTalker board and the rest on the personal computer. The exception to this distribution is DataTalker/PC, a board with no RAM to accommodate emulation. With this product, 128K of personal computer RAM must be allocated.

IBM 3270 emulation modes consist of the SNA/SDLC product that emulates the 3274-51C or 3276-12 controllers, the 3278-2 or 3279-2A terminals, and the 3287-1 or -2 printers. The BSC version emulates the 3271-2, 3275-2, or 3276-2 controllers, 3277-2 terminals, and 3284-3, 3286-1 or -2, or 3287-1 or -2 printers.

The IBM 2780/3780 product emulates the 2780/3780 RJE workstation, and operates in attended and unattended modes. The latter is used for batch transfer operations, and allows the user to list up to 20 files for transmission. Transmission is automatic; the DataTalker breaks the telephone connection at end of transmission. Both text and binary files can be transmitted, and users can select and modify the buffer and record size, compression, transmission code, and time-out delay. Vertical and horizontal forms control can be specified for print operations. An asynchronous ASCII printer can be used in lieu of an IBM unit.

File uploading and downloading is supported by all versions of DataTalker. Except for DataTalker/Coax, all units transfer files via the 2780/3780 emulation package. The Coax product employs more powerful file-transfer routines called QuickFile and CICS, which interface with IBM's TSO and CICS facilities at the host. For the DataTalker/+ and II models, the vendor provides an Applications Interface Module (AIM) that allows users to write applications that directly communicate with the mainframe. This allows screen images to be sent and received from the host.

All models, except DataTalker/Coax, communicate with IBM System/370, 303X, 308X, and the 43XX mainframes via a 3705/3725 communications processor, or directly connect to the

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PRCH: single-unit purchase price. MAINT: monthly maintenance charge. NA: not applicable. Prices current as of February 1985.

Winterhalter DataTalker Family Protocol Converters
Models DataTalker/PC, /PC+, /II & /Coax

host via an Integrated Communications Adapter supporting Type A devices. DataTalker/Coax connects to a 3274 or 3276 controller and depends on it for communication services.

DataTalker/PC, the lowest priced unit in the series, is a short size, single-slot expansion board. It is offered in SNA/SDLC, BSC, or 2780/3780 versions, and is equipped with 2 RS-232C ports—1 for a modem, the other for a CRT diagnostic terminal. Unlike other members of the DataTalker family, this product has no on-board RAM or microprocessor (Z80A). Thus, to run its emulation program, 128K bytes of personal computer RAM must be allocated. The lack of a Z80A means that the personal computers must also handle the communication functions as well.

DataTalker+ has the same emulation facilities as DataTalker, but also features a 64K RAM memory and a Z80A microprocessor. The Z80A and memory supports the vendor's Concurrency Feature, which allows for concurrent processing of the 3270 BSC or SNA/SDLC terminal emulator program and other applications such as word processing, spreadsheets, etc. Users can move between sessions while maintaining the interrupted session. DataTalker+ interfaces the personal computer's bus, and is compatible with MS-DOS, PC-DOS, and CP/M-86 operating systems.

DataTalker II is a standalone unit that emulates the 3271/3275/3276 in BSC mode or 3274/3276 running under SNA/SDLC. Four serial ports are provided; 1 for a modem and 3 for interfacing personal computers or asynchronous ASCII printers. DataTalker II is compatible with most popular personal computers and operating systems, including CP/M-86, concurrent CP/M-86, MP/M-86, and MP/M-II, MS-DOS, PC-DOS, and TurboDOS.

DataTalker/Coax is also a single-slot expansion board that makes the personal computer emulate a 3278 or 3279 terminal. The Coax model, however, does not emulate the 3270 controllers. Rather, it directly attaches to a 3274/3276 controller via a coaxial cable, and depends on the IBM controller for communication. DataTalker/Coax is bus-compatible with the personal computer, meaning that it runs at memory speed instead of I/O speed, which considerably increases data transfer operations. DataTalker/Coax also supports the Concurrency Feature outlined under DataTalker+, and is available in versions handling BSC or SNA/SDLC.

File uploading/downloading is supported by all units. The DataTalker/PC/PC+/II currently handle file transfers when operating in IBM 2780/3780 RJE mode; both TSO and CICS support, like those supported by the Coax unit, are under development. DataTalker/Coax provides the most sophisticated facilities in the form of a modified TSO facility called QuickFile, and a CICS file transfer utility. Both require 128K bytes of RAM, 64K of which is provided by the DataTalker board and 64K by the personal computer. Both file utilities are provided as **standard equipment** with the Coax model. To employ either file-transfer utility, the host-processor must also have the QuickFile or CICS transfer utility interfacing routines appended to the TSO or CICS monitor software. The vendor supplies the routines as part of the file transfer application.

☐ Converters/Emulators

DataTalker/PC

A printed circuit card that plugs into the IBM PC, PC/XT, PC/AT, or compatible products. It emulates the IBM 3274-51C or 3276-12 in SNA/SDLC mode; 3271-2, 3275-2, or 3276-2 in BSC mode; or 2780/3780 RJE also in BSC mode. It emulates the 3278-2/3279-2A display units and 3287-1 or -2 printers in SNA/SDLC mode; 3277-2 display unit and 3286-1 or -2 or 3282-1 or -2 printers in BSC mode; 2 RS-232C ports.

DataTalker/PC SNA ● emulates SNA/SDLC protocol ● runs under MS-DOS and PC-DOS; requires 128K bytes of RAM:

$695 prch	**NA maint**

DataTalker/PC BSC ● emulates IBM BSC protocol ● runs under MS-DOS and PC-DOS; requires 128K bytes of RAM:

695	**NA**

DataTalker/PC 2780/3780 ● emulates IBM 2780/3780 RJE workstation ● runs under MS-DOS and PC-DOS; requires 128K

bytes of RAM:

695	**NA**

DataTalker/+

A printed circuit card that plugs into an IBM PC, PC/XT, PC/AT, or compatible products. It has the same emulation facilities as DataTalker/PC. It contains Z80A and 64K RAM; 2 RS-232C ports.

DataTalker/+ SNA ● emulates SNA/SDLC protocol ● runs under MS-DOS, PC-DOS, CP/M-86; requires 64K bytes of PC RAM:

$1,095 prch	**NA maint**

DataTalker/+ BSC ● emulates IBM BSC protocol ● runs under MS-DOS, PC-DOS, CP/M-86; requires 64K bytes of PC RAM:

1,095	**NA**

DataTalker/+ 2780/3780 ● emulates IBM 2780/3780 RJE Workstation ● runs under MS-DOS and CP/M-86; requires 64K bytes of PC RAM:

1,095	**NA**

DataTalker/II

A standalone unit with the same emulation facilities as DataTalker/PC. It contains 3 ports to accommodate ASCII terminals and/or personal computers with transmit speeds of 9600 bps each. It contains Z80A and 64K RAM and is compatible with CP/M, MP/M II, MS-DOS, PC-DOS, CP/M-86, Concurrent CP/M-86, MP/M-86, TurboDOS, and UNIX.

DataTalker/II SNA ● emulates SNA/SDLC protocol ● requires 64K bytes of PC RAM:

$1,095 prch	**NA maint**

DataTalker/II BSC ● emulates IBM BSC protocol ● requires 64K bytes of PC RAM:

1,095	**NA**

DataTalker/II 2780/3780 ● emulates IBM 2780/3780 RJE workstation ● requires 64K bytes of PC RAM:

1,095	**NA**

DataTalker/Coax

A printed circuit card that plugs into the IBM PC, PC/XT, PC/AT, or compatible products. It emulates IBM 3278 or 3279 Model 2 terminals, and provides a coaxial cable connection to the IBM 3274 or 3276. It contains QuickFile and CICS File Transfer Utilities and runs under MS-DOS and PC-DOS:

$1,095 prch	**NA maint**

☐ Terminals/Printers

The DataTalker product line operates with the IBM PC, PC/XT, PC/AT, or compatible products, and provides the emulation services necessary to allow interaction with IBM mainframes. To accomplish this, DataTalker emulates IBM 3277, 3278, 3279, and 2780/3780 terminals, and 3284 and 3287 printers. DataTalker allows serial ASCII printers to be substituted for IBM units. RS-232C interfaces are employed to handle terminals and printers, and for attaching DataTalker to a modem. In SNA/SDLC mode, terminals and printers function on LU2 and LU3 devices, respectively.

DataTalker handles ASCII and EBCDIC data stream, and converts Hex representations of ASCII codes to actual ASCII data streams, a feature essential to users with ASCII devices, generating characters with no IBM character set equivalents. The supported terminal screen capacity is equivalent to that of Model 2 3278 and 3279, i.e., 1920 characters. All 3270 function keys are supported, as is 4-color representation. Two nonsupported features are Dead (overstrike) keys, and the erase/write alternate command is treated as erase/write command.

☐ Communications

The DataTalker/PC/PC+/II all emulate IBM 3270 remote controllers or 2780/3780 RJE workstations, and attach to the IBM

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Winterhalter DataTalker Family Protocol Converters
Models DataTalker/PC, /PC+, /II & /Coax

System/370, 30XX, 43XX, 8100, and 3790 mainframes via a 3705/3725 communication processor or an Integrated Communications adapter. In addition, the PC+ and DataTalker/II can interface with a public data network via an X.25 interface.

All DataTalker units except the Coax model operate in half-/full-duplex mode over point-to-point or multipoint lines at data rates of 1200 to 19.2K bps. BSC, SNA/SDLC, or X.25 protocols are supported. DataTalker/Coax attaches directly to an IBM 3274 or 3276 controller (and compatible Telex and ITT Courier units) via coaxial cable, and relies on these controllers for communication support. All DataTalker units except the Coax support the attachment of asynchronous ASCII terminals, personal computer, or printers via RS-232C interfaces. The printers can be directly addressed by the host mainframe.

The X.25 models include a packet assembler/disassembler (PAD) that connects asynchronous devices to a public data network. The PAD conforms to X.3 and X.28 protocol standards. It supports the CCITT X.25, X.3, X.28, X.29, LAPB, HDLC, and DTE protocols, and accommodates packets of 64, 128, and 256 bytes. It also permits reverse charging, D-bit modification, and accepts incoming calls. The Winterhalter product has been certified for connection to Telenet, Tymnet, Autonet, and Datapac, and is pending for Transpac (France), Datex-P (Germany), and PSS (UK).

DataTalker/PC+ X.25 PAD • provides all services:

	$1,495 prch	NA maint

DataTalker/II X.25 PAD • provides all services:

	1,495	NA

• **END**

Xerox Ethernet
Baseband Local Area Network

■ PROFILE

Architecture ● Ethernet Local Area Network.

Type ● baseband, packet-switched network using coaxial cable; bus topology.

Transmission Speed ● 10M bps.

Cable Length ● 500 meters between repeaters; 2,500 meters end-to-end between stations for point-to-point communication; 50 meters station-to-transceiver.

Applications ● automated office, electronic mail, file management, and electronic printing.

Configuration ● up to 100 stations per segment; up to 1,024 stations per network; infinite number of stations using internetwork connections.

Interface ● transceiver connects Ethernet control logic in user station to Ethernet cable.

Gateways ● communication servers to other Ethernet networks and outside world.

Support of Foreign Devices ● through stations connected to Ethernet cable.

Communications Management ● distributed among all stations connected to Ethernet cable.

Protocols ● Carrier System Multiple Access with Collision Detection (CSMA/CD) used to control access to network.

Distributed Functions ● not part of Ethernet; controlled by higher level protocols implemented in stations connected to network.

Support Software ● not part of Ethernet; implemented in stations connected to network.

PURCHASE PRICE RANGE

hardware & software ■■■■

5-year maint/serv fee ▭

software
■ $13K to $29K
servers & host interfaces
▭ $46K to $207K
terminal or workstation interfaces
■■■▭ $50K to $519K
other components (transceivers & drop cables)
■ $13K to $64K

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

total system (sum of above) $121K to $819K

■■■▭

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

XEROX ETHERNET LOCAL AREA NETWORK PURCHASE PRICE bar graph covers purchase price range (solid bars) and associated 5-year maintenance fees between "small" and "large" systems ● **SMALL SYSTEM** includes 803 File/Communication Server with 42M-byte disk, 804 Print Server with 10M-byte disk, 50 G26 Shared Interface Units to connect 100 820-II Personal Computers or 16/8 Professional Computers, 52 Transceivers, and 52 15-foot PVC Drop Cables; this configuration allows Ethernet to connect 100 terminals to 2 hosts over BSC links at 9600 bps using 3270 emulation software; software includes H75 File Service, 2 H74 Standard Services Software, H73 Print Service, and 2 T39 3270 Emulators ● **LARGE SYSTEM** 8037 File/Communication Server, 8044 Print Server, 8046 Print Server, 250 G26 Shared Interface Units, 254 Transceivers, 254 Drop Cables, and T39 3270 Emulation Packages and 873 Communications Interface Units ● Xerox provides no facilities to connect Ethernet to foreign hosts except through TTY and IBM 3270 emulation, and no facilities for connecting non-Xerox terminals except through TTY service.

First Delivery ● 1980.

Systems Delivered ● about 5,000 (by all vendors).

Comparable Systems ● Ethernet is unique in that its specifications can be licensed by anyone for $1,000; also it is virtually identical to the IEEE 802.3 Standard for LAN using CSMA/CS access method ● Intecom InteNet, Ohio Scientific Ringnet, Three Rivers Packet Stream, Ungermann-Bass Net/One baseband, and 3COM UNET are Ethernet-compatible ● other networks such as Network Systems Hyperchannel use CSMA/CD for network access control but are not compatible with Ethernet.

Vendor ● Xerox Corporation, Manager of Licensing; Stamford, CT 06904.

Distribution ● products that implement Ethernet available through Xerox Office Products Division sales offices.

■ ANALYSIS

Ethernet networks are probably the most prevalent local area networks installed today. Only the Datapoint ARCnet can challenge Ethernet for number installed. Xerox has not installed as many Ethernets as Datapoint has ARCnets, but many other vendors have installed Ethernet-compatible networks. The combined total of all Ethernets probably exceeds the over 5,000 installed ARCnets.

Ethernet's popularity and general acceptance made it almost a de facto local area network (LAN) standard until the IEEE 802 Committee met in 1980 to develop its own standard. The members of the IEEE Committee were concerned that a standard would be established that did not meet the needs of the growing LAN market. Also, other vendors have developed token-passing ring architectures which they claim are more appropriate for LANs where critical time factors must be considered. After a brisk 2-year effort, the 802 Committee recommendation encompassed Ethernet for baseband LANs as well as a ring-type architecture for broadband LANs and a token-passing baseband bus scheme.
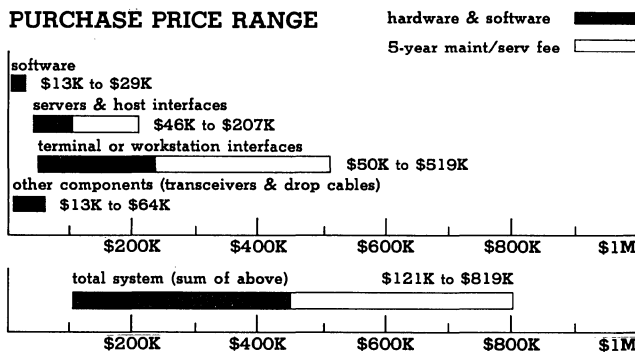
The Ethernet specification offered to the IEEE 802 Committee was jointly developed by Xerox, Intel, and Digital Equipment Corporation.

During the course of 802 Committee deliberations, rumors circulated that Digital Equipment and Intel were having second thoughts about their joint venture with Xerox on Ethernet. On May 20, 1982 Digital laid those rumors to rest when the company announced a number of new products that make Ethernet an integral part of the Digital Network Architecture (DNA) with the DECnet IV release. Ethernet is Digital's LAN.

Intel has confirmed its commitment to Ethernet; it developed an Ethernet chip to implement CSMA/CD protocol. The chip has been generally available since late summer 1983. In addition, Intel is developing a low-speed (1M-bps) chip to implement the IEEE 802 Committee standard. This chip will be used in the MIRLAN network Intel and NCR are jointly developing. This chip will be available by the end of 1983.

Ethernet is also alive and well at Xerox. The higher-level protocols designed to support its automated office systems entrench it even more firmly into the Xerox product lines. Xerox, Digital, and Intel produced the Ethernet II specification after the IEEE recommendation was adopted to bring Ethernet in line with it.

The LAN market developed rapidly, and vendors could not wait for a perfect standard before they developed LAN products. Many vendors, other than Xerox, offer Ethernet-compatible LANs and devices. As data, voice, text, and video communications converge

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Xerox Ethernet
Baseband Local Area Network

and use a common medium, other protocols will be needed. Ethernet is limited to local baseband data communication. At present, voice and data are transmitted over separate local networks and little video transmission is done.

The IEEE 802 Committee recommendation contains other LAN standards in addition to the 802.3 standard.

IEEE Standard 802.4 is a recommendation for a LAN using bus topology and a token-passing access method. This is the scheme used by Concord Data Systems for its Token Net.

IEEE Standard 802.5 is a recommendation for a LAN using ring topology and a token-passing access method. This is the standard IBM has announced it will support on its cable. The IEEE Standard 802.6 is for a metropolitan area network. The IEEE 802.2 is a Logical Link Control Standard that is intended for use with the 4 access standards. The IEEE 802.1 describes the relationship among the standards and their relationship to the Open Systems Interconnection Reference Model and to higher-level protocols.

So far, the major vendor offering the token-passing networks is Datapoint for its ARCnet. A chip is now available to implement the ARCnet access scheme, making interfacing to ARCnet inexpensive. The Datapoint protocol is not currently compatible with the IEEE 802 recommendation, however.

☐ Strengths

Xerox developed Ethernet in the early 1970s and holds the patent on its specification, although the current version was jointly developed with Digital Equipment and Intel. Many vendors supply Ethernet-compatible products, thus supplies are plentiful.

The Ethernet specifications have been well tested, and data is available on the performance of LANs using them. The error rates are low. Few packets are lost. Under normal loads, few collisions occur, and access time is close to zero. Heavier loads produce more collisions, but they are resolved quickly.

The Ethernet design is simple. The transceiver interface to the channel is relatively inexpensive. The Xerox transceiver price is $200.

☐ Limitations

Nobody knows how the LAN market will develop. Gurus predict that video, voice, text, and data will eventually be integrated and transmitted over a common broadband medium. Ethernet is limited to baseband data communications only. Currently, however, data and voice use separate local networks and will continue to do so for a number of years. IBM has announced a cable system and the company's intention to offer a token-passing ring LAN within the next 2 years. So far, all that is available is the cable.

■ NETWORK SUMMARY

Xerox has been developing Ethernet since the early 1970s. An experimental Ethernet network was running as early as 1972. Other Ethernet networks have also been developed and used since then. In the late 1970s, Xerox formed a joint venture with Intel and Digital Equipment Corporation to develop a second generation Ethernet. The venture's objective was to provide compatible communications among computers, terminals, peripherals, and office equipment, even with systems from different vendors. Jointly, the 3 vendors published the formal Ethernet specification in September 1980. This is the specification now called Ethernet. Because it is based on Xerox patents, the license for its use lies with Xerox.

After the IEEE 802 Committee published its 802.3 recommendation for a baseband CSMA/CD bus architecture, Xerox, Digital, and Intel published the Ethernet II specification, which conforms to the IEEE 802.3 standard. This specification differs slightly from the original. The chairman of the IEEE Committee claims Ethernet II differs from the 802.3 recommendation. Xerox spokesmen claim the two are compatible. The controversy centers around some features furnished by the 802.3 standard and unused by Ethernet. The unused features do not interfere with Ethernet transmissions, thus devices supplying the features can run on Ethernet.

Xerox has built 2 network processors: the 1100 for scientific and the 8000 for commercial applications. Xerox has since introduced its 8000 Series of Network Systems including the 8010 Star Information Processing System, providing all the hardware and software components for an entire network system. Other vendors' equipment can communicate over Ethernet by interfacing to the systems connected to the Ethernet cable. The Xerox STAR workstations can emulate the IBM 3278 to communicate with IBM computers under SNA. Xerox also provides VT100 emulation to communicate with DEC computers and 2770/2780/3780 emulation for batch communications. Xerox also provides the hardware and software to attach IBM PCs to Ethernet and uses the server facilities such as electronic mail, disk storage, and printing.

Xerox systems that interface to Ethernet include the 16/8 Professional Computer, 495 facsimile unit, 630 Memorywrite (electronic typewriter), 2700/5700/8700/9700 Electronic Printing Systems, 820-II Personal Computer and 860 Information Processing System. Remote 860s can interface through an 850/860 gateway on a server.

Xerox pioneered the concept of using servers on a network to concentrate functions required by many of the interfaced systems in a single system. Xerox offers file servers, print servers, and communications servers.

File servers contain a high-speed processor, keyboard/display terminal, and a choice of disk storage units depending on the capacity requirements for the application. The processor is pre-programmed to control the disk and to look like an electronic filing cabinet to the workstation user.

The print server consists of a controlling processor, disk storage unit, electronic printer, and a keyboard/display. The printer uses a laser scanner to create the images imprinted on the paper using a Xerography technique.

Communications servers include a processor to handle communication between Ethernet networks and between an Ethernet network and communication lines to external networks. One system can serve as more than one server on the network.

Xerox has also developed 4 higher levels of protocols to implement the Open Systems Interconnection (OSI) recommendation of the International Standards Organization (ISO). The Ethernet Local Area Network Specifications define protocols to implement only the Physical and Data Link levels of the OSI model. The higher level protocols are the Xerox Network System protocols used to implement the OSI Session, Transport, Network, and Presentation levels. Xerox is now offering versions of its Ethernet systems to meet the Federal Government TEMPEST standard for Secure Information Devices (SIDs).

Digital Equipment has announced a 3-year plan to develop products to support Ethernet. Products were delivered beginning in 1983. The first products include a transceiver, coaxial cable, transceiver cable connecting a system node (device) to the transceiver, Ethernet Communication Controller for UNIBUS systems, and software support for DECnet-VAX and DECnet-RSX products. Digital now has interfaces for Q-bus systems to Ethernet as well as a multiplexer to allow multiple interfaces to share a common Ethernet transceiver. The company also offers a gateway from Ethernet to SNA networks.

So far, Intel has developed the Ethernet chip and announced its intention to develop a MIRLAN chip (1M-bps data rate version).

☐ Terms & Support

Terms ● software is available under a pre-paid license with a monthly maintenance fee and under a monthly license fee ● hardware is available for purchase with a monthly maintenance charge or (with exception of 820-II and 16/8) for a monthly rental rate under either a 1-year or 2-year contract ● quantity discounts apply to most software and hardware products: 1 to 4 units—no discount; 5 to 8 units—about 5 percent; and 9 to 14 units—about 8 percent ● software is also available for about a 10 percent discount for 15- to 50-unit quantity ● hardware is also subject to a placement/removal (p/r) charge ● rental credit shall accrue at the rate of 70 percent for each unit/package for first 6 full

Xerox Ethernet
Baseband Local Area Network

calendar months of use and at the rate of 50 percent for each full calendar month.

Support • available under standard monthly maintenance fee for Monday to Friday (except holidays) 8:00 AM to 5:00 PM • time-and-materials service also available during regular hours as well as after hours, weekends, and holidays.

Xerox Ethernet Hardware & Software

Xerox offers an impressive array of products for the automated office environment: copiers, electronic typewriters, printers, photo composers, workstations (word processors), personal computers, disk files, and facsimile terminals; see Figure 1. In addition to office equipment, Xerox supports internetwork communication between Ethernets, between Ethernet and other communication networks, and between Ethernet and foreign host computers. Software is available to support all these devices in various information processing applications, such as word processing, electronic mail, records processing, and data processing. However, Xerox software does not support any foreign hosts or terminals. Xerox supports entry to Ethernet from external networks through an 850/860 Gateway and TTY service; output through 3270 and TTY Emulations.

Hardware provided specifically to interconnect devices on Ethernet includes cables, connectors, transceivers, multiplexers, a network processor, file servers, print servers, and communication servers.

8000 Network Systems

All 8000 Network Systems are built around the 8000 Network

Systems Processor and systems will include the Workstation, File Server, Print Server, and File/Communications Server. All the network systems are now designed so they can be configured as Secure Information Devices (SIDs). The 8000 Network Systems Processor has been shielded to meet the TEMPEST standard for secure systems. All devices that connect to Ethernet require a transceiver and a drop cable.

8010 Information Systems • modular STAR workstations that consist of an 8000 Network System (NS) Processor, an Ethernet interface, diskette drive, rigid disk drive, large format display, keyboard mouse, and memory • price depends on components selected • SID version requires selection of all SID components • combines functions of a computer, text-editing system graphics system, and terminal on Ethernet network.

8011 Information System • basic configuration includes T22 8000 NS Processor, T24 Option 1 PWBA (provides Ethernet, Electronic Printer and RS-232C interfaces, 228 Double-Sided Diskette Drive, 242 10M-byte Rigid Disk Drive (with control), T85 512K-byte Memory Kit, D35 Large Format Display, D36 Keyboard with Mouse, Ethernet transceiver, 15-foot Teflon drop cable, and D84 Standard 8010 Workstation Software:

$730 mo	**$11,495 prch**	**$190/$165 maint**

8011-T SID Information System • basic configuration includes K91 SID Workstation Processor (includes Option 1 PWBA, Double Sided Diskette Drive, and 512K-byte Memory Kit), K95 SID 10M-byte Portable Fixed Disk Drive, K96 SID Large Format Display, K97 SID Keyboard with Mouse, SID transceiver, SID drop cable, and D84 Standard 8010 Workstation software:

1,355	**18,590**	**270/240**
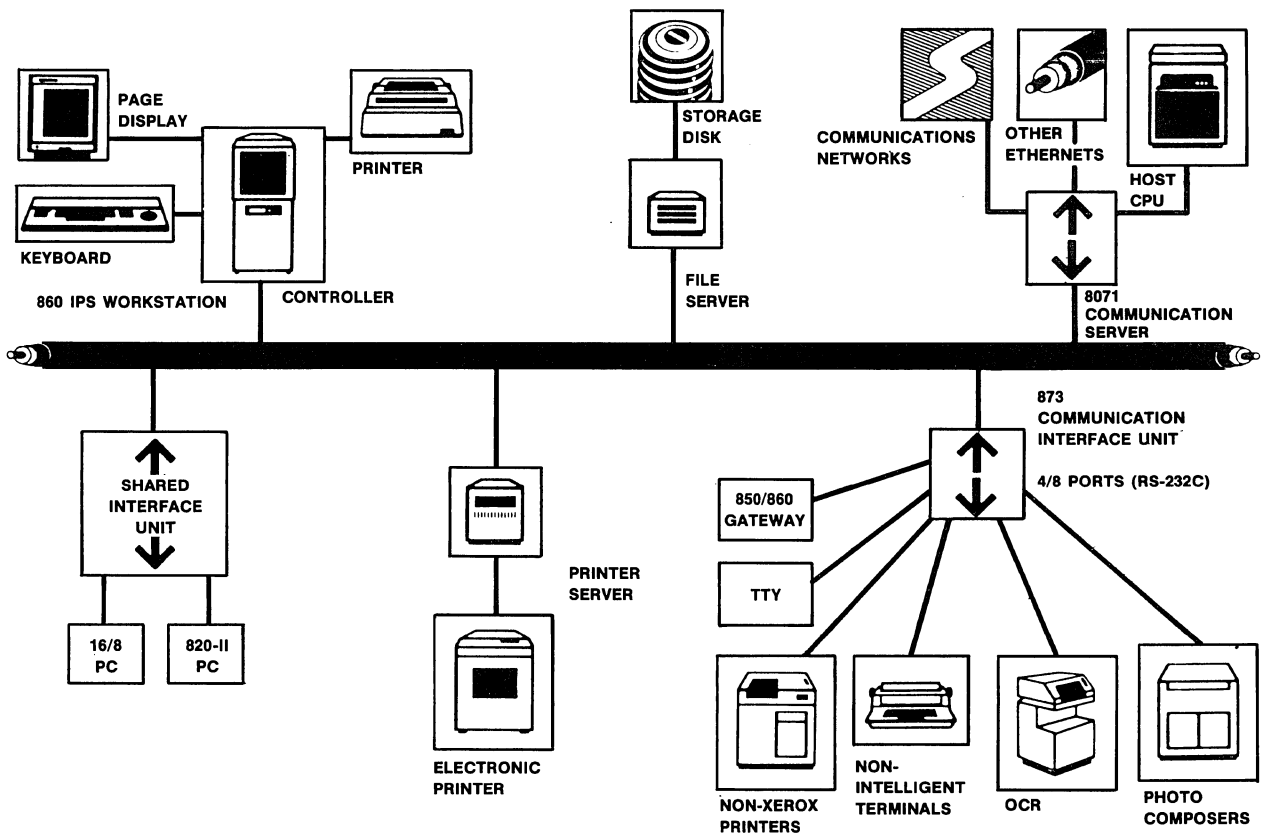
NOTE: Xerox supports only TTY and 850/860 Gateway into Ethernet, and IBM 3270 and TTY emulations out from Ethernet.

Figure 1 • Xerox Ethernet devices and services.

Xerox Ethernet
Baseband Local Area Network

8014 Information System • basic configuration includes same as for 8011 except for H87 42M-byte Rigid Disk Drive in place of 242 10M-byte Rigid Disk Drive:

1,005	16,495	260/230

8014-T SID Information System • basic configuration same as for 8011-T but with M51 SID 42M-byte Portable Fixed Disk Drive in place of K95 SID 10M-byte Portable Fixed Disk Drive:

1,800	26,590	365/330

8000 Network Servers • modular systems which provide network services to workstations; all require an 8000 Network System Processor, an Ethernet interface, diskette drive, keyboard/display monitor and memory; individual servers require additional hardware and software for a specific application.

8044 Print Server • basic configuration includes T22 8000 NS Processor, Option 1 PWBA, 228 Double-Sided Diskette Drive, 242 10M-byte Rigid Disk Drive, T85 512K-byte Memory Kit, T23 Display/Keyboard Server Monitor, 909 Electronic Printer, Ethernet transceiver, drop cable, H74 Standard Services Software (Fixed-Disk), H73 Print Service Software, and F01 Xerox OIS Classic Fonts:

1,360	25,295	395/355

8044-T Print Server • basic configuration includes K92 SIP Print Server Processor (with Option 1 PWBA, and 512K-byte Memory Kit), K95 SID 10M-byte Portable Fixed Disk Drive, M47 Display/Keyboard Server Monitor, K69 SID Electronic Printer, SID Ethernet transceiver, SID drop cable, H74 Standard Services Software (Fixed Disk), H73 Print Service Software, and F01 Xerox OIS Classic Fonts:

1,650	37,455	535/485

8046 Print Server • basic configuration same as 8044 except H87 42M-byte Rigid Disk Drive replaces 242 10M-byte Rigid Disk Drive:

1,635	30,295	465/420

8046-T Print Server • basic configuration same as 8044-T except M51 SID 42M-byte Fixed Disk Drive replaces K95 SID 10M-byte Fixed Disk Drive:

2,015	45,455	630/575

8071 Communication Server • basic configuration includes T22 8000 NS Processor, T24 Option 1 PWBA, 228 Double-sided Diskette Drive, 242 10M-byte Rigid Disk Drive, T85 512K-byte Memory Kit, T23 Display/Keyboard Monitor, Ethernet transceiver, 15-foot Teflon drop cable, and H74 Standard 8010 Services Software (Fixed Disk):

770	11,295	165/145

8037 File Server • basic configuration same as 8071 Communications Server except includes H75 File Services Software:

970	15,295	195/175

8033 File/Communication Server • same as 8031 except H87 42M-byte Rigid Disk Drive replaces 242 10M-byte Rigid Disk Drive:

1,245	20,295	265/240

8033-T SID File/Communication Server • basic configuration includes K93 SID File/Communication Server Processor (with Option 1 PWBA, Double-Sided Diskette Drive, 512K-byte Memory, RS-232C Communication Kit, and 10-foot RS-232C cable), M51 42M-byte Portable Fixed Disk Drive, M47 Display/Keyboard Server Monitor, SID Ethernet transceiver, SID 15-foot Teflon drop cable, and H74 Standard Services Software (Fixed Disk):

1,265	25,455	325/300

8037 Large Capacity File Server • same as 8033 except includes 2 E90 80M-byte or 2 E91 300M-byte Removable Disk Drives with H15 Standard Services Software (Removable Disk) instead of the H87 42M-byte Rigid Disk Drive and H74 Standard Services Software (Fixed Disk) with 2 E90 80M-byte Removable Disk Drives:

2,175	45,295	505/460

With 2 E91 300M-Byte Removable Disk Drives:

2,975	61,295	580/520

8037-T Large Capacity File/Communications Server • same as 8033-T except basic SID configuration includes 2 M50 SID 300M-byte Removable Disk Drives and H15 Standard Services Software (Removable Disk) instead of the M51 SID 42M-byte Portable Fixed Disk Drive with H74 Standard Services Software (Fixed Disk):

3,335	74,955	665/600

Components for 8000 Network Systems

Xerox 8000 Network Systems are modular. The user can configure systems using the required components for each type of system and all optional features, such as additional system memory, second disk drive, and software packages as needed.

The 873 Communications Interface Unit can also be used to add multiple RS-232C ports to Ethernet. The 873 CIV provides protocol emulation to allow many foreign devices to gain access to Ethernet. These include AT&T/Teletype, IBM 2780 RTE BSC, IBM 2770 BSC, IBM 3270 multipoint BSC, and Xerox 850/860 point-to-point. Multiple 873s can be configured on a single system. The 873 requires the Gateway Service provided by the 8000 Communications Server to communicate with host systems.

Processors for 8000 Network Systems

T22 8000 Network Systems (NS) Processor • CPU only:

$350 mo	$4,995 prch	$80/$70 maint

K91 SID Workstation Processor • CPU used when SID Workstation is being configured; 8000 NS shielded to meet TEMPEST standard includes Option 1 PWBA, double-sided diskette drive and 512K-byte memory kit:

420	9,995	130/120

K92 SID Print Server Processor • CPU used when SID print server is being configured; 8000 NS shielded to meet TEMPEST standard:

420	9,995	130/120

K93 SID File/Communication Server Processor • CPU used when SID file/communication server is being configured; 8000 NS shielded to meet TEMPEST standard:

420	9,995	130/120

K94 SID Large Capacity File Server Processor • CPU used when SID large capacity file server is being configured; 8000 NS shielded to meet TEMPEST standard:

420	9,995	130/120

Disk Drives for 8000 Network Systems

242 Rigid Disk Drive • 10M bytes:

$175 mo	$2,500 prch	$40/$35 maint

H87 Rigid Disk Drive • 42M bytes:

450	7,500	110/100

E90 Removable Disk Drive • 80M bytes:

690	13,750	175/160

E91 Removable Disk Drive • 300M bytes:

1,090	21,750	210/190

K95 SID Portable Fixed Disk Drive • 10M bytes; made a Secure Information Device:

235	3,500	55/50

MO: monthly rental or license fee; hardware rental is under a 1-year contract; software has only 1 monthly license rate. PRCH: purchase price for 1- to 4-unit quantity. MAINT: monthly maintenance charge for hardware; Xerox has 2 rates: the first figure is for a 1-year plan; the second figure is for a 2-year plan. NA: not available. NC: no charge. LCNS: prepaid license fee for 1 to 4 software packages. Prices effective as of June 1984.

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M51 SID Portable Fixed Disk Drive ● 42M bytes; made a Secure Information Device:

600	11,500	150/140

M50 SID Removable Disk Drive ● 300M bytes; made a Secure Information Device:

1,335	30,500	245/220

Keyboards/Displays for 8000 Network Systems

D36 Keyboard With Mouse ● for 8010 workstation:

$35 mo	$500 prch	$15/$10 maint

D20 Japanese Keyboard With Mouse ● provides facilities for Katakana and Kanji character sets for 8010 workstation:

35	500	15/10

D35 Large Format Display o for 8010 workstation:

140	2,000	45/35

T23 Display/Keyboard Server Monitor ● for server configurations:

105	1,500	30/25

M47 Display/Keyboard Server Monitor ● for server configurations; must be ordered on all SID servers:

105	1,500	30/25

K96 SID Large Format Display ● for SID workstation:

140	2,995	45/35

K97 SID Keyboard With Mouse ● for SID workstations:

35	900	20/15

Memory for 8000 Network Systems

The 38K-byte memory is no longer offered. Standard memory is 512K bytes. Xerox has run memory specials where a 768K-byte memory is a no-charge item.

T85 512K-Byte Memory Kit ● for workstation and server; requires T86 on servers:

NC mo	NC prch	NC/NC maint

T86 Server Memory Expansion Kit ● from 512K bytes to 1.5M bytes:

35	500	15/10

G55 768K-Byte Memory Kit ● for workstation and servers; servers require T86:

70	1,400	15/10

G56 1M-Byte Memory for Workstations ● servers require T86:

105	2,100	20/15

G57 1.3M-Byte Memory for Workstations ● servers require T86:

140	2,800	25/20

G58 1.5M-Byte Memory for Workstations o servers require T86:

175	3,500	30/25

P35 SID 768K-Byte Memory Kit ● requires T86 for servers:

70	1,400	15/10

M52 SID 1.5M-Byte Memory for Workstations ● requires T86 for servers:

175	3,500	30/25

Printers for 8000 Network Systems

909 Electronic Printer ● for print servers:

$465 mo	$12,500 prch	$210/$190 maint

K69 SID Electronic Printer ● for SID print servers:

625	17,500	285/255

Other Accessories for 8000 Network Systems

873 Communications Interface Unit ● provides shared communication resource on Ethernet between Ethernet and remote workstations, terminals, and host computers ● supports data rates up to 9600 bps in half-/full-duplex mode ● contains 4 or 8 communication ports ● requires 8071 Communication Server to control network, to gain access to host computers, and to downline load 873 software.

T29 873 Communications Interface Unit ● basic unit contains 4 ports; maximum aggregate throughput of 20K bps:

$325 mo	$6,055 prch	$120/$110 maint

T34 873 4-Port Extension Kit ● adds 4 ports to basic 873; extends maximum aggregate throughput to 40K bps:

130	2,600	45/40

Accessories for 8000 Network Systems ● additional units for Ethernet.

322 860 Ethernet Interface Board (EIB) Kit ● mandatory for connecting 860 IPS to Ethernet; other units also required depending on application:

35	655	9

E30 RS-232 Communication Kit ● required when using RS-232C port on a File or Communication Server:

NA	150	NC

Software for 8000 Network Systems ● software is layered to allow network processors to operate as servers on a Xerox Ethernet network, see Figure 2 ● Xerox Software Maintenance is mandatory with all prepaid licenses.

H74 Standard Services Software (Fixed Disk) ● mandatory for 10M-/142M-byte fixed disk ● provides the basic operating software for all servers with fixed disk drives ● includes the Pilot operating system, Services Common Software, Clearinghouse Service, and External Communication Service ● Pilot provides the communication software for assembling data streams into packets; sequencing, addressing, and transmitting the packets ● Services Common Software provides the environment in which services run; provides facilities for easy operation and maintenance of servers ● Clearinghouse Service maintains a Clearinghouse database of information about the network: computers on the network, users, access restrictions for particular services ● External Communication Service allows network users to access and integrate information from sources outside the network; allocates RS-232C ports for Interactive Terminal Service, 860/850 Gateway Service, and Internetwork Routing Service; also includes emulation options for TTY and IBM 3270 Communication Protocols.

140	2,000	15

H15 Standard Services Software (Removable Disk) ● mandatory for 80M-/300M-byte removable disk, provides same services as H74:

140	2,000	15

H75 File Services Software ● manages and controls shared storage on a service; files are organized in a hierarchical fashion; each file, each directory, and each subdirectory can be given a name for easy access; different systems on Ethernet can use different means to access the file service ● the systems administrator establishes access rights to each person's top-level directory at his or her request ● the file service supports the Mail Service; it also functions with the Interactive Terminal Service to allow non-Xerox terminals to exchange Mail Messages with Xerox Network Systems users:

200	4,000	30

H73 Print Services Software ● provides basic server operating system, queues and formats documents received from workstations, and controls the printing facility:

100	2,000	10

T32 Electronic Mail ● supports transmission of documents with variety of formats between users of workstations on a Xerox Network System; requires File Service:

70	1,000	10

T33 Internetwork Routing ● provides communication between systems on a local network with systems on a remote network; logically, it interconnects Ethernets:

100	1,500	15

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FONTS	850/860 GATEWAY SERVICE	INTERACTIVE TERMINAL SERVICE	860 ETHERNET TTY COMM	8010 TTY EMULATION	INTERNETWORK ROUTING SERVICE	8010 3270 BSC EMULATION

ELECTRONIC MAIL

PRINT SERVICE

FILE SERVICE

TTY PROTOCOL

3270 PROTOCOL

STANDARD SERVICES SOFTWARE
(INCLUDES CLEARINGHOUSE SERVICE AND EXTERNAL COMMUNICATION SERVICE)
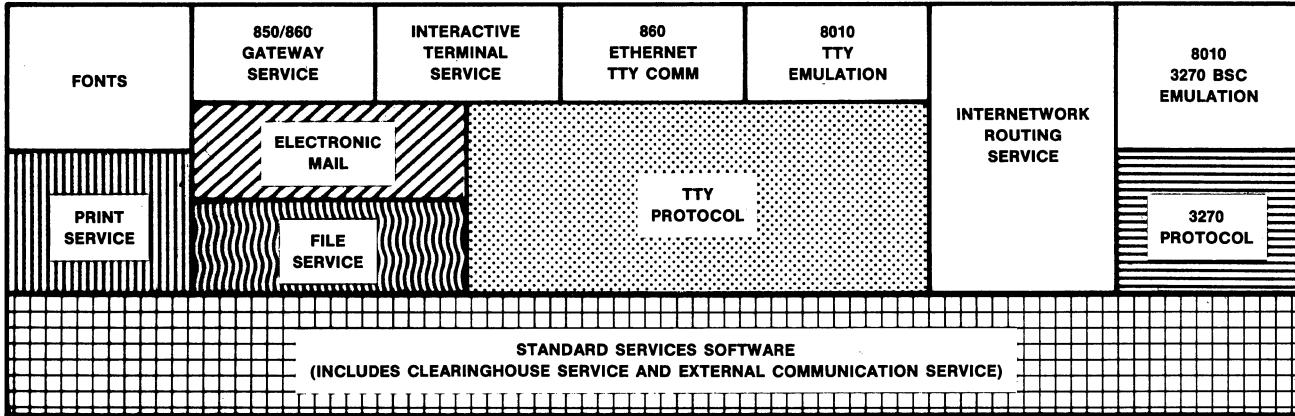
Figure 2 ● server software layering.

T35 TTY Communication Protocol ● supports communication with Ethernet from Teletype-compatible terminal:

25	375	10

T36 850/860 Gateway Service ● supports communication with remote 850/860 through the server's RS-232C port for external communication with Ethernet ● primarily for sending and receiving electronic mail documents:

25	375	10

T39 3270 Communication Service (BSC) ● supports communication with remote host through 3270 BSC emulation ● server emulates functions of an IBM 3276-2 controller:

95	1,500	15

IBM 3278 Communication Service ● supports communication with IBM host through IBM 3278 Display Terminal Emulation; available October 1984; orders taken September 1; prices not yet available:

NA	NA	NA

VT100 Communication Service ● supports communication with host through VT100 Terminal emulation; available October 1984:

NA	NA	NA

2770/2780/3780 Communication Service ● supports batch communication services between IBM mainframe and Ethernet and document format conversion; supports document interchange with other mainframes, word processors, and workstations; available October 1984:

NA	NA	NA

F01 Xerox OIS Classic Fonts ● required with Print Service Software:

25	500	10

F02 Printwheel Fonts ● optional, to print documents in typeface compatible with various 860 metal printwheels:

25	500	10

F03 Xerox OIS Math Classic Fonts ● contains Math and Greek symbols; required to print 8010 equations:

25	500	10

F04 Xerox OIS Modern Fonts ● optional, to print OIS Modern typeface:

70	1,000	10

F88 Interactive Terminal Service ● requires T32 Electronic Mail ● allows user at standalone TTY-type device to send and receive electronic mail using TTY communication:

30	450	10

M37 Japanese Classic Fonts ● available only with removable disk servers and requires F03 Fonts:

70	1,200	15

M55 Japanese Modern Fonts ● available only with removable disk servers and requires F04 Fonts:

70	1,200	15

D84 Standard Workstation Software ● required by all 8010 Information Systems ● provides interface to File Service, Print Service, and Mail Service ● includes facilities to allow user to perform text entry and editing, formatting and layout, graphics and illustration, and forms fill-in with data verification:

65	1,200	20

D85 Equations ● requires Xerox OIS Math Classic Fonts on Print Server to Print; allows user to construct sophisticated formulas and multilevel mathematical equations:

70	1,000	10

D86 Records Processing ● allows user to create records and manipulate them for reports:

105	1,500	15

D87 Advanced Graphics I ● provides capability to create and manipulate bar graphs:

105	1,500	15

D88 TTY Emulation ● allows workstation to operate as TTY 35:

35	500	10

D89 3270 Emulation ● allows terminal to act as IBM 3278-2 Display Station:

70	1,000	15

IBM 3278 Emulation ● allows STAR workstation to emulate IBM 3278 Display Terminal; the 6 STAR windows can provide 6 3278 windows and access up to 6 different applications or mainframes simultaneously; available October 1984; orders taken September 1:

NA	NA	NA

2770/2780/3780 Emulation ● provides emulation of IBM 2770/2780/3780 batch terminals; available October 1984; orders taken September 1:

NA	NA	NA

VT100 Emulation ● allows STAR workstation to emulate VT100 display terminal to communicate with DEC computers for host processing; available October 1984; orders taken September 1:

NA	NA	NA

M34 Extended Language Option ● allows workstation to display optional foreign language simultaneously with English and other standard languages; requires 768K-byte memory on the 8010 workstation:

70	1,500	20

M35 Japanese Tableware ● requires M34 option and at least

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29M-byte disk; allows the display of Japanese Language characters on the workstation:

60	1,000	10

M96 Electronic Spreadsheet ● provides spreadsheet capabilities; includes arithmetic, trigometric, and logic functions; 255 rows by 63 columns:

20	300	10

P83 Data Capture ● bridges gap between terminal emulation with host and document integration on the 8010 workstation:

10	200	NC

Xerox 16/8 Professional Computer ● includes dual processors (Intel 8086 with 128K-/256K-byte memory and Zilog Z80A with 64K-byte memory) with CP/M-86 or MS-DOS operating system for Intel 8086 and CP/M-80 for Z80A ● Xerox 820-II can be upgraded to 16/8.

H69 16/8 Display Processor ● with floppy disk; operating system is free with system:

NA	1,950	38

H70 16/8 Display Processor ● with rigid disk; operating system is free with system:

NA	1,950	38

625 16/8 Low-Profile Keyboard:

NA	295	NC

G26 Shared Interface Unit ● connects 2 820-IIs or 16/8s to Ethernet; provides 2 RS-232C ports for modem connections ● optionally converts Word/Star documents to 860 format for storage on File or Mail Server on Ethernet:

NA	995	18

860 Information Processing System ● a modular system that consists of a System Controller, Display Station, Keyboard, Memory, Disk Drives, Communication Interfaces, Printers, and Software Packages.

322 860 Ethernet Interface Board (EIB) Kit:

35	655	9

IBM PC Interface Kit ● provides software and hardware to interface IBM PC-compatible systems to Ethernet ● kit includes 3COM circuit board, protocol software, and network interface training manual ● orders taken September 1; installations will begin November 1984; requires 1 PC slot:

NA	795	NA

Cables, Connectors, Repeaters & Transceiver

Teflon Insulated Network Cable ● used as main Ethernet cable ● low noise and head resistant.

152S23990 75 Feet:

NA mo	$460 prch	NC maint

152S23991 230 Feet:

NA	1,340	NC

152S23992 385 Feet:

NA	2,080	NC

117P80721 500 Feet:

NA	2,520	NC

117P80713 1,000 Feet:

NA	4,640	NC

PVC Insulated Cable ● used as main Ethernet cable.

152S23980 75 Feet:

NA	135	NC

152S23981 230 Feet:

NA	340	NC

152S23982 385 Feet:

NA	550	NC

117P80722 500 Feet:

NA	675	NC

117P80714 1,000 Feet:

NA	1,275	NC

Teflon Insulated Drop Cable ● connects transceiver to user device.

152S24013 15 Feet:

NA	100	NC

152S24014 30 Feet:

NA	175	NC

152S24015 60 Feet:

NA	300	NC

152S25300 15 Feet ● for SID devices only:

NA	135	NC

152S25301 30 Feet ● for SID devices only:

NA	235	NC

152S25302 60 Feet ● for SID devices only:

NA	405	NC

PVC Insulated Drop Cable ● connects transceiver to user device.

152S23803 15 Feet:

NA	50	NC

152S23804 30 Feet:

NA	75	NC

152S23805 60 Feet:

NA	120	NC

Connectors ● permit connecting or terminating lengths of cable.

113P80647 Barrel Connector:

NA	10	NC

113P80692 Right Angle Coaxial Adapter:

NA	15	NC

114P20072 PVC Type Coaxial Connector ● crimp-on type:

NA	5	NC

114P20073 PVC Type Coaxial Connector ● screw-on type:

NA	5	NC

114P20074 Teflon Type Coaxial Connector ● crimp-on type:

NA	5	NC

114P20075 Teflon Type Coaxial Connector ● screw-on type:

NA	5	NC

116P80772 Tap Block Assembly:

NA	15	NC

601S01245 Tap Block Replacement Kit:

NA	25	NC

113P80648 Terminator ● 50-ohm +/–1% resistive load connected to end of cable segment:

NA	20	NC

T28 Repeater ● required on each additional 500-meter segment; up to 100 transceivers per segment:

65	1,285	15/10

073S80509 Transceiver ● interfaces to Ethernet:

NA	200	NC

073S80541 SID Transceiver ● for SID systems only:

NA	325	NC

■ SPECIFICATION

Ethernet specifications are for data transmission only. Furthermore, it is a datagram service. That means the delivery of messages is not guaranteed, but a best effort is made to deliver them. Also, Ethernet provides no security features. The data can be encrypted by the stations on the network, but that is a higher-level function. Access procedures must also be implemented at a higher level.

Xerox Ethernet
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The components of an Ethernet packet-switched network are stations, controllers, controller/transmission system interfaces, and the transmission system.

Stations are the devices/nodes that use the network. They are the addressable units, which are generally computers. Peripheral devices and terminals connect to the channel through computers.

Each station requires a controller to provide the functions needed to manage access to the channel. The functions can be implemented by hardware, software, and microcode, which are physically located within the station.

The controller implements both receiver and transmitter functions: signaling conventions, encoding/decoding, serial/parallel conversions, data buffering, error detection, address recognition, packet assembly/disassembly, and CSMA/CD channel control.

Controller/transmission system interface provides the data path to/from the transmission system. In the Xerox implementation, the controller connects to the transceiver in the transmission system, so it is called the transceiver cable interface.

The transmission system includes the transmission medium (cable), transceivers to transmit and receive data, and repeaters to extend cable length. The physical medium also includes taps, connectors, and terminators. The controller manages access to the transmission system, and the transmission system merely passes bits through the channel.

Transceivers transmit and receive signals on the channel. They recognize when a station is transmitting or when a collision has occurred because 2 stations are transmitting simultaneously. To extend the length of the cable, 2 transceivers can connect to different Ethernet cable segments to form a single logical channel.

Packet Format

Data is transmitted through the network in packets, which range in size from 72 to 1526 bytes.

Format ● 8-byte preamble, 6-byte destination address, 6-byte source address, 2-byte type field, N-byte data field (N = 46 to 1500 bytes), and 4-byte CRC ● preamble used for synchronization contains alternate 1s and 0s ending in 2 1s ● destination and source addresses are long to provide unique addresses when a local Ethernet network functions as a subnetwork in a larger global distributed network; type field also included for use in a larger network, not used by Ethernet ● minimum data field ensures that valid packets can be distinguished from collisions ● CRC (cyclic redundancy check) is calculated on the destination and source address, type, and data fields ● minimum spacing between packets is 9.6 microseconds ● any sequence of bits shorter than minimum packet size is discarded as collision fragment ● maximum round trip, end-to-end delay is 51.2 microseconds.

Transmission Characteristics

Channel Encoding ● uses Manchester encoding to ensure a transition for every bit position; transmits complement of the bit value in first half of bit time and true value in second half.

Data Rate ● 10M bps equals 100 nanoseconds per bit.

Carrier ● signaled by presence of transitions on the cable; if no transition within 75 to 125 nanoseconds after last transition, the carrier is lost, meaning the cable is free for another transmission.

Control Procedures

Control procedures follow the CSMA/CD scheme to control accesses to the channel from the 1,024 stations that can be connected to the cable. Only one station can transmit at a time, thus before transmission a station must determine if the channel is free. This is done by sensing the carrier on the line. During carrier absence, the station can transmit after waiting the minimum time between packets.

If a station starts to transmit, its data may collide with data from another station that also listened, determined no carrier was present, waited, then transmitted data. When this occurs, the collision is detected and each transmission is aborted. A jam of 4 to 6 bytes of arbitrary data is transmitted to make sure all stations detect the collision.

Each station then backs off and waits for a random retransmission time interval calculated using a backoff algorithm before trying to transmit again. A station will attempt to transmit its data 16 times. Further attempts are dependent on software control. The remote possibility of continued collisions that prevent delivery of a message makes Ethernet a datagram service.

Defer ● a station defers transmission until 9.6 microseconds after carrier is dropped.

Transmit ● when not deferring, a station can transmit until its message is complete or until it detects a collision.

Abort ● when collision is detected, the transmission is aborted and a jam sequence transmitted.

Retransmit ● after an abort, the station waits for a random length of time, then attempts to retransmit ● random number lies in range from 0 to 1023.

Backoff ● retransmission delay calculated using Truncated Binary Exponential Backoff Algorithm; calculates random number in range from 0 to 2 raised to the nth power minus 1 for n less than or equal to 10 where n is the retransmission attempt number; for attempts 11 to 15, 2 raised to the nth power is truncated to 1023 ● time interval before retransmission is 51.2 microseconds times random number generated.

Transmission Medium

Ethernet uses coaxial cable with terminators at each end as the transmission medium. Impedance is 50 ohms. Cable segments can be up to 500 meters long. Standard pressure taps provide for connection to cable. All stations interface to cable through transceivers. Up to 100 transceivers can connect to 1 cable segment. Transceivers must be at least 2.5 meters apart.

☐ Use

Users must develop higher-level protocols in the stations connected to Ethernet to implement applications. Xerox has defined higher-level protocols for its office products, which center around the 8000 Network Processor as the base. Digital will use the higher-level protocols already defined for its Digital Network Architecture (DNA) and implemented in the PDP-11, VAX-11, and PDP-20.

● END

Xerox Telecopier Facsimile Terminals
Models 295, 400-I, 455, 485 & 495-I

■ PROFILE

Function ● variable-speed, AM/FM, FM, and digital transceivers.

Type ● floor-console (Models 485 and 495-I); tabletop (Models 295, 400-I, 455) transceivers.

CCITT Compatibility o Group 1 standard on 400-I o Groups 1 and 2 standard on 455, 485; optional on 295, 485, and 495-I ● Group 3 standard on 295 and 495-I.

Maximum Scanning Width ● 8.5 inches (Models 455 and 485); 9 inches (Model 295); 10.2 inches (Model 495-I); and 11 inches (Model 400-I).

Feeder ● auto-feed, 30-document capacity (Models 295 and 485); auto-feed, 50-document capacity (Model 495-I); manual-feed, 8.5x11 inches (Models 400-I and 455).

Image Resolution ● 204x196/98/64 lpi (Models 295 and 495-I); 97x96/65 lpi and 80x75 lpi (Models 485 and 455); 96x96/64 lpi (Model 400-I).
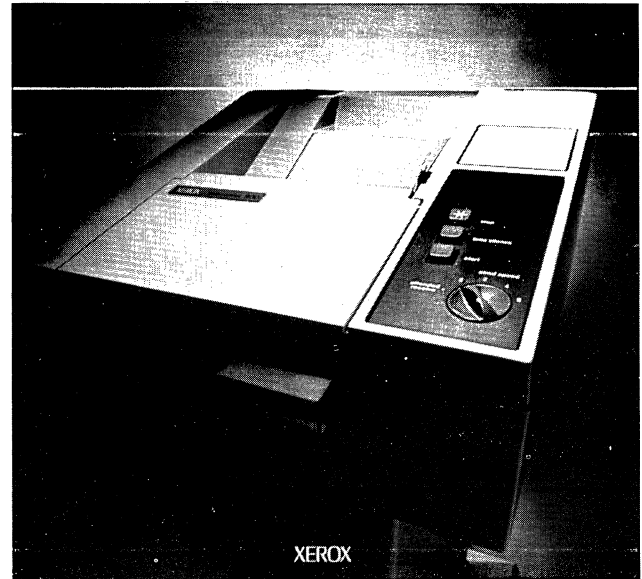
Half-Tone Support ● Models 400-I and 495-I.

Communications ● DDD network or dedicated line; 3/6 minutes for AM/FM transmission; 25 to 30 seconds for Group 3 transmission for 8.5x11-inch page at 9600 bps ● 9600/7200/4800/2400 bps and polling (Models 295 and 495-I); automatic fallback modem ● auto-answer/disconnect (Model 495-I) ● RS-232C port (optional on Models 295 and 495-I) interface with computer mainframe and personal computers; receives ASCII data from remote location for local hard-copy reproduction.

First Delivery ● 1971 (Model 400-I); 1979 (Model 485); 1981 (Model 455); 1983 (Models 295 and 495-I).

Units Installed ● unknown.

Comparable Systems ● image-resolution and transmit/receive speeds put the Xerox offering roughly in the same class as the Alden Models 9317 and 9271; Burroughs dex family; Exxon Qwip 1200, 1300, 200/2150; Infolink Scanatron; Mitsubishi FA 585; 3M's EMT Series, Muirhead K-440, K-441, K470, K560, and the M-Series; Nippon System II and III, Nefax 180 and 3500; Panafax UF 520 and MV; Ricoh models; Siemens HF; Stewart-Warner Models 810 and 825; and Telautograph Omnifax G32.

PURCHASE PRICE RANGE

hardware ▮▮▮
5-yr maint fee ▭

Model 295 — ▭ $4K to $7K
Model 400-I — ▮▭ $1.2K to $2.6K
Model 455 — ▮▭ $2K to $3.2K
Model 485 — ▮▭ $3.2K to $5.6K
Model 495-I — ▮▭ $6.3K to $12.8K

$5K $10K $15K $20K $25K

TELECOPIER FAMILY PURCHASE PRICE bar graph shows purchase price range (solid bars) and associated 5-year maintenance fees between "small" and "large" models ● **Model 295** consists of base unit plus G1 and G2 compatibility, time and date indication, and RS-232C interface ● **Model 400-I** consists of base unit plus unattended answering unit ● **Model 455** is the base unit with no options ● **Model 485** is also a base unit with no options ● **Model 495-I** consists of base unit plus G1 and G2, time and date indication, auto-dialer, RS-232C interface, and Net Master interface. All prices are for single quantity purchase.

Vendor ● Xerox Corporation; 1301 Ridgeview Drive, Lewesville, TX 75067 ● 214-420-7200.

Distribution ● marketed through Xerox sales offices nationwide.
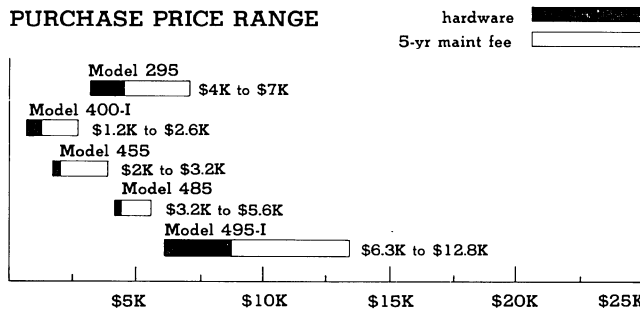
■ ANALYSIS

While Xerox has not added new facsimile products since our last evaluation of this product line, it has taken steps to make its Model 495-I more attractive to organizations requiring sophisticated store-and-forward facilities. Through the new Net Master software and a personal computer, users can establish **selected** distribution lists and store multiple documents on the PC's disk or diskette.

Net Master is a disk-resident software package, which links a personal computer (e.g., an IBM PC/XT or Xerox 16/8) to the Model 495-I. Net Master transfers the contents of the PC user's disk to the attached 495-I facsimile transceiver where the PC's ASCII data stream is converted to a CCITT Group 1, 2, or 3 format for forwarding to the destination facsimile device. Net Master also allows remote Group 1, 2, and 3 facsimile units to transmit documents to 495-I for storage on the personal computer; or a remote personal computer can send files (documents) to a Net Master—equipped personal computer for storage and eventual forwarding to target facsimile units via a 495-I.

While there are competitive products that provide local store-and-forward facilities (Ricoh and Pitney Bowes, for example), none offer the flexibility of Net Master (see Strengths). Those products forward documents via broadcasting, which Net Master allows selective document distribution.

Other Net Master benefits include complete network activity reporting, a transmission audit trail, and local printing services. The latter is accomplished by directing the 495-I's printer to print documents received from a remote **personal computer**. Very handy for those needing an immediate copy of a received document, and/or for those situations where a personal computer printer is unavailable.

Xerox Telecopier Facsimile Terminals
Models 295, 400-I, 455, 485 & 495-I

The reports generated include a delivery status report, providing an audit trail confirming the delivery status of documents sent to various locations; a document availability report, showing a list of documents currently accessible to every network user; system activity report, indicating documents transmitted and error events; and distribution lists established by users. A remote user can even receive an activity report for his location. All interaction with Net Master, incidentally, are password protected to ensure privacy.

The 495-I-to-personal computer link is established by a firmware interface in the 495-I and the Net Master program on the PC's disk. The electrical interface is via the transceiver's and PC's RS-232C interface. Xerox allows existing 495-Is to be field-upgraded to accommodate Net Master.

The Telecopier family is targeted at the low-to-medium volume market. The units offer no exceptional features, except for support of electronic document handling via an RS-232C interface available with the 295 and 495-I that connects the transceiver to a large mainframe or personal computer to retrieve stored pages. Image resolution is adequate for most general applications, but might be unsuitable for fine print, finger prints, or photographs. Resolution for the digital units is twice that of the analog models.

Xerox provides data compression (modified Huffman/Read) to reduce dialup line costs through increased communication efficiency. Data compression is standard on all models except the 400-I and 295.

The RS-232C interface, offered with the 295 and 495-I, is Xerox's response to the growing demand for electronic document handling facilities. Rather than incorporate storage facilities within the transceiver as Ricoh does with its Model 5000 SAD-PAK, Xerox connects its transceivers to large mainframes or personal computers for document storage and retrieval.

The optional auto-dial facility automatically routes pages to addressable destinations. The 295 can also retrieve and print ASCII data. Electronic document handling is also supported by Ricoh's Intelligent-I, offered with its Models 3100/3300.

□ **Strengths**

The strengths of the entire product line are a reasonably good image resolution for all models, data compression facilities for communication efficiency, CCITT conformity for multivendor compatibility, and an RS-232C interface and Net Master for document handling. Image resolution, as pointed out, is good enough to handle most applications except, perhaps, very fine print, fingerprints, or photographs. The conformity to CCITT recommendations means that the Telecopier family can communicate with **any** other facsimile terminal meeting these recommendations.

The RS-232C interface offered with 295 and 495-I make those transceivers extremely attractive for document handling applications. It allows users to establish a store-and-forward network without investing in expensive local storage. Also, by making use of their mainframe or personal computer storage facilities, users can handle a very high number of pages. To interface the transceiver to a computer, users must furnish their own software routines. However, Xerox helps make this process as painless as possible by supplying all the interface specifications.

The Net Master, mentioned under ANALYSIS, allows users to build an extensive and relatively sophisticated store-and-forward facility. By employing a personal computer's disk for storage, users can locally or remotely enter documents from a Model 495-I transceiver (or compatible units) or from a personal computer (IBM, Xerox, or compatible) via an RS-232C interface. Net Master also supports development of distribution lists and will **selectively** forward stored messages to listed destinations.

With both the Ricoh and Pitney Bowes store-and-forward facilities, locally and remotely received messages are stored **within the transceiver**, but forwarding is conducted only on a broadcast basis. Therefore, all locations on the distribution list receive each of the stored documents, which results in increased communication and system overhead since all received documents may not be pertinent to the receiving party. It also produces a security problem, since unauthorized users may receive sensitive documents.

Net Master is also ideal for establishing an electronic mail facility. Each Net Master user can be assigned a mailbox whereby the system will store or retrieve documents. Before beginning the transmission, the 495-I will determine if the remote terminal is a Group 1, 2, or 3 machine and adjust itself to transmit accordingly. Net Master also has an automatic polling facility, and can receive documents from remote locations for local print, or for store-and-forward to other locations. An internal telephone directory for up to 1,000 numbers can be established.

□ **Limitations**

Aside from the aforementioned image-resolution limitations, the principal drawback of the entire family is the lack of an automatic scan resolution adjustment. This facility automatically adjusts the image resolution to compensate for variations in image magnitude. Since documents frequently contain some images that require fine adjustment while others need normal image adjustments, users might set the resolution to meet the average. This compromise could cause reproduced images to appear to be distorted or illegible. Until this year, no facsimile terminals possessed this facility. Now Burroughs offers it with its dex 3606, as does Telautograph with its Omnifax 99.

■ **SOFTWARE**

The control programs for normal Telecopier operations reside in firmware included in the price of the product. The Net Master option is a disk-resident software package loaded into the personal computer. It establishes the aforementioned document store-and-forward facilities when used in conjunction with the Model 495-I. The link between Net Master and the personal computer is established via an RS-232C interface on the electrical level, and a firmware-resident program in the 495-I.

Net Master Control Program ● stores on disk, data received from Model 495-I and/or Xerox 16/8, IBM PC/XT, and compatible products ● establishes and controls document distribution lists; performs password verification ● establishes and maintains 1,000 telephone number directory with alias retrieval ● produces network activity reporting and transmission audit trails:

	NA/NA mo	$895 prch	NA maint

■ **HARDWARE**

□ **Terms & Support**

Terms ● all Xerox terminals and accessories are available for purchase, lease, or 30-day rental basis ● leases are offered on 1-, 2-, and 3-year terms ● a rental credit option with minimum purchase price is offered with terminals and accessories; rental credit accrues at a rate of 50 percent of the then-current published monthly charge.

Support ● vendor support is provided through service locations ● maintenance is bundled into rental units, and priced separately for purchased units ● a full-service maintenance plan is offered for purchased equipment.

□ **Overview**

The Xerox Telecopier family consists of 5 transceivers, all designed for general-purpose facsimile applications. Two units—the 295 and 495-I are CCITT Group 3 compatible, with Group 1 and 2 optional. The 455 and 485 are Group 1 and 3 compatible, while the older 400-I is a Group 1 machine only.

The units are split evenly between floor-console (Models 485, and 495-I) and tabletop (Models 295, 400-I, and 455-I). All employ automatic document feeding except the 400-I. That unit still requires hand-fed, single-copy inputs. The image resolution for the analog Models 400-I, 455, and 485 are 96x96/64 lpi for the 400-I, and 96x97/65 lpi for the 455 and 485, AM and FM

PRCH: purchase price for single quantity unit. MAINT: monthly maintenance fee for purchased units. NA: not available. Prices effective as of December 1984.

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Models 295, 400-I, 455, 485 & 495-I

transmit times are industry standard 3 and 6 minutes, respectively, and all allow a 4-minute FM transmission. In addition, the 455 and 485 also handle proprietary nonstandard transmission of a page in 1 and 2 minutes, with an image resolution of 80x72 lpi.

The digital transceivers—Models 295, and 495-I—have a selectable image resolution of 204x196/98/64 lpi. In addition to these, the 485 selects 97x96-/65-lpi resolution. Typical page transmit times at 9600-bps range between 25 and 30 seconds at the normal image resolution scan rate. For those units accommodating CCITT Group 1 and 2, the transmission rates are the standard 3 and 6 minutes. The new Model 295 can be equipped for nonstandard North American and European transmission rates of 4 or 6 minutes.

Models 295, and 495-I can all transmit data at 9600 bps. However, only the 295 includes a 9600-bps modem as a standard feature. All of these transceivers support polling.

The 295 and 495-I can be equipped with an optional RS-232C interface, which connects the transceiver to a host computer or personal computer for electronic document handling. Through user-written software, the transceivers can retrieve pages stored on the computer and transmit them to other compatible facsimile units. The vendor will supply the interface specifications to allow the user to write the page transfer routines.

Telecopier 295 AM/FM/Digital Transceiver ● tabletop unit measuring 19.3(W) x 16.1(D) x 6.5(H) inches; 34 pounds ● input document: auto-feed; 30-document capacity; 5.9 to 8.5 inches x length of original ● output document: roll-fed, 8.5 inches x length of original; 328-foot roll ● solid-state, flatbed scanning ● 204x196-/98-lpi resolution ● transmission speed for 8.5x11-inch document at 9600 bps is 25 seconds ● 9-inch maximum scanning width ● electrothermal printing ● CCITT Group 3 compatibility standard; Groups 1 and 2 (FM 4/6 minutes) optional; CEPT/Telefax compatibility standard ● white-space skipping optional ● no half-tone support ● 9600/7200/4800/2400-bps auto-fallback modem; polling ● time and date, terminal identification, header print, activity log, status log ● optional RS-232C interface permits communication with mainframe and personal computer; ASCII data can be printed:

$195/$170 mo	$3,995 prch	$41.00 maint

T57 CCITT Group 1 & 2 Compatibility ● supports analog communication with 3-/6-minute transmit/record facsimile units:

25/20	200	NA

Telecopier 400-I FM Transceiver

Tabletop unit measuring 18.4x13.4x4.6 inches; 18 lbs ● input document: to 8.5 inches; manual single-sheet feed ● output document: single sheet to 8.5x11 inches ● rotating cylinder, moving head scanning ● 96x96-lpi; 96x64-lpi resolution ● transmission speed for 8.5x11-inch document: 6 minutes at 96 lpi; 4 minutes at 64 lpi ● 8.5-inch maximum scanning width ● electrosensitive printing ● CCITT Group 1 compatibility; compatible with most 4-/6-minute FM units ● no compression ● 3 shades of gray half-tone support ● DDD operation; acoustic coupler with DAA standard; auto-answer/disconnect optional:

NA/NA mo	$1,195 prch	$16.65 maint

450 Unattended Answering Unit ● auto-answer/disconnect:

15/15	400	NA

Telecopier 455 AM/FM Transceiver

Tabletop unit measuring 17x18x5.7 inches; 28 lbs ● input document: 8 to 8.5x5 to 11.75 inches; single-sheet, manual feed ● output document: single sheet, 8.5x11 inches ● rotating cylinder, moving head scanning ● 96x97-lpi; 96x65-lpi; 80x72-lpi resolution ● transmission speed for 8.5x11-inch document: 3/6 minutes at 96x97 lpi; 4/6 minutes at 96x65 lpi; 1/2 minutes at 80/72 lpi ● 8.5-inch maximum scanning width ● electrosensitive recording ● CCITT Group 1 and 2 compatibility ● white-space skipping ● no half-tone support ● DDD connection; integral handset; DAA included:

NA/$80 mo	$1,195 prch	$20.80 maint

Telecopier 485 AM/FM Transceiver

Floor-console unit measuring 28x12x30 inches; 176 lbs ● input document: 5 to 10x5 to 14 inches; auto-feed 30-document capacity ● output document: roll-fed, 8.5 x length of original; 325-foot roll ● flat-bed, diode array scanning ● 96x97-lpi; 96x65-lpi; 80x72-lpi resolution ● transmission speed for 8.5x11-inch document: 3/6 minutes at 96x97 lpi; 4/6 minutes at 96x65 lpi; 1/2 minutes at 80x72 lpi ● 8.5-inch maximum scanning width ● thermal printing ● CCITT Groups 1 and 2 compatibility; also Xerox TC400/410/200 and most 4-/6-minute FM unit compatibility ● white-space skipping ● no halftone support ● DDD network or dedicated line; DAA polling and auto-answer/disconnect standard:

NA/NA mo	$3,195 prch	$40.00 maint

Telecopier 495-I Digital Transceiver

Floor-console unit measuring 29.5x12.6x31.5 inches; 175 lbs ● input document: 5 to 10x4.7 to 14.6 inches; auto-feed 50-document capacity ● output document: roll-fed, 8.5 x length of original; 328-foot roll ● flat-bed, photo diode array scanning ● 204x64-lpi; 204x98-lpi; 204x196-lpi resolution ● transmission speed for 8.5x11-inch document at 9600 bps: 24 seconds at 204x65 lpi; 33 seconds at 204x196 lpi ● 10.2-inch maximum scanning width ● thermal printing ● CCITT Group 3 compatible; Groups 1 and 2 optional; also Xerox 400, 410, and 200 compatibility ● white-space skipping ● Group 3 and modified Huffman/READ data compression ● no half-tone support ● DDD operation at 9600 bps; auto-fallback modem with DAA, auto-answer/disconnect and polling standard; auto-dial, time and date optional:

$325/$235 mo	$6,295 prch	$79.00 maint

T57, CCITT Group 1 & 2 Compatibility ● supports analog communication with 3-/6-minute transmit/record facsimile units:

35/25	300	NA

T59 Time & Date Recording ● records time, date, and polling terminal ID; verifies legal security codes:

12/10	100	NA

☐ Communications

All terminals can be attached to private lines or the DDD. The 295 includes an auto-fallback 9600/7200/4800/2400-bps modem.

The digital transceivers are all CCITT Group 3 compatible, while those employing analog transmission are Group 1 and/or 2 compatible. In addition, the 455 and 485 support proprietary nonstandard transmission rates of 1 and 2 minutes. The 295 in analog mode can also operate under nonstandard North American and European protocols at a speed of 4 or 6 minutes.

Models 295 and 495-I can all poll, and can deliver and receive pages on a single call. The modems furnished are all FCC-certified, auto-answer/disconnect units. A very powerful auto-dialer option offered with the 495-I allows multipage transmission to multiple locations or to the same location. When used with the RS-232C interface, which supports mainframe and personal computer storage, the auto-dialer provides an elementary form of store-and-forward services.

Data compression performed by Models 295, 455, 485, and 495-I is modified Huffman/Read. These compression facilities employ white-space skipping to increase transmission efficiency.

Automatic Dialer ● automatic dialing feature for Telecopier 495-I; maximum 27-digit numbers:

$15/$11 mo	$250 prch	NA maint

RS-232C Interface ● provides EIA RS-232C interface for 295 and 495-I:

40/29	300	NA

MO: 1-/3-yr monthly lease charges with maintenance. PRCH: single-quantity purchase price. MAINT: monthly maintenance fee for purchased units. NA: not applicable. Prices are current as of December 1984.

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Net Master Interface ● firmware interface between Xerox 16/8, IBM PC/XT (and compatible products), and the 495-I ● provides Net Master services of converting ASCII data to facsimile data and vice-versa:

NA/NA	‸ 895	NA

● **END**