

Lear Siegler ADM Series Display Terminals

Models ADM 3A, 5, 11, 11plus, 12, 12plus, 220 & 1178

■ PROFILE

Function • general-purpose, nonprogrammable interactive keyboard-display ASCII terminals • ADDS Viewpoint and Regent 25; Esprit 1400, 1420, 1500; DEC VT52 compatible (11 and 11plus) • Televideo 925 and 950 compatible (12plus) • ANSI X3.64 and DEC VT52/100/220 compatible (220).

Architectures Supported • any architecture supporting an ASCII terminal; local/remote attachment • local/remote attachment to DEC hosts • local/remote attachment to IBM protocol converters.

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 • none.

Database Management • none; only in conjunction 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 logic • local/remote initiated printing.

Terminals/Workstations • single-keyboard 1920-character display; 1920-/3168-character display on Model ADM 220 and ADM 12plus • auxiliary printer port for local printer attachment.

First Delivery • 1974 (ADM 3A, 5, 11, 12); 1984 (220 and 1178); 1985 (11plus and 12plus).

Systems Delivered • undisclosed.

Comparable Systems • competitive with a number of ASCII display terminals, including ADDS Regent and Viewpoint Series; Beehive DM Series; DEC VT52/100/220; Esprit 1400, 1420, 1500; IBM 3101; Televideo 900 Series.

Vendor • Lear Siegler, Inc (LSI)/Data Products Division; 901 East Ball Road, Anaheim, CA 92805 • 714-778-3500.

Canadian Distribution • Wells Data Products; 450 Matheson Boulevard East, Unit 64, Mississauga, ON L4Z 1R5 • 416-890-2600.

Distribution • sold through distributors and original equipment manufacturers (OEMs) worldwide • European sales and service through Lear Siegler Data Products Limited, Brookwood, Surrey, England.

GSA Schedule • unlisted.



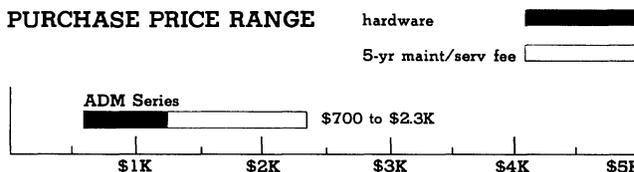
The new ADM 12plus terminal features a 24-line x 80-/132-column display format, up to 4 pages of display memory, and 16 programmable function keys (shiftable to 32 functions).

■ ANALYSIS

Over the past year, Lear Siegler has continued to refine its mature ADM series of display terminals by adding 2 new models to its line-up. The ADM 11plus and 12plus have recently joined the existing models as enhanced versions of the ADM 11 and 12, respectively. Incorporating all of the original ADM 11 features, the ADM 11plus sports 15 additional function keys to provide 16 programmable function keys (shiftable to 32 functions) and 3 additional function keys for a total of 35 functions. The new ADM 12plus extends ADM 12 capabilities with the addition of enhanced display features and expanded editing functions. ADM 12plus supports a 24-line x 80-/132-column display format and provides 2 pages of display memory. A 4-page memory option is also available for doubling the standard memory formats and adding a 158-column x 48-line format. Lear Siegler has also phased out two older models from production. The ADM 24E is now being sold on a custom basis only and the ADM 22 has been withdrawn from manufacturing.

In an effort to remain competitive in this rapidly changing segment of the marketplace, Lear Siegler has reduced the prices on selected models. The DEC-compatible ADM 220 received a 23-percent price reduction when Lear Siegler lowered the price from \$1,165 to \$895. In conjunction with the price decrease, a 14-inch screen option which formerly listed for \$70 has been included as a standard feature. Also, the price of the ADM 1178 was slashed by 30 percent in response to similar moves by competitors. Pricing for the remaining members of the ADM terminal family stayed constant.

Lear Siegler/Data Products Division is one of the oldest independent suppliers of ASCII keyboard-display terminals in the industry. It claims to be the first manufacturer of Teletype-compatible CRTs, and holds copyright on the name Dumb Terminal. The company has introduced new models and enhancements steadily over the course of its 11-year history, and



LEAR SIEGLER ADM SERIES PURCHASE PRICING bar graph covers price range between "small" and "large" configuration for hardware products and associated on-site maintenance fees (open bar) • **SMALL ADM** consists of ADM 3A keyboard-display terminal • **LARGE ADM** consists of ADM 220 with standard 14-inch display, 4-page display memory, RS-422 communication interface, and multinational character set.

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along with newer models is still offering some of the same terminals it started out with.

Models range from the conversational ADM 3A, a truly dumb terminal, to models such as the ADM 12 and 12plus with extensive editing, block mode options. Third-party vendors provide a host of enticing extra-cost options and features, although not all are universally available across the product line.

Lear Siegler competes against well over 100 products in the terminal marketplace. Although dozens of potential model pairs can be compared (see our Data Communication Terminals survey, report #720), we will look at how the ADM family as a whole measures up against the Televideo 900 Series and DEC VT200 Series.

The ADM family competes favorably with the Televideo 900 Series but individual model price/performance differences bear watching. The 900 Series consists of Models 910, 910 Plus, 914, 921, 922, 924, 925, 925E, 950, 970, and Personal Terminal and range in price from \$650 to \$1,495. Both 900 Series and ADM Series provide about the same level of edit functions. Models ADM 12, 12plus, and 220; all other ADM models support destructive scrolling only, whereas almost all Televideo terminals support at least one page of local memory. The low-end Televideo 910 includes programmable function keys and a 256-byte receive buffer; features not available on comparable ADM 3A and 5 models. Televideo does not provide an extended horizontal screen feature available on Lear Siegler's ADM 12 and ADM 12plus.

Most Televideo models support both character and block modes; block transmission is available for ADM models starting with the 12. All upper-end Televideo models (925, 925E, 950, and 970) contain a bidirectional printer port, whereas only the ADM 12, 12plus, and 220 supports this feature. A bidirectional printer port allows a host to print on the terminal's printer while the keyboard operator simultaneously enters data. Televideo now provides DEC-compatible terminal as does Lear Siegler.

Lear Siegler does not have a block mode terminal that competes head-on with DEC's terminal offerings. The ADM 220, however, represents a viable alternative to the DEC VT220. The ADM 220 is priced 10 percent less than the VT220 and supports a standard 14-inch screen. Lear Siegler still has not produced a model that matches the vector and graphics capabilities afforded by the VT240 and VT241 terminals.

DEC is still producing the venerable VT100 series for OEMs and other large users. The VT100 still holds value for several reasons: it is a reliable, adaptable, and upgradable product line. Lear Siegler does not produce a terminal that can be upgraded from a dumb terminal to a personal computer like the VT100, a desirable feature for users who might want to add local processing to their communicating terminals at a future date.

Strengths

Lear Siegler produces a wide range of functional and attractive ASCII display terminals. Users can select from the traditional ADM 3A dumb terminal to models with extensive editing and format features. Lear Siegler's commitment to enhancing this mature product line will be further demonstrated later this year by the release of a new low-end ADM 3E and a totally revamped ADM 3A with plain-language set-up and standard upper-/lowercase characters. Prices are competitive and most models feature modern ergonomic designs for operator comfort.

The majority of the ADM terminals support a variety of ergonomic considerations including low-profile, detachable keyboards; nonglare screens, tilt/swivel monitors; 60-Hz refresh rates; and CRT saver function. In an effort to facilitate operational ease of use, all models except for the low-end ADM 3A and 5 utilize a plain-language set-up menu. Unlike previous set-up modes found on older units, the plain-language set-up menu enables ADM users to choose operating parameters from a menu-driven display.

The ADM 12 and 12plus provide expanded horizontal viewing area ideal for spreadsheet and flowchart applications. The ADM 12plus with up to 4 pages of memory is ideal for word processing, and includes a bidirectional printer port. This port allows the host

to directly transmit data to the printer without interfering with terminal activity, allowing users to enter data while the printer produces copy. The ADM 220 is a DEC VT220-compatible replacement with a lower price tag and 14-inch screen option that is available at no extra charge.

Lear Siegler provides 5 different service/maintenance plans for its customers. These include return-to-factory, on-site, swap-out, and walk-in plans. Most maintenance is performed by Lear Siegler or its representatives; such support is uncommon among terminal vendors.

Limitations

Only one model, the ADM 220, supports ANSI terminal communication standards. The others can communicate only with each other or with the terminals they emulate. For companies with a multivendor equipment policy, this limitation might prove unacceptable.

Although the ADM 1178 is intended as a low-cost replacement for the IBM 3278 display, it does not compare favorably with the newer IBM 3178/3179 with which it also competes. The 3178 combines the functionality of several 3278 models at a lower price, and does not require a protocol converter as does the ADM 1178.

At the present time, the ADM Series lacks a multicolor display model. Chief competitors, DEC and ADDS, both have incorporated models with selectable color display into their product families for enhanced graphics viewing and increased operator productivity. Furthermore, none of the high-end ADM models have any provision for handling vector graphics. DEC VT240/241 terminals support full bit-map graphics generation in both Tektronix 4010/4014 and ReGIS mode.

SOFTWARE

No software support is furnished.

Operating System

None; firmware controls all functions.

HARDWARE

Terms & Support

Terms • all terminal models offered on purchase basis; some distributors provide lease/rental plans • discounts for quantities over 100; contact vendor for quotation • 90-day warranty • separate maintenance contracts available.

Support • all maintenance contracted with Lear Siegler; actual service provided by either Lear Siegler or third party (Dow Jones), depending on level of support • 5 maintenance programs available, covering extended warranty; unlimited modular repair program (UMRP); on-site; express depot service; and mail-in maintenance • extended warranty program provides return to East or West Coast depot of repair for a fixed annual charge of \$72 per year; • unlimited modular repair program (UMRP) provides subassembly repair for a group of like-customer terminals; customer is allowed one of each type of terminal subassembly to be under repair at one time; vendor recommends one UMRP for each 10 to 15 installed terminals, with rates ranging from \$60 to \$127.50 per UMRP per month depending on the model • on-site program provides on-call maintenance in over 3,000 U.S. cities, Monday through Friday, from 9:00 AM to 5:00 PM; monthly charges covered under Model Packages; locations outside a 50-mile radius of the service city (25 miles for the Model 310, 500, and 520 printer) incur a \$10 surcharge for each additional 25 miles • express depot program provides walk-in service in any 1 of 41 U.S. depot locations; repairs are while-you-wait, or within 48 hours at the latest; express depot charges range from \$85 to \$155 per year • mail-in maintenance service provides a plan to users located outside of Dow Jones service range or requiring faster turnaround time than possible at LSI depots; users mail defective equipment to 1 of 18 Dow Jones depots for repair • available turnaround time is 2 working days after receipt of the terminals by Dow Jones; express depot maintenance contract pricing is same for mail-in and carry-in service.

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□ Overview

The Lear Siegler ADM family consists of 8 ASCII keyboard-display terminals designed to operate at speeds of 300 to 19.2K bps (ADM 11, 11plus, 12, and 1178), 50 to 19.2K bps (ADM 12plus), 75 to 19.2K bps (ADM 3A and 5), or 75 to 38.4K bps (ADM 220). The low-end Models ADM 3A, 5, and 11 are traditional "dumb" terminals with little or no screen editing features. Other models contain various combinations of "smart" features, including line or page editing, multipage memories, split-screen formatting, programmable function keys, and screen visual attributes. Models ADM 11, 11plus, 12, and 12plus can be equipped with foreign character sets such as UK ASCII, Spanish, French, German, Italian, Norwegian, and Swedish. For details, see Terminals/Workstations.

The ADM 11plus incorporates all of the ADM 11 features with additional function keys and editing capabilities. Designed to operate in character transmission mode, the ADM 11plus provides 16 programmable function keys along with 3 edit keys and a break key which can be programmed to perform an additional 7 functions. Editing features include character/line insert, character/line delete, line erase, and page erase.

Models ADM 220 and ADM 1178 are intended for Digital Equipment Corporation (DEC) and IBM environments, respectively. The ADM 220 is ANSI X3.64 or DEC VT52/VT100/VT220 compatible in conversational mode. The ADM 1178 includes an IBM 3278 Modified Selectric keyboard, and is designed to be coupled with a pair of protocol converters for use in IBM 3270 networks.

The ADM 12 is another smart editing terminal with extended horizontal screen formatting for viewing spreadsheets and flowcharts, among other applications. Although the ADM 12 displays data in a normal 24-line x 80-character format, it can be scrolled horizontally to view data out to 158 columns.

The ADM 12plus is an enhanced version of the original ADM 12 with a standard 24x80/132 display format, variable format display memory, and advanced editing features. Compatible with existing ADM 12 terminals, the 12plus also emulates Televideo 925 and 950 terminals. The ADM 12plus provides 2 pages of 24-line x 80-/132-column display memory or a choice of wide- and long-page memory configurations. A 4-page memory option is also available to double the standard memory formats and add a 158-column x 48-line display memory format.

In addition, Lear Siegler provides several popular options for certain ADM models as well, including different screen sizes and different interfaces (RS-232C, current loop, and RS-422A). Other third-party vendors also produce operator-convenience items, such as touch-screens and speech input devices.

Operating parameters are established via DIP switches for Models ADM 3A and 5. The ADM 11, 11plus, 12, 12plus, 1178, and 220, on the other hand, are all soft configured from the terminal's keyboard. Moreover, the setup procedures are assisted by English menu prompts. Model ADM 12 and 12plus also have keyboard-selected "personality control," which tailors terminal behavior for specific host computers.

While Lear Siegler provides no sophisticated self-checking routines, integrity checks of hardware/software are performed for all terminals, excluding the ADM 3A and 5, when the terminal is powered up. A test success/failure message is displayed on the screen.

Model Packages

ADM 3A Dumb Terminal • keyboard-display ASCII terminal with 12-inch CRT in green or white phosphor; displays 1920 characters at 24 lines x 80 characters • 5x7 dot matrix • attached, typewriter-style keyboard; 59 keys, including 10 nonprogrammable function control keys • half-/full-duplex 75-bps to 19.2K-bps operation (up to 9600 bps with current-loop interface) • character transmission mode • serial bidirectional (extension) printer port • RS-232C or optional 20-mA current-loop interface, lowercase characters, answerback, numeric keypad, split data rate • standard configuration:

\$695 prch \$17 mo

Lowercase • displays lowercase characters • extra-cost option:

75	NA
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Numeric Keypad • provides 14 keys for operator convenience, including 10 numeric keys, 3 punctuation keys, and ENTER (RETURN) key • extra-cost option:

80	NA
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ADM 5 Dumb Terminal • same as ADM 3A but with built-in numeric keypad; upper- and lowercase character display; tab key; limited editing capability; program mode for storing and displaying control codes; and screen visual enhancements • options include answerback and 20-mA current-loop interface • standard configuration:

745	17
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ADM 11 Conversational Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch screen optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • detached, selectric-style, low-profile typewriter keyboard with separate numeric keypad meets DIN standards; 4 programmable (8 programmable functions) keys • ASCII and 7 optional international characters • terminal operating parameters established from keyboard via 25th status line or from the host • character transmission mode • 1400-character receive buffer • half-/full-duplex • 300-bps to 19.2K-bps operation • serial printer port • RS-232C communication/printer port • options include RS-422 or 20-mA current-loop interface, and answerback • standard configuration:

695	17
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Foreign Keycap Set:

90	NA
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14-Inch (Diagonal) CRT Screen, Green or Amber:

30	NA
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ADM 11plus Conversational Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch screen optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • detached, low-profile, selectric-style keyboard meets DIN standards; 16 programmable (32 programmable functions) keys • ASCII and 7 optional international character sets • terminal operating parameters established from keyboard via 25th status line or from the host • character transmission mode • 1400-character receive buffer • half-/full-duplex • 300 bps to 19.2K bps operation • RS-232C communication/printer port • options include RS-422 or 20-mA current-loop interface, answerback • standard configuration:

695	17
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European Keycap Set:

90	NA
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14-Inch (Diagonal) CRT Screen, Green or Amber:

30	NA
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ADM 12 Editing Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch screen optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • 2-page or enlarged single-page (48 lines x 80 characters or 24 lines x 158 characters) memory • independent scrolling regions • low-profile, detached, selectric-style keyboard meets DIN standards; 16 programmable (32 program functions) keys • ASCII and 7 optional international character sets • terminal operating parameter configuration via 25th-line setup commands • standard business graphics • half-/full-duplex • 300-bps to 19.2K-bps operation • character/block transmission mode • 1400-character receive buffer • serial printer port • RS-232C communication/printer port interface; options include 20-mA current-loop interface, RS-422 interface:

895	22
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PRCH: single-unit purchase price. MO: monthly on-site maintenance charge. NA: not applicable/available. NC: no charge. Prices are current as of August 1985.

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14-Inch (Diagonal) CRT Screen, Green or Amber:

	170	NA
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ADM 12plus Editing Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch screen optional; displays 1920/3168 characters at 24 lines x 80/132 characters, 25th status line • 7x10 dot matrix • 2-page or enlarged single-page (48 lines x 80 characters or 24 lines x 132 characters); optional 4-page display memory provides selection of four 24x80 pages, two 48x80 pages, two 24x132 pages, two 24x158 pages, one 48x158 page, or one 80x96 page (Televideo 925/950 mode) • independent scrolling regions • low-profile, detached, selectric-style keyboard meets DIN standards; 16 programmable (32 programmable function) keys • ASCII and 7 optional international character sets standard • terminal operating parameters configuration via 25th-status line set-up commands • standard business graphics • half-/full-duplex • 50-bps to 19.2K-bps operation • character/block/local transmission mode • 1400-character receive buffer • serial printer port • bidirectional auxiliary printer port • RS-232C communication/printer port interface; options include 20-mA current-loop interface, RS-422 interface:

	745	22
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European Keypad Set:

	90	NA
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14-Inch (Diagonal) CRT Screen, Green or Amber:

	30	NA
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ADM 1178 • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch CRT optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • IBM 3278-compatible, detached keyboard meets DIN standards; contains 24 Program Function (PF) and 2 Program Access (PA) keys • terminal operating parameter configuration via 25th line setup commands • ASCII character set plus IBM extended character set for 25th status line • half-/full-duplex • 300-bps to 19.2K-bps operation • 1526-character receive buffer • character transmission mode; designed for use in conjunction with a protocol converter • serial printer port • RS-232C communication/printer port interface • options include RS-422A interface; 20-mA current-loop interface:

	695	24
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14-Inch (Diagonal) CRT Screen, Green or Amber:

	30	NA
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ADM 220 • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch CRT available at no additional charge; displays 1920/3168 characters at 24 lines x 80/132 characters; 25th status line • ANSI X3.64 or DEC VT52/VT100/VT220 compatible • 7x10 dot matrix • single-page or optional 4-page memory • split-screen with user-definable scrolling regions • low-profile, detached keyboard meets DIN standards; 15 programmable (30 program functions) keys • ASCII and international character sets standard • standard business graphics • terminal operating parameter configuration via 25th line setup commands • full-duplex • 75-bps to 38.4K-bps operation • character transmission mode • bidirectional serial printer port • RS-232C communication/printer port interface • options include 20-mA current-loop interface; RS-422A interface; 4-page display memory:

	895	NA
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Foreign Keypad Set:

	90	NA
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14-Inch (Diagonal) CRT Screen, Green or Amber:

	NC	NA
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CPU & Memory

All newer models and smart terminals are microprocessor controlled. RAM is employed for page scrolling on those models which support it, for printer buffering on selected models, and for temporary terminal operating parameter configuration. The ADM 12 and 12plus can store data in a 24-line x 158-character format, 48-line x 80-character format, or 2 pages of 24 lines x 80 characters, standard. Firmware controls terminal functions.

96-Line (4-Page) Display Buffer • adds 2 additional pages of scrollable memory, 4 pages total:

	\$80	prch	NA	mo
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I/O & Communications

All members of the Lear Siegler ADM family support point-to-point asynchronous ASCII communication. Transmission rates are 75 to 19.2K bps for Models ADM 3A and 5; 300 to 19.2K bps for the ADM 11, 11plus, 12, 12plus, and 1178; and 75 bps to 38.4K bps for the ADM 220. In addition, Model ADM 3A can be configured to operate at different receive/transmit rates by the addition of a Split Baud Rate option.

Incoming data is buffered by some terminal models in a receive (input) RAM memory. Models ADM 11, 11plus, 12, 12plus, and 220 each contain a 1400-character FIFO buffer with XON/XOFF or DTR flow control for stop/start transmission to prevent buffer overflow.

All models communicate over switched or dedicated lines in half-/full-duplex mode and support local echo (echoplex) in conversation (character) mode. Selectable odd, even, or no parity, mark, or space. The character is composed of 7 or 8 data bits, with 1 start bit and 1 or 2 stop bits.

Operating parameters for Models ADM 3A and 5 are established via DIP switches. All other models are soft configured via the display's 25th status line; all parameter changes to operating configuration are established from the terminal's keyboard. Parameter changes for the ADM 11, 11plus, 12, 12plus, and 22 are assisted by English menu prompts. Parameters on all models are retained in nonvolatile memory. Models ADM 12 and 12plus also have "personality control," a feature that modifies terminal behavior for compatibility with various computer systems. The terminal personality is operator selectable from the keyboard, allowing user customization of specific parameters such as ESCape, end-of-block, and lead-in characters as well as other delimiters.

Operating modes vary with the different models. All can communicate in interactive (character) mode, and all except the ADM 3A, 5, 11, 11plus, and 220 can communicate in block mode. Block mode communication supports line and page transmission; the ADM 12 can also operate in message mode, which supports a user-defined block length.

All terminals are equipped with an RS-232C or 20-mA current-loop communication interface. An RS-422 option is available for the ADM 11, 11plus, 12, and 12plus. Models 3A, 5, and 12plus include an RS-232C bidirectional extension interface which can be used to daisy-chain terminals together or connect to a printer. Other models have auxiliary ports which are unidirectional only. All models can attach directly to a host in local processing mode and various current-loop options are available for extension/printer interfaces. The maximum distance between the host processor and terminal is 50 feet for RS-232C; 4,000 feet for RS-422A; and 1,000 feet for current loop.

Current-Loop Interface • provides 20-mA current-loop operation on the communications port • all models:

	\$70	prch	NA	mo
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Extension Port/Current-Loop Interface • provides 20-mA current-loop operation for the ADM 3A and 5 extension port:

	135	NA
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RS-422A Interface • balanced version of EIA RS-449 standard • 37-pin electrical connector • not compatible with RS-232C • extra-cost option for ADM 11, 12, and 1178:

	60	NA
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Answerback • provides an operator-initiated message that identifies terminal to the central site • internally stored message activated by pressing the HERE IS key, which is included in the keyboard but has no function if Answerback not installed • activated by a remote ENQ code • standard feature, ADM 12 and 24E; extra-cost option, ADM 3A and ADM 5:

	115	NA
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Answerback for ADM 11 & 1178:

SO NA

Split Baud Rate • allows different receive/transmit data rates • DIP switch-selectable transmit rate; receive rate governed by addition of a 12-position rotary switch • extra-cost option available for the ADM 3A only:

SO NA

Disk

No disk/diskette is supported.

Terminals/Workstations

Display, editing, and formatting features generally increase as the ADM model scale progresses upward. The ADM 3A is the traditional dumb terminal, and can do little with screen-entered characters except delete them. Limited screen editing functions begin with the ADM 5, which can erase entire lines of text; single-key editing and character/line inserts/deletes begin with the ADM 12. More expensive models also include visual attributes such as blinking, blanking, and underline. Other major differences include protected fields, the amount of programmable (or nonprogrammable) function keys, and split-screen operation.

The ADM 11, the new-generation dumb terminal, includes 4 programmable function keys (shiftable to 8 positions); the enhanced ADM 11plus includes 16 programmable function keys (shiftable to 32 positions). All models except for the low-end ADM 3A and ADM 5 contain new low-profile detached keyboards and tilt/swivel CRT screens. These keyboards include a separate, cross-patterned cursor pad, and 3-key rollover for fast typists. Green or amber screens are available; all other models have a screen choice of either white or green. All models in the ADM lineup feature nonglare screens.

Models ADM 12 and 12plus can include a split-screen function which divides the screen horizontally into 2 separate regions, useful for comparing data. Lines of text in the screen's lower half can be scrolled up or down. These models also support smooth or jump scroll, a convenient feature that allows smooth continuous scrolling or a jump scroll of usually 5 lines per jump (increment). The ADM 12 and 12plus support scrolling in horizontal as well as vertical directions. Both models also support auto-page, another beneficial feature that automatically advances line 1 (top line) off the screen when data is entered following line 24.

Models ADM 12 and 12plus can also support nonembedded visual attributes, which means that character effects such as blinking, blanking, and reverse video do not occupy space on the display or in memory.

Model ADM 220, an ANSI and DEC-compatible model is the only ADM terminal allowing users to display the screen in a 24-line x 80-/132-character (column) format, providing either 1920 or 3168 characters per screen. It is available with a 1-page or optional 4-page memory. The ADM 12 and 12plus provide a standard 2-page (48-line) memory expandable to 4 pages. Models ADM 12 and 12plus can also support a single page of 24 lines x 158 columns for spreadsheet applications.

The ADM 1178 is another "High-Touch" terminal but contains an IBM 3278-compatible keyboard, including special function keys. The unit also includes an IBM extended character set for generating the display's 25th status/setup line. The 1178 must be

used in tandem with any pair of ASCII/3270 protocol converters now on the market.

A graphics feature is available in some form or another for several ADM Series terminals. The ADM 11, 11plus, 12, and 12plus all support limited business/line graphics used for forms generation or simple line drawings. This option, which is standard, generates a character set composed of mosaics and/or line segments.

Configuration • tabletop keyboard-display with typewriter-style keyboard • separate numeric keypad, all models except ADM 3A • keyboards range in size from 59 keys (ADM 3A) to 105 keys (ADM 12, ADM 12plus) • Models ADM 3A and 5 contain fixed keyboards; all others are detached • each terminal can accommodate a local serial printer, either through an extension port or a dedicated printer port depending on the model.

Display • 12 inches standard for all models; optional 14-inch screen, ADM 11, 11plus, 12, 12plus, 1178, 220 • displays 1920 characters at 24 lines x 80 characters (all models); 3168 characters also selectable on ADM 12plus and 220 • 6144 characters viewable on ADM 12 and 12plus via horizontal scrolling • 64 ASCII characters (ADM 3A); 128 ASCII characters all other models • vector graphics option available for ADM 3A and 5 • international character sets including UKASCII, Spanish, French, German, Italian, Norwegian, and Swedish available for ADM 11, 11plus, 12, and 12plus (all character sets may not be available for listed terminal models).

Edit & Format Features • common features for all terminals include cursor left, right, up, down, home; addressable cursor for row and column; auto-repeat keys (2-key operation, ADM 3A) • automatic character wraparound • return, line feed • scrolling • caps lock key, ADM 5 and above • tab, backtab ADM 12 and 12plus • erase to EOL, EOP, ADM 5, and above • clear screen for ADM 11, 11plus, 12, 12plus, 1178 • line insert/delete, character insert/delete for ADM 11, 11plus, 12, 12plus, 220, 1178 • protected fields for ADM 12 and 12plus • erase line/page (all or unprotected positions only) for ADM 12 and 12plus • edit operations from keyboard or host for ADM 11, 11plus, 12, 12plus, 220 • reverse video, underline, blink, and blank for ADM 11, 11plus, 12, 12plus • reduced intensity for all models • double-wide characters for ADM 220 • bold, double-high characters for ADM 220 • auto-page for ADM 12 and 12plus.

Peripherals • RS-232C interface supports local printer attachment • input from terminal or host processor; bidirectional printer port, ADM 12plus.

Line Graphics • limited business graphics provide low-resolution line segments and/or mosaics for printing simple business forms or line drawings • standard feature, Models ADM 11, 11plus, 12, 12plus:

NC prch NC mo

Printers

Lear Siegler no longer manufactures and distributes a single medium-speed, dot-matrix impact printer for any member of its terminal family.

• END

Lear Siegler ADM Series Display Terminals

Models ADM 3A, 5, 11, 12, 22, 24E, 220 & 1178

■ PROFILE

Function • general-purpose, nonprogrammable interactive keyboard-display ASCII terminals • ANSI and DEC VT52, DEC VT100, DEC VT220 compatible (ADM 220).

Architectures Supported • any architecture supporting an ASCII terminal; local/remote attachment • local/remote attachment to DEC hosts • local/remote attachment to IBM protocol converters.

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

Operating System • none.

Database Management • none; only in conjunction 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 logic • local/remote initiated printing.

Terminals/Workstations • single-keyboard 1920-character display; 1920-/3168-character display on model ADM 220 • business graphics for Models ADM 3A, 5, 31, and 36 • auxiliary printer port for local printer attachment.

First Delivery • 1974.

Systems Delivered • undisclosed.

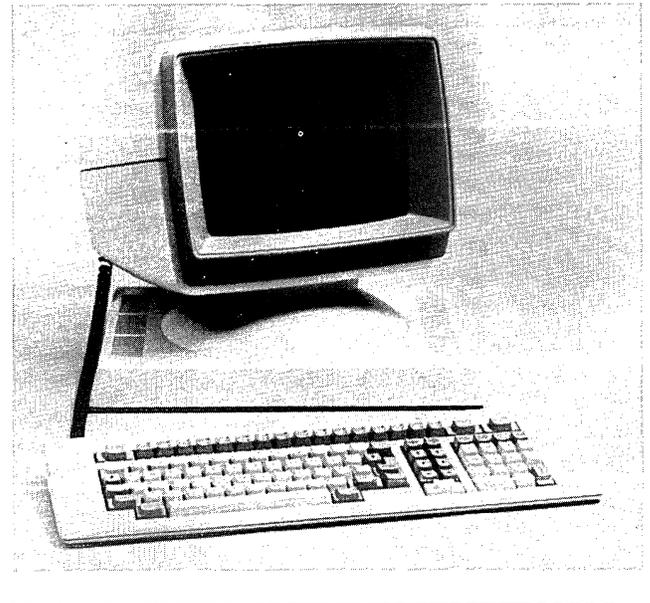
Comparable Systems • competitive with a number of ASCII display terminals, including ADDS Regent and Viewpoint Series; Anderson-Jacobson 510/520; Beehive DM Series; DEC VT100, VT220; Hazeltine 1400, 1420, 1500; and IBM 3101.

Vendor • Lear Siegler, Inc (LSI)/Data Products Division; 901 East Ball Road, Anaheim, CA 92803 • 714-774-1010.

Distribution • sold through distributors and original equipment manufacturers (OEMs) worldwide • European sales and service through Lear Siegler Data Products Limited, Brookwood, Surrey, England.

■ ANALYSIS

Over the past year, Lear Siegler has struggled to contend with lower price/performance ratios and the rapidly changing nature of the ASCII terminal marketplace. The vendor eliminated 8 terminal models from production, and dropped support for integral modem, graphics, multipoint, and printer cut-sheet



options (although multipoint will be a reinstated option for one of the higher-end ADM units sometime in the near future). **Models ADM 11G and 12G** Tektronix-compatible graphics terminals and the ADM 1278 with extended formatting capabilities, announced last November, were **never produced**. End-user pricing for the ADM 3A and ADM 5, both dumb terminals, was raised by \$100. New products introduced include the mid-range ADM 12 editing terminal; the ADM 1178 with IBM 3278 lookalike keyboard; and the ADM 220, a DEC VT220 replacement.

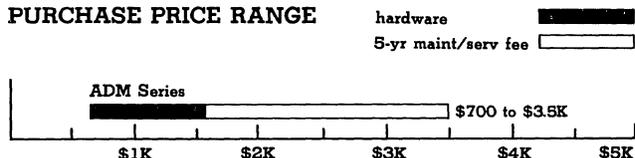
Lear Siegler/Data Products Division is one of the oldest independent suppliers of ASCII keyboard-display terminals in the industry. It claims to be the first manufacturer of Teletype-compatible CRTs, and holds copyright on the name Dumb Terminal. The company has introduced new models and enhancements steadily over the course of its 11-year history, and along with newer models is still offering some of the same terminals it started out with.

Models range from the conversational ADM 3A, a truly dumb terminal, to models such as the ADM 12 and 24E with extensive editing, block mode options. Third-party vendors provide a host of enticing extra-cost options and features, although not all are universally available across the product line. In 1978 the company acquired the Hydra Corporation, a manufacturer of dot-matrix printers, and now provides a low-/medium-speed printer. The Versaprint 500 supports 3 print speeds/qualities, and is available in a 7-color version.

Lear Siegler competes against well over 100 products in the terminal marketplace. Although dozens of potential model pairs can be compared (see report 722-07), we will look at how the ADM family as a whole measures up against the Televideo 900 Series and DEC VT200 Series.

The ADM family competes favorably with the Televideo 900 series but individual model price/performance differences bear watching. The 900 Series consists of models 910, 910 Plus, 914, 924, 925, 950, 970, and Personal Terminal and range in price

PURCHASE PRICE RANGE



LEAR SIEGLER ADM SERIES PURCHASE PRICING bar graph covers price range between "small" and "large" configuration for hardware products and associated on-site maintenance fees (open bar) • **SMALL ADM** consists of ADM 3A keyboard display terminal • **LARGE ADM** consists of ADM 24E with optional 14-inch CRT, 4-page display memory, 4K-byte print buffer, extension port, and RS-422 communication interface.

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from \$650 to \$1,495. Both 900 Series and ADM series provide about the same level of edit functions. Only 2 ADM models (12 and 24E) contain page buffers; all other ADM models support destructive scrolling only, whereas almost all Televideo terminals support at least one page of local memory. The low-end Televideo 910 includes programmable function keys and a 256-byte receive buffer; features not available on comparable ADM 3A and 5 models. Televideo does not provide an extended horizontal screen feature available on Lear Siegler's ADM 12, nor does it provide a user-programmable model such as the ADM 24E—valuable in some OEM applications.

Most Televideo models support both character and block modes; block transmission is available for ADM models starting with the 12. All upper-end Televideo models (925, 950, and 970) contain a bidirectional printer port, whereas only the ADM 24E supports this feature. A bidirectional printer port allows a host to print on the terminal's printer while the keyboard operator simultaneously enters data. Televideo does not provide DEC-compatible terminals as does Lear Siegler, however.

Since Lear Siegler recently discontinued production of the ADM 36 VT100-compatible terminal, it does not have a block-mode model to compete with the DEC world. The ADM 220, however, scheduled for general availability this August, is a direct replacement for the newer VT220. The ADM 220 is 10 percent cheaper than the VT220, includes a tiltable monitor, and supports an optional 14-inch screen. Lear Siegler cannot match the vector graphics and color capabilities, however, afforded by DEC's high-end VT240 and VT241.

DEC is still producing the venerable VT100 series for OEMs and other large users. The VT100 still holds value for several reasons: it is a reliable, adaptable, and upgradeable product line. Lear Siegler does not produce a terminal that can be upgraded from a dumb terminal to a personal computer like the VT100, a desirable feature for users who might want to add local processing to their communicating terminals at a future date.

□ Strengths

Lear Siegler produces a wide range of functional and attractive ASCII display terminals. Users can select from the traditional ADM 3A dumb terminal on up to models with extensive editing and format features. Prices are competitive and most models feature modern ergonomic designs for operator comfort.

The ADM 12 provides an expanded horizontal viewing area ideal for spreadsheet and flowchart applications. The ADM 24E with up to 4 pages of memory is ideal for word processing, and includes a bidirectional printer port. This port allows the host to directly transmit data to the printer without interfering with terminal activity, allowing users to enter data while the printer produces copy. The ADM 220 is a DEC VT220-compatible replacement with a lower price tag and 14-inch screen option.

Lear Siegler provides 5 different service/maintenance plans for its customers. These include return-to-factory, on-site, swap-out, and walk-in plans. Most maintenance is performed by Lear Siegler or its representatives; such support is uncommon among terminal vendors.

□ Limitations

The most serious limitation for the ADM family is its lack of upgradeability. The lack of personal computer option, as offered by DEC for its VT100 family, could also be a serious limitation. In the future, we believe that organizations will base their purchasing decisions on overall product flexibility, and will choose those with software-upgradeable features.

Only one model, the ADM 220, supports ANSI terminal communication standards. The others can communicate only with each other or with the terminals they emulate. For companies with a multivendor equipment policy, this limitation might prove unacceptable. Also, Lear Siegler does not address color- or graphics-terminal markets.

Although the ADM 1178 is intended as a low-cost replacement for the IBM 3278 display, it does not compare favorably with the newer IBM 3178/3179 with which it also competes. The 3178 combines the functionality of several 3278 models at a lower

price, and does not require a protocol converter as does the ADM 1178.

■ SOFTWARE

No software support is furnished.

□ Operating System

None; firmware controls all functions.

■ HARDWARE

□ Terms & Support

Terms • all terminal and printer models offered on purchase basis; some distributors provide lease/rental plans • discounts for quantities over 100; contact vendor for quotation • 90-day warranty • separate maintenance contracts available.

Support • all maintenance contracted with Lear Siegler; actual service provided by either Lear Siegler or third party (Dow Jones), depending on level of support • 5 maintenance programs available, covering extended warranty; super extended warranty; unlimited modular repair program (UMRP); on-site; and express depot service • extended warranty program provides return-to-factory repair for a fixed annual charge ranging from \$72 to \$240 per year; • super extended warranty service provides an average 48-hour factory repair turnaround time (in-house), compared to an average 10-day turnaround time for standard extended warranty program; available for ADM 11 and ADM 12 only at \$110 and \$125 per unit per year, respectively • unlimited modular repair program (UMRP) provides subassembly repair for a group of like customer terminals; customer is allowed one of each type of terminal subassembly to be under repair at one time; vendor recommends one UMRP for each 10 to 15 installed terminals, with rates ranging from \$60 to \$127.50 per UMRP per month depending on the model • on-site program provides on-call maintenance in over 80 U.S. cities, Monday through Friday, from 9:00 AM to 5:00 PM; monthly charges covered under Model Packages; locations outside a 50-mile radius of the service city (25 miles for the Model 310, 500, and 520 printer) incur a \$10 surcharge for each additional 25 miles • express depot program provides walk-in service in any one of 41 U.S. depot locations; repairs are while-you-wait, or within 48 hours at the latest; express depot charges range from \$85 to \$155 per year.

□ Overview

The Lear Siegler ADM family consists of 8 ASCII keyboard-display terminals designed to operate at speeds of 300 to 19.2K bps (ADM 11, 12, and 1178), 75 to 19.2K bps (ADM 3A, 5, 22, and 24E), or 75 to 38.4K bps (ADM 220). The low-end models ADM 3A, 5, and 11 are traditional "dumb" terminals with little or no screen editing features. Other models contain various combinations of "smart" features, including line or page editing, multipage memories, split-screen formatting, programmable function keys, and screen visual attributes. Models ADM 11, 12, and 24E can be equipped with foreign character sets such as UKASCII, Spanish, French, German, Italian, Norwegian, and Swedish. For details, see Terminals/Workstations.

Models ADM 220 and ADM 1178 are intended for Digital Equipment Corporation (DEC) and IBM environments, respectively. The ADM 220 is ANSI X3.64 or DEC VT52/VT100/VT220 compatible in conversational mode. The ADM 1178 includes an IBM 3278 Modified Selectric keyboard, and is designed to be coupled with a pair of protocol converters for use in IBM 3270 networks.

The ADM 12 is another smart editing terminal with extended horizontal screen formatting for viewing spreadsheets and flowcharts, among other applications. Although the ADM 12 displays data in a normal 24 line x 80 character format, it can be scrolled horizontally to view data out to 158 columns.

The ADM 24E is a flexible model with a variety of available options, and is aimed at both end-user and OEM markets. It is the only Lear Siegler terminal supporting host programming and split-screen operation, and contains room for up to 56K bytes of RAM/ROM program space. Lear Siegler provides several

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popular options for certain ADM models as well, including different screen sizes and different interfaces (RS-232C, current loop, and RS-422A). The company has increasingly designed new products with operator comfort in mind, and the new models ADM 11, 12, 24E, 1178, and 220 are specifically aimed at the ergonomics minded. Other third-party vendors also produce operator-convenience items, such as touch-screens and speech input devices.

Operating parameters are established via DIP switches for Models ADM 3A and 5. The ADM 11, 22, 24E, 1178, and 220, on the other hand, are all soft configured from the terminal's keyboard. Moreover, the ADM 11, 36, and 36I setup procedures are assisted by English menu prompts. Model ADM 12 also has keyboard-selected "personality control," which tailors terminal behavior for specific host computers.

While Lear Siegler provides no sophisticated self-checking routines, integrity checks of hardware/software are performed for all terminals, excluding the ADM 3A and 5, when the terminal is powered up. A test success/failure message is displayed on the screen.

Model Packages

ADM 3A Dumb Terminal • keyboard-display ASCII terminal with 12-inch CRT in green or white phosphor; displays 1920 characters at 24 lines x 80 characters • 5x7 dot matrix • attached, typewriter-style keyboard; 59 keys, including 10 nonprogrammable function control keys • half-/full-duplex 75-bps to 19.2K-bps operation (up to 9600 bps with current-loop interface) • character transmission mode • serial bidirectional (extension) printer port • RS-232C or optional 20-mA current-loop printer interface, lowercase characters, answerback, numeric keypad, split data rate • standard configuration:

\$895 prch	\$17 mo
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Lowercase • displays lowercase characters • extra-cost option:

75	NA
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Numeric Keypad • provides 14 keys for operator convenience, including 10 numeric keys, 3 punctuation keys, and ENTER (RETURN) key • extra-cost option:

80	NA
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ADM 5 Dumb Terminal • same as ADM 3A but with built-in numeric keypad; upper- and lowercase character display; tab key; limited editing capability; program mode for storing and displaying control codes; and screen visual enhancements • options include answerback and 20-mA current-loop printer interface • standard configuration:

745	17
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ADM 11 Conversational Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch screen optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • detached, selectric-type, low-profile typewriter keyboard with separate numeric keypad meets DIN standards; 4 programmable (8 programmable functions) keys • terminal operating parameters established from keyboard via 25th status line or from the host • character transmission mode • 1400-character receive buffer • half-/full-duplex • 300-bps to 19.2K-bps operation • serial printer port • RS-232C communication/printer port • options include RS-422 or 20-mA current-loop interface, answerback and international character sets • standard configuration:

695	17
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ADM 12 Editing Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch screen optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • 2-page or enlarged single-page (48 lines x 80 characters or 24 lines x 158 characters) memory • independent scrolling regions • low-profile, detached, Selectric-style keyboard meets DIM standards; 16 programmable (32 program functions) keys • ASCII and 7 optional international character sets standard • terminal operating parameter configuration via 25th line setup commands • standard business graphics • half-/full-duplex • 300-bps to 19.2K-bps operation • character/block transmission mode • 1400-character receive

buffer • serial printer port • RS-232C communication/printer port interface; options include 20-mA current-loop interface, RS-422A interface:

695	22
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14-inch (Diagonal) CRT Screen, Green or Amber:

170	NA
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ADM 22 • keyboard-display ASCII terminal with 12-inch CRT; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x11 dot matrix • detached, Selectric-style typewriter keyboard with separate numeric keypad; 7 pre-programmed function keys • terminal operating parameter configuration via 25th line setup commands • character or block transmission modes • emulates Hazeltine 1500 and ADDS Regent 25 terminal codes • half-/full-duplex • 75-bps to 19.2K-bps operation • serial printer port • RS-232C or 20-mA current-loop communication interface; RS-232C printer interface; no options; standard configuration:

695	19
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ADM 24E Host Programmable Terminal • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch CRT optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x11 dot matrix • 2-page or optional 4-page memory • split-screen with user-definable scrolling regions • low-profile, detached, Selectric-style keyboard meets DIN standards; 16 programmable (32 program functions) keys • ASCII and 11 international character sets standard • terminal operating parameter configuration via 25th line setup commands • standard business graphics • half-/full-duplex • 75-bps to 19.2K-bps operation • character/block/local transmission mode • 1400-character receive buffer • bidirectional serial printer port; extension port optional • RS-232C communication/printer port interface • options include 20-mA current-loop interface; RS-422A interface; 2K-/4K-byte print buffer:

1,250	30
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European Keycap Set:

90	NA
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14-inch (Diagonal) CRT Screen, Green or White:

170	NA
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ADM 1178 • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch CRT optional; displays 1920 characters at 24 lines x 80 characters; 25th status line • 7x10 dot matrix • IBM 3278-compatible, detached keyboard meets DIN standards; contains 24 Program Function (PF) and 2 Program Access (PA) keys • terminal operating parameter configuration via 25th line setup commands • ASCII character set plus IBM extended character set for 25th status line • half-/full-duplex • 300-bps to 19.2K-bps operation • 1526-character receive buffer • character transmission mode; designed for use in conjunction with a protocol converter • serial printer port • RS-232C communication/printer port interface • options include RS-422A interface; 20-mA current-loop interface:

995	24
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14-inch (Diagonal) CRT Screen, Green or Amber:

170	NA
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ADM 220 • keyboard-display ASCII terminal with 12-inch tilt-and-swivel CRT, 14-inch CRT optional; displays 1920/3186 characters at 24 lines x 80/132 characters; 25th status line • ANSI X3.64 or DEC VT52/VT100/VT220 compatible • 7x10 dot matrix • single-page or optional 4-page memory • split-screen with user-definable scrolling regions • low-profile, detached keyboard meets DIN standards; 15 programmable (30 program functions) keys • ASCII and international character sets standard • standard business graphics • terminal operating parameter configuration via 25th line setup commands • full-duplex • 75-bps to 38.4K-bps operation • character transmission mode • bidirectional serial printer port • RS-232C communication/

PRCH: single-unit purchase price. MO: monthly on-site maintenance charge. NA: not applicable/available. NC: no charge. Prices effective as of June 1984.

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printer port interface • options include 20-mA current-loop interface; RS-422A interface; 4-page display memory:

1,165	NA
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14-inch (Diagonal) CRT Screen, Green or Amber:

170	NA
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CPU & Memory

All newer models and smart terminals are microprocessor controlled. RAM is employed for page scrolling on those models which support it, for printer buffering on selected models, and for temporary terminal operating parameter configuration. The ADM 12 can store data in a 24 line x 158 character format, 48 line x 80 character format, or 2 pages of 24 lines x 80 characters, standard. The ADM 24E also includes 56K bytes of RAM or ROM program space, which can be loaded locally or downline-loaded from the host. Firmware controls terminal functions.

96-Line (4-Page) Display Buffer • adds 2 additional pages of scrollable memory, 4 pages total, for the 24E only:

\$50 prch	NA mo
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2K Print Buffer • adds 2K characters of RAM printer buffer for the 24E only:

30	NA
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4K Print Buffer • adds 4K characters of RAM printer buffer for the 24E only:

50	NA
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I/O & Communications

All members of the Lear Siegler ADM family support point-to-point asynchronous ASCII communication. Transmission rates are 75 to 19.2K bps for Models ADM 3A, 5, 22, and 24E; 300 to 19.2K bps for the ADM 11, 12, and 1178; and 75 bps to 38.4K bps for the ADM 220. In addition, Model ADM 3A can be configured to operate at different receive/transmit rates by the addition of a Split Baud Rate option.

Incoming data is buffered by some terminal models in a receive (input) RAM memory. Models ADM 11, 12, 24E, and 220 each contain a 1400-character FIFO buffer with XON/XOFF or DTR flow control for stop/start transmission to prevent buffer overflow.

All models communicate over switched or dedicated lines in half-/full-duplex mode and support local echo (echoplex) in conversation (character) mode. Selectable odd, even, or no parity, mark, or space. The character is composed of 7 or 8 data bits, with 1 start bit and 1 or 2 stop bits.

Operating parameters for Models ADM 3A and 5 are established via DIP switches. All other models are soft configured via the display's 25th status line; all parameter changes to operating configuration are established from the terminal's keyboard. Parameter changes for the ADM 11, 12, and 24E are assisted by English menu prompts, whereas ADM 22 parameters are selected on a bit-position "map." Parameters on all models are retained in non-volatile memory. Model ADM 12 also has "personality control," a feature that modifies terminal behavior for compatibility with various computer systems. The terminal personality is operator selectable from the keyboard, allowing user customization of specific parameters such as ESCape, end-of-block, and lead-in characters as well as other delimiters.

Operating modes vary with the different models. All can communicate in interactive (character) mode, and all except the ADM 3A, 5, 11, and 220 can communicate in block mode. Block mode communication supports line and page transmission; the ADM 12 can also operate in message mode, which supports a user-defined block length. Model 24E can operate in local mode, whereby data is keyed to the screen as in block mode but does not pass through the communication facility.

All terminals are equipped with an RS-232C or 20-mA current-loop communication interface. An RS-422A option is available for the ADM 11, 12, and 24E. Models 3A and 5 include an RS-232C bidirectional extension interface which can be used to daisy-chain terminals together or connect to a printer; an extension port is optional for the ADM 24E. Other models have auxiliary ports which are unidirectional only. All models can

attach directly to a host in local processing mode and various current-loop options are available for extension/printer interfaces. The maximum distance between the host processor and terminal is 50 feet for RS-232C; 4,000 feet for RS-422A; and 1,000 feet for current loop.

Current-Loop Interface • provides 20-mA current-loop operation on the communications port • all models:

\$70 prch	NA mo
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Extension Port/Current-Loop Interface • provides 20-mA current-loop operation for the ADM 3A and 5 extension port:

135	NA
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Extension Port Interface • provides an RS-232C extension port for the ADM 24E:

75	NA
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RS-422A Interface • balanced version of EIA RS-449 standard • 37-pin electrical connector • not compatible with RS-232C • extra-cost option for ADM 11, 12, and 1178:

60	NA
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Answerback • provides an operator-initiated message that identifies terminal to the central site • internally stored message activated by pressing the HERE IS key, which is included in the keyboard but has no function if Answerback not installed • activated by a remote ENQ code • standard feature, ADM 12 and 24E; extra-cost option, ADM 3A and ADM 5:

115	NA
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Answerback for ADM 11 & 1178:

50	NA
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Split Baud Rate • allows different receive/transmit data rates • DIP switch-selectable transmit rate; receive rate governed by addition of a 12-position rotary switch • extra-cost option available for the ADM 3A only:

50	NA
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Disk

No disk/diskette is supported.

Terminals/Workstations

Display, editing, and formatting features generally increase as the ADM model scale progresses upward. The ADM 3A is the traditional dumb terminal, and can do little with screen-entered characters except delete them. Limited screen editing functions begin with the ADM 5, which can erase entire lines of text; single-key editing and character/line inserts/deletes begin with the ADM 12. More expensive models also include visual attributes such as blinking, blanking, and underline. Other major differences include protected fields, the amount of programmable (or nonprogrammable) function keys, and split-screen operation.

Models ADM 11, 12, and 24E, the latest members of the Lear Siegler terminal line, have been dubbed "American Dream Machines" because of their enhanced ergonomic ("High-Touch") design. The ADM 11, the new-generation dumb terminal, includes 4 programmable function keys (shiftable to 8 positions); it and the ADM 12, 24E, 1178, and 220 contain new low-profile detached keyboards and tiltable/swiveling CRT screens. These keyboards include a separate, cross-patterned cursor pad, and 3-key rollover for fast typists. Green or amber screens will be available; all other models have a screen choice of either white or green. All models in the ADM lineup feature nonglare screens.

Models ADM 12 and 24E can include a split-screen function which divides the screen horizontally into 2 separate regions, useful for comparing data. Lines of text in the screen's lower half can be scrolled up or down. These models also support smooth or jump scroll, a convenience feature that allows smooth continuous scrolling or a jump scroll of usually 5 lines per jump (increment). The ADM 12 supports scrolling in horizontal as well as vertical directions. Both models also support auto-page, another convenience feature that automatically advances line 1 (top line) off the screen when data is entered following line 24.

Models ADM 12, 22, and 24E can also support nonembedded visual attributes, which means that character effects such as

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blinking, blanking, and reverse video do not occupy space on the display or in memory.

Model ADM 220, an ANSI and DEC-compatible model is the only ADM terminal allowing users to display the screen in a 24-line x 80- or 132-character (column) format, providing either 1920 or 3168 characters per screen. It is available with a 1-page or optional 4-page memory. The ADM 12 and 24E provide a standard 2-page (48-line) memory expandable to 4 pages in the ADM 24E. The ADM 12 can also support a single page of 24 lines x 158 columns for spreadsheet applications.

The ADM 1178 is another "High-Touch" terminal but contains an IBM 3278-compatible keyboard, including special function keys. The unit also includes an IBM extended character set for generating the display's 25th status/setup line. The 1178 must be used in tandem with any pair of ASCII/3270 protocol converters now on the market.

A graphics feature is available in some form or another for several ADM Series terminals. The ADM 11, 12, and 24E all support limited business/line graphics used for forms generation or simple line drawings. This option, which is standard, generates a character set composed of mosaics and/or line segments.

Configuration • tabletop keyboard-display with typewriter-style keyboard • separate numeric keypad, all models except ADM 3A • keyboards range in size from 59 keys (ADM 3A) to 105 keys (ADM 24E) • Models ADM 3A and 5 contain fixed keyboards; all others are detached • each terminal can accommodate a local serial printer, either through an extension port or a dedicated printer port depending on the model.

Display • 12 inches standard for all models; optional 14-inch screen, ADM 11, 12, 24E, 1178, 220 • displays 1920 characters at 24 lines x 80 characters (all models); 3168 characters also selectable on ADM 220 • 6144 characters viewable on ADM 12 via horizontal scrolling • 64 ASCII characters (ADM 3A); 128 ASCII characters all other models • line graphics on Models ADM 21 and 24E; vector graphics option available for ADM 3A and 5 • international character sets including UKASCII, Spanish, French, German, Italian, Norwegian, and Swedish available for ADM 11, 12, and 24E (all character sets may not be available for listed terminal models).

Edit & Format Features • common features for all terminals include cursor left, right, up, down, home; addressable cursor for row and column; auto-repeat keys (2-key operation, ADM 3A) • automatic character wraparound • return, line feed • scrolling • caps lock key, ADM 5 and above • tab, backtab ADM 12 • erase to EOL, EOP ADM 5, and above • clear screen for ADM 11, 12, 24E, 1178 • line insert/delete, character insert/delete for ADM 11, 22, 24E, 220, 1178 • protected fields for ADM 12, 22, 24E •

erase line/page (all or unprotected positions only) for ADM 12, 22, 24E • edit operations from keyboard or host for ADM 11, 12, 24E, 220 • reverse video, underline, blink, and blank for ADM 11, 12, 22, 24E (ADM 22 does not blank, ADM 11 does not underline) • reduced intensity for ADM 21, 23, 24, 24E, 31, 32, 36, and 36I • dual intensity for ADM 22 only • double-wide characters for ADM 24E, 220 • bold, double-high characters for ADM 220 • splitscreen for ADM 24E • auto-page for ADM 12, 24E.

Peripherals • RS-232C interface supports local printer attachment • input from terminal or host processor; bidirectional printer port, ADM 24E.

Line Graphics • limited business graphics provide low-resolution line segments and/or mosaics for printing simple business forms or line drawings • standard feature, Models ADM 11, 12, 22, 24E:

NC prch	NC mo
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□ Printers

Lear Siegler manufactures and distributes a single medium-speed, dot-matrix impact printer that can attach to a terminal (or CPU) through parallel, serial, or current-loop interfaces. It receives data either directly from the host or from the terminal.

Versaprint 500 • RO • 2500-/4500-character buffer • 180/90/45 cps, 7x9/14x9/14x18 matrix impact, bidirectional • selectable USASCII, UKASCII, German, French, Swedish, Finnish, Danish, and Norwegian character sets standard • dot graphics capability • 136 columns at 10/12/16 cpi, plus elongated (expanded) printing • space and blank suppression • built-in acoustic cover • 16-inch tractor platen; friction-feed optional • switch-selectable form lengths • 75 to 9600 bps • half-/full-duplex • XON/XOFF flow control • ASCII code; 7 data bits; 1 or 2 stop bits; odd/even/no parity • EIA RS-232C, Centronics parallel, and 20-mA current-loop interfaces standard:

\$1,695 prch	NA mo
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Versaprint 520 • same as Versaprint 500 but includes color printing:

2,195	NA
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Customized PC Board • "Daughter board" provides customized interfaces or programs • requires factory quotation:

NA	NA
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2K Buffer Option • provides 2K characters of additional RAM memory; 4500 characters maximum:

NA	NA
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• END

Lee Data 300 & 400 Series 3270-Compatible Display Systems

Models 306, 308, 310, 311, 320, 321, 408, 410, 411, 420 & 421

■ PROFILE

Function • local and remote cluster, IBM 3270-compatible, display terminal system employed in inquiry/update, data entry, and program development • all processing and database services handled by host, unless Personal Workstation is employed.

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 non-switched private or switched dial line communications facilities in BSC/SDLC at rates up to 19,200 bps for BSC and SDLC • asynchronous ASCII/TTY communications at speeds up to 9600 bps.

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 • 2000- to 19,200-bps BSC/SDLC protocols; 1200 to 9600 bps asynchronous • half-/full-duplex • ASCII/EBCDIC code • point-to-point/multipoint • RS-232C interface.

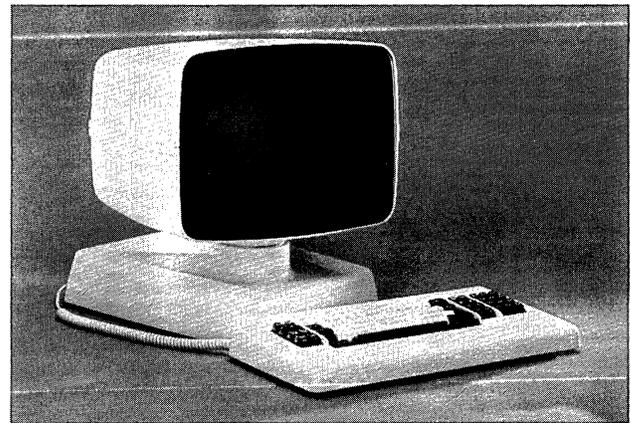
Operating System • service through host processor under DOS, DOS/VS, DOS/VSE, OS, OS/VS, VM 370.

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

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.

Support Software • supported by and employs software and program facilities of host processor • no local independent (from host) off-line programming/processing capabilities except when Personal Workstation is employed • 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 • 2,336 systems with 33,407 terminals.

Comparable Systems • emulates the IBM 3274 Models 1C, 21C, 31C for remote processing; and Models 1A, 21A, 31A, 1B, and 1D for local attachment • other competitive systems include Racal-Milgo 4270, Davox Series 1000, Harris 8100/9200, ITT Courier 2700 and 9000, Memorex 1370/2070, NCR 7950, Telex 270, and MDS Hero.

Vendor • Lee Data Corporation; 7075 Flying Cloud Drive, Eden Prairie, MN 55344 • 612-828-0300.

Distribution • direct through Lee Data sales offices worldwide.

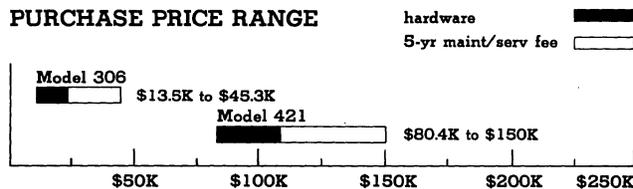
■ ANALYSIS

Lee Data offers some of the most innovative products in the IBM 3270 replacement arena. For example, it was the leader with cluster controllers that support concurrent communication with multiple host processors; it pioneered the first terminal to encompass all the display attributes of IBM 3278 Models 2 through 5 in a single terminal; it was the first to offer the local terminal multiplexer; and it is among the handful of vendors offering asynchronous emulation and **direct** communication with ASCII hosts.

In many ways, the Lee Data systems are representative of the IBM 3270 lookalikes. They support up to 32 display stations/printers, can be configured for point-to-point or multipoint communication when operating as a remote system, and support both BSC and SDLC protocols. Like the 3270, the Lee Data terminals are also targeted primarily for online data entry, inquiry/updates, and interactive program-development applications.

There are, however, some important differences between the Lee and IBM products that deserve strong consideration. For example, the 3274—the clustered system that the Lee Series 300 and 400 systems compete against—are strictly BSC and/or

PURCHASE PRICE RANGE



LEE DATA 300/400 PURCHASE PRICING bar graph covers price ranges between "small" and "large" configurations for hardware products (solid bar) and associated 5-year period maintenance fees (open bar) • **Model 306** small configuration consists of a Model 306 cluster controller supporting 3 Model 1216 displays and keyboards, and an 180-cps printer; **large** configuration consists of Model 306 cluster controller supporting 6 Model 1216 displays and keyboards, and 2 180-cps printers • **Model 421** small configuration consists of a Model 421 cluster controller supporting 8 Model 1221 and 8 Model 1221W displays and keyboards, 4 700 Series personal workstations, 4 80-cps printers, and a 340-cps printer; **large** configuration includes a Model 421 cluster controller supporting 8 Model 1221 and 8 Model 1221W displays and keyboards, 8 Model 1216 displays and keyboards; 4 Model 1231-3A Color displays and keyboards, 8 700 Series personal workstations with 256K-byte RAM upgrades and 4 optional 5.25-inch diskettes • all prices are for single-quantity purchase; discounts are available.

Lee Data 300 & 400 Series 3270-Compatible Display Systems

Models 306, 308, 310, 311, 320, 321, 408, 410, 411, 420 & 421

SNA/SDLC compatible products. While Lee also handles these protocols, its Series 400, in addition, **can accommodate ASCII/TTY asynchronous communication**, a strong user benefit for distributed data processing environments where multivendor products with incompatibilities are involved. For example, a network incorporating both IBM 3270s and DEC VT 50/100s would require separate terminals and communication links to support the different terminals. With Lee's approach, the IBM and DEC protocols are emulated by the same controller, and basically the same terminal is used. The only difference is the keyboard, of course, to accommodate specific functions of the different terminals.

In addition, Lee Data has cluster controllers that let users access 2 or more IBM-type mainframes by combining local channel and remote communication interfaces in a single controller. Both Models 321 and 421, for example, access the local mainframe through connection to a byte, selector, or block-multiplexer channel, and the remote host via BSC or SNA/SDLC protocols. In addition, both interfaces operate **concurrently**, enabling display stations to move freely from one mainframe to the other using simple keyboard commands. Such a facility is indeed unique, and extremely useful.

Until the Spring of this year, Lee enjoyed a technical and marketing lead over IBM with its "all-in-one" terminal, which incorporates all the display attributes of the IBM 3278-2 through -5, and allows the user to switch modes from the keyboard. But IBM ended Lee's competitive lead this year when it introduced the 3180 Model 1, which supercedes and obsoletes the 3278. Aside from being functionally equivalent to Lee's terminal, the IBM's terminal is less expensive. Lee quickly responded to IBM; at the NCC Lee introduced its own version of the 3180 Model 1214. In addition to duplicating IBM in functionality and price, the 1214 is also offered in versions that emulate asynchronous terminals. When attached to the Series 300 or 400 cluster controllers, users can directly interface with both IBM hosts under BSC/SDLC and ASCII hosts. The user merely switches modes from the terminal.

An enhanced version of the Model 1221 terminal is another recently introduced product. The terminal also competes against the IBM 3278 and 3180. The new versions of the 1221, however, offer a display windowing facility (a la the IBM 3270 PC) and also emulates asynchronous terminals. IBM has nothing to match it.

In addition to normal terminal operation, all of Lee Data's displays can attach a personal computer to provide a local processing capability. To effect this, Lee Data is offering its 700 Series Personal Workstation, an IBM-compatible unit that employs a 16-bit Intel 8088 microprocessor with 128K-byte RAM, and a 5.25-inch diskette drive with 360K-byte storage. Control is under M/DOS with CP/M 86 optional. The basic Personal Workstation is offered with enhancements which increase main storage to 1M bytes and auxiliary storage to 640K bytes. The latter is accomplished by adding a second 5.25-inch diskette drive and 10M-byte Winchester. The upgrade to intelligence for each terminal follows IBM's lead in this area. In March 1983, IBM introduced the capability by permitting the 5150 personal to be retrofitted to existing 3278 terminals.

Lee's response to the IBM 3270 PC is a power package called the Series 70, which supports up to 7 windows plus PC graphics, and IBM 3279-S-3G host graphics. The window feature allows 4 interactive host sessions (3270 **and async**), a personal computer session and 2 notepads. Like the IBM product, the Series 70 also permits data transfer among windows. It is delivered with 128K bytes of RAM, a 5.25-inch diskette with 360K bytes of storage, MS-DOS, and the hardware necessary to support graphics. The software, however, is optional. The main memory can be increased to 1M bytes and auxiliary storage expanded with the addition of another 5.25-inch diskette or a 10M-byte Winchester hard disk. In short, the Series 70 is a very strong competitor for the 3270 PC and is compatible with it.

Lee's attention to multivendor environments is also notable. Cluster controller Models 408 and 411, for example, provide direct interfaces for IBM and ASCII hosts such as those produced by DEC, Data General, etc. When teamed with Lee's asynchronous-emulating terminals (some even emulate the DEC VT100 and VT132), they provide an easy path for linking users with incompatible hardware through one set of components.

□ Strengths

The strength of the Lee products rests with the overall flexibility of the product line. The controllers in the Model 400 line, for example, operate as 3270 BSC or SNA/SDLC units and also emulate ASCII/TTY terminals such as the DEC VT 52/100 and Hewlett-Packard HP 2624-B. While Lee **does not** permit the actual attachment of ASCII terminals, their functions are emulated through the Model 1214, 1216, 1220, and 1221 display stations. Such flexibility is particularly attractive for users with a multivendor policy. Instead of having 2 different types of terminals to handle ASCII and 3270 applications, only 1 is needed. Also eliminated is the need for separate control and communications software.

Further flexibility is reflected in the dual-mode capability of the recently announced Model 321 and 421 controllers. Both units allow connection to **local and remote hosts**, with concurrent operation. Display stations move from 1 mainframe to another through simple keyboard commands. This dual-mode capability is unique and ideally suited for organizations where the applications mix consists of fast-response tasks and normal 3270 interactive operations.

Another example of flexibility are the Model 1214, 1220, and 1221 terminals. These display stations provide all of the operational and display capabilities of IBM's 3278 Models 2, 3, 4, and 5, and also emulate ASCII/TTY terminals. Users therefore can buy 1 terminal with the assurance that as their needs change, they needn't bear the experience of upgrades. Shops moving towards distributed processing where multivendor mainframes—particularly minicomputers—are involved will appreciate this flexibility.

The multiwindow facility of the Model 1221 is also a distinct advantage. Users can have up to 4 independent windows, allowing for such concurrent operations as program development, record updating, and inquiry over multiple hosts. IBM has the same facilities with its 3270 PC, but that product is much more expensive.

Providing an intelligent upgrade to its terminal line was a smart move for 2 reasons: (1) IBM did it, and (2) it removed or at least alleviated the need for the host mainframe to handle all processing functions. The latter is a long-standing weakness of the 3270. Aside from making processing inconvenient, especially when operating in a heavily loaded environment, it also ran up data communications costs. Of course, if you opt not to buy this upgrade. . . .

A substantial cost-saving benefit can be gained by the optional Coax Eliminator. This unit combines up to 8 terminals/printers on 1 coaxial or twisted-wire cable, thus reducing the cost of cables normally needed to handle this configuration by a factor of 7. The Coax Eliminator also allows terminals/printers to be located beyond the 5000-foot unit imposed by IBM units attached via coaxial cable. By chaining Coax Eliminators together, distances can be increased by 2500-feet for each eliminator added.

□ Limitations

The Lee products suffer from many of the same limitations which weaken the 3270's position in the distributed processing marketplace. For example, the Lee systems (and 3270) must rely on the host for all processing services unless the intelligent upgrade is used; it has no data compression; it has no spooler; and it does not allow peer-to-peer terminal addressing on a local level.

The lack of these capabilities produces a higher load on the communications facility, which can spell delays in servicing users as well as higher communications overhead costs. Something as simple as changing a screen format, for example, must be requested from the host. In an environment where such changes happen frequently and the overall processing load is high, long delays could easily occur.

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 Lee products could certainly benefit from this capability.

Print spooling is a technique whereby information bound for a

Lee Data 300 & 400 Series 3270-Compatible Display Systems

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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 Lee nor IBM offers a spooler, but try to compensate with fast printers.

Lee Data, 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).

A final limitation is a lack of data encryption capability. When transmitting sensitive information over a communications network, some ability to encrypt this information is a real plus. In fact, some organizations—especially those dealing in financial matters—insist on data encryption. IBM offers this with the 3270; Lee does not.

□ Distributed Communications

The 300 and 400 Series communicate in a point-to-point or multipoint arrangement over switched or dedicated lines at speeds of 2000- to 19,200-bps half-/full-duplex under BSC/SDLC protocols, and 1200 to 9600 asynchronous. Both ASCII and EBCDIC characteristics are supported.

Communications control rests with the IBM host terminal access methods supported. For the IBM S/360, S/370, 3030, 3081, and 4300 host, these include IBM BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, ACF/VTAME, and EXTM. For a description of these access methods, see report 950-I048-3270.

□ Distributed Configurations

The 300 and 400 systems are composed of 11 cluster controllers, 4 monochromatic display terminals, 2 color display terminals, 6 printers, and 3 local terminal multiplexers. The number of attachable display terminals/printers varies with the particular controller (see Controllers). The largest configuration attainable handles 32 display terminals/printers in any combination.

A basic system consists of 1 cluster controller and up to 8 display stations and/or printers configured in any combination; the only restriction is that at least 1 display station must be included. If more peripherals are required, they can be added in groups of 8 devices via terminal adapters up to a maximum of 32 terminals/printers. All peripherals attach directly to the cluster controller; peripherals can be located up to 5000 feet from the controller.

In addition to direct collocation, terminals/printers can also interface with the cluster controller via a terminal multiplexer called a Coax Eliminator. This device, described under I/O channels, attached up to 8 devices to a single coax cable or twisted wire.

□ Distributed Utilities

The vendor supplies 2 utilities which allow the user to configure the systems software from the display station keyboard to meet operational requirements; to create backup copies of the system diskette; to incorporate software modifications or updates; and to initialize diskettes for use in copy operations. In addition to the vendor-supplied utilities, users may also avail themselves of a host of IBM software designed for 3270.

Lee Data also supports response time measurement and statistics, which measures and reports the time interval between terminal-initiated functions and host CPU response. The Response Time Statistics (RTS) feature calculates the seconds and tenths of a second between the time a system function is initiated by depressing a Program Attention, Clear, Enter, or Sys Req key and the host responds. A cumulative list of response times for each class of request is maintained in a table and displayed on request. The information includes last response time; average response time; longest response time; number of transactions; cumulative transaction time; number of transactions over xx seconds; and overflow indicator.

In addition to measuring system functions, RTS can also measure polling times. The host system issues a command to the controller which causes that unit to send RTS counts to the host; send RTS

counts to the host and reset the RTS counters; or reset the RTS counters. The response time statistics can be used immediately for management reports, or stored for later analysis. The RTS reporting feature requires a user-provided "data reduction" program.

Diskette Initialize Utility • provides for preparing new diskettes for use as a destination diskette during a Copy Utility operation.

Copy Utility • provides for reproducing entire system diskette to create backup copies; or copies with other operating configurations • system (source) diskette and destination diskette must be alternately loaded during a copy operation.

The Lee 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 300 and 400 operate under control of the host processor's software. In ASCII mode, the terminal generates and responds to coded sequence per ANSI standards X3.41-1974 and X3.64-1977. If DEC VT 52 mode is chosen, the terminal can run software written for the VT 52.

The following briefly summarizes the software support provided by IBM hosts.

□ Operating System

IBM S/360, S/370, 3030, 3081 & 4300 Processors

The 300 and 400 operate under IBM OS, DOS, OS/VS1, OS/VS2(SVS), OS/VS2 (MVS, MVS/SE, MVS/SP), DOS/VS, DOS/VSE, and VM/370 (VM, VME, VM/BSE, VM/SP) in conjunction with other systems software and programs.

IBM TSO (Time Sharing Option) • provides for time-shared option under all OS/DOS or communications/OS/DOS facilities.

□ Database Management

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

□ Communications/Networks

The 300 and 400 Series can be configured as clusters of terminals/printers. Communication control is handled by the cluster controller which interacts with the host under BTAM, BTAM-ES, TCAM, ACF/TCAM, VTAM, ACF/VTAM, and VTAME.

□ Application Development Aids

The vendor offers 1 application development aid called Disclose. Other than that, users must avail themselves of services furnished by IBM for its 3270. These include: 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.

□ Other Facilities

IBM S/360, S/370, 3030, 3081 & 4300 Processors

IBM DEMF (Display Exception Monitoring Facility) • provides for network problem determination and isolation in BSC mode under OS/VS.

IBM DIDOCS (Device Independent Display Operator Console Support) • provides uniform services for all displays on OS and OS/VS systems • DIDOCS establishes linkage between

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displays and systems allowing displays to function as operator consoles; provides for processing and routing of messages from operating system or application program to console in multiconsole environments; and extends such support to printers operating as output-only hardcopy consoles.

IBM NPDA (Network Problem Determination Application) • provides for network problem definition and isolation in BSC/SDLC modes under VTAM or TCAM.

IBM IIS (Interactive Instruction System) • provides interactive online training capabilities for database/communications systems users under IMS/CICS/TCAM.

■ HARDWARE

□ Terms & Support

Terms • all products are offered on a purchase or lease basis; quantity purchase discounts are available • leases may be contracted on a 12/24/36-month basis • discounts ranging up to 20% are offered.

Support • support for all products is available from factory or through Lee Data Customer Support Centers • support services include telephone consulting and on-site visitation by field-service engineers.

□ Packaged Components/Overview

All LDC controllers emulate either the local or remote versions of the IBM 3274 cluster control units, and can be configured with from 8 to 32 terminal/printers. Six of these units permit concurrent communication with 2 independent host processors.

Models 306, 308, 310, and 410 are remote controllers that emulate IBM 3274C models and support a high-speed link. Models 311, 321, and 421 allow concurrent communication with 2 remote hosts, while Models 321 and 421 will concurrently operate with a local and a remote host. IBM has nothing to match the multitrunk capabilities of these controllers. IBM also has no equal for Lee Models 408 and 411. The 408 links a remote IBM host and up to 8 asynchronous ASCII hosts. Model 411 supports 2 remote IBM hosts and up to 16 asynchronous ASCII hosts.

All display terminals supported by the Lee Data controller can accommodate a personal computer to handle local processing. An upgrade is provided by Lee's 700 Series Personal Workstation, an IBM-compatible system consisting of an Intel 8088 microprocessor, 128K-byte RAM, and a 5.25-inch diskette drive with 360K-byte storage capacity. Main memory can be expanded to 1M bytes, and a second identical diskette drive can be added. The Lee Data Personal Workstation, like the IBM unit, supports mainframe-to-personal computer file transfers.

For those who require a standalone personal computer facility, Lee offers its own Series 70 Personal Workstation, or will provide a personal computer adapter to allow an IBM PC to interface with the Lee controllers.

The Series 70 is a color-graphics workstation, which is functionally compatible with the IBM 3270 PC, and can handle PC graphics and IBM 3279-S3G host graphics. Up to 16 colors can be displayed in the PC graphics mode, and the user can create high-resolution business graphics. In addition to graphics, the Series 70 supports a display windowing facility whereby users can view up to 7 windows at a time. These windows can represent as many as 4 interactive host sessions, a personal computer session, and 2 notepads. Data can be transferred from window to window.

The Series 70 combines both local processing and 3270/Async host access. The basic unit supports local processing, and includes 128K bytes of RAM, a 5.25-inch diskette drive with 380K bytes of storage, and a low-profile 122-key keyboard. Graphics and windowing require an optional Model 80188 co-processor board with associated memory.

The IBM PC adapter plugs into an expansion slot on the PC and permits the unit to be connected to any Lee Series 300 or 400 controller. The PC adapter offers increased functionality to the IBM PC. For example, it permits the unit to function as an IBM 3278-2 or 3279-2A terminal, and permits the use of Lee file

transfer utilities. In addition to the IBM PC, the adapter also works with the PC-XT, AT&T, and other compatible PCs.

The display station/terminal combination is configured into groups of 8 devices. Any combination of display stations and printers is acceptable. User-specified configurations are software defined, with the user specifying devices and their assignments from the keyboard. All configurations are held on a diskette integrated into the cluster controller.

Configuring the system involves selecting options and features that modify systems software, enabling and disabling display stations and printers, and defining operating modes for stations and printers. Configurations are held on a systems diskette and loaded into the controller upon operator command.

The cluster controller operates in 3 modes—normal (online) mode; off-line mode; and utility mode. In normal mode, all display stations and printers are in direct communications with the host processor and all applications programs running at the host.

When in off-line mode (local mode), the user may transfer data from the display to a local printer; send local messages from one station to another or all stations (broadcast); reassign display station access to printers; redefine printer and display station address to permit their use at other host-recognized address; and display performance statistics, including blocks transmitted, received, and number of errors. Most local functions use the operator information display screen line (25th line), and therefore can be performed without terminating or interrupting a current normal mode function.

The utility mode allows the user to specify the software and equipment configurations. This includes host-recognized address of the system controller; host-recognized address of each display station and/or printer; operational status of each station or printer (active or inactive); password or security code for display station; relationship of display station to printer—e.g., printer class and specific address assignments.

An important option available for all cluster controllers is the LDC Coaxial Eliminator. This unit allows 8 displays/printers to connect to a single coaxial cable or twisted pair, eliminating the need and cost for a separate cable per terminal. The Coaxial Eliminator can also be used to extend the normal 5000-foot limit between the controller and terminals/printers by chaining the eliminators every 2500 feet. The chained eliminators, in this case, act like amplifiers.

The local controllers attach to the local host via (selector, byte, or block multiplexer) channels. The remote controllers communicate half-/full-duplex over point-to-point/multipoint switched or dedicated lines at speeds from 2000 to 19,200 bps for terminals operating under BSC/SDLC protocols, and 1200 to 9600 bps for each asynchronous terminal. All terminals connected to Models 306 and 308 operate at 2000 to 9600 bps. An RS-232C interface connects to the communications link via a modem.

□ Controllers

The LDC 300 and 400 Series are a family of cluster controllers that emulate the IBM 3274 local and/or remote control units. Five controllers (Models 306, 308, 310, 410, and 411) are remote units emulating the IBM 3274 "C" models. Two controllers (Models 320 and 420) are for local connection to the host and emulate 3274 Models A, B, and D. All of these controllers support only a single link to the host processor. Lee controllers support up to 32 BSC/SDLC terminals/printers, and up to 16 ASCII terminals via emulation.

Lee also offers controllers with multiple host-processor links. Models 311, 321, and 421 support concurrent communication with 2 independent links. Model 311 communicates with 2 remote hosts; and Models 321 and 421 with a local and a remote host. Model 408 links a remote IBM host and up to 8 asynchronous ASCII hosts. Model 411 supports 2 remote IBM hosts and up to 16 asynchronous ASCII hosts. Model 410 supports a remote IBM and 32 ASCII hosts, while Model 420 supports a local IBM and up to 32 remote ASCII hosts. Model 411 communicates with 2 remote IBM and up to 16 ASCII hosts.

Models 306 and 308 are compatible with IBM 3274 Models 51C

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Models 306, 308, 310, 311, 320, 321, 408, 410, 411, 420 & 421

and 61C, respectively. The other models emulate Models 1C, 21C, 31C, and 41C when connected as remote units, and Models 1A, 21A, 31A, 1B, and 1D in local mode. When operating in remote mode, communication with the host is via BSC or SNA/SDLC.

In addition to 3270-mode operation, Models 408, 410, 411, 420, and 421 emulate most ASCII/TTY-compatible terminals, such as the DEC VT52/100, HP 2624B, etc. When operating in asynchronous mode, the controllers employ Lee Data Models 1214, 1216, 1220, and 1221 terminals to emulate the desired units. No asynchronous ASCII terminals per se can be connected.

Models 310, 311, 320, 321, 410, 411, 420, and 421 support up to 32 BSC or SDLC terminals, or up to 31 printers. Model 308 accommodates up to 8 and Models 308 and 408 handle 16 terminals/printers each.

In addition to 3270-type terminals, the 410, 411, 420, and 421 can also emulate up to 32 asynchronous terminals. Model 408 can handle up to 16. The Lee cluster controllers interface just about all of the available terminals/printers. The Model 306, however, cannot use the Model 1221 terminals.

The controllers all share the same basic microprocessor components that perform the central processing and I/O processing. The central processing unit (CPU) consists of a 16-bit microprocessor. The CPU controls internal communication between station adapters, and data/message transfers between the controller and host.

One or 2 workstation adapters, each capable of supporting 8 or 16 BSC/SDLC display stations/printers are available. The station adapter contains an 8-bit microprocessor, and directs message transmission and reception functions needed to support the concurrent I/O activities of up to 16 workstations. For the asynchronous handling controller, 2 workstation adapters handling 8 channels each are supported.

An 8-bit microprocessor-controlled diskette/communication adapter controls program loading from the diskette and communication between diskette and other display stations. The microprocessor also supports communication between controllers and the remote host.

Models 306 & 308 Remote Cluster Controllers • tabletop units supporting 8 (Model 306) or 16 (Model 308) BSC/SDLC terminal displays/printers in any combination • dual Intel 8088 16-bit microprocessors; 128K-byte RAM for emulator; 64K-byte RAM for communication • integrated single system diskette for cluster controller software • Model 306 includes 8 terminal display/prINTER interfaces; Model 308 includes 16 • communicates with S/360, 370, 303X, and 4300 processors at speeds from 2000 to 9600 bps • RS-232C interface.

Model 306 Prices Are:

\$167/\$142 mo	\$3,420 prch	\$33 maint
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Model 308 Prices Are:

298/252	6,460	50
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Models 310 & 410 Remote Cluster Controllers • tabletop units supporting up to 32 BSC/SDLC terminals/printers in any combination; Model 410 also emulates up to 16 ASCII/TTY asynchronous terminals • 32K-byte RAM • 8-channel BSC/SDLC terminal adapter standard on both models; 8-channel asynchronous terminal adapter standard on Model 410 • integrated single diskette for cluster software • communicates with S/360, 370, 303X, and 4300 processors at speeds from 2000 to 19,200 bps • RS-232C interface.

Model 310 Prices Are:

512/428	11,764	60
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Model 410 Prices Are:

665/558	14,820	95
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Model 311 Dual-Host Remote Cluster Controller • tabletop unit supporting any combination up to 32 BSC/SDLC terminals/printers • dual Intel 8086 microprocessors with 128K-byte RAM for emulator, 256K RAM memory, and an 8085 microprocessor with 8K bytes of ROM for terminal/prINTER control

• integrated system diskette for cluster controller software • 9600 bps per link:

629/524	14,542	70
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Models 320 & 420 Local Cluster Controllers • identical to Models 310 and 410 except they are floorstanding and attach directly to local host S/360, 370, and 303X processor via byte, selector, or block-multiplexer channels; connection to 4300 is via block or byte multiplexer • a 140-nanosecond bipolar microprocessor handles high-speed channel transfer rates and contains embedded diagnostics.

Model 320 Prices Are:

606/504	14,056	65
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Model 420 Prices Are:

856/715	19,520	105
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Models 321 & 421 Local/Remote Cluster Controllers • floorstanding units supporting up to 32 BSC/SDLC terminal displays/printers in any combination; Model 421 also emulates up to 16 ASCII/TTY asynchronous terminals • dual Intel 8088 microprocessors; 128K-byte RAM for each microprocessor; 256K-byte shared global memory for applications and communication • Model 421 has separate Intel 8088 and 64K-byte RAM for each 8 ASCII/TTY asynchronous terminals • local and remote interfacing same as for Models 310, 410, 320, and 321 • Models 321 and 421 have 16 standard BSC/SDLC terminal/prINTER interfaces; Model 421 also has 8 standard ASCII/TTY RS-232C interfaces.

Model 321 Prices Are:

726/606	16,556	89
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Model 421 Prices Are:

970/811	21,964	125
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Models 408 & 411 Remote Cluster Controllers • tabletop units supporting 16 (Model 408) or 32 (Model 411) BSC/SDLC terminals/printers; 16 ASCII operation via emulation • 8 terminal adapters standard on Model 408; 32 standard on Model 411 • RS-232C interface.

Model 408:

371/312	8,075	60
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Model 411:

781/653	17,435	110
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3300 Host Response Statistics • measures and reports response times between terminal and host interaction:

65/53	1,696	NA
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□ I/O Channels

Models 306, 308, 310, 311, 321, 408, 410, 411 & 421 Remote Processor Attachment

Controllers communicate with the host processor via switched or dedicated facilities and host channel-connected control units/adapters. On the S/360, 370, 3030, and 4300 processors, communication facilities connect via 2701 Data Adapter Unit, 2703 Transmission Control, or 3704/3705 communication controllers. On the S/370 Models 115, 125, 135, and 138 connection is via an Integrated Communications Adapter; the Communications Adapter is used on the 4331.

Models 320, 321, 420 & 421 Local Processor Attachment

Controllers directly connect to a local host via processor channels. From 8 to 32 BSC/SDLC terminals and from 8 to 16 asynchronous terminals in 8-terminal increments can be attached. No more than 32 terminals or 31 printers are permitted. Both controllers attach to an S/360, 370/115 through 370/168,

MO: monthly 2-year/3-year lease charge including maintenance. PRCH: purchase price. MAINT: monthly maintenance charge for purchase units. NA: not available. NC: no charge. Prices are for single-unit quantity and are effective as of August 1984.

Lee Data 300 & 400 Series 3270-Compatible Display Systems

Models 306, 308, 310, 311, 320, 321, 408, 410, 411, 420 & 421

3031, 3032, 3033, and 3081 processors via a byte, selector, or block-multiplexer channel. Any 4300 processor attaches via a block or byte multiplexer. A microprocessor-controlled channel adapter handles data transfers and provides diagnostics.

Terminal/Printer-to-Controller Attachment

Display stations/printers attach directly at the cluster controller via coaxial cable, which connects to terminal adapters. The adapters fit into a workstation adapter module, which can accommodate 8, 16, or 32 BSC/SDLC workstations/printers; up to 16 emulated asynchronous devices.

Terminal and printers can be located up to 5000 feet from the controller. For extended distances, the vendor offers a Coax Eliminator. This unit interfaces up to 8 terminals and printers over a single coaxial channel or 4-wire twisted pair with the cluster controller. Terminals and printers can be located up to 2500 feet from the Coax Eliminator. To extend peripheral distances beyond 5000 feet, Coaxial Eliminators can be chained at 2500-foot increments. Chaining is limited only by access to power. Even with Coaxial Eliminators, the number of terminals and printers cannot exceed 32 BSC/SDLC units or 16 asynchronous devices.

Coax Eliminator T1 • provides connection to 1 coaxial or 1 4-wire twisted pair:

\$50/\$42 mo	\$1,116 prch	\$7 maint
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Coax Eliminator T8 • provides connection to 8 coaxial cables and 1 4-wire twisted pair:

52/44	1,152	8
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Coax Eliminator C8 • provides connection to 8 coaxial cables:

46/39	1,008	7
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1270 Station Expansion • 16-channel card adapters expand 16-channel controllers to 32 channels:

66/56	1,440	11
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1293 Async Port Expansion • 8-channel card adapters expand asynchronous terminal emulation capacity from 8 to 16 channels:

80/68	1,728	14
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2901 Personal Computer Adapter • connects IBM PC, PC-XT, AT&T, and other compatible PCs to Series 300 or 400 controllers:

NA/NA	1,150	NA
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□ Communications

All of the remote controllers support BSC or SNA/SDLC protocols. In addition, the Models 410, 420, and 421 emulate leading ASCII terminals such as DEC VT52/100 and Hewlett-Packard HP 2624-B. The ASCII terminals themselves **may not** be used; rather their functions/capabilities are emulated through Lee's Display Station Models 1214, 1216, 1220, and 1221.

All remotely attached models employing BSC/SDLC protocol communicate with the host via half-/full-duplex data transmission over point-to-point or multipoint, switched or nonswitched lines at speeds of 2000 to 19,200 bps, except Models 306 and 308 which tap out at 9600 bps. An RS-232C interface connects the cluster controller to the modem. All transmission is block mode.

The asynchronous ports also employ RS-232C interface. The terminals support autodialing of 15-digit asynchronous line phone number, expandable to 30 digits. Eight asynchronous terminal adapter ports are standard with 8 additional optional. Point-to-point communications can be performed over switched or dedicated lines; transmission speeds vary with the number of terminals attached, but the aggregate for each adapter cannot exceed 9600 bps. Typically this breaks down to 8 terminals (lines) at 1200 bps; 4 at 2400 bps; 2 at 4800 bps; and 1 at 9600 bps.

Two aids are provided to measure the response times and determine problems in the network. The response time feature measures the CPU response time for each requested transaction and displays the result on the requesting display. The second aid is called line/channel trace, and records data exchanges and displays them in hexadecimal or character format.

1891 High-Speed Link Interface • allows controller to

communicate with host at 19.2K bps; RS-232C interface • for single host only:

\$52/\$44 mo	\$1,120 prch	\$9 maint
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1892 High-Speed Link Interface • allows controller to communicate with host at 14.4K bps; RS-232C interface • for single host only:

45/38	960	8
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□ Diskette

A single-drive 140K-byte diskette unit integrated into the cluster controller stores systems configuration tables, emulation and utility software. Users may modify the contents of the diskette from the display station keyboard, and may create duplicate copies of the configuration or develop multiple configurations which may be loaded into the cluster controller as the processing needs dictate. The diskette may not be used for any other functions, such as local storage for housing applications.

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

□ Workstations/Terminals

The Lee family of interactive terminals consist of Models 1214, 1216, 1220, 1221, 1230, and 1231 that compete against the IBM 3178/3180/3278/3279. Also, 2 personal computers are available, the 700 Series and the Series 70 IBM PC and 3270 PC replacements. Lee Model 1214, introduced at the 1984 National Computer Conference, essentially competes with the 3180 Model 1 and 3278-2, but is also offered in a version that emulates an asynchronous ASCII terminal plus a 3180 or 3278-2. Lee Model 1216 is comparable to IBM's 3178. Model 1220, Lee's older "all-in-one" terminal supports all the display capabilities of the IBM 3278-2 through -5.

Model 1221, also an IBM 3180 replacement, is now available in versions that support asynchronous emulation, personal computer, and 4 independent window operations. Each window represents a fully interactive session, with all 4 sessions conducted concurrently. Applications can use BSC/SDLC/async protocol, and up to 132 columns can be displayed. Each window set is user-defined and data can be copied from window-to-window. Windows can be zoomed to full-screen size. The new Model 1221 is also menu driven, and provides a keystroke record/playback that enables users to save commonly used keystroke sequences. Each window can save a 96-character string such as log-on, ID numbers, or passwords. The 1221 cannot be used with the Model 306 cluster controller.

Terminals are offered with a choice of keyboards. The 87-key EBCDIC typewriter layout, the 75-key EBCDIC data entry, and the 75-key EBCDIC data entry/keypunch are all IBM 3278 compatible. The modified 87-key EBCDIC typewriter layout is a modified IBM 3277 keyboard with changes initiated to reduce shifting. The 87-key EBCDIC typewriter layout with numeric keypad is an IBM 3278 keyboard with numeric keys, decimal point, and tab placed for accounting applications. It can also be adapted for APL. The final keyboard, the 3270/asynchronous, has keycap changes to support the DEC VT 100.

Lee Data also offers 2 color display terminals called the Models 1230 and 1231. The displays are IBM 3279 Models 2A and 3A compatible and feature high-quality character presentation in red, blue, green, and white. Both terminals offer the same edit and format features, and can accommodate any keyboard offered. The difference between models is that the 1230's format is 24 lines x 80 characters, whereas the Model 1231 in addition, displays 32 lines x 80 characters. The user selects the 24-/32-line format from the keyboard.

Lee also offers an optional personal computer attachment which allows all terminals, including the color module, to emulate IBM's Personal Computer. Called the 700 Series Personal Workstation,

Lee Data 300 & 400 Series 3270-Compatible Display Systems

Models 306, 308, 310, 311, 320, 321, 408, 410, 411, 420 & 421

it consists of an Intel 8088 16-bit microprocessor, a standard memory module board with 128K-byte RAM which can be field expanded to 256K bytes, and a 5.25-inch diskette drive with 360K-byte capacity. An additional diskette drive can be added to increase auxiliary storage to 720K bytes. Main memory can be expanded to 1M bytes in 128K- or 256K-byte increments. Additional plug-in memory boards are required. The standard operating system is Microsoft's MS-DOS; Digital Research's CP/M 86 is optional.

The Series 70 Personal Workstation is an IBM 3270 PC replacement that can handle up to 7 display windows, PC graphics, and IBM 3279-S3G host graphics. The graphics and windowing facilities are implemented via Intel 80188 co-processor board. This same board allows programs such as Lotus, Visicalc, and Wordstar to run without modification.

In the PC graphics mode, up to 16 colors can be displayed. In 3279-S3G emulation mode, up to 8 colors are supported. The window feature allows 4 interactive host sessions (3270 and async), a personal computer session, and 2 notepads. Data can be transferred among windows.

Series 70 contains 128K bytes of RAM, expandable in 128K- or 256K-byte increments to 1M bytes. Standard auxiliary storage consists of a 5.25-inch diskette with 360K bytes of storage. This can be augmented via a second diskette or 10M-byte hard disk. Standard operating system is MS-DOS with CP/M-86 being optional.

Model 1214 Display Station

Configuration • microprocessor-controlled, tabletop display with 87- or 124-key low-profile keyboard • intelligent upgrade through 700 Series Personal Workstation.

Display • tilt/swivel, 14-inch diagonal • 1920 characters, 24-line x 80-character (column) format for Models 2 and 2A; 1920/2560/3440/3564 characters configured 24/32/43 lines x 80 columns and 27 lines x 132 columns, respectively, on all other models • 96 ASCII/EBCDIC character set.

Edit & Format Features • cursor up, down, left, right; home, new line, tab, backtab, backspace key functions • cursor address write • erase EOF; clear input • character insert/delete • protected and numeric-only fields • intensity, nondisplay attributes • print • reverse video, underscore, blinking, scrolling.

Communications • via controller—see Communications section.

Peripherals • cluster printers via controller • directly attached 80-cps printer • attachable Personal Workstation.

Keyboards • 1260 and 2293.

Model 1214-2 • 1920-character display; includes keyboard:

NA/NA mo	\$1,462 prch	NA maint
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Model 1214-A • 1920-character display; includes keyboard; supports ASCII emulation:

NA/NA	1,862	NA
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Model 1214-B • 1920/2560/3440/3564-character user-selectable display; includes keyboard; supports ASCII emulation:

NA/NA	2,162	NA
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Model 1214-D • same as Model 1214-B, except does not support ASCII emulation:

NA/NA	1,762	NA
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Model 1216 Display Station

Configuration • microprocessor-controlled tabletop display; accommodates, but does not include, 75-key data entry or 87-key typewriter-style keyboard with or without numeric keypad • intelligent upgrade through Personal Workstation attachment.

Display • tilt/swivel, 14-inch diagonal • 1920 characters, 24-line x 80-column (character) format • 94 ASCII/EBCDIC character set • blink and nonblink underscore and block cursor.

Edit & Format Features • cursor up, down, left, right, home, new line • tab, backtab, backspace • cursor address • erase EOF; clear input • character insert/delete • protected and numeric

fields • reverse video • auto-repeat keys • 10, 12, or 24 user-programmable function keys.

Communications • via controller—see Communications section.

Peripherals • cluster printers via controller • directly attached 80-cps printer • directly attachable Personal Workstation.

Keyboards • 1260, 1261, 1264:

\$48/\$41 mo	\$1,046 prch	\$8 maint
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Model 1220 Display Station

Configuration • microprocessor-controlled, tabletop display; modular detachable typewriter-/data-entry keyboards with numeric and cluster keypads • VT 100 keyboard functions include SCROLL, BELL, ESCAPE, BREAK, and CONTROL on Model 1220 • attaches to cluster controller via coaxial cable at distances up to 5000 feet • intelligent upgrade.

Display • tiltable and rotatable, 15-inch diagonal • 7x9 matrix • Model 1220 displays 3564 characters at 27 lines x 132 columns, 3440 columns at 43 lines x 80 columns, 2560 characters at 32 lines x 80 characters and 1920 characters at 24 lines x 80 columns with status indicator lines • 96 EBCDIC set • blink/nonblink underscore/block cursor.

Edit & Format Features • auto-repeat keys • 10, 12, or 24 user function keys • cursor up, down, left/double left, right/double right; home, new line, tab, backtab, backspace key functions • cursor address write • erase to EOF; clear input, clear • character insert/delete • protected and numeric-only fields • intensity, nondisplay attributes • print • reverse video, underscore, blinking, and scrolling.

Peripheral Control • print key sends data to specified printer • cancel key cancels printouts to malfunctioning printer • alternate function selection permitted.

Communications • via controller—see Communications section.

Peripherals • all peripherals attach to cluster controller • cluster printers via controller • directly attached 80-cps printer • direct attach Personal Workstation.

Keyboards • 1260, 1261, 1262, 1264, 1265, 1266, 1267, 1280, 1287 (Models 1218 and 1220), 2280 (Model 1221A), and 2293 (Models 1221W and 1221B).

Model 1220 All-In-One Display • displays user-selectable 1920/2560/3440/3564 characters in 32x80, 43x80, and 27x132 character formats; has all capabilities of IBM 3278 Models 2, 3, 4, and 5:

\$106/\$89 mo	\$2,425 prch	\$13 maint
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Model 1221 All-In-One Display • displays user-selectable 1920/2560/3440/3564 characters in 24x80, 32x80, 43x80, and 27x132-character format; has all capabilities of IBM 3278 Models 2, 3, 4, and 5; and IBM 3180 Model 1:

72/61	1,650	9
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Model 1221A • same as Model 1221, except also supports asynchronous terminal emulation:

92/77	2,150	10
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Model 1221B • same as Model 1221A, except also supports windowing and asynchronous terminal emulation; requires Model 2293 keyboard:

109/91	2,550	11
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Model 1221W • same as Model 1221B, except does not support asynchronous emulation:

105/88	2,450	11
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Models 1230 & 1231 Color Display Station

Configuration • color cluster display employed with 300 and 400 Series. Modular (detached) typewriter, typewriter/text, data entry, data entry keypunch keyboards • intelligent upgrade.

Display • tiltable and rotatable 15-inch diagonal • 1920-character 24-line x 80-character format (1230 and 1231); 2560-character 32-line x 80-character format (1231 only); 25th status line on both models • 96 EBCDIC/ASCII character set • 4-color presentation (white, red, blue, and green) • blink and

Lee Data 300 & 400 Series 3270-Compatible Display Systems

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nonblink cursor at 10- and 40-cps; underscore or rectangle.

Edit & Format Features • auto-repeat keyboard • 10, 12, or 24 (12 + 12 shift) user function keys • cursor up, down, left, right pad; home, new line, tab, backtab, backspace key functions • cursor address write • erase to EOF: clear input, clear • character insert and delete • protected and numeric-only fields • underscore, blinking and reverse video field highlighting • local print.

Peripheral Control • same as for Model 1220.

Communications • via controller.

Peripherals • same as Model 1220.

1230 Color Display Terminal • 4-color, 1920-character display station; includes keyboard:

NA/NA mo	\$1,879 prch	\$9 maint

1231 Color Display Terminal • 4-color, 1920-/2560-character display station; includes keyboard:

NA/NA	2,199	11

3302 APL Feature • required on Models running under APL; requires Model 1266 keyboard:

20/17	403	4

3303 3270/Async Feature • provides IBM 3270/Async facilities to Models 1230 and 1231 color terminals:

20/17	403	4

3305 3270/Async Feature • same as 3303, except operates on Model 1216 terminal:

23/20	503	4

3306 3270/Async/PC • same as 3303, except also provides for personal computer operation:

31/26	703	4

700 Series Personal Workstation Upgrade

Configuration • Intel 8088 16-bit microprocessor with 128K-byte RAM expandable to 1M bytes; 5.25-inch diskette drive with 360K-byte capacity, MS-DOS operating systems, display and printer interfaces.

Display • attaches to and employs same display as Models 1214, 1216, 1220, 1221, 1230, and 1231 display terminals.

Edit & Format • not applicable.

Peripheral Control • through operating system data access method.

Communications • through cluster controller.

Peripherals • single or dual 5.25-inch diskette drive • 10M-byte Winchester hard disk • single 80-/160-cps matrix printer:

NA/\$108 mo	\$2,733 prch	\$23 maint

Keyboards • same as for Models 1214, 1216, 1220, 1221, 1230, and 1231 terminals.

Series 70 Personal Workstation

Configuration • Intel 8088 16-bit microprocessor with 128K-byte RAM (expandable to 1M bytes); 5.25-inch diskette drive with 360K-byte capacity; MS-DOS operating system.

Display • 14-inch CRT • 1920-/2560-character, 24/32 lines x 80 characters • 720x480 pixel graphics resolution • 8-color display; 16-color support (black, brown, blue, white, green, gray, cyan, light blue, red, light green, magenta, light cyan, yellow, and intense white) • 96 EBCDIC/ASCII character set.

Edit & Format • not applicable.

Peripheral Control • through operating system data access method.

Communications • through cluster controller.

Peripherals • single or dual 5.25-inch diskette drive • 10M-byte Winchester hard disk • single 80-/160-cps matrix printer.

Keyboards • 122-key typewriter-style:

NA/NA mo	\$5,711 prch	NA maint

128K RAM Memory Expandable • add-in memory to standard memory module board and expansion memory module boards • increase total RAM capacity to 256K bytes per board:

NA/11	281	2

128K RAM Memory Module Expansion Board • 128K-byte expansion memory module board • accepts an additional 128K-byte add-in memory to increase total capacity to 256K bytes per board:

NA/18	438	4

256K RAM Memory Module Expansion Board • 256K-byte expansion memory module board:

NA/28	718	6

Second 5.25-Inch Diskette Drive • adds 360K bytes of auxiliary memory storage:

NA/19	450	5

CP/M 86 Operating System:

NA/NA	240	NA

10M-Byte Winchester Disk • factory-installed 10M-byte Winchester hard disk with 256K RAM and 360K-byte diskette:

NA/77	1,190	15

Field Upgradable 10M-Byte Winchester Disk • same as factory-installed version:

NA/77	2,350	17

Display Window Option • provides 7-window display capability:

NA/NA	300	NA

PC Graphics Option • provides IBM PC graphics support:

NA/NA	200	NA

Host Graphics Option • provides IBM 3279 graphics support:

NA/NA	435	NA

□ Keyboards

1260 87-Key EBCDIC Typewriter Keyboard • IBM 3278 layout; 24 program function keys; 10-key numeric keypad:

\$19/\$16 mo	\$416 prch	\$3 maint

1261 75-Key EBCDIC Data Entry Keyboard • separate control and cursor keys; 10 program function keys:

17/14	365	3

1262 75-Key EBCDIC Data Entry/Keypunch • data entry, keypunch-style keyboard; 10 program function keys:

19/16	416	3

1264 87-Key EBCDIC Typewriter Keyboard/Numeric Pad • 24 program function keys; 10-key numeric keypad:

19/16	416	3

1265 87-Key EBCDIC Typewriter Keyboard (Modified) • modified IBM 3277 layout; changes include clear, erase, input, PA 1 and PA 2 keys changed from alternate to primary; PF 1 through PF 12 duplicated on keypad and second set elevated to primary keys, not offered with Model 1216:

19/16	416	3

1266 87-Key EBCDIC Typewriter/APL & Numeric Pad • IBM 3278 layout; numeric keypad on right-hand side; numerics 0 to 9, decimal point, and tab forward replace PF 13 through PF 24 as primary keys (these keys available as alternate shift keys):

26/22	576	4

1267 3270/Asynchronous Keyboard • similar to 87-key EBCDIC typewriter keyboard with numeric keypad; new keycaps include Scroll, Escape, Break, Tab, Caps Lock, Bell, Backspace, Return, Shift, Alternate/Control, Line Feed, and Device Control • supports the DEC VT100:

17/21	576	4

1280 Personal Computer Keyboard • required for attachment of 700 Series PC upgrade to Models 1216, 1218, and 1220:

19/16	416	3

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Models 306, 308, 310, 311, 320, 321, 408, 410, 411, 420 & 421

1287 3270/Asynchronous Keyboard VT132 • same as above except supports DEC VT132 • used with Models 1218 and 1220:

19/16	416	3
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2280 122-Key Keyboard • employed with Model 1221A for asynchronous and multiwindow support:

19/16	416	3
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2293 122-Key Keyboard • employed with Models 1221W and 1221B for multiwindow support:

19/16	416	3
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Printers

Lee's printer line consists of a correspondence-quality printer (Model 1370), a dot-matrix printer (Model 1316), and 3 line printers • all printers attach to any model of the 300 and 400 cluster controllers, and can be shared among user terminals. Model 1370, in addition, can be directly attached to Models 1214, 1216, 1218, and 1230 displays plus the Series 70 and 700 Series Personal Workstations.

The cluster printers all attach via standard coaxial cable at distances up to 5000 feet. These printers can also be used in conjunction with the Coax Eliminator, a multiplexer which handles up to 8 workstations/printers. Configuration restrictions for the controller limit the number of printers attachable to 31. Terminal adapters interface the printer to the host. Each adapter handles 8 printers.

All printers can be configured to operate in local mode, system mode, and shared mode. In local mode, the printer can be used for off-line print functions only. Data is transferred from the display station to the printer. In system mode, the printer is entirely under control of the host processor, and cannot be used by the local operator. In shared mode, the printer can be addressed by the host or the local operator, but obviously not at the same time. When the host is addressing the printers, terminals are free to communicate with the host.

The Model 1370 50-cps letter-quality printer is a tabletop unit for use with the Series 300 and Series 400 3270/Async communication systems. It operates in BSC/SDLC environments (3287 compatible). The printer provides a variety of type fonts, and uses either metal or plastic printwheels. The unit accepts 96-character printwheels in 10, 12, and 15 pitch, and is offered in Courier 12, Elite 12, Letter Gothic 12, Manifold 10, Pica 10, and Prestige Elite 12 font styler. Pica 10 is the shipped printwheel.

Model 1316, as mentioned earlier, attaches to the cluster controller for shared use, or to display station for direct printing or screen data. The unit employs logic-seeking bidirectional printing techniques and dot-matrix printing, and runs at 80 cps. Both 80- and 132-column lines are supported, and up to 3 copies can be provided. Character sets supported include 96-character ASCII and 9 special symbols.

The 180-/320-character printers (Models 1350 and 1360) are microprocessor-controlled, bidirectional units. Features include: variable print line from 1 to 132 columns; variable page length from 1 to 99 lines; vertical-line density of 6 or 8 lpi; single- or double-spaced lines; 7x7 dot-matrix characters; 94 EBCDIC character set; single- or multipart (6-part maximum) paper handling at form length of 3 inches to 14 inches and widths of 4 inches to 17.3 inches; 70-yard ribbon cassette (cartridge). Forms control specifications can be established through a configuration table for default values, through local command for dynamic changes, or through printer-control panel (line spacing and line density only).

Model 1380 is a 300-/400-lpm dot-matrix printer that connects to a cluster controller and operates under BSC/SDLC remote and SNA/non-SNA local channel protocols. It is compatible with the IBM 3287 printer, and can be fitted with a graphics option. The latter produces logos, bar codes, and other labels; line/box segment graphics; stored forms overlaid with new data; and other graphics. It will also expand characters up to 99 times normal size for text emphasis and other graphics.

Model 1370 Letter-Quality Printer • 50-cps impact • 10, 12, or 15 cpi; 6/8 lpi • friction-feed platen • prints up to 6 copies:

\$240/\$204 mo	\$4,995 prch	\$48 maint
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Model 1316 Station Printer • bidirectional 80-cps dot matrix • 96 ASCII character set and 9 symbols • 9x9 dot matrix • 80 columns normal or 132 columns condensed; 10/16.5 cpi • fanfolds, original plus 2 copies:

26/22	553	5
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Model 1317 Matrix Printer • 160-cps dot-matrix printer for terminals running multiple window displays:

NA/NA	795	16
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Model 1350 3287-Style Printer • 180-cps dot-matrix printer compatible with IBM 3287:

250/211	5,467	40
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Model 1360 Matrix Printer • 340-cps dot-matrix printer • prints at 132 to 698 lpm:

285/243	5,913	58
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Model 1380 Line Printer • 300- or 400-lpm dot-matrix printer • 9x9 dot matrix • 6/8 lpi; 10 cpi normal or 15 cpi compressed • 96 ASCII character set plus 64 additional characters • edge-punched fanfold paper 3 to 16 inches wide • prints 300 lpm at 132 characters per line; 400 lpm with reduced character set:

417/NA	12,015	NA
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1381 Graphics Option • graphics facility for Model 1380:

75/NA	2,000	NA
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• END

Mathematica ATLAS

TP Monitor System

■ PROFILE

Function • medium-to-large-scale, multitasking TP monitor for IBM DOS/VSE users.

Computers/Operating Systems Supported • any IBM S/370-class computer under DOS/VSE Release 2.0 or later.

Languages Supported • IBM COBOL, PL/1, and assembler.

TP & File Access Methods • BTAM, VTAM, DAM, ISAM, VSAM, TDAM, selected DBMS.

Terminal Devices • 3270, 328X, Teletype (or equivalent).

Security • 3-level user, terminal, program ID used separately or in combinations; TITAN adds user-profile security feature.

Logging/Accounting • full transaction logging; online program trace.

Failure/Recovery • warm restart with transaction log file.

Special Options • TITAN interactive applications program development system; DES Data Entry System.

Current Version • 2.3.

Number of Installations • over 50.

Comparable Systems • IBM CICS/DOS/VS, Cullinet IDMS/DC, ADR DATACOM/DC.

Vendor • Mathematica Products Group, Inc; P.O. Box 2392, Princeton, NJ 08540; 609-799-2600 • Mathematica Products Group Canada Ltd; 300 Fifth Avenue SW, Suite 2050, Calgary AL T2P 3C4; 403-290-0668; other offices in Mississauga and Nepean, ON.

■ ANALYSIS

Mathematica has so far always delivered on its promises. The delivery may be delayed by Mathematica's seemingly relentless pursuit for technical perfection, but the delivered product is usually pretty consistent with Mathematica's paper claims. Users tend to regard Mathematica's persistence as a high form of technical integrity; marketing-oriented competitors probably see it as a slow form of corporate suicide. The reality is somewhere between these extremes.

Mathematica was built on RAMIS, which was a home-grown report writer which has matured into a true DBMS. Later on, Mathematica built its communications expertise based on MPGSWIFT, which was an acquired TP monitor. Mathematica's growth has not been meteoric in, say, the style of Cullinet, but it has been consistent and has developed around an unusually

faithful user base. Now with the added backing of its newly acquired headquarters company Martin Marietta, the growth rate might significantly increase. On the technical side, Mathematica has held its own with reasonably well conceived progressions from RAMIS to RAMIS II, TIPS to TITAN, etc, and has pushed the state of the art with products like RELATE.

□ Strengths

ATLAS' major strength derives from a design approach that treats the TP monitoring function as an integrated extension of the operating system rather than as a tacked-on software multiplexer for the teleprocessing environment. The ATLAS design takes maximum advantage of the extensive multitasking facilities built into DOS/VSE by allocating and manipulating resources just as the operating system would do if it interfaced directly with the teleprocessing environment. The effects of this technological marriage between the ATLAS and DOS/VSE are 2-fold. The first effect is a radical performance improvement between terminal transactions run under CICS versus the same transactions run under ATLAS. MPG publishes the results of benchmark tests based on 200 transactions per terminal, where each transaction consisted of 8 VSAM reads and 2 terminal writes. The host computer was an IBM 4331, Comp 2, running DOS/VSE. Results were tabulated for 1 through 15 terminals. The 1-terminal average elapsed time for ATLAS versus CICS was 74 seconds versus 216 seconds; corresponding CPU times were 25.3 versus 55.15 seconds. Fifteen terminal results were 290.47 versus 992.07 seconds and 206 versus 609.78 seconds, respectively. The ratios of improvement with ATLAS were no less than 2:1 and frequently exceeded 3:1.

The second effect is a marked improvement in the programming interface because applications programs under ATLAS can use any operating system facility directly.

The basic concept of ATLAS is fairly simple. It operates within a DOS/VSE partition and subpartitions that partition to form, in effect, a DOS/VSE subset within the context of DOS/VSE. MPG plans to extend the techniques to encompass MVS by mid-1985. This implementation will enable interactive RAMIS II use, giving a complete DB/DC package not only in DOS/VSE, as at present, but also in the OS environment. In the first quarter of 1985, ATLAS will begin to support PC use in the DOS/VSE environment, again for RAMIS II users, through the RAMIS II component RAMLink.

□ Limitations

Some of ATLAS' earlier limitations (Release 1.0) were an inability to handle VTAM and no interface to SNA. These limitations have both been corrected in Release 2.0. Ongoing limitations are ATLAS' obviously restricted accessibility to only DOS/VSE users (although an MVS version is promised) and terminal support for only 3270-, 3280-, and Teletype-like devices.

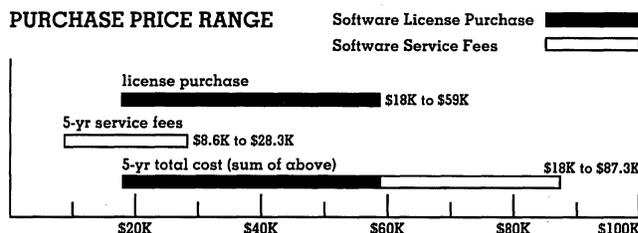
■ OVERVIEW

□ Terms & Support

Terms • license (25-year paid-up lease) available for one-time fee; 1- to 5-year payout, yearly rental, or month-to-month rental plans also available; month-to-month fee is approximately 4% of prevailing one-time fee • installation fee is charged at a separate rate of \$400 per day plus expenses.

Support • maintenance service is free for the first year of a paid-up lease and is bundled into the cost of payout and rental plans for contract duration; ongoing annual maintenance fee for paid-up licenses is 12% of the prevailing paid-up lease fee • service includes all software updates, telephone consultation, and cor-

PURCHASE PRICE RANGE



MATHEMATICA ATLAS 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 fee is included in license purchase price • **MINIMUM CONFIGURATION** is ATLAS (Level 1) • **MAXIMUM CONFIGURATION** is ATLAS with TITAN and DES options (Level 5).

Mathematica ATLAS

TP Monitor System

rection of user-documented system faults; improvements designated as options by MPG carry extra charges • separate training fees are levied at \$600 per day plus expenses at user site.

Component Summary

The ATLAS system offers 5 separately priced levels that collectively accommodate the entire IBM System/370-class product line. Each of the mainframe levels are structured to conform to the IDC (International Data Corporation) Performance Rating Breakpoints for the 4331, 4341, 4381, 3081, and 3084 processors, with Level 1 designating the low end of the ratings list and Level 5 equivalent to the 3084 rating.

ATLAS is a self-contained TP monitor with no extra-cost internal options. It is upward compatible from MPGSWIFT. Three separately priced options are available: TITAN, an online interactive programming support package; DES, a data entry system that can be implemented either as an ATLAS option or as a standalone package; and TIPS/FSE, a terminal interactive programming system with full-screen entry/edit facilities.

ATLAS • Level 1:

\$18,000	lcns	\$720/\$432	mo	\$2,160	serv
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ATLAS • Level 2:

24,000		960/576		2,880	
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ATLAS • Level 3:

28,000		1,120/672		3,360	
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ATLAS • Level 4:

32,000		1,280/768		3,840	
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ATLAS • Level 5:

36,000		1,440/864		4,320	
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Host Computers/Operating System

ATLAS runs on IBM S/370-class systems under DOS/VSE Release 2.0 and later.

Minimum Operating Requirements

ATLAS requires approximately 600K bytes of main memory and about 4,000 blocks (depends on number of terminals) of FBA disk external storage or equivalent CKD space.

Network & Device Interfaces

ATLAS handles all terminal communications through BTAM or VTAM. Complete device support is provided for local/remote 3270s (includes remote dial-up support without operator intervention or hardware options), Teletype units, and local/remote 328X printers (or equivalents).

Access Methods/DBMS Interfaces

ATLAS supports DAM, ISAM, and VSAM file access methods. Interfaces to MPG RAMIS II or Cullinet IDMS DBMSs are normally available with ATLAS. Interfaces to other DBMSs are available on special request.

Languages Supported

ATLAS supports all versions of IBM COBOL, PL/1, and assembler that normally execute under DOS/VSE.

■ TP MONITOR FACILITIES

The design philosophy applied by MPG to ATLAS was simply to maximize its interaction with and use of DOS/VSE facilities. This philosophy is expressed in an extensive use of tasks, both system and application, controlled out of a dedicated partition, and it promotes ATLAS interaction as another batch application in the context of DOS/VSE.

Task Facilities

DOS/VSE supports 2 to 12 partitions. ATLAS resides in a dedicated partition from which it executes 4 control tasks, and 2 to 20 applications tasks.

Control Tasks

Highest execution priority is given to the master task, which generally establishes priorities for, and dispatches, the applications tasks, and handlesabend detection/recovery chores. Priorities are based on statistics developed by a system performance monitoring facility. The master task also manages the event control block and timer wait queues. The system console reader task maintains an active READ function at the system console to sustain an open communications link between the system and the console operator. The telecommunications line control task handles all line/device management and housekeeping functions through BTAM or VTAM. This task executes all error handling and other chores for the terminals, and defers to the master task only for exceptional servicing requirements. The master utility task supports the master task with logically distinct utilities for functions such as ATLAS command set support and statistics file updating.

Applications Tasks

Up to 20 applications tasks can be managed concurrently by ATLAS. Each application task consists of several reentrant application service routines and is functionally similar to a batch job partition in DOS/VSE. An application session typically consists of transactions and events. A transaction is identical to a DOS/VSE job stream and an event is similar to a DOS/VSE job step. An event is the basic processing unit in ATLAS. Each transaction's event components are stacked in a "ready to run" queue and are called by ATLAS' execution logic. The transaction's associated application program is then executed, event by event, by an application task.

ATLAS can load programs into the application's task area or into a dynamic area. The applications task area can be used only by the allocated applications task; the dynamic area can be used by all applications tasks. Programs defined as permanently or temporarily resident must be loaded into the dynamic area.

Other TP Monitor Facilities

Utility Areas

ATLAS produces a dynamic communications area that gathers general information about application executions. Newly entering applications can refer to this area for execution assistance. A task work area is provided as a general-purpose scratchpad for currently executing applications. A terminal save area is maintained by ATLAS at the system level (across event boundaries). It can be accessed and modified by an application. System work areas are provided in memory and on disk. They support inter-application communications.

Files

A disk save/restore file maintains 1 record for each terminal identified to the system. The records are keyed to terminal IDs and can cross event boundaries. An accounting file maintains ATLAS-developed statistical information about ATLAS execution. A user option permits this file to gather accounting data about other activity in the ATLAS partition. A terminal output data queuing file on disk extends the normal memory queue for nonprinter terminals, as needed, and is the only queue for printer data. Optional transaction files permit users to log selected transaction information in sequential VSAM or SD files.

Message Switching

ATLAS permits the data stream to be directed to a terminal that invoked the calling program, to all terminals on a given line, or

LCNS: cost of 25-year single-payment lease with first-year maintenance included. MO: first figure represents the month-to-month rental charge based on 0.04 of the current paid-up lease price; the second figure represents the monthly charge for a 60-month payout lease plan. SERV: the cost for annual maintenance for the 25-year lease after the first year based on 12% of the prevailing single-payment lease price. Prices effective as of February 1984.

Mathematica ATLAS

TP Monitor System

to all terminals/printers in the network. The controlling routine also supports terminal message spooling.

Pseudo Terminal Transactions

ATLAS allows certain applications to execute as fully privileged transactions without originating from a terminal. A pseudo transaction is initiated by a call from a real transaction. One MPG-suggested use of pseudo transactions is for intermittent sampling of statistical information. Pseudo transactions are processed asynchronously relative to the initiating terminal.

Utility Programs

Utility programs available with ATLAS allow display of systems information such as POWER queues and CPU activity. ATLAS also provides a utility to interface POWER spool queues to terminal printers.

Other User Interfaces

Applications Program Development

TITAN • online interactive programming system released in 1984; compatible with ATLAS; provides internal fully supported libraries; supports external access to RAMIS II and to DOS/VSE source statement and procedure libraries; permits access to DOS/VSE POWER queues; job streams can be written directly to DOS/VSE input queue; files can be concatenated for submission to interface, and special JCL files can be included at runtime • library facility is a partitioned-by-user data set; data is stored in compressed format; verification code prevents accidental update; line-by-line audit trail maintained for each file includes change data/time data and change initiator; audit trail reports include differences between file versions, lines modified between selected dates or times, and lines modified by given user; unlimited number of versions can be maintained online or off-line; back level recall permits any module to be recreated according to date/time, by absolute rank, or by relative rank of archived level • screen consists of command and response fields, and display/entry area; display/entry area can be partitioned into up to 12 combinations of up to 4 windows; each window is logically and functionally unique but can also be affected collectively by 1 command; selected source/output combinations can be displayed simultaneously; full-screen entry is supported with full-screen editing and with context editing • extended security capability is provided through user profile technique.

TITAN • Level 1:

	\$8,000 lcns	\$320/\$192 mo	\$960 serv
	10,000	400/240	1,200

TITAN • Level 2:

	12,000	480/288	1,440
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TITAN • Level 3:

	14,000	560/336	1,680
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TITAN • Level 4:

	16,000	640/384	1,920
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TITAN • Level 5:

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TIPS/FSE • Terminal Interactive Programming System/Full Screen Entry package permits application program development/modification, execution, and output review; developed programs are stored as "books" in a proprietary update-in-place library; language permits books to be expanded at submission to support separate JCL and program storage.

TIPS/FSE • Level 1 standalone version:

	6,000	240/144	720
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TIPS/FSE • Level 2 standalone version:

	7,000	280/168	840
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TIPS/FSE • Level 3 standalone version:

	8,000	320/192	960
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TIPS/FSE • Level 4 standalone version:

	9,000	360/216	1,080
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TIPS/FSE • Level 5 standalone version:

	10,000	400/240	1,200
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TIPS/FSE • Level 1 ATLAS option:

	4,000	160/96	480
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TIPS/FSE • Level 2 ATLAS option:

	4,500	180/108	540
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TIPS/FSE • Level 3 ATLAS option:

	5,000	200/120	600
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TIPS/FSE • Level 4 ATLAS option:

	5,500	220/132	660
--	-------	---------	-----

TIPS/FSE • Level 5 ATLAS option:

	6,000	240/144	720
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Data Entry System (DES)

DES can be installed on a standalone basis or implemented as an option in an ATLAS configuration. It supports IBM 3270-type terminals for data entry and verification. All data records are entered into a batch and are written to the TDAM file. Simultaneous use of data on the TDAM file is prevented; only users who have opened the batch file can use it. Data can be extracted from the TDAM file either by off-line utility functions or by a user program CALL statement. A set of utility functions allows the batch data to be transferred to another medium or to be printed on a line printer.

The DES program is menu driven. Many of its functions are performed automatically through the use of the terminal's PA (Program Attention) keys. Besides performing data entry and verification functions, DES supports chaining of screen formats, stores information in batches, and allows users to browse through the TDAM file.

There are 4 DES modes. The format control mode allows users to create and maintain screen formats that the operator can use to enter, verify, or retrieve information from online files. Users can display up to 20 formats/displays from a directory of active formats. Formats can be duplicated, and additional field attributes can be inserted into existing formats without redesigning total format. The batch control mode allows users to perform administrative tasks such as opening batches, receiving entries, closing batches, and changing associated information. Batches from the terminal can be recycled, and automatic format cycling can be suppressed. Chained formats can be initiated/alterd, and security codes can be modified. Verify mode allows users to verify a batch by rekeying or by sight and optionally supports changes, additions, and/or deletions. Special capabilities in this mode include the ability to locate multiple occurrences of a key field, to verify successive records, and to automatically close a batch or exit. In data retrieval mode, users can review records from an online file directly on the CRT screen. The Data Retrieval mode supports browsing.

DES • Level 1 standalone version:

	\$8,000 lcns	\$320/\$192 mo	\$960 serv
	9,000	360/216	1,080

DES • Level 2 standalone version:

	10,000	400/240	1,200
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DES • Level 3 standalone version:

	11,000	440/264	1,320
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DES • Level 4 standalone version:

	12,000	480/288	1,440
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DES • Level 5 standalone version:

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DES • Level 1 ATLAS option:

	5,000	200/120	600
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DES • Level 2 ATLAS option:

	5,500	220/132	660
--	-------	---------	-----

DES • Level 3 ATLAS option:

	6,000	240/144	720
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Mathematica ATLAS TP Monitor System

DES • Level 4 ATLAS option:

6.500	260/156	780
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DES • Level 5 ATLAS option:

7.000	280/168	840
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■ USER REFERENCE LIST

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

- Mr. Ronald Steiner
Data Processing Manager
Grange Insurance Association
200 Cedar Street
Seattle, WA 98121
Tel: 206-622-4911
- Mr. Michael Mills
D.P. Manager
Montgomery Data Systems
10400 Connecticut Avenue
Kensington, MD 20795
Tel: 301-949-1898
- Mr. Russ Wood
Systems Programmer
Hughes Supply
P.O. Box 2273
Orlando, FL 32802
Tel: 305-841-4710.
- Mr. Bob Gillen
D.P. Manager
Dura Company
4500 North Detroit Avenue
Toledo, OH 43695
Tel: 419-470-0400

• END

Mathematica Products Group MPGSWIFT TP Monitor System

■ PROFILE

Function • small-to-medium-scale, multithread TP monitor.

Computers/Operating Systems Supported • IBM System/370, 3000, 4300, and compatible computers; DOS/VS, DOS/VSE, and all compatible replacement operating systems; supports POWER/VS(E).

Networks & Protocols • direct, dial-up, and multidrop lines; BSC and start-stop.

Languages Supported • COBOL (ANS and nonstandard), FORTRAN, PL/1, RPG, and assembler.

DBMS Interfaces • Mathematica RAMIS II, ADR DATACOM/DB, Cincom TOTAL, Cullinet IDMS, IBM DBOMP.

TP & File Access Methods • BTAM, EXCP; TDAM (proprietary) and all standard IBM access methods.

Terminals • 2260, 3270, 2740, 3741, 3767, and compatibles; TTY-type devices.

Special Options • Data Entry System (DES), Terminal Interactive Programming System (TIPS/FSE), MPGDITTO, remote terminal support, printer spooling facility.

Security • terminal sign-on procedures; program ID code; password protection; alternate log-on procedure.

Logging/Accounting • transaction log file; optional accounting file facility.

Failure/Recovery • warm restart with transaction log file; before and after imaging.

Current Version • 80.

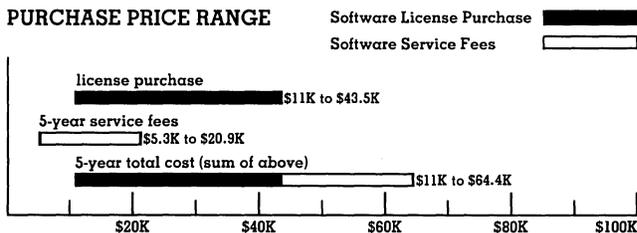
Installations • 100.

Comparable Systems • IBM CICS/DOS/VS; Westinghouse WESTI.

Vendor • Mathematica Products Group, Inc; P.O. Box 2392, Princeton, NJ 08540 • 609-799-2600.

■ ANALYSIS

MPGSWIFT was one of the more popular DOS/VS- or DOS/VSE-oriented, general-purpose telecommunications monitors designed for use with small-to-medium-sized network environments. It started out on the West Coast, went through a series of hands, and finally came to rest in the capable hands of the Mathematica



MATHEMATICA MPGSWIFT 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 the license purchase price • **MINIMUM CONFIGURATION** is the cost of a 25-year license for a Level 1 (4331-type) version of MPGSWIFT • **MAXIMUM CONFIGURATION** represents the cost of a 25-year license for a Level 5 (3084-type) version of MPGSWIFT, with the following options: MPGDITTO, CPU-to-CPU Communications, DES, and TIPS/FSE.

Products Group. Since its acquisition, the product has been enhanced significantly by MPG, and offered as a competent small system TP associate to their RAMIS II database management system.

Since our last report one year ago, MPGSWIFT I, the single-thread version of the system, has been discontinued. MPGSWIFT II, the multithread version (referred to simply as MPGSWIFT), is now the sole Mathematica entry-level TP monitor. MPGSWIFT handles all code conversion, intrasystem communication, polling, message switching, broadcasting, and other terminal-oriented operations. Several optional facilities can be tailored into the system. Some are no-charge selective options; others are extra-cost add-ons. Since our last report, the pricing structure for MPGSWIFT has changed. Now, several options that were selectable and extra-cost items have been incorporated into the basic system, with an associative increase in the base system license cost. These include the network and protocol interfaces, the printer spooling option, the DBMS interfaces, and the PL/1 and RPG language interfaces.

An upward-compatible replacement for MPGSWIFT has recently become available from Mathematica. ATLAS, a DOS/VSE and OS/VS TP monitor that incorporates all of the major capabilities available in MPGSWIFT, plus many additional capabilities (please see referenced product report in this section). This new monitor is obviously MPGSWIFT's successor. A fact emphasized by the substantial conversion credits being offered MPGSWIFT users to upgrade.

While ATLAS provides the upward migration path for MPGSWIFT I and II users, Mathematica continues to offer and support the MPGSWIFT products for those who do not require all the bells and whistles of ATLAS. In our opinion, however, this situation has all the earmarks of laying the groundwork for MPGSWIFT's demise in the very near future. In fact, it has been more than 2 years since there have been any changes or enhancements to the product, outside of changes to the pricing structure.

□ Strengths

MPGSWIFT provides a small-to-medium-size installation running a DOS operating system with a flexible, high-performance TP monitor that is relatively easy to install and to use. Once the system has been tailored by the installation team to meet a particular network configuration, MPGSWIFT can practically operate by itself. The hardware configuration control tables can be altered very easily without regenerating the entire system.

Security is one of the major benefits afforded by MPGSWIFT. Several levels are supported: passwords; data set, terminal, and system ID codes; and, if desired, user-written security routines. In fact, MPGSWIFT supports a "Userhook" facility that provides users with all the tools required to insert any specialized routine into the MPGSWIFT environment.

For MPGSWIFT users operating in a nonvirtual environment, a Fast Loader Option allows a program awaiting transient area space to be selected directly from the core image library and placed on a fast load disk file until it is ready to be loaded. This option reduces the wait time on the system and could reduce response time significantly. MPGSWIFT generation options are presented in a single YES/NO selection format, and Mathematica's documentation clearly spells out the advantages and disadvantages associated with each option.

□ Limitations

A product as sophisticated as MPGSWIFT is bound to contain a few limitations that may or may not be significant, depending on each user's environment. For example, one major inherent limi-

Mathematica Products Group MPGSWIFT TP Monitor System

tation is a lack of support for any of the newer IBM TP access methods, such as TCAM or VTAM. All MPGSWIFT coding is based on the ancient BTAM access method, with some EXCP coding thrown in. Also, many of MPGSWIFT's testing facilities can, if not thoroughly understood, seriously degrade the performance of the entire operating system environment. Another limitation is that MPGSWIFT does not permit a write record capability unless the file has been predefined for the record. Users can either rewrite or change an existing record. All file facilities must be predefined for MPGSWIFT, including the file definition descriptors (DTFs). Because MPGSWIFT handles all file manipulation, information such as FILE SECTION data and LINKAGE SECTION parameters are not permitted in COBOL programs. This prohibition could lead to a great deal of application program recompilation and rewriting, especially if users want to integrate many previously written application programs into the system.

Many MPGSWIFT features require considerable attention from the operator/programmer. For example, if an operator wants to take a partition dump, the monitor must be terminated. This means that all terminals on the network must be notified, and all lines, except the one for the operator initiating the dump, must be disabled. Otherwise, there will be chaos on the system. Also, users who want to run a trace program must bar application programs from the upper 4K bytes of memory because this portion is required by the trace program. The MPGSWIFT philosophy of putting the responsibility for data control in the hands of the users yields extraordinary flexibility but demands very strict operational rules to avoid the possibility of data destruction.

■ OVERVIEW

Terms & Support

Terms • all MPG products are priced according to the power of the CPU as defined by International Data Corporation (IDC) performance determination of IBM mainframes • products are available on a 25-year license; a 60-month time payment plan is available for monthly fees equal to 2.4% of the single-payment fees; monthly fees for other time payment plans are available on request from the vendor; a month-to-month rental plan is available for monthly fees equal to 4.0% of the single-payment, 25-year license; conversion from a rental plan to a 25-year license allows the user to receive a credit equal to the last 2 months' payments.

Support • maintenance service is free for the first year of a paid-up lease and is included in the cost of a pay-out lease or rental plan; installation support is available for \$400 per day plus travel and living expenses; after the first year of a paid-up lease, the annual maintenance cost is 12% of the then-current 25-year lease price; additional documentation costs \$12.50 for a Systems Programmer Guide and \$25 for an Application Programmer's Manual; each additional Reference Card costs \$1 • additional training is available at rates of \$125 per person at vendor's education center to \$600 (not including travel and living costs) per day at the user's installation; consulting services are available on a per diem basis; contact vendor for rates.

Component Summary

MPGSWIFT is a generative TP monitor, meaning that many facilities can be incorporated into or eliminated from the final system as implemented at the user site. Several major options can be implemented in addition to the standard terminal support programs that make up the heart of MPGSWIFT. Some of these are: use of the system console as a monitor terminal to invoke utilities and user-written programs; an internal trace facility to fine tune the monitor; a SYSIN option, which permits users to decide whether the start-up JCL and control statement file should reside on the same SYSIN file; a general versus a specific poll capability; an enqueue/dequeue function to protect against simultaneous update problems; a CPU alarm function to warn users when established error criteria have been overstepped (e.g., looping); warm restart with Transaction File option versus cold start; the ability to establish memory-resident subroutines; an accounting file option for resource usage billing and usage analysis; and an AUTO-RETURN facility that can be used to prevent lockout due to heavy I/O usage by a single program. ISAM users converting to a VSAM

environment are supplied with a feature that converts all ISAM calls to VSAM calls without the need for extensive program conversion. An ABEND interception routine is optionally available to perform message transmission and logging.

The Data Entry System (DES) is a standalone data entry system that can be interfaced with MPGSWIFT or ATLAS to provide a menu-driven screen system with a set of comprehensive data validation capabilities. It uses a command vocabulary along with the 3270 terminal PA (Program Attention) and PF (Program Function) keys to activate data retrieval, format control, batch control, data verification, and standard data entry editing.

The Terminal Interactive Programming System (TIPS/FSE) provides users with online program development and update facilities. It can be used to initiate and control the performance of user-constructed job streams and provides a supportive environment for program testing and source code modification. TIPS/FSE operates either in the same partition as MPGSWIFT or as a stand-alone product. Its run control monitor initiates application programs in a different partition. TIPS/FSE and DES share the same TDAM file.

MPGSWIFT • Level 1 (4331-type):

\$11,000	1cns	\$440/\$264	mo	\$1,320	serv
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MPGSWIFT • Level 2 (4341-type):

14,000	560/336	1,680
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MPGSWIFT • Level 3 (4381-type):

17,000	680/408	2,040
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MPGSWIFT • Level 4 (3081-type):

19,000	760/456	2,280
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MPGSWIFT • Level 5 (3084-type):

22,000	880/528	2,640
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Host Computer/Operating Systems

MPGSWIFT can be implemented on any System/370, 3000, 4300, or compatible computer capable of running under DOS/VS, DOS/VSE, or any of the popular independent replacement operating systems. POWER/VSE and similar replacement spooling programs are also supported. The host CPU must have the hardware Storage Protect feature installed in order to run MPGSWIFT.

Minimum Operating Requirements

The memory requirements for MPGSWIFT are variable and depend on the size of the network being supported, on the size of the largest application program, and on the implemented options. A minimum average system requires at least 40K bytes for the root phase and another 40K bytes plus the size of the largest application for the MPGSWIFT partition. The DES system in stand-alone mode requires about 50K bytes of memory; as a routine with MPGSWIFT, it requires about 24K bytes in the User Program Area (UPA). TIPS/FSE also operates out of the UPA and requires about 24K bytes of memory. The TDAM access method accounts for another 20K bytes of memory in the root phase.

Protocols & Network Interfaces

MPGSWIFT supports BSC and start-stop protocols only. It uses BTAM to control the network terminals. Both direct and dial-up line communications are supported. Options are included to support remote terminals, TTY, and the 3741 teleprinter.

LCNS: cost of a 25-year single payment license with first-year maintenance included. **MO:** first figure represents the month-to-month rental charge based on 4% of the current paid-up license price; second figure represents the monthly charge for a 60-month payout lease plan based on 2.4% of the license price monthly. **SERV:** the cost for annual maintenance on a 25-year license after the first year; based on 12% of the prevailing single-payment license price. Prices are effective as of February 1984.

Mathematica Products Group MPGSWIFT TP Monitor System

Access Methods

MPGSWIFT supports all standard IBM file access methods, including ISAM, VSAM, and DAM. In addition, it supports a proprietary access method called TDAM for use with TIPS/FSE and DES. A printer spooling function is also available for use with POWER/VS(E) and other supported spoolers.

DBMS Interfaces • several of the more popular DBMSs can be interfaced with MPGSWIFT; Mathematica's own RAMIS II system is one; others are Cincom TOTAL, Cullinet IDMS, ADR DATA-COM/DB, and IBM DBOMP.

Languages Supported

Applications programs written in most high-level languages can be handled under MPGSWIFT, including IBM assembly languages, standard and nonstandard COBOL language processors, FORTRAN, PL/1, and RPG.

TP MONITOR FACILITIES

The MPGSWIFT multithreaded communications processor executes in a partitioned environment exactly as any other system application program. It maintains external and internal tables that keep track of the terminals on the network and how the terminals are to be supported (security codes, line and terminal characteristics, etc). When a terminal requests service, MPGSWIFT loads the requested program from the operating system library into its partition. The program then assumes control and invokes terminal and file manipulation activities through MPGSWIFT by means of CALL statements. MPGSWIFT can be thought of as a centralized housekeeping routine. It uses BTAM to dispatch and receive data from local or remote terminals, and it manages data movement to and from online disk files built through the standard IBM access methods or its own TDAM access method.

SAVE/RESTORE Facility

Each terminal in the network is assigned a unique save area, called the System Work Area (SWA), on the MPGSWIFT roll file located on disk. The SWA can be used as a scratch pad by the application program, as a buffer for input queue overflow, or as a spool area for terminal printing and/or query. Two SWAs are assigned to each terminal. One is the terminal's save area, and the second is for queue overflow. Many user SWAs can also be constructed. A user SWA can be accessed by any program from any terminal on the system.

The SWA is a 3500-byte unblocked record on the roll file. The roll file entry maintains all the reinitialization data required to reinstate (or restore) a frequently loaded program. Any saved data supplied to the restored copy of the program. This facility permits a terminal operator to reexecute a program simply by depressing the ENTER key on the terminal.

AUTO-RETURN

This facility is designed to automatically partition lengthy programs that could monopolize the system. The AUTO-RETURN facility partitions long program cycles by forcing unconditional interrupts within the cycle.

Polling Facilities

MPGSWIFT users can select a generalized polling technique or a specific polling option. With generalized polling, MPGSWIFT polls the control unit on the remote line. The control unit then interrogates each of the terminals attached to it. If more than one terminal requests service, a selection algorithm is used to randomize the selection process. Theoretically, a terminal could be randomized into perpetual lockout, but in practice the probability of lockout is vanishingly small.

With the specific polling option, MPGSWIFT similarly polls each terminal on a given control unit for service requests. MPGSWIFT then refers to a file of maintained statistics on "last attached" terminals to determine the servicing schedule. This queued stack form of guarantees equitable terminal servicing, but it is frequently slower than the general polling technique because 2 passes must be made through the terminal list.

Message Switching • supports transfer of messages from any terminal on the system to any or all other terminals on the system; up to 240 characters of information can be transferred; messages can be directed over any line or group of lines on the system without modifying other lines.

Printer Support • support is provided by the PA1 key on the 3270; all requests are directed to spool file on disk printing; terminal is free as soon as records are written to spool file.

Input Mapping • supports 3270-type devices; allows for native mode program code using field-addressing capability of hardware to input data streams.

Timer Support • initiates programs automatically after stated interval of time has elapsed; monitor formats entry in input queue and sets timer for user-specified interval; entry is dequeued and executed without intervention; normally used to execute a program that computes totals and statistics at predetermined intervals.

Transaction Logging • logs transactions for batch processing, file backup, and recovery; keeps transaction activity statistics; record format is designed by the user; used in combination with warm restart option.

Accounting File Option • provides system usage statistics; statistics are maintained for both online and program usage; can be used to institute user billing system; can be used to analyze overall system performance and online application efficiency; accounting file is treated as 2 files so that flip-flop action automatically takes place when first file is full; operator is notified for off-line dumping of full file; monitor subroutine maintains file, blocks records, and writes records to accounting file; file must be on same type of device as roll file.

Editing Facilities • can be used to convert graphics data to binary data; converts standard internal hexadecimal format to printable hexadecimal format; provides for editing of numeric fields; can read both formatted and nonformatted data streams.

User-Selectable Options

MPGDITTO • is an online disk display program; operates as an application program under MPGSWIFT; provides terminal users with test and debugging facilities, including scanning of disk labels, VTOCs, and individual file records; acts as a utility program to the monitor.

MPGDITTO • Level 1:

	\$1,000 lcms	\$40/\$24 mo	\$120 serv
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MPGDITTO • Level 2:

	1,500	60/36	180
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MPGDITTO • Level 3:

	2,000	80/48	240
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MPGDITTO • Level 4:

	2,500	100/60	300
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MPGDITTO • Level 5:

	3,000	120/72	360
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CPU-to-CPU Communications • provides ability to transmit a file, card images, or tape contents from one machine to another; supports transmittal of information to another CPU, to a remote batch terminal, or to an IBM System/3 or HASP workstation.

CPU-to-CPU • Level 1:

	2,500	100/60	300
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CPU-to-CPU • Level 2:

	3,000	120/72	360
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CPU-to-CPU • Level 3:

	3,500	140/84	420
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CPU-to-CPU • Level 4:

	4,000	160/96	480
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CPU-to-CPU • Level 5:

	4,500	180/108	540
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Mathematica Products Group MPGSWIFT TP Monitor System

■ USER INTERFACES

□ Data Entry System (DES)

DES can be installed on a standalone basis or implemented as an option in an MPGSWIFT configuration. It supports IBM 3270-type terminals for data entry and verification. All data records are entered into a batch and are written to the TDAM file. Simultaneous use of data on the TDAM file is prevented; only users who have opened the batch file can use it. Data can be extracted from the TDAM file either by off-line utility functions or by a user program CALL statement. A set of utility functions allows the batch data to be transferred to another medium or to be printed on a line printer.

The DES program is menu driven. Many of its functions are performed automatically through the use of the terminal's PA (Program Attention) keys. Besides performing data entry and verification functions, DES supports chaining of screen formats, stores information in batches, and allows users to browse through the TDAM file.

There are 4 DES modes. The format control mode allows users to create and maintain screen formats that the operator can use to enter, verify, or retrieve information from online files. The batch control mode allows users to perform administrative tasks such as opening batches, receiving entries, closing batches, and changing associated information. Verify mode allows users to verify a batch by rekeying or by sight and optionally supports changes, additions, and/or deletions. In data retrieval mode, users can review records from an online file directly on the CRT screen. The Data Retrieval mode supports browsing.

DES Standalone • Level 1:

	\$8,000 linc	\$320/\$192 mo	\$960 serv
DES Standalone • Level 2:	9,000	360/216	1,080
DES Standalone • Level 3:	10,000	400/240	1,200
DES Standalone • Level 4:	11,000	440/264	1,320
DES Standalone • Level 5:	12,000	480/288	1,440
DES (Option to MPGSWIFT) • Level 1:	5,000	200/120	600
DES (Option to MPGSWIFT) • Level 2:	5,500	220/132	660
DES (Option to MPGSWIFT) • Level 3:	6,000	240/144	720
DES (Option to MPGSWIFT) • Level 4:	6,500	260/156	780
DES (Option to MPGSWIFT) • Level 5:	7,000	280/168	840

DES Standalone • Level 2:

DES Standalone • Level 3:

DES Standalone • Level 4:

DES Standalone • Level 5:

DES (Option to MPGSWIFT) • Level 1:

DES (Option to MPGSWIFT) • Level 2:

DES (Option to MPGSWIFT) • Level 3:

DES (Option to MPGSWIFT) • Level 4:

DES (Option to MPGSWIFT) • Level 5:

□ Transaction Interactive Programming System (TIPS/FSE)

TIPS/FSE can also be implemented on a standalone basis or as an option to MPGSWIFT. Operating as an application program in an MPGSWIFT environment, TIPS/FSE coresides with MPGSWIFT in the same partition. The TIPS/FSE run control monitor, however, is invoked in a separate partition when it is controlling the execution of the constructed input job streams. TIPS/FSE is a program development tool that allows programmers to create, review, debug, modify, and execute application programs from a CRT terminal. Programs created with TIPS/FSE, along with programs extracted from the DOS system's core image library, are classified as "books" in the TDAM file. These books, which are libraries of programs normally classified by application programming languages, are selected from the TDAM file for execution in separate partitions.

Any TIPS/FSE-initiated program can access any other file on the system. The connection between the TIPS/FSE member to be executed and the partition selected for program execution depends on either the TIPS/FSE run control monitor or on a driver program that interfaces with a spooling system supported under MPGSWIFT. The supported systems currently are POWER/VS(E) with the IBM DOS/VS(E) system, ESF with the Nixdorf EDOS/VS system, and SAGE with the Software Pursuits DOS/MVT/VSE operating system.

TIPS/FSE syntax is specific. All commands and statements are screen formatted in fixed positions on the menu-oriented screen. A full list of features to support full-screen entry and editing (FSE) is provided, including cursor type-over, upper-/lowercase support, use of hardware editing keys, and more. The repertoire of statements is small but relatively rich. COPY allows users to create a new TIPS/FSE book and then copy all or part of existing books into the newly created book. CREATE allows users to begin a new book on the TDAM file. Other commands allow for displaying and reviewing a book, for listing book (or program) contents, and for scanning, updating, renaming, and running a program within a book.

Users must note that regardless of what medium the TIPS/FSE output is eventually scheduled to go on, when jobs are submitted for batch execution using the RUN command and the TIPS/FSE run control monitor, the format of the output statement can reflect only disk output. If not, any job running under the monitor or driver will be cancelled. This restriction does not apply when a job is submitted to execute under any of the system-supported spooling subsystems (e.g., POWER/VS). The RUN operation is used to execute TIPS/FSE books in the assigned batch partition. It causes the book identified in the run book file of the command to be selected. When a RUN is requested, a run queue entry is created on the TDAM file, and the assigned run number is displayed at the top of the TIPS/FSE operation screen. When the run control monitor is executed in a batch partition, it scans the TDAM file for run queue entries, selects the one with the lowest run number and the highest priority among those that can be run in the partition, expands it into a SYSIN job stream, and passes control to the DOS system for execution. Neither TIPS/FSE nor MPGSWIFT need be running to permit the control monitor to function.

TIPS/FSE Standalone • Level 1:

	\$6,000 linc	\$240/\$144 mo	\$720 serv
TIPS/FSE Standalone • Level 2:	7,000	280/168	840
TIPS/FSE Standalone • Level 3:	8,000	320/192	960
TIPS/FSE Standalone • Level 4:	9,000	360/216	1,080
TIPS/FSE Standalone • Level 5:	10,000	400/240	1,200
TIPS/FSE (Option) • Level 1:	5,000	200/120	600
TIPS/FSE (Option) • Level 2:	5,500	220/132	660
TIPS/FSE (Option) • Level 3:	6,000	240/144	720
TIPS/FSE (Option) • Level 4:	6,500	260/156	780
TIPS/FSE (Option) • Level 5:	7,000	280/168	840

TIPS/FSE Standalone • Level 2:

TIPS/FSE Standalone • Level 3:

TIPS/FSE Standalone • Level 4:

TIPS/FSE Standalone • Level 5:

TIPS/FSE (Option) • Level 1:

TIPS/FSE (Option) • Level 2:

TIPS/FSE (Option) • Level 3:

TIPS/FSE (Option) • Level 4:

TIPS/FSE (Option) • Level 5:

■ USER REFERENCE LIST

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

Mathematica Products Group MPGSWIFT TP Monitor System

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• END

MCI Telecommunications

Customized Business Communication Services

■ PROFILE

Function • interstate voice-grade, digital, and wideband, switched and dedicated channel, carrier network services for voice, message, data, and facsimile transmission.

Facilities • primarily terrestrial microwave facilities using analog or digital transmission techniques; some usage of satellite-based facilities • terrestrial extension channels expand access to many areas.

Services • voice/data/facsimile/teleprinter transmissions • metered use business, residential, Execunet, WATS, Hotel WATS, Credit Card, and Quickline services • dedicated voice-grade leased line and extension point services • digital services up to 56K bps or at 1.544M bps (T1) • wideband analog transmission at 240 KHz to 960 KHz • Common Control Switching Arrangement service (CCSA) • multiple access data collection and program channel services • facsimile services.

Access • public dial-up lines; dedicated leased lines to 9600 bps • service generally provided to major metropolitan areas • extension point service to other communities • nationwide calling throughout the contiguous United States • international calling • 96 microwave relay entrance sites nationwide.

First Available • 1972.

Number Users • over 1 million customers.

Comparable Services • American Satellite, AT&T Communications, RCA Americom, Satellite Business Systems, U.S. Transmissions (ITT), and Western Union for on-site dedicated channels; AT&T Communications DDD and WATS, and GTE SPRINT for switched voice-grade services.

Vendor • MCI Telecommunications Corporation; 1133 19th Street, Washington, DC 20036 • 202-872-1600.

Canadian Headquarters • none.

■ ANALYSIS

MCI's customized Business Communication Services span a broad range of customer services and include dedicated analog voiceband, digital, and wideband offerings, as well as metered-use services, a facsimile service, and a data collection service. Such a broad range of services not only satisfies the needs of many applications within the business communication environment, but those of residential customers as well. MCI has gained prominence as a long-distance carrier through AT&T—alternative offerings at a substantial cost savings. Founded in 1968, it has become the largest independent competitor in the long-distance telephone market. MCI's service is available in the contiguous United States with destination points in Alaska, Canada, Hawaii, Puerto Rico, and the U.S. Virgin Islands. Overseas destination points are reachable through MCI's International Service, which is available through most of its metered-use services.

MCI entered the international telecommunication market late in 1981, with a letter of agreement to purchase Western Union International (WUI) from Xerox Corporation, WUI is a leader in the international communication field, offering a range of subscriber services between the U.S. and more than 100 foreign countries, including Telex, Cablegram, and private leased channels, for data transfer.

MCI's Dedicated Leased Line Service, an alternative to AT&T Communications' Private Line Service, now offers digital services equivalent to the Accunet DATAPHONE Digital Service (DDS) and Accunet T1.5 Service; however, digital service is currently limited to about 20 major cities.

MCI Leased Line Minimum Usage Costs

Configuration • 189-mile channel; New York to Boston • 2-point channel arranged for alternate voice/data service at 9600 bps.

Minimum Start-Up Costs • \$210 total • consists of \$50 to process installation order and total of \$160 to install a circuit termination in each city.

Minimum Monthly Operating Costs • \$507.78 per month total • consists of \$350.28 per month for channel mileage; \$157.50 per month for 2 circuit terminations.

MCI's metered-use services includes Execunet, Quickline, MCI WATS, Hotel WATS, and Credit Card Service. Execunet essentially duplicates AT&T's direct-distance dialing (DDD) toll service, but at substantially lower prices. MCI prices for business day service typically average 15 percent less; night and weekend long-distance rate savings can be as high as 50 percent with average savings of about 35 percent. The dollar savings do not come without side effects, at least not now. At present, Execunet customers require Touch-Tone instruments, and this locks out roughly two-thirds of the telephones in operation in the United States. Moreover, users outside equal access locations must "punch" in as many as 24 digits to establish a connection, and calls, for the most part, are restricted to interstate traffic. However, these drawbacks will soon be relegated to the dustbin of history. The settlement of the AT&T antitrust trial requires that the divested operating companies provide equal access to all parties. Equal access began to become effective in April 1984 with Charleston, West Virginia. Since then, it has spread across the U.S. and is now available in many areas within major U.S. cities. It will continue its spread until all areas nationwide will have equal access. An equal access subscriber need dial only a "1" followed by the standard 10-digit number to connect to the desired destination. MCI will retain its 22-digit dialing in equal access areas and will also allow nonsubscribers to access MCI service by dialing 10222 for specific calls.

In judging the appeal of MCI service on economic grounds, the user must ascertain his own traffic history. There is a front-end MCI cost to be considered; typically, a \$5 or \$10 a month subscription fee is levied; or else the user may opt for a \$75 a month minimum use charge.

Quickline is an MCI variation of AT&T Communications' Private Line Service. Both services base their charges on airline distances, but unlike AT&T's fixed monthly charge, MCI's Quickline is a metered-use service billed on a per-minute basis—no discounts and a minimum service charge per line. Based on usage, it can be considerably less expensive than AT&T's service. However, Quickline is limited to just 54 major U.S. cities.

MCI WATS and Hotel WATS are akin to AT&T Communications WATS. Hotel WATS is a variation of MCI WATS, and is available to those customers whose distribution of total monthly traffic for a Service Group is such that at least 20 percent of the traffic occurs within each of the 3 rate periods. Both services use the same rate table, but Hotel WATS billing is based on the call origination location and the terminating Service Area. MCI WATS billing is based on the Service Area to which the customer subscribes, and includes services to all lower-numbered Service Areas. Calls cannot be placed to destinations within higher-numbered Service Areas. MCI currently does not offer an in-WATS service

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equivalent to AT&T Communications 800 Service.

MCI's Credit Card Service allows customers to place calls from touch-tone phones anywhere in the contiguous U.S. Charges are usage sensitive and are based on airline mileage rate period and call origination area. Calls can be placed via a 7-digit access number or an 800 toll-free number depending on call location. MCI has begun introducing credit-card public telephones at airports and other busy locations. These MCI phones will accept national credit cards including MasterCard or VISA.

Strengths

MCI has become the largest independent telecommunication carrier in the industry. Its total current assets for 1984 were \$1.5 billion and is compared with total current liabilities of \$481 million. Its 1984 net income was 156 million on revenues of \$1.7 billion. MCI has invested over \$2 billion in its communication network, which consists of 17,000 route miles of high-capacity transmission facilities, including a microwave backbone and fiber-optic and satellite links as well as digital tandem and packet switches. In 1984, MCI expanded its network with a new microwave route across mid-U.S. When completed, the route will extend from Baltimore to San Francisco. MCI is also expanding its network with fiber-optic links. In March 1984, MCI inaugurated its link between Washington, DC and New York, which links all major cities along the route. It is the longest (229 miles) and highest capacity single mode fiber-optic link in operation. The cable consists of 27 pairs of fiber and can carry 820,000 simultaneous conversations. MCI's currently adding fiber-optic links between cities and is planning many more. Satellites augment MCI's terrestrial network where needed to reach remote locations. In 1984, MCI launched 2 spacecrafts, each with 12 transponders.

MCI's strengths are fundamentally its compatible services and low costs. It offers a variety of needed services that appeal to business and residential customers alike at substantial cost reductions over AT&T Communications. And it is adding services that are heavily in demand. Among these are MCI Mail, nationwide electronic mail service, a public credit card telephone service available to customers in air terminals and other busy locations, and cellular telephone service throughout the nation to respond to the mushrooming mobile telephone market, which forecasts 1 million car telephone users by 1990; and paging, also a rapidly expanding market, which expects to reach 20 million pagers by the end of the decade.

So, in assessing the strengths of MCI, and there are many, one might list the growth record, the installed base of capital equipment, the large following of satisfied customers, the economic incentives for users, and the array of telephonic services which directly compete with AT&T. These assets are substantial and important, but in the turbulent period which lies ahead, MCI's greatest strength probably lies in its awesome management ranks. Young, aggressive, and smart, the MCI executive team steered the company through a very precarious period of its history without losing sight of the ultimate business objectives. For this, it rates high grades and one can reasonably pre-suppose that MCI will prosper and expand in the opportunistic communication market which is opening up.

Limitations

The limitations of the MCI service are well known. Lack of easy access in some geographical areas, service restrictions due to an occasional shortage of facilities, and the requirement for a Touch-Tone telephone along with an excessive amount of digit "dialing," in nonequal access areas, are certainly factors worthy of consideration. But the cost savings of the MCI service have found a market among budget-conscious users. These limitations will eventually disappear as more MCI plants come on-stream and the equal access provisions of the consent decree take effect. Equal access, however, cuts both ways; it also means equal charges for local interconnect via the operating companies.

MCI's data transmission facilities are extremely limited with service offerings only up to 9600 bps under Execunet and its variants. MCI's Digital Service, inaugurated in mid-1984, is equivalent to AT&T Communications' Accunet DDS and T1.5 services, however, the number of MCI access cities for Digital

Service is currently only about 20. MCI must expand its access locations considerably to efficiently compete with AT&T Communications. MCI does offer a wideband service which provides 960 KHz of bandwidth, but its digital-data carrying capacity will vary with the digitizing equipment employed by the user, plus the service is limited to only 3 city pairs, a severe restriction. Voice inputs, for example, are quantized by Pulse Code Modulation (PCM) or Continuously Variable Slope Delta (CVSD) digitizing techniques. Under PCM, each voice input requires 64K-bps bandwidth, while CVSD can quantize voice at 16K or 32K bps. In the wideband arena, MCI will receive very stiff competition from AT&T Communications' Accunet T1.5 Service. This facility offers nationwide terrestrial data services at 1.544M bps, and is priced very attractively.

In the emerging post-consent decree world, the comfortable price advantage enjoyed by MCI might suffer erosion. MCI pays operating companies for local loops at the origin and termination points. Historically, the other common carriers have paid less than AT&T for local loop service. But this will change. Also, would a "lean and mean" AT&T, stripped of a lot of baggage, opt for a long-distance rate decrease to combat the competition? Probably not a very likely scenario for AT&T in the short run, given the internal dynamics of its financing, and the gigantic share of the long-distance market which it controls.

■ NETWORK

Terms & Conditions

Billing Criteria • dedicated leased line charges are based on monthly charges for circuit mileage; a short-haul monthly surcharge is also levied for circuits less than 176 miles • Execunet service charges are based on monthly charges for circuit mileage, elapsed call time, period of day, and a subscription fee or monthly minimum use charge • monthly charges include: elapsed time, circuit termination, and a subscription fee or monthly minimum use charge • monthly charges for Quickline service • monthly Credit Card service charges include: mileage, elapsed time, and period of day, plus an access charge per call • Extension Point service monthly charges include the passthrough charges from a participating common carrier and an MCI access charge per circuit • Wideband service monthly charges are on a mile-per-month basis plus a monthly access charge • monthly charges for CCSA service are based on a customer selected Data Access Arrangement.

Billing Conditions • minimum 1-month (30-day) service; service offered on 24-hour day basis; 30-day advanced notice for cancellation; service also offered on metered-use basis; advance deposits may be required; at MCI option, deposit may be refunded or credited to customer prior to service termination • customer responsible for payment of service charges; recurring charges billed in advance; one-time nonrecurring charges payable on completion of task • billing payable upon receipt; interest at 1.50 percent per month (unless proscribed by law, in which event, at the highest rate allowed by law) accrues upon any unpaid amount commencing 35 days after billing date • pre-payment credits offered by MCI are financial transactions subject to separate letter agreements.

Other Conditions • services offered subject to availability of facilities and provisions of MCI tariff • MCI reserves the right to discontinue service upon written notice • services shall not be used for unlawful purposes • services shall not be used for purposes for which any payment or other compensation is received by customer except when customer is a duly authorized common carrier; joint-user, nonprofit making, cost sharing is permissible.

Overview

Within the array of telephonic services at its beck and call, MCI has something for everyone; both business and residential. Besides a dedicated leased line service, the company provides 5 versions of its metered use communication service, a wideband transmission offering, extension point facilities and a common control switching arrangement. Less popular services also available under tariff include facsimile, multiple access data collection, and program channel service.

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Dedicated Leased Line Service, which mirrors AT&T Communications' Private Line and Accunet Services, is offered in the form of discrete intercity communications facilities which are dedicated to the use of a specific customer and are billed at pre-determined fixed monthly rates. The customer may elect to have MCI provide local facilities, may provide his own, or may arrange for any combination thereof. Dedicated leased line service is offered in 5 transmission modes: Voice-Grade Service, Data Service; Alternate Voice/Data Service, Teleprinter Service, and Digital Service.

Voice-Grade Service is provided in increments of 1 or more voice-grade channels, each with nominal bandwidth of 4 KHz. Voice-grade channels or combinations of voice-grade channels may be utilized, on a permissive basis, for voice service, data service, facsimile service or combinations thereof, and may be interconnected with the facilities of other communications carriers and users for a customer's communication needs, such as voice connecting arrangements. **Analog Data Service** is offered at approximate data speeds of 0 to 300, 1200, 2400, 4800, 7200, or 9600 bits per second (bps). **Alternate Voice Data Service** is offered with the capability of voice-grade communication and data communication on an alternate use basis. If required, MCI will provide a handset at each circuit end as part of this service. **Teleprinter Service** furnishes transmission at speeds of 0 to 75 bps and 0 to 150 bps. **Digital Service** is available as Digital Data Service (DDS) at data rates of 2400, 4800, 9600, or 56K bps, or as Terrestrial Data Service (TDS) at 1.544M bps for T1 carrier transmission.

Metered use service furnishes intercity communication facilities which are shared among multiple users, and is provided on the basis of 5 distinctly different services (Execunet, Quickline, MCI WATS, Hotel WATS, and Credit Card). Execunet is comparable to AT&T Communications' toll services. The customer may select the manner in which calls are originated and terminated, may obtain 1-way or 2-way service, may enjoy point-to-point or multipoint service, or may originate calls in multiple cities.

Quickline is a nondiscounted 2-way point-to-point service using dedicated facilities between customer premise and MCI's terminal location. MCI WATS is equivalent to AT&T Communications WATS while Hotel WATS is a variation of MCI WATS that, unlike MCI WATS, allows subscriber calls to any geographic location, but is available **only** for **qualified usage**. Credit Card Service is a 1-way dial-in/dial-out multipoint service that allows customers to place calls via MCI-provided local business telephone lines in multiple designated serving cities. Calls may terminate in all contiguous U.S. cities, Hawaii, Alaska, Puerto Rico, and the U.S. Virgin Islands.

International Service is available for call termination to all customers of Execunet, MCI WATS, Hotel WATS, and Credit Card Service. Domestically originated calls can be made to Europe, the Middle East, South Africa, Australia, South America, and Canada.

Metered use service involves, at the customer's choice, a monthly subscription fee or a recurring minimum charge for intercity facility usage. A monthly listing of each call and its duration is available as a standard feature. At additional cost, each metered use service offers a customer the ability to identify the users and allocate the cost of his long-distance facilities through the use of authorization codes, reduce the amount of dialed digits through the use of speed numbers, and receive their call records on magnetic tape.

Under each of the metered use services, the individual customer's total monthly charges for their use of the intercity communication facilities are based upon the total time the customer utilizes such facilities. In that regard, individual intercity facilities usage charges, as well as other specific charges, discounts and/or features are applicable to each individual service. When a metered use service call is established in one time-of-day rate application period and ends in another, the rate in effect in each rate application period applies to the portion of the call occurring within that rate application period.

Execunet service is a 1-way, dial-in/dial-out multipoint service allowing the customer to originate and terminate calls via MCI-provided local business telephone lines. Subscribers to Execunet service may originate calls only in the city or cities in which they maintain an active Execunet account. Customers may

terminate calls in all service cities as listed in the Execunet Access section following. All Execunet calls are rounded to the next higher full minute.

Metered use Quickline service provides a nondiscounted 2-way, point-to-point service requiring the customer to originate and terminate calls via dedicated facilities between his premises and MCI's terminal location. At additional cost, the customer may elect to have the service operate without any dialed digits (pre-programmed automatic signaling). All Quickline calls are rounded to the next higher 30-second increment.

Metered use Credit Card service, a 1-way dial-in/dial-out multipoint service, allows the customer to originate calls via MCI-provided local business telephone lines, in multiple designated serving cities. Credit Card customers may terminate calls in all cities within the contiguous United States. All Credit Card service calls are rounded to the next higher full minute.

Wideband service is offered utilizing a minimum of 240 KHz of bandwidth transmitted between any given city-pair and is subject to a minimum usage period of 5 months at the appropriate monthly charge. Should the customer desire to cancel the Wideband service within 11 months of inauguration of service, a 60-day written notice is required. After such time period, the normal 30-day cancellation notice is applicable. Customers utilizing a 240 KHz bandwidth facility between a given city-pair may order additional Wideband service in minimum increments of 48 KHz between the same 2 locations. Subject to availability of facilities, Wideband service is offered between given city-pairs, up to a maximum of 960 KHz of bandwidth.

For customers who desire access to locations not served by MCI, MCI offers, at its prerogative, service via the facilities of other common carriers connected to the closest MCI terminal location equipped to furnish the required MCI service. Monthly rates, charged by the other common carriers for extension facilities, are passed through to the customer.

MCI's Common Control Switching Arrangement (CCSA) is a switching service for interconnecting network trunks furnished either by MCI or other participating common carriers. CCSA allows the user without a "smart" switch to optimize his mix of communication facilities without manual intervention.

A full-service version of CCSA, known as Option A (Telemangement), provides the user with a wide choice of basic functions. Least-cost-first-routing provides automatic selection of the least expensive facility available for each intercity call on an online basis. Route choices for this function are limited only by the total switch capacity. Another useful Option A function provides dialed prefix codes to identify the calling party for authorization or accounting. The customer may select up to 100 codes (either authorization or accounting) per dedicated access arrangement. Abbreviated 4-digit dialing codes (speed numbers), limited to 2 codes per dedicated access arrangement, permit convenience dialing of frequently called numbers. Priority level routing arrangements on CCSA Option A, apply routing restrictions to certain trunk groups based upon authorization codes. The customer can designate 3 levels of personnel priority by authorization code.

A tone notification function provides an audible signal to the user before a particular trunk group (usually a higher cost trunk) is automatically selected. As part of the CCSA Option A accounting offering, the customer is provided with monthly call detail and authorization/accounting code reports. For additional monthly charges, the CCSA Option A user can obtain other reports including: high volume and WATS band call traffic destination by half-hour segment, area code traffic summary, and area code traffic detail. Also, for an extra monthly charge, summary authorization/accounting reports and call records are available on magnetic tape.

The limited service, lower cost, CCSA Option B provides a least-cost-first-routing function, which is limited to 3 route choices, and monthly reports of call detail. For an extra monthly charge, the Option B user can allocate up to 99 accounting codes per originating location.

Other less frequently used MCI services deserve mention. A multiple access data collection service is offered at data speeds up to 300 bps interfacing with data processing and/or computer

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switching equipment. Data transmitted via these channels to and from customer-provided equipment may be stored, forwarded to other locations, converted as to speed or code, or returned to the customer in the same or different form, as required. These low-speed data channels (minimum of 20 prior to inauguration of service) will be concentrated into a single channel by MCI at an MCI terminal and transmitted/received for computer access in broadband format at another MCI terminal. A Program Channel service, available 24 hours a day, 7 days a week, provides 1-way or 2-way transmission of audio program material in a choice of three bandwidths: 3.5 KHz, 5 KHz, and 8 KHz. Faxnet, an MCI facsimile service, provides a means for transmitting facsimile data between compatible authorized facsimile terminals or between an authorized facsimile terminal and an MCI Faxnet forwarding facility. If desired, MCI will supply the facsimile terminals. This service also provides for the forwarding of facsimile data from a Faxnet forwarding facility via the United States Postal Service, or the retention of facsimile data by MCI at a Faxnet forwarding facility for pickup by the subscriber, the addressee or his agent.

Dedicated Leased Line Service

Dedicated Leased Line Service is offered by MCI in the form of discrete intercity communication facilities which are dedicated to the use of a specific customer and are billed at pre-determined fixed monthly rates. The customer may elect to have MCI provide local facilities, may provide his own, or may arrange for any combination thereof. This service is available for **analog or digital transmission**, and is offered in the following modes: voice-grade service, analog data service, alternate voice/data services, digital data service, and terrestrial data service. These services are defined below.

Voice Grade Service • offered in increments of 1 or more voice grade channels, each with a nominal bandwidth of 4 KHz • these voice grade channels or combinations of voice grade channels may be utilized, on a permissive basis, for voice, data, facsimile service, or combinations thereof, and may be interconnected with the facilities of other communication carriers and users for a customer's needs, such as voice connecting arrangements.

Analog Data Service • offered at data speeds of up to 300, 1200, 2400, 4800, 7200, or 9600 bps.

Alternate Voice/Data Service • offered with the capability of voice grade and data communication on an alternate-use basis.

Teleprinter Service • offered at transmission speeds of up to 75 bps and up to 150 bps.

Digital Service • offered as Digital Data Service at transmission speeds of 2400/4800/9600/56K bps; or as Terrestrial Data Service at a transmission speed of 1.544M bps (T1).

Traffic Charges

Since MCI channels used in this service are leased full-time, customers do not pay for volume of traffic transmitted or connect time. Charges are assessed principally on the airline mileage between the MCI exchanges as well as access charges. MCI uses standard 4-digit vertical and horizontal (V and H) coordinate tables to calculate the inter-exchange mileage.

Mileage Charges

Charges are based on airline mileage calculated from standard vertical and horizontal (V and H) coordinate tables. A monthly short-haul charge is levied for analog service for each circuit less than 176 miles in length. MCI applies a reduced monthly mileage rate for long haul Teleprinter Service. Analog long haul charges are presented in **Table #1**. Digital Data Service Long Haul Charges are presented in **Tables #2** and **3**. Digital Terrestrial Charges are presented in **Table #3**.

Reduced Monthly Mileage Charge for Teleprinter Service • MCI applies a reduced monthly mileage rate for Teleprinter Service. The reduced rate is a percentage of the monthly mileage charges.

0 to 75 bps • Teleprinter Service:	50 percent
0 to 150 bps • Teleprinter Service:	75

Analog Service

Short-Haul Surcharge • a monthly short-haul surcharge for each leased circuit less than 176 miles in length; rate per circuit per month:

\$31.50 mo

Dedicated Leased Line Access Charges

A basic monthly charge is assessed for each circuit termination end. Customer is also charged an installation fee for each circuit termination end as well as a fee for each order processed to install one or more leased lines. The customer may elect to pay voice-grade termination charges for permissive data use. MCI warrants that if the customer selects a data termination, the circuit will operate within normally acceptable error rate parameters. If the customer desires additional line conditioning, MCI will provide via a special customer arrangement. A special access surcharge will be applied to each voice-grade equivalent circuit end for each access line provided by a local exchange carrier unless customer furnishes MCI with an Exemption Certificate.

Voice-Grade Service • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per circuit termination end; a monthly charge for each circuit termination end; and a surcharge for each voice-grade equivalent circuit end for access lines provided by a local exchange carrier.

Access line to customer premises:

\$50.00 ord	\$80.00 instal	\$36.75 mo	\$25.00 srchg
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Interconnection to an interstate switched private line service provided by another carrier:

50.00	80.00	36.75	25.00
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Local business telephone line:

50.00	80.00	111.30	25.00
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Analog Data Service • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per circuit termination end; a monthly charge for each circuit termination end; and a surcharge for each voice-grade equivalent circuit end for access lines provided by a local exchange carrier.

0 to 300, 1200, 2400, or 4800 bps:

50.00	80.00	36.75	25.00
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7200 bps:

50.00	80.00	78.75	25.00
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9600 bps:

50.00	80.00	78.75	25.00
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Alternate Voice/Data Service • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per circuit termination end; a monthly charge for each circuit termination end; and a surcharge for each voice-grade equivalent circuit end for access lines provided by a local exchange carrier.

0 to 300, 1200, 2400, or 4800 bps:

50.00	80.00	78.75	25.00
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7200 bps:

50.00	80.00	78.75	25.00
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9600 bps:

50.00	80.00	78.75	25.00
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Teleprinter Service • charges comprise one-time processing charge for each order for installation(s); one-time installation

MO: monthly charge. INSTAL: installation charge associated with specific network feature or option. ORD: charge per service order. MIN: charge per minute of use. NC: no charge. OTC: one-time charge. TRANS: transaction charge for Faxnet Class 4 & 5 service. SRCHG: per page surcharge for Faxnet Class 4 & 5 services. Prices current as of March 1985.

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charge per circuit termination end; a monthly charge for each circuit termination end; and a surcharge for each voice-grade equivalent circuit end for access lines provided by a local exchange carrier.

0 to 75 bps • Teleprinter Service:			
50.00	80.00	57.75	25.00
0 to 150 bps • Teleprinter Service:			
50.00	80.00	57.75	25.00

Digital Service • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per circuit termination end; a monthly charge for each cabinet termination end; and a surcharge for each voice-grade equivalent circuit end for access lines provided by a local exchange carrier:

Digital Data Service • at 2400 or 4800 bps:			
50.00	275.00	220.00	25.00
At 9600 bps:			
50.00	275.00	295.00	25.00
At 56K bps:			
50.00	275.00	435.00	25.00
Terrestrial Data Service • at 1.544M bps:			
50.00	2,000.00	1,000.00	600.00

Customer-Provided Business Telephone Line • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per circuit termination end; and a monthly charge for each circuit termination end:

50.00	80.00	36.75
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Additional Feature Charges

Additional Extension Handset Connection • one-time charge per connection:

\$35.00 OTC

Call Records on Magnetic Tape • charge for each recorded reel of magnetic tape per month:

100.00 mo

One-Time Set-Up Charge • one-time charge to set up system to provide monthly call records on magnetic tape; charge per account:

500.00 OTC

Central Office Multiplexing • provided by local telco for Terrestrial Digital Service per circuit end:

250.00 mo

Per Arrangement:

250.00 OTC

Digital Leased Line Service Access

MCI provides digital dedicated leased line services between the following metropolitan area terminal city locations:

- District of Columbia** • Washington.
- Illinois** • Bensenville; Chicago; Springfield.
- Indiana** • Indianapolis.
- Maryland** • Baltimore.
- Missouri** • St. Louis; Springfield.
- New Jersey** • Camden; Newark.
- New York** • New York City.
- Ohio** • Cincinnati.
- Oklahoma** • Oklahoma City; Tulsa.
- Pennsylvania** • Philadelphia; Pittsburgh.
- Texas** • Dallas; Richardson.
- Virginia** • Richmond.

TABLE 1 • MCI Analog Long Haul Charges*

Mileage Per Circuit	Base Monthly Rate	Monthly Rate Per Mile Over Base
1	\$ 60.75	\$0.00
2 - 15	60.75	2.12
16 - 25	90.43	1.76
26 - 100	108.03	1.34
101 - 1001	208.53	0.75
1001 - 1500	883.53	0.46
over 1500	1113.53	0.34

*Per circuit charge.

TABLE 2 • MCI Digital Long Haul Service — 2400 to 9600 bps*

Mileage Per Circuit	Base Monthly Rate	Monthly Rate Per Mile Over Base
1 - 50	\$ 28.00	\$1.36
51 - 100	28.00	1.36
101 - 500	83.00	.81
501 - 1000	168.00	.64
over 1000	468.00	.34

*Per circuit charge.

TABLE 3 • MCI Digital Long Haul Service — 56K bps*

Mileage Per Circuit	Base Monthly Rate	Monthly Rate Per Mile Over Base
1 - 50	\$ 119.00	\$4.76
51 - 100	119.00	4.76
101 - 500	315.00	2.81
501 - 1000	591.00	2.25
over 1000	1654.00	1.19

*Per circuit charge.

TABLE 4 • MCI Digital Long Haul Service — 1.544M bps* (Terrestrial)

Mileage Per Circuit	Base Monthly Rate	Monthly Rate Per Mile Over Base
1 - 50	\$ 400.00	\$30.00
51 - 100	600.00	26.00
101 - 150	800.00	24.00
151 - 250	1000.00	22.60
251 - 500	1300.00	21.40
over 500	2500.00	19.00

*Per circuit charge.

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Analog Access Cities

Arkansas • Little Rock.

Arizona • Tucson.

California • Anaheim; Bakersfield; Fresno; Inglewood; Los Angeles; Oakland; Palo Alto; Sacramento; San Diego; San Jose; San Francisco; San Jose; Sherman Oaks.

Colorado • Denver.

Connecticut • Bridgeport; Hartford; New Haven; Stamford.

Delaware • Wilmington.

District of Columbia • Washington.

Florida • Daytona Beach; Ft. Lauderdale; Jacksonville; Miami; Orlando; Tampa; West Palm Beach.

Georgia • Atlanta; Savannah.

Illinois • Bensenville; Champaign; Chicago; Downers Grove; Peoria; Rockford; Springfield.

Iowa • Cedar Rapids; Davenport; Des Moines; Iowa City; Sergeant Bluff.

Indiana • Evansville; Fort Wayne; Gary; Indianapolis; South Bend.

Kansas • Topeka; Wichita; Lexington; Louisville.

Louisiana • Shreveport.

Maryland • Baltimore.

Massachusetts • Boston; Springfield.

Michigan • Climax; Detroit; Grand Rapids; Lansing; Southfield.

Minnesota • Minneapolis; St. Paul.

Missouri • Creve Coeur; Kansas City; Olivette; Springfield; St. Louis.

Nebraska • Lincoln; Omaha.

Nevada • Las Vegas; Reno.

New Hampshire • Nashua.

New Jersey • Camden; Crystal Lake; Newark.

New Mexico • Albuquerque.

New York • Albany; Buffalo; Rochester; Ryebrook; Syracuse; White Plains.

Ohio • Akron; Cincinnati; Cleveland; Columbus; Dayton; Toledo; Youngstown; Oklahoma City; Tulsa.

Pennsylvania • Erie; Philadelphia; Pittsburgh.

Rhode Island • Providence.

South Dakota • Sioux City.

Tennessee • Knoxville; Memphis; Nashville.

Texas • Abilene; Amarillo; Austin; Bryan; Corpus Christi; Dallas; El Paso; Fort Worth; Houston; Irving; Longview; Lubbock; Orange; Richardson; San Angelo; San Antonio; Terminal; Waco.

Utah • Salt Lake City.

Virginia • Norfolk; Richmond.

West Virginia • Charleston.

Wisconsin • Madison; Milwaukee.

Analog Leased Line Service Access

Arizona • Little Rock; Phoenix; Tucson.

California • Anaheim; Bakersfield; Fresno; Inglewood; Los Angeles; Oakland; Palo Alto; Sacramento; San Diego; San Francisco; San Jose; Sherman Oaks.

Colorado • Denver.

Connecticut • Bridgeport; Hartford; New Haven; Stamford.

Delaware • Wilmington.

District of Columbia • Washington.

Florida • Jacksonville; Miami; Orlando; Tampa.

Georgia • Atlanta; Savannah.

Illinois • Bensenville; Champaign; Chicago; Downers Grove; Peoria; Rockford; Springfield.

Indiana • Evansville; Gary; Indianapolis; South Bend.

Iowa • Cedar Rapids; Davenport; Des Moines; Iowa City; Sergeant Bluff; Sioux City.

Kansas • Topeka; Wichita.

Kentucky • Lexington; Louisville.

Maryland • Baltimore.

Massachusetts • Boston; Springfield.

Michigan • Ann Arbor; Climax; Detroit; Grand Rapids; Lansing; Southfield.

Minnesota • Minneapolis; St. Paul.

Missouri • Creve Coeur; Kansas City; Olivette; St. Louis; Springfield.

Nebraska • Lincoln; Omaha.

Nevada • Las Vegas; Reno.

New Jersey • Camden; Crystal Lake; Newark.

New Mexico • Albuquerque.

New York • Albany; Buffalo; New York City; Rochester; Ryebrook; Syracuse.

Ohio • Akron; Cincinnati; Cleveland; Columbus; Dayton; Toledo; Youngstown.

Oklahoma • Oklahoma City; Tulsa.

Pennsylvania • Erie; Philadelphia; Pittsburgh.

Rhode Island • Providence.

South Dakota • Sioux Falls.

Tennessee • Knoxville; Memphis; Nashville.

Texas • Abilene; Amarillo; Austin; Bryan; Corpus Christi; Dallas; El Paso; Ft. Wayne; Houston; Irvine; Longview; Lubbock; Orange; Richardson; San Angelo; San Antonio; Sugarland; Terminal; Waco.

Utah • Salt Lake City.

Virginia • Charleston.

Wisconsin • Madison; Milwaukee.

Wideband Service

Wideband service, as offered by MCI, utilizes a minimum bandwidth of 240 KHz between any given city-pair. Service is subject to a minimum usage period of 5 months. Customers utilizing a 240-KHz facility between any given city-pair may order additional service in increments of 48 KHz between the same 2 locations. Maximum bandwidth between given city-pairs is 960 KHz. Charges for special arrangements including: engineering, construction, labor, facility costs, etc, are additional, and at the expense of the customer.

Long-Haul Monthly Mileage Charges

Initial 240-KHz Wideband Channel • charge per mile per month:	\$27.00 mo
Additional 48-KHz Wideband Channel Increments • charge per mile per month per increment	5.40

Access Charges

Customer service monthly access charges are applied to each city-pair.

Initial 240-KHz Wideband Channel • charge per city-pair per month:	\$2,000.00 mo
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Additional 48-KHz Wideband Channel Increments • charge per city-pair per month:

400.00

Access

Wideband service is currently offered between the following 3 city-pairs: Hammond, Indiana/Philadelphia, Pennsylvania; Irving, Texas/Denver, Colorado; and Irving, Texas/Los Angeles, California.

METERED USE SERVICES

Metered Use Service offers the use of intercity communication facilities shared among multiple users and is provided on the basis of 5 separate service options (Execunet, Quickline, MCI WATS, Hotel WATS, and Credit Card Service).

Depending on the option(s) chosen, the customer may select the manner in which calls are originated and terminated, may obtain 1-way or 2-way service, may enjoy point-to-point or multipoint service, or may originate calls in multiple cities.

Certain Metered Use Service involves, at the customer's option, a monthly subscription fee, a one-time initiation fee or a recurring minimum charge for intercity facility usage. A monthly listing of each call and its duration is available as a standard feature. At additional cost, certain Metered Use Service options offer a customer the ability to: (1) identify the users and allocate the cost of his long-distance facilities through the use of accounting codes, (2) reduce the amount of dialed digits through the use of speed numbers, and (3) receive their call records on magnetic tape.

Under each of the service options, the individual customer's total monthly charges for their use of the intercity communication facilities are based upon the total time the customer (account) utilizes such facilities. In that regard, individual intercity facilities usage charges, as well as other specific charges, discounts and/or features are applicable to each individual service option. When a metered use service call is established in 1 time-of-day rate application period and ends in another, the rate in effect in each rate application period applies to the portion of the call occurring within that rate application period. A specific description of each of the Metered Use Service options and its

recurring and nonrecurring charges, features, applicable discounts, and service availability follows.

Execunet Service

Execunet is a 1-way, dial-in/dial-out, multipoint, metered-use service allowing the customer to originate and terminate calls, via MCI-provided local business telephone lines. Calls can originate only in the city or cities in which subscribers maintain an active account. Customers in central offices where equal exchange access is available with established MCI accounts, may use Execunet on a direct-dial basis or by dialing the access number (10222). Customers in central offices where equal exchange is **not** available, may use Execunet by dialing a 7-digit access number. All calls are rounded to the next higher full minute. A Corporate Account Billing arrangement is available at the customer's option.

Execunet Traffic Charges

Traffic Charges are based on intercity airline, mileage, time-of-day, and day-of-week. Mileage is calculated using standard vertical and horizontal (V&H) coordinate tables according to AT&T Communications Tariff 274. U.S. Mainland and Mainland to Hawaii/Alaska charges apply to calls that originate in the cities as listed in the Access section and terminate in all cities within the contiguous U.S., Alaska, and Hawaii. U.S. Mainland to Puerto Rico/U.S. Virgin Islands charges apply to calls that originate in the cities as listed in the Access section except Honolulu and terminate in Puerto Rico and the U.S. Virgin Islands. Charges are on a per-minute basis, and are presented in **Tables 5 and 6**.

The business day rate extends from 8 AM to 5 PM, Monday through Friday. The evening rate extends from 5 PM to 11 PM, Sunday through Friday, and MCI recognized National Holidays when a lower rate would normally apply. The night and weekend rate extends from 11 PM to 8 AM, Monday through Friday and weekends excluding Sunday 5 PM to 11 AM. All calls are rounded to the next higher minute.

Volume discounts are available to those customers with established accounts and whose total monthly charges equals \$20 or more. Discounts are based on the total monthly charges incurred in each rate period and are presented in **Table 7**.

TABLE 5 • Execunet Usage Charges — U.S. Mainland & Mainland to Hawaii/Alaska

Intercity Mileage Bands, Miles	Business Day		Evening		Night & Weekend	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
1 - 10	\$.1524	\$.1470	\$.1080	\$.0882	\$.0720	\$.0588
11 - 22	.2037	.1949	.1368	.1194	.0912	.0796
23 - 55	.2864	.2522	.1890	.1514	.1260	.0992
56 - 70	.3510	.3310	.2268	.2027	.1512	.1319
71 - 124	.3510	.3310	.2268	.2027	.1512	.1315
125 - 292	.3618	.3465	.2268	.2176	.1512	.1431
293 - 430	.4400	.3647	.2310	.2241	.1540	.1499
431 - 925	.4698	.3740	.2861	.2352	.1906	.1565
926 - 1910	.4920	.3854	.3129	.2400	.2090	.1583
1911 - 3000	.5831	.4324	.3465	.2646	.2371	.1759
3001 - 4250	.6035	.4562	.3560	.2822	.2478	.1877
4251 - 5750	.6212	.4767	.3759	.2940	.2573	.1960

TABLE 6 • Execunet Usage Charges — U.S. Mainland to Puerto Rico/U.S. Virgin Islands

Mileage Rate Band*	Business Day		Evening		Night & Weekend	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
1	\$.4920	\$.3854	\$.3129	\$.2400	\$.2090	\$.1583
2	.5831	.4324	.3465	.2646	.2371	.1759
3	.6035	.4562	.3560	.2822	.2478	.1877

*For rate band definitions, see Execunet Service Access — U.S. Mainland to Puerto Rico/Virgin Islands, page 10.

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TABLE 7 • MCI Execunet & Credit Card Services — Volume Discount Rates

Total Monthly Usage	Day/Standard	Evening/Discount	Night & Weekend/Economy
\$0 - \$19.99	0.0%	0.0%	0.0%
\$20 - \$74.99	2.0	7.0	8.0
\$75 - \$149.99	3.5	7.5	8.5
\$150 and over	5.0	8.0	10.0

Execunet Access Charges

At the customer's option, access charges are payable on the basis of either a monthly minimum usage (traffic) charge or a standard monthly subscription fee. Access to the MCI network is restricted during business-day periods for Basic customers (see explanation under Traffic Charges). MCI provides all newly installed subscription fee customers with their initial five minutes of MCI's service at no traffic charge. The minimum monthly usage (traffic) charge and subscription fee are not applicable to customers who access Execunet and Basic via a single-digit access level as part of MCI's agreement with Northwest Iowa Telephone Company, Sergeant Bluff, Iowa.

Minimum Monthly Usage (Traffic) Charge • customer may elect to pay either a minimum monthly usage (traffic) charge or a monthly subscription fee:

\$75.00 mo

Execunet Monthly Subscription Fee:

10.00

Additional Feature Charges

Authorization Codes (5-Digit) • a code, 1 or more of which are available, to enable customers to identify individual user or groups of users.

First Codes:

NC mo

Additional Codes • limited to 50 total codes per customer per originating location; charge per code per month:

5.00

Speed Numbers (4-Digit) • signaling arrangement by which a customer may elect to dial a pre-programmed 4-digit number in place of a designated 10-digit number; charge per speed number per month:

5.00

Call Records on Magnetic Tape • charge for each recorded reel of magnetic tape per month:

100.00

One-Time Set-Up Charge • one-time charge to set-up system to provide monthly call records on magnetic tape; charge per account:

500.00

Accounting Codes • a code of 2 digits (1 to 99) per authorization code per minimum charge or Standard Subscription Fee account:

5.00

Access

Execunet services are available between the following cities except where such cities are located in the same state. However, pursuant to an exemption from state regulatory authority by act of the Texas State Legislature, MCI provides service within Texas on an intrastate basis. Calls may only originate in the city or cities in which the user maintains an active Execunet account. Calls may be terminated in all cities listed. Service to Canada, Puerto Rico, and the U.S. Virgin Islands is also available. See International Access for those states offering this service.

Execunet Access Cities

Alabama • Birmingham; Gadsen; Huntsville; Mobile; Montgomery.

Arkansas • Benton; Hot Springs; Little Rock.

Arizona • Phoenix; Tucson.

California • Anaheim; Bakerfield; Berkeley; Beverly Hills; Canoga Park; Capistrano Valley; Colton; Compton; Concord; Del Mar; Downey; El Monte; Escondido; Fair Oaks; Fremont; Fresno; Hayward; Inglewood; La Canada; Los Angeles; Modesto; Monroe; Monterey; Oakland; Oceanside; Ontario; Palm Desert; Palo Alto; Pasadena; Pleasanton; San Francisco; Sacramento; Salinas; San Rafael; San Jose; San Pedro; Santa Barbara; Santa Cruz; Santa Rosa; Santa Ana; Santa Monica; Saticoy; Sherman Oaks; Stockton; Vacaville; Vallejo; Van Nuys; Ventura; Vista.

Colorado • Colorado Springs; Denver; Ft. Collins; Grand Junction; Greeley; Longmont; Loveland; Pueblo.

Connecticut • Bridgeport; Bristol; Danbury; Hartford; Meriden; New London; New Britain; New Haven; Norwalk; Rockville; Stamford; Torrington; Waterbury.

Delaware • Dover; Wilmington.

District of Columbia • Washington.

Florida • Boca Raton; Clearwater; Daytona Beach; Ft. Lauderdale; Gainesville; Jacksonville; Miami; Orlando; Pensacola; Tallahassee; Tampa; West Palm Beach.

Georgia • Athens; Atlanta; Augusta; Columbus; Macon; Rome; Savannah.

Hawaii • Honolulu.

Idaho • Boise; Pocatello; Twin Falls.

Illinois • Bensenville; Blue Island; Champaign; Chicago Heights; Chicago; Danville; Decatur; Downers Grove; Edgemont; Elk Grove; Forest Park; Geneva; Glenview; Hinsdale; Joliet; Kankakee; Maywood; Peoria; Rockford; Round Lake; Skokie; Springfield; Sycamore; Waukegan.

Indiana • Anderson; Bloomington; Chesterton; Columbus; Ft. Wayne; Gary; Indianapolis; Kokomo; Marion; Muncie; South Bend; Valparaiso.

Iowa • Ames; Cedar Rapids; Clinton; Davenport; Des Moines; Ft. Dodge; Iowa City; Sergeant Bluff; Sioux City; Waterloo.

Kansas • Hutchinson; Manhattan; Topeka; Frankfort; Ft. Knox; Lexington; Louisville.

Louisiana • Baton Rouge; Houma; Lafayette; New Orleans; Shreveport.

Maryland • Annapolis; Baltimore; Bel Air; Cambridge; Cape Girardeau; Easton; Frederick; Hagerstown; Salisbury.

Massachusetts • Amherst; Attleboro; Boston; Fall River; Fitchburg; Haverhill; Hyannis; Lawrence; Lexington; Lowell; Natick; New Bedford; Pittsfield; Randolph; Taunton; Worcester

Michigan • Ann Arbor; Battle Creek; Benton Harbor; Detroit; Flint; Grand Rapids; Holland; Jackson; Kalamazoo; Lansing; Midland; Plymouth; Pontiac; Fort Huron; Saginaw; Southfield; Warren; Wyandotte.

Minnesota • Minneapolis; Rochester; St. Cloud; St. Paul; Climax; Creve Coeur; Joplin; Kansas City; Springfield; St. Louis; St. Joseph; St. Charles; Valley Park.

Mississippi • Jackson

Nebraska • Lincoln; Omaha.

Nevada • Las Vegas; Reno.

New Hampshire • Manchester; Nashua.

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New Jersey • Caldwell; Camden; Florence; Hackensack; Haddonfield; Long Branch; Matawan; Morristown; Mt. Holly; Pleasantville; Princeton; Rahway; Trenton; Williamstown.

New Mexico • Albuquerque.

New York • Albany; Binghamton; Buffalo; Deer Park; Garden City; New Rochelle; New York; Niagara Falls; Rochester; Syracuse; Tonawanda; Utica; White Plains; Yonkers.

North Carolina • Charlotte; Durham; Greensboro; Raleigh; Winston-Salem.

North Dakota • La Platte.

Ohio • Akron; Canton; Cincinnati; Cleveland; Columbus; Dayton; Delaware; Elyria; Findlay; Hamilton; Lancaster; Lorrain; Marion; Newark; Painesville; Sandusky; Springfield; Toledo; Youngstown.

Oklahoma • Bartlesville; Enid; Lawton; Muskogee; Oklahoma City; Stillwater; Tulsa.

Oregon • Eugene; Salem.

Pennsylvania • Allentown; Belle Vernon; Butler; Carlisle; Chester; Collegeville; Erie; Gibsonia; Greensburg; Harrisburg; Indiana; Jenkintown; Johnstown; Lancaster; Langhorne; Lenape; New Castle; Norristown; Philadelphia; Pittsburgh; Reading; Rochester; Scranton; Souderton; Uniontown; Washington; Wyoming; York.

Rhode Island • Newport; Providence.

South Carolina • Charleston; Columbia; Greenville; Spartanburg.

Tennessee • Bristol; Chattanooga; Clarksville; Knoxville; Memphis; Nashville; Oakridge; Smyrna.

Texas • Abilene; Alice; Amarillo; Austin; Bay City; Beaumont; Beeville; Big Springs; Borger; Brownsville; Bryan; Channelview; Clute; Corpus Christi; Dallas; Denison; Denton; Edinburg; El Paso; Frisco; Ft. Worth; Galveston; Greenville; Greenwich; Harlingen; Hereford; Houston; Huntsville; Laredo; Longview; Lubbock; Marshall; Nederland; New Braunfels; Paris; Plainview; Richardson; San Angelo; Temple; Terminal; Texarkana; Tyler; Victoria; Waco; Waxahachie; Wichita Falls.

Utah • Ogden; Provo; Salt Lake City.

Virginia • Dale City; Fredericksburg; Leesburg; Manassas; Newport News; Norfolk; Petersburg; Richmond; Roanoke.

Washington • Seattle; Tacoma.

West Virginia • Charleston; Wheeling.

Wisconsin • Appleton; Eau Claire; Fond du Lac; Janesville; Madison; Menomonee Falls; Milwaukee; Monroe; Racine; Sheboygan; West Bend.

Wyoming • Cheyenne.

Execunet Service Access Locations—U.S. Mainland & Mainland—Hawaii

Service is available between the following cities and from these cities within the contiguous U.S. to Alaska, Hawaii, Puerto Rico, and U.S. Virgin Islands.

Alabama • Birmingham; Gadsden; Huntsville; Mobile; Montgomery.

Arizona • Phoenix.

Arkansas • Benton; Hot Springs; Little Rock; Tucson.

California • Anaheim; Bakersfield; Berkeley; Beverly Hills; Canoga Park; Capistrano Valley; Colton; Compton; Concord; Del Mar; Downey; El Monte; Escondido; Fair Oaks; Fremont; Fresno; Hayward; Inglewood; La Canada; Los Angeles; Modesto; Monterey; Oakland; Oceanside; Ontario; Palm Desert; Palo Alto; Pasadena; Pleasanton; Sacramento; Salinas; San Diego; San Francisco; San Jose; San Pedro; San Rafael; Santa Ana; Santa Barbara; Santa Cruz; Santa Monica; Santa Rosa; Saticoy; Sherman Oaks; San Francisco; Stockton; Vacaville; Vallejo; Van Nuys; Ventura; Vista.

Colorado • Colorado Springs; Denver; Ft. Collins; Grand Junction; Greeley; Longmont; Loveland; Pueblo.

Connecticut • Bridgeport; Bristol; Danbury; Greenwich; Hartford; Meriden; New Britain; New Haven; New London; Norwalk; Rockville; Stamford; Torrington; Waterbury.

Delaware • Wilmington.

District of Columbia • Washington.

Florida • Boca Raton; Clearwater; Daytona Beach; Ft. Lauderdale; Gainesville; Jacksonville; Miami; Orlando; Pensacola; Tallahassee; Tampa; West Palm Beach.

Georgia • Athens; Atlanta; Augusta; Columbus; Macon; Rome; Savannah.

Hawaii • Honolulu.

Idaho • Boise; Pacatello; Twin Falls.

Illinois • Alton; Bensenville; Blue Island; Champaign; Chicago; Chicago Heights; Decatur; Downers Grove; Edgemont; Elk Grove; Forest Park; Geneva; Glenview; Hinsdale; Joliet; Kankakee; Maywood; Peoria; Rockford; Round Lake; Skokie; Springfield; Sycamore; Waukegan.

Indiana • Anderson; Bloomington; Chesterton; Columbus; Ft. Wayne; Gary; Indianapolis; Kokomo; Marion; Muncie; South Bend; Valparaiso.

Iowa • Ames; Cedar Rapids; Clinton; Davenport; Des Moines; Ft. Dodge; Iowa City; Sergeant Bluff; Sioux City; Waterloo.

Kansas • Hutchinson; Lawrence; Manhattan; Topeka.

Kentucky • Ft. Knox; Frankfort; Lexington; Louisville.

Louisiana • Baton Rouge; Houma; Lafayette; Monroe; New Orleans; Shreveport.

Maryland • Annapolis; Baltimore; Bel Air; Cambridge; Cape Girardeau; Easton; Frederick; Hagerton; La Plata; Salisbury; Valley Park.

Massachusetts • Amherst; Attleboro; Boston; Fall River; Fitchburg; Haverhill; Lawrence; Lexington; Lowell; Natick; New Bedford; Pittsfield; Randolph; Springfield; Taunton; Worcester.

Michigan • Ann Arbor; Battle Creek; Climax; Detroit; Flint; Grand Rapids; Holland; Jackson; Janesville; Kalamazoo; Lansing; Midland; Monroe; Muskegon; Plymouth; Pontiac; Port Huron; Saginaw; Southfield; Warren; Wyandotte.

Minnesota • Minneapolis; Rochester; St. Cloud; St. Paul.

Missouri • Creve Coeur; Joplin; Kansas City; St. Charles; St. Joseph; St. Louis; Springfield.

Mississippi • Jackson.

Nebraska • Lincoln; Omaha.

Nevada • Las Vegas; Reno.

New Hampshire • Manchester; Nashua.

New Jersey • Camden; Florence; Hackensack; Haddonfield; Long Branch; Matawan; Morristown; Mt. Holly; Newark; New Brunswick; Pleasantville; Princeton; Rahway; Trenton; Williamstown.

New Mexico • Albuquerque.

New York • Albany; Binghamton; Buffalo; Deer Park; Garden City; New Rochelle; New York; Niagara Falls; Rochester; Syracuse; Tonawanda; White Plains; Utica; Yonkers.

North Carolina • Charlotte; Durham; Greensboro; Raleigh; Winston-Salem.

Ohio • Akron; Alliance; Canton; Cincinnati; Cleveland; Columbus; Dayton; Delaware; Elyria; Eugene; Hamilton; Lancaster; Lorain; Marion; Middletown; Newark; Painesville; Sandusky; Springfield; Toledo; Youngstown.

Oklahoma • Bartlesville; Enid; Lawton; Muskogee; Oklahoma; Stillwater; Tulsa.

Oregon • Portland; Salem.

Pennsylvania • Allentown; Altoona; Belle Vernon; Butler; Carlisle; Collegeville; Erie; Gibsonia; Greensburg; Harrisburg; Johnstown; Lancaster; Langhorne; Lenape; New Castle; New Kingston; Norristown; Philadelphia; Pittsburgh; Reading;

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Rochester; Scranton; Souderton; Uniontown; Washington; Wyoming; York.

Rhode Island • Newport; Providence.

South Carolina • Charleston; Columbia; Greenville; Spartanburg.

Tennessee • Bristol; Chattanooga; Clarksville; Jackson; Knoxville; Memphis; Nashville; Oakridge; Smyrna.

Texas • Abilene; Alice; Amarillo; Austin; Bay City; Beaumont; Beeville; Big Springs; Borger; Brownsville; Bryan; Channelview; Clute; Corpus Christi; Dallas; Denison; Denton; Edinburg; El Paso; Ft. Worth; Frisco; Galveston; Greenville; Harlingen; Hereford; Houston; Laredo; Longview; Lubbock; Marshall; Nederland; New Braunfels; Paris; Planview; Richardson; San Angelo; San Antonio; Temple; Terminal; Texarkana; Tyler; Victoria; Waco; Waxahachie; Wichita Falls.

Utah • Ogden; Provo; Salt Lake City.

Virginia • Dale City; Fredericksburg; Leesburg; Manassas; Newport News; Norfolk; Petersburg; Richmond; Roanoke.

Washington • Seattle; Tacoma.

West Virginia • Charleston; Wheeling.

Wisconsin • Fond du Lac; Kenosha; Madison; Menomonee Falls; Milwaukee; Racine; Sheboygan; West Bend.

Wyoming • Cheyenne.

Execunet Service Access Locations—U.S. Mainland to Puerto Rico/U.S. Virgin Islands

Service rates to Puerto Rico and the U.S. Virgin Islands are based on calls originating from states within 1 of 3 discrete geographic areas MCI refers to as bands. The states that correspond to each band are defined below.

Band 1

AL, CT, DE, DC, FL, GA, IN, KY, LA, MD, MA, MS, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VA, WV.

Band 2

AZ, AR, CO, IL, IA, KS, MI, MN, MO, NE, NM, OK, TX, UT, WI, WY.

Band 3

CA, ID, NV, OR, WA.

Quickline Service

Quickline is a nondiscounted, 2-way, point-to-point, metered-use service through which the customer originates and terminates calls using dedicated facilities between his premises and MCI's terminal location. The customer may elect to have MCI-provided dedicated access lines or intercity dedicated leased lines, or the customer may himself obtain and provide facilities of other common carriers. Principal charges for this service are based on traffic and access charges.

Quickline Service Traffic Charges

Traffic charges are principally based on intercity airline mileage and the elapsed call time. Circuit mileage is calculated using standard vertical and horizontal (V and H) coordinate tables according to AT&T Communications Tariff 274. All Quickline calls are rounded to the next higher 30-second increment.

Quickline rates are presented below.

Quickline Service Access Charges

At the customer's option, Quickline access charges are payable on the basis of either a minimum monthly usage (traffic) charge or a monthly subscription fee. Customer also pays a monthly charge for each circuit termination end.

Minimum Monthly Usage (Traffic) Charge:

\$75 mo

Monthly Subscription Fee:

10

Circuit Termination Charges • charges comprise one-time

Intercity Mileage Band	Charge per Minute
1 to 10 miles	\$0.0792
11 to 16	0.1144
17 to 22	0.1320
23 to 30	0.1672
31 to 40	0.1936
41 to 55	0.2288
56 to 70	0.2464
71 to 124	0.2640
125 to 196	0.2816
197 to 292	0.2992
293 to 925	0.3168
926 to 1910	0.3344
1911 to 3000	0.3520

processing charge for each order for installation(s); one-time installation charge per circuit termination end; and a monthly charge for each circuit termination end • a \$25 per-month special access surcharge applies to each circuit end if access line is provided by local exchange carrier:

50.00 ord	120.00 instal	70
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Additional Feature Charges

Authorization Codes (5-Digit) • a code, 1 or more of which are available, to enable customers to identify individual user or groups of users • no charge for first code.

Additional Codes • limited to 50 total codes per customer per originating location; charge per code per month:

\$5 mo

Pre-Programmed Automatic Signaling • arrangement by which customer may automatically signal a predetermined 10-digit telephone number without dialing any digits; charge per month, point-to-point:

100

Call Records on Magnetic Tape • charge for each recorded reel of magnetic tape per month:

100

One-Time Set-Up Charge • one-time charge to set-up system to provide monthly call records on magnetic tape; charge per account:

500

Quickline Service Access Locations

Arizona • Phoenix; Tucson.

California • Anaheim; Los Angeles; Palo Alto; San Diego; San Francisco.

Colorado • Colorado Springs; Denver.

Connecticut • Hartford; Stamford.

Delaware • Wilmington.

District of Columbia • Washington.

Georgia • Atlanta.

Illinois • Chicago.

Indiana • Indianapolis; South Bend.

Iowa • Cedar Rapids; Davenport; Des Moines.

Louisiana • New Orleans.

Maryland • Annapolis; Baltimore.

Michigan • Detroit.

Minnesota • Minneapolis.

Missouri • Kansas City; St. Louis.

Nebraska • Lincoln; Omaha.

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- New Jersey** • Newark.
- New York** • New York City.
- North Carolina** • Charlotte; Greensboro.
- Ohio** • Akron; Cincinnati; Cleveland; Columbus; Dayton; Toledo.
- Oklahoma** • Oklahoma City; Tulsa.
- Pennsylvania** • Philadelphia; Pittsburgh.
- Tennessee** • Memphis.
- Texas** • Austin; Beaumont; Dallas; Ft. Worth; Houston; San Antonio.
- Utah** • Salt Lake City.
- Virginia** • Norfolk; Richmond.
- Wisconsin** • Milwaukee.

Credit Card Service

MCI Credit Card service is a 1-way, dial-in/dial-out multipoint, metered-use service allowing the customer to originate calls, via MCI-provided local business telephone lines, in multiple designated serving cities. Credit Card service customers may terminate calls in all cities within the contiguous United States. Principal charges for this service are based on traffic and access charges.

Credit Card Service Traffic Charges

Traffic charges for this service are based on intercity airline mileage, elapsed call time, time of day, and day of week. Circuit mileage is calculated using standard vertical and horizontal (V and H) coordinate tables according to AT&T Communications Tariff 274. The business day rate (day) extends from 8:00 AM to 5:00 PM, Monday through Friday. The evening rate (eve) extends from 5:00 PM to 11:00 PM, Sunday through Friday, and all day on MCI-recognized National Holidays except when a lower rate would normally apply. The night and weekend rate (ngt-wknd) extends from 11:00 PM to 8:00 AM, Monday through Friday; this rate is also applied to the 48-hour weekend period excluding from 5:00 PM to 11:00 PM on Sunday. All Credit Card service calls are rounded to the next higher full minute.

Intercity facilities **usage charges are based on Tier Rates**. Tier 1 rates apply to those calls that originate from the cities listed under **Tier 1 Access Locations**. Tier 2 rates apply to calls that originate in cities other than those listed, and are determined by the Service Areas in which the call originates and terminates. Credit Card Service Areas are listed under **Tier 2 Access Locations**. Credit Card Service usage charges are presented in Tables 8, 9, 10 & 11.

Credit Card Service Access Charges

At the customers' option, Credit Card Service access charges are payable on the basis of either a minimum monthly usage (traffic) charge or a monthly subscription fee. Customer also pays an undiscounted access charge for each Credit Card Service call.

Minimum Monthly Usage (Traffic) Charge • customer may elect to pay either a minimum monthly usage (traffic) charge or a monthly subscription fee:

\$75 mo

Monthly Subscription Fee:

5

Credit Card Service Access Charge • an undiscounted access charge applied to each Credit Card Service call; charge per call:

0.15 call

Additional Feature Charges

Authorization Codes (7-Digit) • a code, 1 or more of which are available, to enable customers to identify individual user or groups of users.

First Code:

NC mo

Additional Codes • limited to 50 total codes per customer per originating location; charge per code per month:

1.00

Speed Numbers (4-Digit) • signaling arrangement by which a customer may elect to dial a pre-programmed 4-digit number in place of a designated 10-digit number; charge per speed number per month:

5.50

Call Records on Magnetic Tape • charge for each recorded reel of magnetic tape per month:

100.00

One-Time Set-Up Charge • one-time charge to set-up system to provide monthly call records on magnetic tape; charge per account:

500.00

Credit Card Service—Tier 1 Access Locations

Credit Card Service is available for call origination under **Tier 1 rates** in the following cities. Mileage Rate Bands (1 through 3) are specified for each Tier 1 state, and only apply to calls originating in Tier 1 cities and terminating in Puerto Rico or the U.S. Virgin Islands. **Tier 2 rates** apply to all calls that originate in cities other than those listed below, and are determined by the Service Areas in which the call originates and terminates. **See Tier 2 Access Locations**. Calls may be terminated in all cities within the contiguous United States except where such cities are located in the same state as the city where the call originated. However, pursuant to an exemption from state regulatory authority by act of the Texas State Legislature, MCI provides Credit Card Service within Texas on an **intrastate** basis.

Arizona (2) • Phoenix; Tucson.

California (3) • Berkeley; Concord; Fresno; Los Angeles; Oakland; Sacramento; San Diego; San Francisco; San Jose; Santa Ana; Sherman Oaks.

TABLE 8 • Tier 1 Credit Card Service Usage Charges — U.S. Mainland & Mainland to Hawaii/Alaska

Intercity Mileage Bands, Miles	Business Day		Evening		Night & Weekend	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
1 - 10	\$.1524	\$.1470	\$.1080	\$.0882	\$.0720	\$.0588
11 - 22	.2037	.1949	.1368	.1194	.0912	.0796
23 - 55	.2864	.2522	.1890	.1514	.1260	.0992
56 - 70	.3510	.3310	.2268	.2027	.1512	.1319
71 - 124	.3510	.3310	.2268	.2027	.1512	.1319
125 - 292	.3618	.3465	.2268	.2176	.1512	.1431
293 - 430	.4400	.3647	.2310	.2241	.1540	.1499
431 - 925	.4698	.3740	.2861	.2352	.1906	.1565
926 - 1910	.4920	.3854	.3129	.2400	.2090	.1583
1911 - 3000	.5831	.4324	.3465	.2646	.2371	.1759
3001 - 4250	.6035	.4562	.3560	.2822	.2478	.1877
4251 - 5750	.6212	.4767	.3759	.2940	.2573	.1960

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TABLE 9 • Tier 2 Credit Card Service Usage Charges — U.S. Mainland & Mainland To Hawaii/Alaska

Service Area*	Rates for Service Terminating in the Contiguous U.S.					
	Day		Evening		Night/Weekend	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
Intra-Area	\$.4362	\$.3568	\$.2135	\$.2134	\$.1430	\$.1428
Area 1 to 2, 1 to 3, 2 to 3	.4685	.3690	.2725	.2226	.1815	.1490
Area 3 to 4, 2 to 4	.4825	.3755	.2980	.2329	.1990	.1508
Area 1 to 4	.5760	.4190	.3300	.2520	.2258	.1675
	Rates for Service Terminating in Alaska & Hawaii					
Area 4	\$.5760	\$.4190	\$.3300	\$.2520	\$.2258	\$.1675
Area 2 & 3	.5950	.4484	.3390	.2728	.2360	.1788
Area 1	.6105	.4685	.3580	.2822	.2450	.1890

*See Tier 2 Access Locations for call originating states listed under each of the 4 Service Areas.

TABLE 10 • Credit Card Service Usage Charges — U.S. Mainland To Puerto Rico/U.S. Virgin Islands

Mileage Rate Band 4*	Tier 1 Usage Charges					
	Day		Evening		Night/Weekend	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
Band 1	\$.4920	\$.3854	\$.3129	\$.2400	\$.2090	\$.1583
Band 2	.5831	.4324	.3465	.2646	.2371	.1759
Band 3	.6035	.4562	.3560	.2822	.2478	.1877
Service Area**	Tier 2 Usage Charges					
Areas 1 & 3	\$.4920	\$.3854	\$.3129	\$.2400	\$.2090	\$.1583
Area 2	.5831	.4324	.3465	.2646	.2371	.1759
Area 4	.6035	.4562	.3560	.2822	.2478	.1877

*See Tier 1 Access Locations for call originating states within each Rate Band.

**See Tier 2 Access Locations for call originating states listed under each of the 4 Service Areas.

Colorado (2) • Denver.

Connecticut (1) • Stamford; Hartford; New Haven.

Delaware (1) • Wilmington.

District of Columbia (1) • Washington.

Florida (1) • Ft. Lauderdale; Jacksonville; Miami; Orlando.

Georgia (1) • Atlanta.

Illinois (2) • Chicago; Peoria; Rockford.

Indiana (1) • Ft. Wayne; Gary; Indianapolis; South Bend.

Iowa (2) • Des Moines.

Kansas (2) • Topeka.

Kentucky (1) • Louisville.

Louisiana (1) • New Orleans; Shreveport.

Maryland (1) • Baltimore.

Massachusetts (1) • Boston.

Michigan (2) • Ann Arbor; Detroit; Grand Rapids; Lansing; Saginaw.

Minnesota (2) • Minneapolis.

Missouri (2) • Kansas City; St. Louis; Springfield.

Nebraska (2) • Omaha.

New Jersey (1) • Hackensack; Newark; Pleasantville; Trenton.

New York (1) • New York; White Plains.

Ohio (1) • Akron; Cincinnati; Cleveland; Columbus; Dayton; Toledo; Youngstown.

Oklahoma (2) • Oklahoma City; Tulsa.

Pennsylvania (1) • Philadelphia; Pittsburgh.

Tennessee (1) • Knoxville; Memphis.

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TABLE 11 • Credit Card Service Usage Charges — U.S. Mainland to Canada

Intercity Mileage Band, Miles	Tier 1 Usage Charges					
	Business Day		Evening		Night	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
1 - 8	\$.1271	\$.1080	\$.0887	\$.0710	\$.0547	\$.0435
9 - 18	.1617	.1578	.1129	.1028	.0696	.0635
19 - 30	.2324	.2043	.1622	.1331	.1001	.0838
31 - 50	.2789	.2498	.1947	.1584	.1201	.0980
51 - 80	.3203	.2785	.2236	.1815	.1380	.1100
81 - 110	.3416	.3064	.2384	.1997	.1471	.1225
111 - 140	.3630	.3342	.2534	.2178	.1563	.1330
141 - 180	.3843	.3621	.2683	.2360	.1655	.1470
181 - 220	.4056	.3885	.2831	.2520	.1747	.1555
221 - 270	.4341	.4225	.3030	.2753	.1870	.1715
271 - 345	.4934	.4500	.3444	.2866	.2125	.1795
346 - 430	.5238	.4950	.3656	.3097	.2256	.1948
431 - 630	.5542	.5300	.3868	.3323	.2387	.2100
631 - 900	.5845	.5700	.4080	.3553	.2517	.2300
901 - 1200	.6149	.6100	.4292	.3783	.2648	.2450
1201 - 1610	.6453	.6400	.4505	.4013	.2779	.2590
1611 - 2220	.6756	.6755	.4716	.4242	.2910	.2625
2221 - 4000	.7060	.7050	.4928	.4510	.3040	.2880

Service Area*	Tier 2 Usage Charges					
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
Areas 1 & 2	\$.4341	\$.4225	\$.3030	\$.2753	\$.1870	\$.1715
Area 3	.6149	.6100	.4292	.3783	.2648	.2450
Area 4	.6453	.6400	.4505	.4013	.2779	.2590

*See Tier 2 Access Locations for call originating states listed under each of the 4 Service Areas.

Texas (2) • Abilene; Amarillo; Austin; Corpus Christi; Dallas; El Paso; Fort Worth; Houston; Longview; Lubbock; San Angelo; San Antonio; Terminal; Waco.

Utah (2) • Salt Lake City.

Virginia (1) • Richmond.

Wisconsin (2) • Milwaukee.

Credit Card Service—Tier 2 Access Locations

Credit Card Service is available for call origination under Tier 2 rates in cities **not** listed under Tier 1 Access Locations. Tier 2 cities are determined according to Credit Card Service Area, which segments the U.S. into 4 discrete areas by State as presented below.

■ **MCI WATS & HOTEL WATS SERVICE**

MCI WATS and Hotel WATS are 1-way, multipoint, metered-use services requiring the customer to originate calls via **dedicated** facilities between the customer's premises and MCI's terminal location, and allows the termination of calls via a combination of MCI-provided intercity facilities, local telephone lines, and the resold facilities of other carriers.

All calls are subject to a **1-minute average connect time**, and are rounded to the next 6-second increment, except for international calls, which are rounded to the next higher full minute.

Hotel Wats, a variation of MCI WATS, is available to customers whose distribution of total monthly traffic for a service group is such that **at least 20 percent of the traffic occurs within each of**

Credit Card Service Areas

Area 1	Area 2	Area 3	Area 4
Connecticut	Illinois	Alabama	Arizona
Delaware	Indiana	Arkansas	California
Maine	Iowa	Colorado	Idaho
Maryland	Kentucky	Florida	Montana
Massachusetts	Michigan	Georgia	Nevada
New Hampshire	Minnesota	Kansas	North Dakota
New Jersey	Missouri	Louisiana	Oregon
New York	Ohio	Mississippi	South Dakota
North Carolina	Wisconsin	Nebraska	Utah
Pennsylvania		New Mexico	Washington
Rhode Island		Oklahoma	Wyoming
South Carolina		Tennessee	
Vermont		Texas	
Virginia			
Washington, D.C.			
West Virginia			

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the 3 rate periods. Calls may terminate in **any** Service Area and are rated according to the Service Area in which the call terminates.

Traffic Charges

Traffic (usage) charges for MCI WATS and Hotel WATS are billed according to the **average** monthly use for each Rate Period of each dedicated access line within a Service Area Group (MCI WATS) or Service Group (Hotel WATS).

Rate Periods

Rate Periods consist of Business Day rate period, Evening rate period, and Night/Weekend rate period. Business Day rate period extends from 8:00 AM to 5:00 PM, Monday through Friday. Evening rate period extends from 5:00 PM through 11:00 PM, Sunday through Friday, and all day on MCI-recognized National Holidays except when a lower rate would normally apply. Night and Weekend rate period extends from 11:00 PM to 8:00 AM, Sunday through Friday, 8:00 AM to 11:00 PM, Saturday, and 8:00 AM to 5:00 PM, Sunday.

Service Areas

A Service Area is a geographic region in the U.S. consisting of designated states (including the District of Columbia) or portions of states. It is used to determine usage rates for MCI WATS and Hotel WATS customers. A **Service Area Group**, used to determine MCI WATS usage charges, denotes one or more dedicated access lines for the same single Service Area, terminated in the same multiline terminating device at the same customer premises. A **Service Group**, used to determine Hotel WATS usage charges, denotes one or more dedicated access lines terminated in the same multiline terminating device at the same customer premises.

MCI has defined **5 Service Areas** (SA1 through SA5) for each call originating state or state subdivision; these are defined by **Table 14, MCI WATS and Hotel WATS Home State Service Areas**. For MCI WATS, service to a higher numbered Service

Area includes service to all lower numbered Service Areas. Service to international locations is available with every Service Area. For Hotel WATS, Service Areas determine the appropriate rate to be charged for **each individual call**. Access lines are **not** Service Area specific, therefore, all calls, including International, may be carried on all Hotel WATS access lines. The rate at which Hotel WATS is charged is determined by the originating location and the terminating Service Area.

Traffic Charges Per Rate Step

Usage charges are determined by Rate Steps and Rate Period. MCI WATS and Hotel WATS rate tables contain 18 Rate Steps, which are dependent on Service Area and originating state. Rate Steps are presented for both services in **Table 12**. The applicable Rate Step for a given Service Area is determined by locating the Rate Step number under the appropriate Service Area that corresponds to the call originating or home state.

Monthly Usage Charges

Once the Rate Step for a given Service Area and originating state has been determined from **Table 12**, the usage charge per hour of use, per rate period, per access line can be determined from the **Hourly Usage Table (Table 13)**. This table divides Rate Steps into Tier 1 and Tier 2 usage charges, which are based on Rate Periods. **Tier 1 charges** apply to all calls terminating via MCI-provided intercity facilities in those cities defined under the Access section. **Tier 2 charges** apply to calls terminating via resold intercity facilities of other carriers in cities other than those defined under the Access section. Calls terminating in international locations will be billed according to International Usage Charges.

Access Charges

Access lines are only furnished **within the contiguous United States**. Each access line is utilized either for MCI WATS or Hotel WATS service. Each of these services is subject to a monthly minimum access charge. A circuit termination charge is applied to each dedicated line between the customer installation and MCI

TABLE 12 • MCI WATS & Hotel WATS Service — Rate Step Table

HOME RATE STATE	RATE STEP**					HOME RATE STATE	RATE STEP**				
	SA1	SA2	SA3	SA4	SA5		SA1	SA2	SA3	SA4	SA5
ALABAMA*	4	7	9	11	17	NEVADA	5	8	13	16	18
ARIZONA	6	9	12	15	18	NEW HAMPSHIRE*	2	7	11	15	18
ARKANSAS	4	7	9	11	15	NEW JERSEY	1	5	9	13	18
CALIFORNIA-N	8	12	15	17	18	NEW MEXICO	6	8	10	13	17
CALIFORNIA-S	7	11	15	17	18	NEW YORK-NE	3	7	10	14	18
COLORADO	7	8	10	12	16	NEW YORK-SE	1	7	10	14	18
CONNECTICUT	1	7	10	14	18	NEW YORK-W	3	5	10	14	18
DELAWARE	1	5	9	13	18	NORTH CAROLINA*	4	7	8	12	18
DIST. OF COLUMBIA	1	4	8	12	18	NORTH DAKOTA*	6	9	11	14	15
FLORIDA	7	10	12	13	18	OHIO-N	3	5	7	10	17
GEORGIA	4	7	10	12	18	OHIO-S	3	5	8	10	17
IDAHO*	5	9	13	15	18	OKLAHOMA	5	7	9	12	15
ILLINOIS-N	3	6	8	10	15	OREGON*	5	9	15	17	18
ILLINOIS-S	3	6	8	10	15	PENNSYLVANIA-E	1	5	8	12	18
INDIANA	3	6	8	10	16	PENNSYLVANIA-W	3	5	8	12	18
IOWA	4	7	9	11	14	RHODE ISLAND*	1	6	11	14	18
KANSAS	5	7	9	12	14	SOUTH CAROLINA*	4	7	9	12	18
KENTUCKY	3	5	8	10	17	SOUTH DAKOTA	5	8	10	12	15
LOUISIANA	5	8	10	13	16	TENNESSEE	5	6	8	10	17
MAINE*	6	9	12	16	18	TEXAS-E	6	9	11	14	16
MARYLAND	2	5	9	12	18	TEXAS-S	8	11	12	14	16
MASSACHUSETTS	2	7	11	14	18	TEXAS-W	7	9	11	14	16
MICHIGAN-N	5	8	9	12	17	UTAH	6	7	11	14	18
MICHIGAN-S	4	7	9	12	17	VERMONT*	2	7	11	14	18
MINNESOTA	6	8	10	12	15	VIRGINIA	3	5	8	11	18
MISSISSIPPI*	5	7	9	11	16	WASHINGTON*	8	11	15	17	18
MISSOURI	5	7	8	10	15	WEST VIRGINIA	2	5	7	11	18
MONTANA	7	10	12	14	17	WISCONSIN	3	7	9	11	16
NEBRASKA	5	8	9	12	14	WYOMING*	5	9	10	13	16

*Service is not currently available from these states; for future reference.

**Rate steps defined by Home Rate state and Service Area; see Table 10 for Service Area designations.

MCI Telecommunications Customized Business Communication Services

TABLE 13 • MCI WATS & Hotel WATS Hourly Usage Charges Per Rate Period & Rate Step Per Access Line

RATE STEPS	First 15 Hours		Next 25 Hours		Next 40 Hours		Over 80 Hours		All Hours
	Business Day	Evening	Business Day	Evening	Business Day	Evening	Business Day	Evening	Night/Weekend
1: Tier 1	12.00	8.50	10.67	7.56	9.94	6.62	8.42	5.60	4.83
Tier 2	15.53	10.09	13.81	8.98	12.10	7.86	10.24	6.65	5.40
2: Tier 1	12.61	8.94	11.23	7.96	10.47	6.98	8.86	5.90	5.08
Tier 2	16.32	10.62	14.53	9.45	12.73	8.29	10.78	7.01	5.67
3: Tier 1	12.90	9.14	11.49	8.14	10.71	7.14	9.06	6.02	5.20
Tier 2	16.70	10.86	14.87	9.67	13.03	8.47	11.02	7.15	5.81
4: Tier 1	13.14	9.31	11.70	8.29	10.91	7.26	9.23	6.14	5.28
Tier 2	17.00	11.05	15.14	9.84	13.27	8.62	11.22	7.29	5.91
5: Tier 1	13.34	9.45	11.87	8.41	11.07	7.38	9.36	6.24	5.36
Tier 2	17.26	11.22	15.36	9.98	13.46	8.76	11.39	7.41	5.99
6: Tier 1	13.51	9.57	12.03	8.53	11.22	7.47	9.49	6.32	5.44
Tier 2	17.48	11.36	15.57	10.12	13.65	8.88	11.54	7.50	6.07
7: Tier 1	13.73	9.73	12.23	8.65	11.40	7.59	9.64	6.42	5.52
Tier 2	17.77	11.55	15.82	10.28	13.87	9.02	11.73	7.63	6.17
8: Tier 1	13.98	9.91	12.44	8.81	11.60	7.73	9.82	6.54	5.63
Tier 2	18.10	11.77	16.10	10.46	14.11	9.18	11.94	7.76	6.29
9: Tier 1	14.19	10.06	12.63	8.95	11.79	7.84	9.97	6.64	5.71
Tier 2	18.37	11.94	16.35	10.63	14.34	9.31	12.13	7.89	6.38
10: Tier 1	14.38	10.19	12.81	9.07	11.94	7.96	10.10	6.72	5.79
Tier 2	18.61	12.10	16.57	10.78	14.52	9.45	12.28	7.98	6.48
11: Tier 1	14.54	10.30	12.94	9.16	12.08	8.05	10.22	6.81	5.85
Tier 2	18.82	12.23	16.75	10.88	14.69	9.55	12.43	8.08	6.54
12: Tier 1	14.69	10.40	13.07	9.27	12.19	8.12	10.31	6.87	5.91
Tier 2	19.02	12.35	16.92	11.01	14.83	9.64	12.54	8.15	6.60
13: Tier 1	14.83	10.51	13.19	9.35	12.31	8.20	10.41	6.93	5.96
Tier 2	19.19	12.48	17.07	11.11	14.97	9.73	12.67	8.22	6.66
14: Tier 1	14.98	11.18	13.33	10.01	13.01	8.85	11.09	7.29	6.83
Tier 2	19.99	13.21	17.85	11.58	15.73	10.13	13.39	8.62	7.03
15: Tier 1	15.13	11.29	13.48	10.12	13.14	8.95	11.21	7.58	6.89
Tier 2	20.18	13.33	18.05	11.88	15.88	10.25	13.52	8.71	7.08
16: Tier 1	15.31	11.43	13.63	10.23	13.29	9.04	11.34	7.73	6.97
Tier 2	20.41	13.48	18.23	12.00	16.05	10.34	13.68	8.80	7.18
17: Tier 1	15.48	11.55	13.78	10.36	13.44	9.14	11.47	7.83	7.05
Tier 2	20.63	13.61	18.43	12.20	16.23	10.46	13.82	8.90	7.20
18: Tier 1	15.78	11.78	14.04	10.55	13.70	9.32	11.68	7.97	7.20
Tier 2	21.03	13.88	18.77	12.41	16.53	10.80	14.07	9.00	7.32

TABLE 14 • MCI WATS & Hotel WATS — Home State Service Areas

Home State	SERVICE AREAS				
	SA1	SA2	SA3	SA4	SA5
AL*	FL,GA,KY,LA,MS, TN	AR,IL-S,IN,MO,NC, OH-S	DC,IL-N,IA,MD, OH-N,OK,TX,VA, WV	CT,DE,KS,MI,MN, NE,NJ,NY,PA,RI, WI	AK,AZ,CA,CO,ID, HI,ID,MA,ME,MT, NV,NH,NM,ND,OR, PR,SD,UT,VT,VI, WA,WY
AZ	CA-S,CO,NV,NM, UT	CA-N,ID,TX-W,WY	AR,KS,MT,NE, ND,OK,OR,SD, TX-E,TX-S,	AL,IL,IN,IA, KY,LA,MN,MS, MO,TN,WI	AK,CT,DC,DE,FL, GA,HI,ME,MD,MA, MI,NH,NJ,NY,NC, OH,PA,PR,RI,SC, VT,VI,VA,WV
AR	LA,MS,MO,OK, TN,TX-E	AL,IL-N,IL-S,KY	FL,GA,IN,IA, NE,NC,OH,SC, TX-S,TX-W, WV,WI	CO,DE,DC,MI, MD,MN,ND,NM, PA,SD,VA,WY	AK,AZ,CA,CT,ID, ME,MA,MT,NV,NH, NJ,NY,OR,PR,RI, UT,VT,VI,WA,HI
CA-N	AZ,ID,NV,OR	CO,MT,NE,NM,WY	IA,KS,MN,MO, ND,OK,SD,TX	AL,AR,IL,IN, KY,LA,MI,MS, WI	AK,CT,DE,DC,FL, GA,HI,ME,MD,MA, NH,NJ,NY,NC,OH, PA,PR,RI,SC,TN, VT,VI,VA,WV

*Service is not currently available from these states; for future reference.

MCI Telecommunications

Customized Business Communication Services

TABLE 14 • MCI WATS & Hotel WATS — Home State Service Areas (Continued)

Home State	SERVICE AREAS				
	SA1	SA2	SA3	SA4	SA5
CA-S	AZ,NV,NM,OR,UT	CO,ID,TX-W,WA,WY	IA,KS,MN,MO,MT,NE,ND,OK,SD,TX-E,TX-S	AL,AR,IL,IN,KY,LA,MI,MS,TN,WI	AK,CT,DE,DC,FL,GA,HI,ME,MD,MA,NH,NJ,NY,NC,OH,PA,PR,RI,SC,VT,VI,VA,WV
CO	AZ,KS,NE,NM,OK,UT,WY	ID,MT,NV,SD,TX-W	AR,CA,IA,MN,MO,ND,TX-E	IL,IN,LA,MI,MS,OR,TN,TX-S,WA,WI	AK,AL,CT,DE,DC,FL,GA,HI,KY,ME,MD,MA,NH,NJ,NY,NC,OH,PA,PR,RI,SC,VT,VI,VA,WV
CT	MA,NH,NJ,NY-NE,NY-SE,PA-E,RI,VT	DE,DC,ME,MD,NY-W,OH-N,OH-S,PA-W,VA,WV	AL,GA,IL,IN,KY,MI,NC,SC,TN,WI	AR,FL,IA,KS,LA,MN,MS,MO,NE,ND,OK,SD	AK,AZ,CA,CO,HI,ID,MT,NV,NM,OR,PR,TX,UT,VI,WA,WY
DE	DC,MD,NJ,VA,NY-SE,PA-E	CT,MA,NH,NY-E,NY-W,NC,OH-S,PA-W,RI,VT,WV	AL,FL,GA,IL,IN,KY,ME,MI,OH-N,SC,TN	AR,IA,KS,LA,MN,MS,MO,NE,ND,OK,SD,WI	AK,AZ,CA,CO,HI,MT,NV,NM,OR,PR,TX,UT,VI,WA,WY,HI
DC	DE,MD,NJ,PA-E,PA-W,VA,WV	CT,NY-NE,NY-SE,NC,OH-N,OH-S,RI	AL,FL,GA,IL,IN,KY,ME,MA,MI,NH,SC,TN,VT	AR,IA,KS,LA,MN,MS,MO,NE,ND,OK,SD,WI	AK,AZ,CA,CO,HI,ID,MT,NV,NM,OR,PR,TX,UT,VI,WA,WY
FL	AL,GA,LA,MS,NC,SC,TN	AR,DE,DC,IN,KY,ND,OH-S,VA,WV	IL,MO,NJ,OH-N,OK,PA,TX	CT,IA,KS,MA,MI,NE,NH,NY,PR,RI,VT,VI,WI	AK,AZ,CA,CO,HI,ID,ME,MN,MT,NV,NM,ND,OR,SC,UT,VA,WY
GA	AL,FL,KY,MS,NC,SC,TN	AR,IL-S,IN,LA,OH-S,VA,WV	DE,DC,IL-N,MD,MI,MO,NI,NY,OH-N,PA	CT,IA,KS,MA,NE,NH,OK,RI,TX,VT,WI	AK,AZ,CA,CO,HI,ID,ME,MN,MT,NV,NM,ND,OR,PR,SD,UT,VI,WA,WY
ID*	MT,NV,OR,UT,WA,WY	CA-N,CA-S,CO	AZ,IA,KS,MN,MO,NE,NM,ND,OK,SD,WI	AR,IL,IN,KY,LA,MI,MS,TX	AK,AL,CT,DE,DC,FL,GA,HI,ME,MD,MA,NH,NJ,NY,NC,OH,PA,PR,RI,SC,TN,VT,VI,VA,WV
IL-N	IN,IA,MI-S,MO,WI	AR,KY,MI-N,MN,OH-N,OH-S,TN	AL,GA,KS,LA,MS,NE,NC,OK,PA,SC,VA,WV	CO,DE,DC,MD,NJ,NY,ND,SD,TX	AK,AZ,CA,CT,FL,HI,ID,ME,MA,MT,NV,NH,NM,OR,PR,RI,UT,VT,VI,WA,WY
IL-S	IN,IA,KY,MD,OH-S,TN	AL,AR,MI-S,MS,OH-N,WI	GA,KS,LA,MN,MI-N,NE,NC,OK,PA,SC,VA,WV	CO,DE,DC,MD,NJ,NY,ND,SD,TX	AK,AZ,CA,CT,FL,HI,ID,ME,MA,MT,NV,NH,NM,OR,PR,RI,UT,VT,VI,WA,WY
IN	IL-N,IL-S,KY,MI-S,OH-N,OH-S	IA,MO,PA-W,TN,WV,WI	AL,AR,DE,DC,GA,MD,MI-N,MN,MS,NY,NC,PA-E,SC,VA	CT,FL,KS,LA,MA,NE,NH,NJ,ND,OK,RI,SD,VT	AK,AZ,CA,CO,HI,ID,ME,MT,NV,NM,OR,PR,TX,UT,VI,WA,WY
IA	IL-N,IL-S,MN,MO,NE,SD,WI	IN,KS,MI-N,MI-S,OK	AL,AR,CO,KY,LA,MS,ND,OH,TN,WV,WY	DC,GA,MD,MT,NM,NC,PA,SC,TX,VA	AK,AZ,CA,CT,DE,FL,HI,ID,ME,MA,NV,NH,NJ,NY,OR,PR,RI,UT,VT,VI,WA
KS	CO,IA,MO,NE,OK,SD	AR,IL-S,NM,TX-E,TX-W	AL,IL-N,IN,KY,LA,MN,MS,ND,TN,TX-S,UT,WI,WY	AZ,GA,ID,MI,MT,NV,NC,OH,SC,VA,WV	AK,CA,CT,DE,DC,FL,HI,ME,MD,MA,NH,NJ,NY,OR,PA,PR,RI,VT,VI,WA
KY	IL-S,IN,MO,OH-S,TN,VA,WV	AL,GA,IL-N,NC,OH-N,SC	AR,DE,DC,IA,LA,MD,MI,MS,NJ,PA,WI	CT,FL,KS,MA,MN,NH,NE,NY,OK,RI,TX,VT	AK,AZ,CA,CO,HI,ID,ME,MA,MT,NV,NM,ND,OR,PR,SD,UT,VI,WA,WY
LA	AL,AR,MS,OK,TX-E,TX-S	GA,IL-S,KY,MO,TN,TX-W	FL,IL-N,IN,IA,KS,NE,NM,NC,OH,SC,WV	CO,DE,DC,MD,MI,MN,NJ,PA,SD,VA,WI	AK,AZ,CA,CT,HI,ID,ME,MA,MT,NV,NH,NY,ND,OR,PR,RI,UT,VT,VI,WA,WY
ME*	CT,MA,NH,NJ,NY-NE,NY-SE,RI,VT	DE,DC,MD,NY-W,OH-N,PA-E,PA-W,WV	GA,IL,IN,KY,MI,MN,NC,OH-S,SC,TN,WI	AL,AR,FL,IA,KS,LA,MS,MO,NE,ND,OK,SD	AK,AZ,CA,CO,HI,ID,MT,NV,NM,OR,PR,TX,UT,VI,WA,WY
MD	DE,DC,NJ,VA,NY-SE,PA-E,PA-W,WV	CT,MA,NC,NY-NE,NY-W,OH-N,RI	AL,FL,GA,IL,IN,KY,ME,MI,NH,SC,TN,VT	AR,IA,KS,LA,MN,MS,MO,NE,ND,OK,SD,WI	AK,AZ,CA,CO,HI,ID,MT,NV,NM,OR,PR,TX,UT,VI,WA,WY

*Service is not currently available from these states; for future reference.

MCI Telecommunications Customized Business Communication Services

TABLE 14 • MCI WATS & Hotel WATS — Home State Service Areas (Continued)

Home State	SERVICE AREAS				
	SA1	SA2	SA3	SA4	SA5
MA	CT,ME,NH,NJ, NY-NE,NY-SE, PA-E,RI,VT	DE,DC,MD,NY-W, OH-N,OH-S,PA-W, VA,NV	AL,GA,IL,IN, IA,KY,MI,NC, SC,TN,WI	AR,FL,KS,LA,MN, MS,MO,NE,ND,OK, SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA,WY
MI-N	IL-N,IA,MN, OH-N,WI	IL-S,IN,KY,MO, NY-W,ND,PA-W, OH-S	CT,DE,DC,MD, MA,NH,NJ,NC, NY-NE,NY-SE, PA-E,RI,SD, TN,VT,VA,WV	AL,AR,CO,FL,GA, KS,LA,ME,MS,NE, OK,SC	AK,AZ,HI,ID,MT, NV,NH,OR,PR,TX, UT,VA,VI,WA,WY
MI-S	IL-N,IN,NY-W, OH-N,OH-S,WI	DC,IL-S,IA,KY, NY-NE,PA-E,PA-W, WV	CT,DE,MD,MA, MN,MO,NH,NJ, NY-SE	AL,AR,CO,FL,GA, KS,LA,ME,MS,NE, ND,OK,SC	AK,AZ,CA,HI,ID, MT,NV,NM,OR,PR, TX,UT,VI,WA,WY
MN	IL-N,IA,MI-N, NE,ND,SD,WI	IL-S,IN,KS,MI-S, MO	AR,CO,KY,MT, OH,OK,PA,TN, WV,WY	AL,DC,ID,LA,MD, MS,NM,NY,TX,UT, VA	AK,AZ,CA,CT,DE, FL,GA,HI,ME,MA, NV,NH,NJ,NC,OR, PR,RI,SC,VT,VI,WA
MS*	AL,AR,GA,LA,TN, TX-E	FL,IL-S,KY,MO, OK,SC	IL-N,IN,IA, KS,NC,OH,TX-S, TX-W,VA,WI	CO,DE,DC,MD,MI, MN,NE,NJ,NM,PA, SD	AK,AZ,CA,CT,HI, ID,ME,MA,MT,NV, NH,NY,ND,OR,PR, RI,UT,VT,VI,WA,WY
MT*	ID,ND,OR,SD,UT, WA,WY	CA-N,CO,MN,NE,NV	AZ,CA-S,IA,KS, MO,NM,OK,WI	AR,IL,IN,KY,MI, OH,TX	AK,AL,CT,DE,DC, FL,GA,HI,LA,ME, MD,MA,MS,NH,NJ, NC,PA,PR,RI,SC, VT,VI,VA,WV
MO	AR,IL-N,IL-S, IA,KS,KY,NE,OK, TN	IN,LA,MS,WI	AL,GA,MI,MN, OH,SD,TX,WV	CO,DE,DC,FL,MD, NM,NC,ND,PA,SC, VA	AK,AZ,CA,CT,HI, ID,ME,MA,MT,NV, NH,NJ,NY,OR,PR, RI,UT,VT,VI,WA
NE	CO,IA,KS,MO,SD, WY	IL-N,MN,ND,OK, WI	AR,ID,IL-S,IN, MI,MT,NM,TX, UT	AL,AZ,GA,KY,LA, MS,NV,OH,OR,TN, WV	CA,CT,DE,DC,FL, ME,MD,MA,NH,NJ, NY,NC,PA,PR,RI, SC,VT,VI,VA,WA,HI
NV	AZ,CA-N,CA-S, ID,OR,UT	CO,WA,WY	IA,KS,MT,NE, NM,ND,OK,SD, TX	AR,IL,IN,LA,MI, MN,MS,MO,TN,WI	AK,AL,CT,DE,DC, FL,GA,HI,KY,ME, MD,MA,NH,NJ,NY, NC,OH,PA,PR,RI, SC,VT,VI,VA,WV
NH*	CT,ME,MA,NJ, NY-NE,NY-SE, RI,VT	DE,DC,MD,NY-W, OH-N,OH-S,PA-E, PA-W,VA,WV	GA,IL,IN,IA, KY,MI,NC,SC, TN,WI	AL,AR,FL,KS,LA, MN,MS,MO,NE,ND, OK,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA,WY
NJ	CT,DE,DC,MD,MA, NY-SE,PA-E,RI	NH,NY-NE,NY-W, VT,VA,WV	AL,GA,IL,IN, KY,ME,MI,SC, TN,WI	AR,FL,IA,KS,LA, MN,MS,MO,NE,ND, OK,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA,WY
NM	AZ,CO,OK,TX-W, UT	KS,NE,NV,TX-E, TX-S,WY	AR,CA,ID,IA, LA,MO,MT,SD	AL,IL,IN,KY,MN, MS,ND,OR,TN,WA, WI	AK,CT,DE,DC,FL, GA,HI,ME,MD,MA, MI,NH,NJ,NY,NC, OH,PA,PR,RI,SC, VT,VI,VA,WV
NY-NE	CT,DE,MD,MA,NH, NJ,PA-E,PA-W, RI,VT	DC,ME,MI-S,OH-N, OH-S,VA,WV	AL,GA,IL,IN, IA,KY,MI-N, MO,NC,SC,TN, WI	AR,FL,KS,LA,MN, MS,NE,ND,OK,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA, WY
NY-SE	CT,DE,DC,MD,MA, NH,NJ,PA-E,RI, VT	ME,NC,OH-N,OH-S, PA-W,VA,WV	AL,GA,IL,IN, IA,KY,MI,MO, NC,SC,TN,WI	AR,FL,KS,LA,MN, MS,ND,NE,OK,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA,WY
NY-W	DE,DC,MD,NJ, OH-N,PA-E,RI, WV	CT,ME,MA,MI-S, NH,OH-S,MI-N, VT,VA	AL,GA,IL,IN, IA,KY,NE,MO, NC,SC,TN,WI	AR,FL,KS,LA,MA, MS,ND,NE,OK,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA,WY
NC*	DE,DC,GA,MD,SC, OH-S,TN,VA,WV	AL,KY,NJ,OH-N, PA-E,PA-W	CT,FL,IL,IN, MA,MI,MS,NY, RI,VT	AR,IA,KS,LA,ME, MN,MO,NE,NH,OK, TX,WI	AZ,CA,CO,HI,ID, MT,NV,NM,ND,OR, PR,SD,UT,VI,WA,WY
ND*	IA,MN,MT,NE,SD, WY	CO,IL,IL-N,KS, MI-N,WI	AR,IL-S,IN, MI-S,MO,NV,NM, OK,OR,UT,WA	AZ,CA,KY,MS,OH, TN,TX,WV	AK,AL,CT,DE,DC, FL,GA,HI,LA,ME, MD,MA,NH,NJ,NY, NC,PA,PR,RI,SC, VT,VI,VA

*Service is not currently available from these states; for future reference.

MCI Telecommunications

Customized Business Communication Services

TABLE 14 • MCI WATS & Hotel WATS — Home State Service Areas (Continued)

Home State	SERVICE AREAS				
	SA1	SA2	SA3	SA4	SA5
OH-N	IN,KY,MI-S,VA, WV	DE,DC,IL-N,MD, IL-S,PA-E,TN	AL,CT,GA,IA, MA,MI-N,MO, NJ,NC,NY-NE, NY-SE,NC,SC, VT,WI	AR,FL,KS,LA,ME, ME,MS,NE,NH,ND, OK,RI,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA, WY
OH-S	IN,KY,MI-S,VA, NY-W,PA-W,WV	DC,IL-N,IL-S, MD,NC,PA-E,TN	AL,CT,DE,GA, IA,MA,MI-N, MO,NJ,NY-NE, NY-SE,SC,VT,WI	AR,FL,KS,LA,ME, MN,MS,NE,NH,ND, OK,RI,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA, WY
OK	AR,CO,KS,MO,NM, TX-E,TX-W	LA,MS,NE,TX-S	AL,IL,IN,IA, KY,MN,SD,TN, UT,WI,WY	AZ,FL,GA,MI,MT, NC,ND,OH,SC,VA, WV	AK,CA,CT,DE,DC, HI,ID,ME,MD,MA, NV,NH,NJ,NY,OR, PR,PA,RI,VT,VI,WA AL,CT,DE,DC,FL, KY,ME,MD,MA,NH, NJ,NY,NC,OH,PR, RI,SC,TN,VT,VI, VA,WY
OH*	CA-N,ID,NV,UT, WA	AZ,CA-S,MT,WY	CO,IA,KS,MN, NE,ND,OK,SD,	AR,IL,IN,LA,MI, MO,MS,WI	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA, WY
PA-E	CT,DE,DC,MD,NJ, NY-NE,NY-SE, NY-W	MA,NH,NC,OH-N, OH-S,RI,VT,VA, WV	AL,GA,IL,IN, KY,ME,MI,MO, SC,TN,WI	AR,FL,IA,KS,LA, MN,MS,NE,ND,OK, SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA, WY
PA-W	DE,DC,MD,NY-NE, NY-W,OH-N,OH-S, VA,WV	CT,MA,MI-S,NJ, NY-SE,NC	AL,GA,IL,IN, KY,ME,MI-N, MO,NH,RI,SC, TN,VT,WI	AR,FL,IA,KS,LA, MN,MS,NE,ND,OK, SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA, WY
RI*	CT,MA,NH,NJ,VT, NY-NE,NY-SE	DE,DC,ME,MD,VA, NY-W,OH-N,PA-E, PA-W,WV	AL,GA,IL,IN, KY,MI,NC,SC, TN,WI	AR,FL,IA,KS,LA, MN,MS,MO,NE,ND, OK,PR,SD,VI	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, TX, UT,WA,WY,HI
SC*	AL,GA,KY,NC,TN, VA,WV	DE,DC,FL,IN,MD, OH-N,OH-S,PA-W	AR,CT,IL,LA, MS,MO,NJ,NY, PA-E	IA,KS,ME,MA,MI, NH,OK,RI,TX,VT, WI	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, NM,ND,OR,PR,SD, UT,VI,WA,WY
SD	IA,MN,MT,NE,ND, WY	CO,IL-N,KS,MO, WI	AR,ID,IL-S, IN,MI,OK,TX, UT	AL,AZ,KY,LA,MS, NV,OH,OR,TN,WA, WV	AK,CA,CT,DE,DC, FL,GA,HI,ME,MD, MA,NH,NJ,NY,NC, PA,PR,RI,SC,VT, VI,VA
TN	AL,AR,GA,KY,MS, MO,NC,VA	IL-N,IL-S,IN, OH-N,OH-S,SC	DC,FL,IA,LA, MD,MI,OK,PA, WI	CT,DE,KS,MN,NE, NJ,NY,RI,TX	AK,AZ,CA,CO,HI, ID,ME,MA,MT,NV, NH,NM,ND,OR,PR, SD,UT,VT,VI,WA,WY
TX-E	AR,KS,LA,MS,MO, OK	AL,CO,IL-S,NE,NM, TN	AZ,FL,GA,IL-N, IN,IA,KY,SD, UT,WY	ID,MI,MN,MT,NV, NC,ND,OH,SC,WV, WI	AK,CA,CT,DE,DC, HI,MD,ME,MA,NH, NJ,NY,OR,PA,PR, RI,VT,VI,VA,WA
TX-S	AR,KS,LA,MS,MN, OK	AL,AZ,CO,MO,TN	FL,GA,IL,IN, IA,KY,NE,SD, TN,WY	ID,MI,MN,MT,NV, NC,ND,OH,SC,WV	AK,CA,CT,DE,DC, HI,MD,ME,MA,NH, NJ,NY,OR,PA,PR, RI,VT,VI,VA,WA
TX-W	AR,CO,KS,NM,OK	AZ,LA,MS,MO,NE, UT	AL,FL,GA,IL, IN,IA,KY,SD, TN,WY	ID,MI,MN,MT,NV, NC,ND,OH,SC,WV, WI	AK,CA,CT,DE,DC, HI,ME,MD,MA,NH, NJ,NY,OR,PA,PR, RI,VT,VI,VA,WA
UT	AZ,CO,ID,NV,NM, WY	CA-N,CA-S,MT	IA,KS,NE,ND, OK,OR,SD,TX	AR,IL,IN,LA,MI, NM,MS,MO,TN,WI	AK,AL,CT,DE,DC, FL,GA,HI,KY,ME, MD,MA,NH,NJ,NY, NC,OH,PA,RP,RI, SC,VT,VI,VA,WV
VA	DE,DC,KY,MD,NC, OH-S,PA-W,TN, WV	NJ,NY-SE,NY-W, OH-N,PA-E,SC	AL,CT,FL,GA, IL,IN,MA,MI, MS,NH,NY-NE, RI,VT	AR,IA,KS,LA,ME, MN,MO,NE,OK,SD, WI	AK,AZ,CA,CO,HI, ID,MT,NV,NM,ND, OR,PR,TX,UT,VI, WA,WY
VT*	CT,ME,MA,NH,NJ, NY-NE,NY-SE,RI	DE,DC,MD,NY-W, OH-N,OH-S,PA-E, PA-W,VA,WV	GA,IL,IN,IA, KY,MI,NC,SC, TN,WI	AL,AR,FL,KS,LA, MN,MS,MO,NE,ND, OK,SD	AK,AZ,CA,CO,HI, ID,MT,NV,NM,OR, PR,TX,UT,VI,WA,WY

*Service is not currently available from these states; for future reference.

MCI Telecommunications Customized Business Communication Services

TABLE 14 • MCI WATS & Hotel WATS — Home State Service Areas (Continued)

Home State	SERVICE AREAS				
	SA1	SA2	SA3	SA4	SA5
WA*	CA-N, ID, MT, NV, OR	CA-S, ND, UT, WY	AS, CO, IA, KS, MN, MO, NE, NM,	AR, IL, MI, TX	AK, AL, CT, DE, DC, FL, GA, HI, IN, KY, LA, ME, MD, MA, MS, NH, NJ, NY, NC, OH, PA, PR, RI, SC, TN, VT, VI, VA, WV
WV	DC, KY, MD, NC, VA, OH-N, OH-S, PA-W	DE, IN, NJ, NY-W, PA-E, SC, TN	AL, CT, GA, IL, MA, MI, MO, NH, NY-NE, NY-SE, RI, VT, WI	AR, FL, IA, KS, LA, ME, MN, MS, NE, OK, SD	AK, AZ, CA, CO, HI, ID, MT, NV, NM, ND, OR, PR, TX, UT, VI, WA, WY
WI	IL-N, IA, MI-N, MI-S, MN	IL-S, IN, MO, NE, OH-N, OH-S, SD	AR, DC, KS, KY, MD, NY, ND, OK, PA, TN, VA, WV	AL, CO, CT, DE, GA, LA, MA, MS, MT, NH, NJ, NC, RI, SC, VT, WY	AK, AZ, CA, FL, HI, ID, ME, NV, NM, OR, PR, TX, UT, VI, WA
WY*	CO, ID, MT, NE, SD, UT	AZ, KS, NM, ND, NV, OR	CA, IA, MN, MO, OK, WA, WI	AR, IL, IN, KY, LA, MI, MS, TX	AK, AL, CT, DE, DC, FL, GA, HI, ME, MD, MA, NH, NJ, NY, NC, OH, PA, PR, RI, SC, TN, VT, VI, VA, WV

*Service is not currently available from these states; for future reference.

central office. Access lines can be provided by MCI, the local exchange carrier, or the customer. Directory assistance is available and is charged on a per-call basis. Nonrecurring charges are applied to installation, physical changes, administrative changes, expedited orders, and Service Area conversions and service conversions.

Other nonrecurring charges are set-up charges for call records on magnetic tape and authorization codes.

Minimum Monthly Usage Charge • for all usage:
\$75.00 mo

Circuit Termination Charge • MCI-provided dedicated access line; charge per line:
100

Local Exchange Company-Provided Access Line; charge per line:
25

Customer-Provided Dedicated Access Line; charge per line:
50

Directory Assistance • charge per directory assistance call:
0.45

Additional Feature Charges

The following are customer options.

Accounting Codes • from 1 to 99 codes per customer per originating location; charges for accounting codes will not be prorated; charge per up to 99 codes:
\$15.00 mo

Authorization Codes • from 1 to 99,999 codes per Service Area 5 customer per originating switch location; charge per up to 99,999 codes:
1,500.00

Call Records On Magnetic Tape • charge for each recorded reel of magnetic tape per month; charge per account:
100.00

Nonrecurring Charges

Installation • charge per access line per order:
\$120 line \$50 ord

Physical Change • charge per access line per order:
100 50

Administrative Change • charge per order:
NC 20

Expedite • charge per expedited order:
NC 105

Cancellation of Order • charge per access line:
130 NC

Service Area & Service Conversions • charge per access line per order:
120 50

One-Time Set-Up Charges • set-up system to provide monthly call records on magnetic tape and to provide 5-digit authorization codes.

Call Records On Magnetic Tape • charge per account:
500

Authorization Codes (5-Digit) • charge per 1,000 or less codes:
300

MCI WATS & Hotel WATS Termination & Origination Access Cities

Arkansas • Little Rock.

Arizona • Phoenix; Tucson.

California • Anaheim; Bakersfield; Fresno; Inglewood; Los Angeles; Oakland; Palm Desert; Palo Alto; Sacramento; San Jose; San Francisco; San Diego; Sherman Oaks.

Colorado • Denver.

Connecticut • Bridgeport; Hartford; New Haven; Stamford.

Delaware • Wilmington.

District of Columbia • Washington.

Florida • Daytona Beach; Ft. Lauderdale; Jacksonville; Miami; Orlando; Tampa; West Palm Beach.

Georgia • Atlanta; Savannah.

Illinois • Bensenville; Champaign; Chicago; Downers Grove; Peoria; Rockford; Springfield.

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Indiana • Evansville; Ft. Wayne; Gary; Indianapolis.

Iowa • Cedar Rapids; Davenport; Des Moines; Iowa City; Sergeant Bluff; Sioux City.

Kansas • Topeka; Wichita; Lexington; Louisville.

Louisiana • New Orleans; Shreveport.

Maryland • Springfield; Baltimore; Olivette.

Massachusetts • Boston; Springfield.

Michigan • Ann Arbor; Climax; Detroit; Grand Rapids; Lansing.

Minnesota • Minneapolis; St. Paul.

Missouri • Creve Coeur; Kansas City; Springfield; St. Louis.

Nebraska • Omaha.

Nevada • Las Vegas; Reno.

New Hampshire • Nashua.

New Jersey • Camden; Crystal Lake; Newark.

New Mexico • Albuquerque.

New York • Albany; Buffalo; New York; Rochester; Ryebrook; Syracuse; White Plains.

Ohio • Akron; Cincinnati; Cleveland; Columbus; Dayton; Toledo; Youngstown.

Oklahoma • Oklahoma City; Tulsa.

Pennsylvania • Erie; Philadelphia; Pittsburgh.

Rhode Island • Providence; Richardson.

Tennessee • Knoxville; Memphis; Nashville.

Texas • Abilene; Amarillo; Austin; Bryan; Corpus Christi; Dallas; El Paso; Ft. Worth; Houston; Irving; Longview; Lubbock; San Angelo; San Antonio; Sugarland; Terminal; Waco.

Utah • Salt Lake City.

Virginia • Richmond.

West Virginia • Charleston.

Wisconsin • Madison; Milwaukee.

MCI WATS & Hotel WATS Termination-Only Access Cities

Alabama • Birmingham; Gadsden; Huntsville; Mobile; Montgomery.

Arkansas • Benton; Hot Springs.

California • Berkeley; Canoga Park; Capistrano Valley; Colton; Compton; Concord; Del Mar; Downey; El Monte; Escondido; Fremont; Hayward; La Canada; Monterey; Moorpark; Oceanside; Ontario; Pasadena; Pleasantville; Pleaston; Salinas; San Francisco; San Rafael; San Pedro; Santa Rosa; Santa Monica; Santa Cruz; Santa Barbara; Santa Ana; Saticoy; Stockton; Vacaville; Vallejo; Van Nuys; Ventura; Vista.

Colorado • Colorado Springs; Fort Collins; Grand Junction; Greeley; Longmont; Loveland; Pueblo.

Connecticut • Bristol; Danbury; Greenwich; Meriden; New London; New Britain; Norwalk; Rockville; Torrington; Waterbury.

Florida • Boca Raton; Clearwater; Daytona Beach; Gainesville; Pensacola; Tallahassee.

Georgia • Augusta; Columbus; Macon; Rome; Honolulu.

Idaho • Boise; Forest Park; Pocatello; Twin Falls.

Illinois • Alton; Blue Island; Chicago Heights; Decatur; Edgemoor; Elk Grove; Geneva; Glenview; Hinsdale; Joliet; Kankakee; Maywood; Round Lake; Waukegan.

Indiana • Anderson; Bloomington; Chesterton; Clarksville; Columbus; Kokomo; Marion; Newburgh; Valparaiso.

Iowa • Ames; Clinton; Fort Dodge; Sergeant Bluff; Sioux City; Waterloo.

Kansas • Hutchinson; Lawrence; Manhattan.

Kentucky • Fort Knox; Frankfort.

Louisiana • Baton Rouge; Houma; Lafayette; Modesto; Monroe.

Maryland • Annapolis; Cambridge; Easton; Frederick; Hagerstown; La Plato; Salisbury.

Massachusetts • Attleboro; Fall River; Fitchburg; Haverhill; Lawrence; Lexington; Lowell; Lynn; Natick; New Bedford; Pittsfield; Randolph; Taunton; Worcester.

Michigan • Battle Creek; Flint; Holland; Jackson; Kalamazoo; Midland; Monroe; Muskegon; Plymouth; Pontiac; Port Huron; Saginaw; Warren; Wyandotte.

Minnesota • Rochester; St. Cloud.

Mississippi • Jackson.

Missouri • Cape Girardeau; Joplin; St. Joseph; St. Charles; Valley Park.

Nebraska • Lincoln.

New Hampshire • Manchester.

New Jersey • Florence; Hackensack; Haddonfield; Lakewood; Long Branch; Matawan; Morristown; Mt. Holly; New Brunswick; Pompton Lake; Princeton; Rahway; Ridgeway; Summit; Sycamore; Trenton; Vineland; Williamstown; Woodbury.

New Mexico • Santa Fe.

New York • Binghamton; Deer Park; Garden City; New Rochelle; Niagara Falls; Queens; Tonawanda; Utica; Yonkers.

North Carolina • Charlotte; Durham; Greensboro; Raleigh; Winston-Salem.

Ohio • Alliance; Canton; Delaware; Elyria; Lancaster; Lorain; Marion; Middletown; Newark; Painesville; Sandusky; Springfield; Tiffin; Kenia.

Oklahoma • Battlesville; Enid; Lawton; Muskogee; Stillwater.

Oregon • Eugene; Portland; Salem.

Pennsylvania • Allentown; Altoona; Belle Vernon; Butler; Carlisle; Collegeville; Gibsonia; Greensburg; Harrisburg; Jenkintown; Johnstown; Lancaster; Langhorne; Lenape; New Kensington; New Castle; Norristown; Reading; Rochester; Scranton; Souderton; Uniontown; Upper Darby; Washington; Wyoming.

Rhode Island • Newport.

South Carolina • Charleston; Columbia; Greenville; Spartanburg.

Tennessee • Bristol; Chattanooga; Jackson; Oakridge; Smyrna.

Texas • Alice; Bay City; Beaumont; Beeville; Belair; Big Springs; Borger; Brownsville; Bryan; Channelview; Clute; Denison; Denton; Edinburg; Frisco; Galveston; Greenville; Harlingen; Hereford; Huntsville; Laredo; Marshall; Nederland; New Braunfels; Paris; Plainview; Texarkana; Tyler; Victoria; Wakahachie; Wichita Falls.

Utah • Ogden; Provo.

Virginia • Dale City; Fredericksburg; Leesburg; Manassas; Newport News; Petersburg; Roanoke.

Washington • Seattle; Tacoma.

West Virginia • Wheeling.

Wisconsin • Fond du Lac; Janesville; Kenosha; Menomonee Falls; Racine; West Bend.

Wyoming • Cheyenne.

International Service

International service is available for call termination to all customers of Execunet, Credit Card, MCI WATS, and Hotel WATS, services subject to the provisions set forth under each service.

International calls which begin in 1 rate period and end in another will be charged at the rate in effect at the time the connection was established. Per minute rates are country specific, with the exception of the rates to Canada, and are in effect 7 days a week.

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European standard rate extends from 7:00 AM to 12:59 PM; discount rate extends from 1:00 PM to 5:59 PM; economy rate extends from 6:00 PM to 6:59 AM Near East standard rate extends from 8:00 AM to 2:59 PM; discount rate extends from 9:00 PM to 7:59 AM; economy rate extends from 3:00 PM to 8:59 PM South American standard rate extends from 7:00 AM to 12:59 PM; discount rate extends from 1:00 PM to 9:59 PM; 10:00 PM to 6:59 AM Australia standard time extends from 5:00 PM to 10:59 PM; discount rate extends from 10:00 AM to 4:59 PM; economy rate extends from 11:00 PM to 9:59 AM.

European region includes Belgium, German Democratic Republic, and Greece, Cyprus, Egypt, Jordan, Kenya, and Qatar provided on a transit basis via Greece. Near East region includes United Arab Emirates. South American region includes Brazil/Argentina, Australia. The U.S. Mainland to International Region rates are presented in **Table 15**; those for Canada are presented in **Table 16**.

Extension Point Service

Where a customer requests service to locations not served by MCI, MCI will, at its option, provide service via other common carriers connected to the nearest MCI terminal location equipped to provide the specified MCI service.

Other Common Carrier Charges

MCI will pass through to the customer the monthly recurring rates

charged to MCI, under an appropriate tariff, by those common carriers providing extension facilities when it is in provision of an existing MCI service.

MCI will assess a monthly recurring charge per circuit or the rates charged to MCI by those carriers providing the facilities under an appropriate tariff, when the facility is not used in provision of an existing MCI service. An administration fee is also charged per circuit per month.

Monthly Recurring Charges • charge per circuit plus administration fee per circuit:

\$100 circuit \$10 admin

Access Charges

MCI Extension Point Service Access Charges • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per circuit; and a one-time administrative charge per circuit:

\$50.00 ord \$80.00 instal \$20.00 admin

Access

MCI provides Extension Point Service to every city within the contiguous United States.

CCSA Service

The MCI CCSA service (Common Control Switching Arrange-

TABLE 15 • International Service Usage Charges — U.S. Mainland to International Regions

Call Termination Country	Standard		Discount		Economy	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
Belgium	\$1.89	\$1.15	\$1.29	\$0.89	\$1.19	\$0.68
German Democratic Rep	2.19	1.24	1.64	0.93	1.29	0.74
Greece	1.91	1.17	1.31	0.91	1.21	0.71
United Arab Emirates	3.44	1.24	2.56	0.93	2.05	0.74
Brazil/Argentina	2.59	1.09	1.94	0.83	1.39	0.66
Cyprus	2.19	1.18	1.58	0.89	1.27	0.71
Jordan/Qatar	3.28	1.18	2.46	0.89	1.98	0.71
South Africa/Algeria	2.43	1.27	1.83	0.96	1.46	0.76
Egypt/Kenya	2.68	1.35	1.99	0.99	1.56	0.79
Australia	3.37	1.36	2.23	1.03	1.90	0.87

TABLE 16 • International Service Usage Charges — U.S. Mainland to Canada Mileage Band Rate

Intercity Mileage Band, Miles	Business Day		Evening		Night & Weekend	
	1st Min	Add'l Min	1st Min	Add'l Min	1st Min	Add'l Min
1 - 8	\$.1271	\$.1080	\$.0887	\$.0710	\$.0547	\$.0435
9 - 18	.1617	.1578	.1129	.1028	.0696	.0635
19 - 30	.2324	.2043	.1622	.1331	.1001	.0838
31 - 50	.2789	.2498	.1947	.1584	.1201	.0980
51 - 80	.3203	.2785	.2236	.1815	.1380	.1100
81 - 110	.3416	.3064	.2384	.1997	.1471	.1225
111 - 140	.3630	.3342	.2534	.2178	.1563	.1330
141 - 180	.3843	.3621	.2683	.2360	.1655	.1470
181 - 220	.4056	.3885	.2831	.2520	.1747	.1555
221 - 270	.4341	.4225	.3030	.2753	.1870	.1715
271 - 345	.4934	.4500	.3444	.2866	.2125	.1795
346 - 430	.5238	.4950	.3656	.3097	.2256	.1948
431 - 630	.5542	.5300	.3868	.3323	.2387	.2100
631 - 900	.5845	.5700	.4080	.3553	.2517	.2300
901 - 1200	.6149	.6100	.4292	.3783	.2648	.2450
1201 - 1610	.6453	.6400	.4505	.4013	.2779	.2590
1611 - 2200	.6756	.6755	.4716	.4242	.2910	.2625
2221 - 4000	.7060	.7050	.4928	.4510	.3040	.2880

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ment) does not involve the provision of intercity communication channels, but rather, is offered as a switching service interconnecting networks trunks including circuits and services provided either by MCI or by other participating common carriers. use of MCI's common control switching equipment in connection with this service may be shared with other customers or other services. Two options are available for this offering: a full-service Option A (Telemanagement) and a limited-service Option B (Least Cost Routing). The CCSA service provides a versatile array of elements designed to simplify calling procedures and to automate routing and accounting functions. Some of these elements, whose availability is contingent on the option selected, include: least-cost first routing, authorization/accounting codes, abbreviated dialing codes, priority-level routing arrangements, tone notification before trunk group selection, and call detail/authorization-accounting code reporting.

Traffic Charges

For the CCSA Service, traffic charges are applied only to non-MCI traffic utilizing a Dedicated Access Arrangement. This charge does not apply to calls which are not completed.

CCSA Switch Utilization Charge • charge per minute for non-MCI traffic:

\$0.01 min

Access Charges

The basic charge for CCSA Service is a monthly charge for each Dedicated Access Arrangement (DAA). Monthly charge depends upon option (A or B) and method of access selected.

Dedicated Access Arrangement (DAA) • the following charges anticipate that access will be via MCI-provided dedicated access lines.

Option A (Telemanagement) DAA Charges • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per DAA; and a monthly charge for each DAA:

\$50.00 ord	\$120.00 instal	\$230.00 mo
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Option B (Least Cost Routing) DAA Charges • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per DAA; and a monthly charge for each DAA:

50.00	120.00	105.00
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Dedicated Access Arrangement (DAA) • the following charges apply if the customer elects this service via an MCI intercity facility or via a customer-provided facility.

Option A (Telemanagement) DAA Charges • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per DAA; a monthly charge for each DAA; a special access surcharge will be applied to each DAA:

50.00 ord	120.00 instal	165.00 mo	25.00 srchg
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Option B (Least Cost Routing) DAA Charges • charges comprise one-time processing charge for each order for installation(s); one-time installation charge per DAA; a monthly charge for each DAA; a special access surcharge will be applied to each DAA:

50.00	120.00	50.00	25.00
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Additional CCSA Feature Charges

The charges for the following extra CCSA features are additional monthly charges per Dedicated Access Arrangement.

Option A (Telemanagement) Features • charges per DAA per month.

High-volume and WATS-band CCSA call traffic destination by half-hour segment:

\$20.00 mo

CCSA area code traffic summary report:

25.00

CCSA area code traffic call detail:

30.00

Summary by authorization/accounting code:

20.00

Option B (Least Cost Routing) Features • charges per DAA per month.

Accounting Codes (2-Digit) • a group of 99 codes per customer per originating location:

15.00

Multiple Access Data Collection Service

Multiple Access Data Collection Service is offered at a data speed of up to 300-bps interfacing with data processing and/or computer switching equipment. Data transmitted via these channels to and from customer-provided equipment may be stored, forwarded to other locations, speed or code converted, or returned to the customer in the same or different form as required.

The low-speed data channels will be concentrated into a single channel by MCI at an MCI terminal and transmitted/received for computer access in broadband format at another MCI terminal. A minimum of 20 channels is required prior to inauguration of service; if below 15 channels for any continuous 90-day period, MCI will terminate the customer's service.

Circuit Termination Charge • charges comprise one-time processing charge for each order; one-time installation charge for each circuit end, a monthly rate for each 0- to 300-bps circuit end, and a monthly rate for each broadband format circuit end:

\$50.00 ord	\$80.00 instal	\$27.90 mo	\$57.90 mo
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Traffic Charges

Charge is based per month, per mile for each 0- to 300-bps circuit:

\$0.198 mo

MCI Faxnet Facsimile Service

Faxnet provides a means of transmitting facsimile data among and between compatible authorized facsimile terminals or between an authorized facsimile terminal and an MCI Faxnet Forwarding Facility. At customer's option, MCI will provide facsimile terminals. Faxnet provides for forwarding of facsimile data from a Faxnet Forwarding Facility via the U.S. Postal Service, or the retention of facsimile data by MCI at a Faxnet Forwarding Facility for pickup by subscriber, addressee, or his agent.

Authorized facsimile terminal connections to the Faxnet Service System will be made via any combination of intracity or intercity private lines. Message Telecommunication Service or Wide Area Telecommunications Service, provided either by MCI or other duly authorized and regulated common carriers pursuant to applicable tariff provisions and restrictions. A Dual-Tone Multifrequency (D.T.M.F.) device is required for system entry.

This service may be utilized only for the transmission of facsimile data between compatible authorized facsimile terminals or between an authorized facsimile terminal and an MCI Faxnet Forwarding Facility.

Authorized Facsimile Terminals

Faxnet provides the capability for using a carrier-provided analog facsimile terminal capable of transmitting a page of data in approximately 4 minutes (Type A) or a customer-provided analog facsimile terminal capable of transmitting a page of data in approximately 2 (Type B), 3 (Type C), or 4 (Type D) minutes.

Terminal-to-Terminal Transmission

Facsimile data can be sent to premises where the addressee has a compatible authorized facsimile terminal under 1 of 3 service classes: Class 1 Service attempts delivery within 15 minutes of Faxnet system entry time; Class 2 Service attempts delivery, on a prearranged basis, within 2 hours of Faxnet system entry time; Class 3 Service attempts, on a prearranged basis, overnight delivery by 9 AM of the following day of Faxnet system entry time.

Terminal-to-Faxnet Forwarding Facilities Transmission

Subscribers can send facsimile data to premises where the

MCI Telecommunications Customized Business Communication Services

addressee does not have an authorized terminal. Upon prior arrangement with MCI, subscribers may transmit to MCI's Faxnet forwarding facilities either by Class 4 Service where data received between 8 AM and 3 PM, local time, Monday through Friday, at said facility will be deposited in U.S. Mail as special delivery by 6 PM; Class 5 Service where data received between 3 PM and 5 PM, local time, Monday through Friday, at said facility will be retained there pending pickup by subscriber or addressee.

Access Charges

A monthly access charge of \$10 is payable by each subscriber. Rates are based on per-page entry or exit. There are separate charges for entry and exit. These charges are based on rate period and class of service.

Daytime Rates			
Terminal Type	Class 1 15-Minute Delivery	Class 2 Two-Hour Delivery	Class 3 Overnight Delivery
A	\$.40	\$.32	\$.24
B	.40	.32	.24
C	.30	.24	.18
D	.20	.16	.12

Nighttime Rates			
Terminal Type	Class 1 15-Minute Delivery	Class 2 Two-Hour Delivery	Class 3 Overnight Delivery
A	\$.28	\$.22	\$.17
B	.28	.22	.17
C	.21	.17	.13
D	.14	.11	.08

Class 4 & 5 Service Charges • include postage charges incurred by MCI, a per transaction charge, a per page surcharge, and transmission charge as outlined in above tables:

\$1.00 trans \$0.10 srchg

Maximum Monthly Charge • per terminal for system entry or exit:

70 mo

MCI-Provided Terminal • Type A (4 min/page) terminal one-time charge and monthly charge; 3-month minimum service period:

25 OTC 42

Access

Faxnet Service, Classes 1, 2, and 3, is available between the following cities, except where such cities are located in the same state. However, MCI provides services within Texas on an intra-state basis, pursuant to an exemption from state regulatory authority.

Arizona • Phoenix; Tucson.

California • Los Angeles; San Diego; San Francisco.

Colorado • Denver.

Delaware • Wilmington.

Illinois • Chicago.

Indiana • South Bend.

Maryland • Baltimore.

Michigan • Detroit.

Minnesota • Minneapolis.

Missouri • Kansas City; St. Louis.

Nebraska • Omaha.

New Jersey • Newark.

New York • New York City.

Ohio • Akron; Cincinnati; Cleveland; Columbus; Dayton; Toledo.

Oklahoma • Oklahoma City.

Pennsylvania • Philadelphia; Pittsburgh.

Texas • Dallas; Houston.

Faxnet Service, Classes 4 and 5, is available at the following locations:

California • 666 S. Los Angeles Street, Los Angeles.

Illinois • 875 N. Michigan Avenue, Chicago.

New York • 1301 Avenue of the Americas, New York; 55 Water Street, New York.

Ohio • Keith Building, 1621 Euclid Avenue, Cleveland.

Pennsylvania • 117 South 17th Street, Suite 500, Philadelphia.

Texas • 2001 Bryan Street, Suite 5950, Dallas; Two Shell Plaza, Room 2475A, Houston.

Other Services

School of Telecommunications Management

The MCI School of Telecommunications Management provides professional seminars and courses to help corporate communications managers keep abreast of rapidly changing developments in telecommunications and to aid decision-making on telephony matters. Courses are scheduled in major cities throughout the country. MCI also offers an "in-house" training program under which MCI instructors are brought directly to companies with 15 or more students.

• END

Micom Line Drivers & Switched/Dedicated Modems

Micro400 Line Drivers and DialNet3000, Micro4000 & Micro5000 Modems

■ PROFILE

Function • AT&T 43401-compatible and non-AT&T-compatible line drivers • medium-to-high speed CCITT- and AT&T-compatible modems • AT&T 212A/103 and CCITT V.22 bis-compatible modems for the public switched network (DDD).

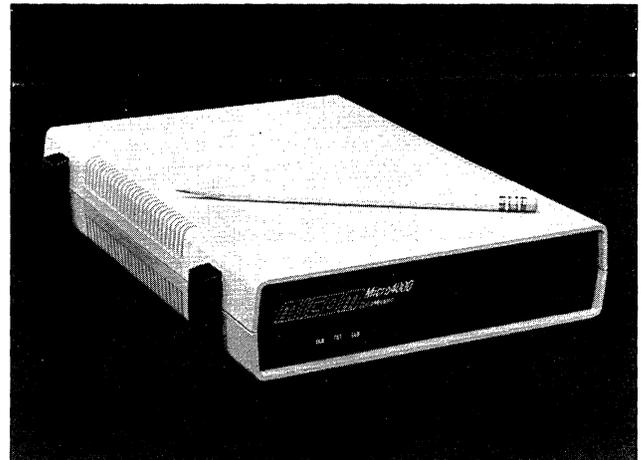
Communication/Networks • point-to-point communication up to 19.2K bps over 4-wire privately owned twisted-pair metallic circuits; up to 19.2K bps AT&T 43401-compatible 4-wire unloaded/loaded or privately owned twisted-pair metallic circuits; up to 19.2K-bps point-to-point or multipoint communications over privately owned lines on 2- or 4-wire metallic circuits • 2400-bps AT&T 201/CCITT V.26-compatible point-to-point or multipoint communication over unconditioned 4-wire dedicated Type 3002 facility • 4800-bps CCITT V.27-compatible point-to-point or multipoint communication over unconditioned 2- or 4-wire dedicated Type 3002 facility • 9600-bps CCITT V.29-compatible communication over unconditioned 2- or 4-wire dedicated Type 3002 facility • 300-/1200-bps AT&T 212A/103 compatibility and 1200-/2400-bps AT&T 212A/CCITT V.22 bis compatibility over switched network.

First Delivery • Micro400: 1980; Models M430/M431: 1983 • Micro5000: 1980 • Micro4000: 1981 • DialNet3000: 1984.

Units Delivered • Micro400: 100,000 • Micro4000: 4,000 • Micro5000: 100.

Comparable Systems • principal competition for Micro400 Series from Avanti Local Area Data Distributors; Codex 8200 Series Limited Distance Modems; and Gandalf LDS Models 25, 309, and 319 • for DialNet3000 Series from AT&T-IS; Anderson Jacobson; General DataComm; Racal-Vadic; Rixon; UDS; and others • for Micro4000 Series from Codex "E" Series; Kinex CCITT-compatible modems; Rixon R96; and UDS 9600 A/B • no comparable competition for Micro5000 Series modems.

Vendor • Micom Systems, Inc; 20151 Nordhoff Street,



Chatsworth, CA 91311 • 213-998-8844.

Distribution • nationwide and worldwide through factory-authorized distributors and representative/distributors • Canada through ATELCO, Scarborough, Ontario; United Kingdom through Micom-Borer, Limited, Berkshire, England; Mexico through Transdata, Mexico City; Japan through ITS-Japan Co, Limited, Tokyo.

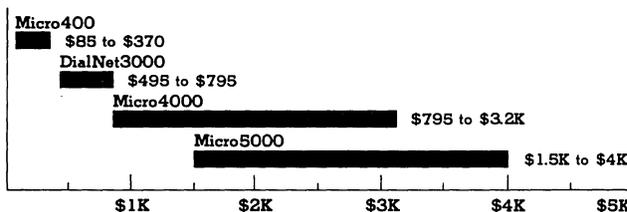
■ ANALYSIS

In July 1984, Micom introduced a family of modems for the public switched (DDD) network. The modems differ in standard features, but all (except for one) provide transmission compatibility with the AT&T 212A and the 103. The one exception is compatible with both the 212A at 1200 bps only, and with CCITT V.22 bis at 2400 bps. The new DialNet3000 modems are an important complement to Micom's existing families of line drivers and dedicated modems. They benefit the needs of users that require both dialup and dedicated lines within their network.

Although Micom is known primarily for its low-end statistical multiplexer and data circuit switches, a natural outgrowth of this business has been the development of modems to support its traditional customer base. Micom has been oriented toward data communication support for minicomputer users, including those inexperienced in implementing and managing complex data communication networks. The Micom modems reflect this same emphasis: they are designed to provide low-cost, medium-to-high-speed uncomplicated data communication over dedicated lines for either synchronous or asynchronous inputs. The modem products encompass the Micro400 line drivers for use over Telco-supplied or user-supplied metallic circuits; the Micro4000 Series 2400- to 9600-bps modems for synchronous and asynchronous transmissions; and the Micro5000 Series "Intelligent" Modems with conversion and error control permitting high-speed asynchronous terminals to communicate over dedicated voice grade telephone lines inherently suited for synchronous transmissions.

The Micro400 Series line drivers are designed for local data transmission at rates up to 19.2K bps and for distances up to 31

PURCHASE PRICE RANGE



MICOM DIALNET3000 & MICRO400/4000/5000 LINE DRIVERS/MODEM PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations for hardware • the Micom Micro400 Model M430 small configuration is a pocket-sized 9600-bps asynchronous line driver for direct plug-in to terminal/computer; Model M421 large configuration is a 19.2K-bps synchronous line driver • Micom DialNet3000 Model M3012 small configuration is a 300-/1200-bps AT&T 103/212A-compatible modem; Model M3024 large configuration is a 1200-/2400-bps AT&T 212A/CCITT V.22 bis-compatible modem • Micom Micro4000 Model M4024 small configuration is a 2400-bps synchronous modem; Model M4096/4+ large configuration is a multipoint synchronous modem with 4-channel TDM and includes Dial Backer • Micom Micro5000 Model M5596/24 small configuration is a 2400-bps modem with error control and asynchronous-to-synchronous conversion capability; Model M4496/96 large configuration is a 9600-bps modem with error control and asynchronous-to-synchronous conversion capability.

Micom Line Drivers & Switched/Dedicated Modems

Micro400 Line Drivers and DialNet3000, Micro4000 & Micro5000 Modems

miles (at lower data rates). Micom divides the Micro400 Series into 2 groups: **line drivers** for use over customer-supplied twisted-pair metallic circuits, and **local datasets** for use over telephone company-supplied loaded or unloaded metallic circuits. Local datasets conform to AT&T Publication 43401, which means they provide filtering to prevent transmitted signals from interfering with adjacent wire pairs in the same telephone cable. The first Micro400 Series models were introduced during the same year as the Micro600 Port Selector (data PBX), and complement the Micro600 in the role of driving data from locally scattered terminals to the data PBX, which switches the connections to computer ports and/or other terminals. The Micro400 Series also can be used, of course, to connect local terminals directly to computer ports in dedicated fashion.

The Micro4000 Series modems conform to international CCITT specifications and provide medium-to-high-speed performance at low cost. Some models are basic no-frills variants, while others provide enhanced features for specific applications. **Speed shifting**, for instance, although not a new concept in the modem world, is a standard feature on "+" (plus) models with benefits for inquiry-type multidrop applications, where data traffic typically involves short inquiries to the CPU followed by long replies. When sending an inquiry, the multidropped modem must equalize, or train, on the line—a time-consuming process in relative terms; speed shifting allows training to 4800 bps in 2 stages. In essence, the speed shift models use 9 milliseconds to train to 2400 bps, at which point they begin transmitting data while continuing to train to a 4800-bps data rate. It takes 26 additional milliseconds to train to the 4800-bps rate, during which time 62 bits of data have passed at the 2400-bps rate. Because the total training time to 4800 bps is 35 milliseconds, and since the 62 bits already transmitted at the lower rate equates to 13 milliseconds at 4800 bps, Micom claims that speed shifting is equivalent to an ordinary 4800-bps modem with a 22-millisecond training time (35 minus 13 milliseconds). What this all means to the user is that if his inquiries are kept very **short** (10 characters or under), his terminal response time will be better with speed shifting than with conventional fast-poll modems, because some data is getting through while the modem is waiting to train to 4800 bps. The longer the inquiry, the less efficient speed shifting becomes. Also, remember that the 9600-bps speed-shift modem is restricted to a 4800-bps transmit rate because the technique does not allow another shift to 9600 bps (although it can still receive at 9600 bps).

The Micro5000 Series Intelligent Modems contain an asynchronous-to-synchronous converter; however, unlike the Micro4000 modem models M4024/ASYN and M4124/ASYN, which also contain the same converter, the Micro5000 Series provides a data link control (DLC) protocol similar to the one employed by Micom's 800/2 statistical multiplexer. This means that data transmitted from a DTE is buffered before passing through the modem, with flow control and error detection/correction methods instituted when necessary to maintain data integrity. These and other "intelligent" features make the Micro5000 Series a logical solution for connecting high-speed asynchronous terminals to computers over long distances.

About 3 years ago, Micom acquired Borer Ltd, a British telecommunication firm that had the long-haul modem technology Micom needed to expand its product line. Since then, the company has incorporated modems into packaged combinations with Micro800 and Micro900 statistical multiplexers, and reduced the modem's size (increasing reliability) and increased their functionality with extra features. Micom also trades technology with Black Box Catalog, another recent Micom acquisition, in the production of short-haul modems. Combine these activities with Micom's excellent marketing efforts and after-sales support, and you have a company that is well-equipped to meet the data communication requirements of its customers—most seeking simple solutions to otherwise complex problems.

□ Strengths

The chief advantages of Micom modems are their low cost and relative simplicity. Both short- and long-haul models are available to meet a variety of applications; all models are easily installed by

the user, and faulty units can be swapped for replacement through Micom's successful overnight express service.

The Micro400 Series replaces expensive, long-haul modems for short distance connections. The Model M402 accommodates extra control signal for use with dial-up computer ports; and Models M430 and M431 are miniature pocket-sized units that plug directly into a terminal or computer interface and are powered by the unit they support, eliminating the need for messy modem cable and power cords.

The DialNet3000 Series modems are priced well below their AT&T equivalents and offer beneficial features not available on the AT&T modems. Dual- and triple-modem compatibility adds operating flexibility and eliminates the extra cost of separate modems. Directory-driven auto-dialing also increases operating flexibility, allowing the user to dial and redial up to 20 different programmed numbers via a 2-digit command keyed into his terminal. And the dual 212A/CCITT V.22 bis compatibility allows users to communicate in the full-duplex mode at twice the speed of the 212A with the option to switch to 212A mode when necessary. All models are equipped with switchable manual and automatic answer for unattended operation; auto-answer has automatic speed detection to adjust modem speed to that of the received data rate. What's more, all models support alternate voice/data communication where voice coordination is necessary; an external handset plugs into the modem. Also, all models can be mixed in the same card cage according to user needs, and the cage is only 8.75 inches high for high-density installations. Another strength of the DialNet3000 is a full complement of diagnostics including an integral test pattern generator.

The Micro4000 Series includes 4800- and 9600-bps "speed-shift" modems that are ideal for multidrop networks with applications for short terminal inquiries followed by long replies from the CPU. When inquiries are comprised of 10 characters or less, these modems can provide users with faster response time than ordinary fast-poll modems.

The Micro5000 Series permits high-speed asynchronous terminals to transmit over dedicated voice-grade lines, a transmission medium suitable to asynchronous traffic only at high data rates. The Micro5000 Series achieves this by converting asynchronous data to synchronous and adds error control, flow control, and data compression as well.

□ Limitations

Micom modems are aimed at less sophisticated users than are some other classes of high-speed modems. This factor necessarily limits Micom modems' use in complex multinode networks that require sophisticated diagnostics and management reporting. Micom does not provide a hot-spare modem switch, for instance, which could switch connections between a failed modem and a collocated hot spare; nor are different modem-card types mixable in the same card cage, a possible disadvantage for users with large central-site rackmount requirements.

The DialNet3000 Series modems require manual setup of operating parameters, and, except for the auto-dial feature, cannot be programmed through the attached DTE. Parameters are established through strapping options on the PC card and by setting DIP switches behind the front panel of a standalone unit or on the edge of a PC card rackmount unit. These are inexpensive methods but cause operator inconvenience when reconfiguring the unit. Also, the status indicators are limited; none of the normal EIA signals are displayed such as DTR, CTS, or CD. Absence of these indicators could result in time lost in identifying the cause of a problem.

The Micro4000 Series modems with speed shift capability are only suited to applications involving short inquiries of a host and would be a poor choice for batch transmissions or other long (over 10 characters) data queries transmitted to a host. Furthermore, 9600-bps speed-shift models are limited to transmitting data at 4800 bps. Although CCITT compatible, users require 2 Micom "plus" modems at both ends of transmission in order to implement speed shifting.

The Micro5000 Intelligent Modems are also CCITT compatible,

Micom Line Drivers & Switched/Dedicated Modems

Micro400 Line Drivers and DialNet3000, Micro4000 & Micro5000 Modems

but again, 2 Micom modems, 1 at each end of transmission, are required in order to implement error control, flow control, and data compression. Moreover, the Micro5000 Series communicates only with ASCII terminals, and although they accept any 8-bit code, they are essentially ASCII devices; users with different terminals are not able to take advantage of most of the Micro5000 Series capabilities.

■ HARDWARE

□ Terms & Support

Terms • OEM purchase through Micom; end-user purchase or lease only through Micom distributors and representative/distributors; separate maintenance contracts not available • 1-year warranty on all models • quantity discounts for OEM purchase at 5% for 10 to 25 units, 10% for 25 to 50 units, 15% for 50 to 100 units, and 20% for 100 plus units; end-user discounts set by individual distributors and distributor/ reps.

Support • all models installed by user; maintenance available through factory swap-out arrangement, with overnight express service available; repair or replacement at no cost for equipment under warranty • Express Service swaps the user's defective unit for a working replacement overnight; Federal Express shipping charges are extra; Express Service available for both in- and out-of-warranty equipment • Customer Service locations providing telephone assistance and factory repair located in Chatsworth, CA; Woodbridge, NJ; Boston, MA; and St. Louis, MO • on-call maintenance performed during Principal Period of Maintenance (PPM) 8:00 AM to 5:00 PM, Monday through Friday except holidays; sales and service provided by over 40 major stocking distributors in the U.S., and by 35 international distributors in 40 territories.

□ Overview

The Micom Micro400 Series line drivers and Micro4000/5000 Series modems offer flexible application capabilities for local (in-plant or on-campus) or long-haul communication requiring low-to-high-speed data rates and satisfying point-to-point, multipoint, and multichannel configuration requirements. The Micro400 Local Datasets and Line Drivers, for example, are used in pairs over user-owned or Telco metallic circuits (DC continuity); the "local datasets" (as Micom calls them) are AT&T 43401-compatible line drivers for use over Telco 4-wire lines; the "line drivers" are designed for user-owned twisted-pair 2- or 4-wire transmissions and are not AT&T compatible. One Micro400 model, the M402, offers dial-up emulation that allows asynchronous dial-up computer ports to operate with high-speed local datasets on privately owned lines with no required changes to system software or protocol. In addition, the Micro400 user has a choice of 19, 22, 24, or 26 gauge conductors, which determine various ratios of distance/data rates. Micom recently introduced pocket-sized models, the M430 and M431, tiny 2 x 2.75 x 0.75 inches (matched with a tiny purchase price) for plugging into terminals or computers, which provide power for the modem.

The Micom DialNet3000 Series modems are designed for the public switched telephone (DDD) network, and are compatible with the AT&T 212A and 103, except for Models M3024 and M3224, which are compatible with the 212A at 1200 bps, but also provide CCITT V.22 bis compatibility at 2400 bps. The models differ in standard features.

The Micom Micro4000 Series Data Modems, on the other hand, can support 2- or 4-wire operations in point-to-point or multipoint synchronous environments with data rates from 2400 to 9600 bps, and in asynchronous environments at 2400 bps. The 4800- and 9600-bps modems, which are a compact 8x11x2 inches in size and can be optionally housed in an 8-modem rack chassis, are packaged in a No-Frills version and do not include features available with + models such as "speed shift" for quick training time to enhance multipoint operations, and antistreaming, which automatically disconnects a faulty modem to prevent total line failure. The 9600-bps modem model, on the other hand, includes a modem packaged with an integral TDM 4-channel multiplexer.

The Micro5000 Series Intelligent Modems combine a high-speed synchronous modem with a PC card supporting asynchronous-to-synchronous conversion capability, flow control, and CRC error

control. The Micro5000 modem thereby provides error-free transmissions for asynchronous terminals at speeds from 110 to 9600 bps, converting the data into a synchronous format for link transmissions at 2400, 4800, and 9600 bps. A clocked synchronous mode is available for IBM computer port interface to asynchronous terminals for operations at 2400 bps or better. In total, the Micro5000 offers an impressive array of automatic control functions, including, in addition to error control and the conversion capability, split channel speeds, buffer flow control, link outage recovery, and comprehensive diagnostics that include "TACT" for terminal and end-to-end link self tests.

All Micom modems and line drivers are packaged as standard standalone units; a rackmount option is an extra-cost addition unless the unit is originally packaged for rackmount. Some multichannel rackmounted card cages are available for card module versions of the Micro4000 modems and the Micro400 line drivers. All Micom modems and line drivers include diagnostic capabilities for analog/digital, local/remote modem, and line testing. Micom recently introduced a dial backup unit dubbed "Dial Backer" for all Micom or non-Micom modems operating at 2400 to 9600 bps, thereby providing fault-tolerant modem operations. The Dial Backer is FCC certified for direct telephone line connection.

Micro400 MP Series Local Datasets & Line Drivers • data rates from 1200 to 19.2K bps; AT&T 4301-compatible or non-AT&T-compatible models for transmission over metallic circuits (DC continuity) on privately-owned or Telco lines.

DialNet3000 Series Modems • switched network modems with AT&T 212A/103 and CCITT V.22 compatibility.

Micro4000 Series Data Modems • point-to-point or multipoint configurations with fixed 2400-, 4800-, 9600-bps data rates with fallback at 1200, 2400, and 7200/4800 bps, respectively • 9600-bps multipoint modem includes 4-channel TDM multiplexer • antistreaming • "speed shift" training time for quick inquiry to central site in multipoint configurations at 4800/9600 bps • integral Dial Backer packaged systems for + models.

Micro5000 Series Intelligent Modems • 2400- (1200 fallback), 4800-, 9600-bps data rates; controller designed with asynchronous/synchronous conversion and error control for asynchronous terminal transmissions at high speeds.

□ Packaged Line Drivers & Modems

Standalone packaging standard for all models; rackmount optional • card module version for Micro400 line drivers and Micro4000 modems available for multichannel rackmount chassis • rackmount chassis provides designated slots for accommodating dual power supply for optional redundant power operations: each power supply supplies 50 percent power to modem card units; in event of failure in one power unit, the second power supply provides 100 percent of power • Dial Backer is available either as integral component of Micro4000 + model packaged units or as PC card for rackmount • Micro400 line drivers used in pairs, 1 line driver required at each end of line • Micro5000 modem units include 2 PC card modules: a high-speed synchronous modem and a PC card with 3K-RAM buffer (2700 characters), asynchronous-to-synchronous protocol converter, and CRC-16 error-control logic; no rackmount version available.

Micro400 Local Datasets & Line Drivers

Model M400MP Asynchronous Line Driver • standard 2- or 4-wire twisted-pair 19.2K-bps line driver • compatible with other M400MP only:

\$220 prch

Model M4400MP • same as Model M400MP except contained on single PC card for rackmounting • fits M4000 card cage:

150

PRCH: purchase price; leasing available through distributors or representatives only. NC: no-charge item. Prices effective as of August 1984.

Micom Line Drivers & Switched/Dedicated Modems

Micro400 Line Drivers and DialNet3000, Micro4000 & Micro5000 Modems

Model M400/600 Asynchronous Line Driver • same as Model M400MP except with connect button for use with Micro600:

220

Model M401 Asynchronous Local Dataset • standard 4-wire 9600-bps line driver for privately owned twisted-pair metallic circuits, or 4-wire 9600 bps over Telco-supplied metallic circuits (AT&T 43401-compatible):

250

Model M4401 • same as M401 except contained on single PC card for rackmounting • fits M4000 card cage:

180

Model M402 Smart Asynchronous Local Dataset • standard 2- or 4-wire 19.2K-bps line driver for privately owned twisted-pair metallic circuits, or 4-wire 9600-bps line driver for Telco-supplied metallic circuits (AT&T 43401-compatible):

330

Model M4402 • same as Model M402 except contained on single PC card for rackmounting • fits M4000 card cage:

260

Model M420MP Synchronous Line Driver • standard 2- or 4-wire 1200- and 9600-bps line driver for privately owned twisted-pair metallic circuits:

320

Model M4420MP • same as Model M420MP except contained on single PC card for rackmounting • fits M4000 card cage:

250

Model M421 Synchronous Local Dataset • standard 4-wire 19.2K-bps line driver • AT&T 43401 compatible:

370

Model M4421 • same as M421 except contained on single PC card for rackmounting • fits M4000 card cage:

300

Model M430 Asynchronous Line Driver • standard 4-wire 19.2K-bps line driver for privately owned twisted-pair metallic circuits • direct plug-in for terminal/computer • pocket size (2 x 2.75 x 0.75 inches):

85

Model M431 Asynchronous Local Dataset • standard 4-wire 9600-bps line driver • AT&T 43401-compatible • pocket size (2 x 2.75 x 0.75 inches):

95

DialNet3000 Modems

Model M3012 • standard 2-wire, full-duplex, 300-/1200-bps modem for use on the public switched network (DDD) • compatible with AT&T 212A modems at 1200 bps and with AT&T 103 modems at 300 bps:

\$495 prch

Model M3212 • same as Model M3012 except contained on single PC card for rackmounting • fits in slot of ModemRack M3200 card cage:

445

Model M3012TA • standard 2-wire, full-duplex, 300-/1200-bps answer-only triple modem for use on the public switched network (DDD) • compatible with AT&T 212A or Racal Vadec 3400 at 1200 bps and AT&T 103 at 300 bps:

695

Model M3212TA • same as Model M3012TA except contained on single PC card for rackmounting • fits in slot of ModemRack M3200 card cage:

645

Model M3012+ • standard 2-wire, full-duplex, 300-/1200-bps, auto-dial, auto-answer modem for use on the public switched network (DDD) • compatible with AT&T 212A at 1200 bps and with AT&T 103 at 300 bps:

595

Model M3212+ • same as Model M3012+ except contained on single PC card for rackmounting • fits in slot of ModemRack M3200 card cage:

545

Model M3024 • standard 2-wire, full-duplex, 1200-/2400-bps modem for use on the public switched network (DDD) • compatible with AT&T 212A at 1200 bps and CCITT V.22 bis at 2400 bps:

795

Model M3224 • same as Model M3024 except contained on single PC card for rackmounting • fits in slot of ModemRack M3200 card cage:

745

Micro4000 Data Modems

Model M4024 • standard 4-wire dedicated 2400-bps standalone modem • AT&T 201 B/C-compatible, CCITT V.26 A and B compatible:

\$795 prch

Model M4124 • same as Model M4024 except contained on single PC card for rackmounting • fits M4100 card cage:

680

Model M4024/ASYNC • same as M4024 except with interface to accommodate asynchronous terminal:

895

Model M4124/ASYNC • same as Model M4024/ASYNC except contained on single PC card for rackmounting • fits M4100 card cage:

710

Model M4048/V.27+ • standard 2- or 4-wire dedicated 4800-bps standalone modem • CCITT V.27 bis compatible:

1,750

Model M4248/V.27+ • same as Model 4048/V.27+ except contained on a single PC card for rackmounting • fits M4100 card cage:

1,595

Model M4048/DB+ • Model 4048/V.27+ with integral Dial Backer:

2,450

Model M4096/V.29+ • standard 2- or 4-wire 9600-bps modem • CCITT V.29 compatible:

2,450

Model M4296/V.29+ • same as Model M4096/V.29+ except contained on a single PC card for rackmounting • fits M4100 card cage:

2,295

Model M4096/4+ Multiport Modem • standard 4-wire 9600-bps modem with integral TDM 4-channel multiplexer • CCITT V.29 compatible:

3,150

Model M4096/DB+ Multiport Modem • same as Model M4096/4+ with integral Dial Backer:

3,150

Model M4002 Dial Backer • standalone unit:

750

Model M4202 Dial Backer Card • fits M4200 card cage:

600

Micro5000 Modems

Model M5596/24 • standard 4-wire dedicated 2400-bps standalone modem • contains converter for asynchronous-to-synchronous transmission and error control logic • AT&T 201 compatible; CCITT V.26 B compatible:

\$1,500 prch

Model M4496/48 • standard 4-wire dedicated 4800-bps

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standalone modem • contains converter for asynchronous-to-synchronous transmission and error control logic • CCITT V.27 compatible:

3,450

Model M4496/96 • standard 4-wire dedicated 9600-bps standalone modem • contains converter for asynchronous-to-synchronous transmission and error control logic • CCITT V.29 compatible:

4,000

Rackmount Enclosures

Model M3200 • 16-slot card nest accommodates up to 16 DialNet3000 PC card modems in any combination of models • includes integral power supply:

\$750 prch

Model M4000 • 16-slot card nest accommodates up to 16 Micro400 card module line drivers • designated slots accommodate standard power pack and optional second power pack for redundant operations:

700

Model M4100 • 13-slot card nest accommodates up to 13 Micro4000 1200-bps card modems • designated slots accommodate standard power pack and optionally added second power pack for redundant operations:

1,500

Model M4200 • 8-slot card nest accommodates up to 8 Micro4000 4800- or 9600-bps card modems • designated slots accommodate standard power pack and optionally added second power pack for redundant operations:

1,700

U4000/RMK • field-installable Rack-Mount Kit for converting standalone to rackmount configuration • for Micro4000 models:

75

U5000/RMK • field-installable Rack-Mount Kit for converting standalone to rackmount configuration • for Micro5000 models:

75

Model M4104 • redundant power supply for M4100 rackmount enclosure:

795

Model M4201 • redundant power supply for M4200 rackmount enclosure:

895

Application

Micro400 Local Datasets & Line Drivers

Model M400MP Asynchronous Line Driver • point-to-point over 4-wire user-supplied twisted-pair or Telco metallic circuits using 19 to 26 (AWG) gauge conductors.

Model M401 Asynchronous Local Dataset • point-to-point over 4-wire Telco metallic circuits (AT&T 43401 compatible) or over user-supplied twisted-pair cable • 19 to 26 (AWG) gauge conductors.

Model M421 Synchronous Local Dataset • point-to-point over 4-wire user-supplied twisted-pair or Telco metallic circuits (AT&T 43401 compatible) • 19 to 26 (AWG) gauge conductors.

Model M402 Smart Asynchronous Local Dataset • point-to-point over 2- or 4-wire user-supplied metallic circuits, or Telco 4-wire lines (AT&T 43401 compatible) • 19 to 26 (AWG) gauge conductors • dial-up emulation.

Model M420MP Synchronous Multipoint Line Driver • point-to-point or multipoint over 2- or 4-wire user-supplied metallic circuits, or Telco 4-wire lines • 19 to 26 (AWG) gauge conductors.

Model M430 Asynchronous Line Driver • point-to-point over 4-wire user-supplied twisted-pair lines using 19 to 24 (AWG) gauge cable.

Model M431 Asynchronous Local Dataset • point-to-point over 4-wire Telco private line metallic circuits using 19 to 24 (AWG) gauge cable.

DataNet3000 Modems

These modems are designed for use on the public switched (DDD) network and are available as standalone units or as PC card plug-in modems for rackmount installations. Models M3012TA and M3212TA are intended for central computer site installation. Models 3024 and 3224 can also be used on a 2-wire point-to-point dedicated line.

Micro4000 Series Data Modems

Model M4024 • point-to-point and multipoint communication over unconditioned dedicated 4-wire Type 3002 voice channels • selectable 8/25/150-millisecond training time (RTS/CTS) delay.

Model M4048/V.27+ • point-to-point or multipoint communication over unconditioned dedicated 2- or 4-wire Type 3002 voice channels • training time in V.27 mode: selectable 9/50 milliseconds in multipoint and 2-wire arrangements; 0/15 milliseconds for 4-wire point-to-point arrangements • training time in speed-shift mode: 9 milliseconds to reach 2400 bps; another 26 milliseconds transmitting at 2400 bps to reach 4800 bps and continues transmitting at 4800 bps.

Model M4096/V.29+ • point-to-point or multipoint communication over unconditioned dedicated 2- or 4-wire Type 3002 voice channels • training time in V.29 mode: selectable at 0/15 milliseconds for 4-wire point-to-point; 9/50/75/100 milliseconds for 2-wire multipoint • training time in speed-shift mode: 9 milliseconds to reach 2400 bps; another 26 milliseconds transmitting at 2400 bps to reach 4800 bps; receiving data at 9600 bps, but transmitting at 4800 bps.

Model M4096/4+ Multipoint Modem • point-to-point and multipoint communication over single unconditioned leased line • selectable 0/12/60/160 milliseconds training (RTS/CTS) delay.

Micro5000 Intelligent Modems

Model M5596/24, M4496/48 & M4496/96 • point-to-point communication over unconditioned 4-wire dedicated Type 3002 voice channels.

Operating Parameters

Micro400 Local Datasets & Line Drivers

Model M400MP • asynchronous; full-duplex; up to 19.2K bps • transmission distance ranges from 0.5 miles at 19.2K bps to 15 miles at 110 bps on 19 gauge conductor; from 0.25 miles at 19.2K bps to 13 miles at 110 bps on 26 gauge conductor.

Model M401 • asynchronous; full-duplex; up to 9600 bps • transmission distance ranges from 6 miles at 9600 bps to 40 miles at 110 bps on 19 gauge conductor; from 2.5 miles at 9600 bps to 29 miles at 110 bps on 26 gauge conductor.

Model M421 • synchronous; full-duplex; up to 19.2K bps • unloaded 4-wire transmission distance ranges from 6 miles at 19.2K bps to 17 miles at 1200 bps on 19 gauge conductor; 3 miles at 19.2K bps to 9 miles at 1200 bps on 26 gauge conductor • typical transmission distances/rates over 26 gauge loaded conductor: 6 miles at 4800 bps (maximum) to 12 miles at 1200 bps.

Model M402 • asynchronous; full-duplex; up to 9600 bps over Telco lines; up to 19.2K bps over user lines • transmission distance ranges over 4-wire Telco lines from 5.5 miles at 9600 bps to 31 miles at 110 bps with 19 gauge conductor; from 2.5 miles at 9600 bps to 27 miles at 110 bps over 26 gauge conductor • transmission distance ranges over 4-wire and 2-wire user-owned lines: over 4-wire from 3 miles at 19.2K bps to 37 miles at 110 bps over 19 gauge conductor; from 2 miles at 19.2K bps to 33 miles at 110 bps over 26 gauge conductor; 2-wire lines from 1 mile for 19.2K bps to 110 bps over 19 gauge and at 0.5 miles for 19.2K bps over 26 gauge conductor • dial-up emulation allows asynchronous dial-up computer ports to operate with

Micom Line Drivers & Switched/Dedicated Modems

Micro400 Line Drivers and DialNet3000, Micro4000 & Micro5000 Modems

high-speed local datanets on privately owned lines with no required changes to system software or protocol.

Model M420MP • synchronous; half-/full-duplex; up to 19.2K bps • point-to-point 4-wire transmission distances range from 5.5 miles at 19.2K bps to 18 miles at 1200 bps on 19 gauge conductor; 3 miles at 19.2K bps to 10 miles at 1200 bps on 26 gauge conductor • point-to-point 2-wire transmission distances range from 5.5 miles at 19.2K bps to 18 miles at 1200 bps on 19 gauge conductor to 3 miles at 19.2K bps to 8.5 miles at 1200 bps on 26 gauge conductor • multipoint network transmission ranges depend on the number of terminals and multipoint physical arrangement; generally, maximum transmission range between any 2 M420MPs can be 30% lower than ranges specified for point-to-point transmission ranges.

DialNet3000 Modems

All models, except Models 3024 and 3224, operate asynchronously at 300 bps (AT&T 103 compatibility) or synchronously at 1200 bps (AT&T 212 compatibility). Models M3024 and M3224 operate synchronously at 1200 bps (AT&T 212 compatibility) or 2400 bps (CCITT V.22 bis compatibility) • switch-selectable parameters via DIP switches • full-duplex mode • modulation is FSK at 300 bps and DPSK at 1200/2400 bps • selectable 8 to 11 bits per character including start and stop bits at 1200/2400 bps.

Micro4000 Data Modems

Model M4024 • synchronous; full-duplex at 2400 bps with 1200-bps fallback • 4-phase PSK modulation • strap-selectable compromise equalizer.

Model M4024/ASYNC • asynchronous input converted to synchronous full-duplex for link transmission at 2400 bps; 1200-bps fallback • 4-phase PSK modulation • strap-selectable compromise equalizer.

Model M4048/V.27+ • synchronous; half-/full-duplex at 4800 bps; 2400-bps fallback • 8-phase DPSK modulation • automatic adaptive equalizer.

Model M4096/V.29+ • synchronous; half-/full-duplex at 9600 bps; 7200-/4800-bps fallback • 8-phase QAM modulation • automatic adaptive equalizer.

Model M4096/4+ • synchronous; full-duplex at 9600-bps composite data rate • QAM modulation • automatic adaptive equalizer.

Micro5000 Intelligent Modem

Model M5596/24 • synchronous; full-duplex at 1200 or 2400 bps • DPSK modulation • optimized for C2 conditioned lines.

Model M5596/48 • synchronous; full-duplex at 4800 bps • 8-phase DPSK modulation • optimized for C2 conditioned lines.

Model M5596/96 • synchronous; full-duplex at 9600 bps • 8-phase 4-amplitude QAM modulation • optimized for C2 conditioned lines.

□ Channel Functions

Multipoint • Micro4000 Model 4096/4+ contains an integral 4-channel synchronous TDM multiplexer • accommodates any mix of synchronous rates from 2400 to 9600 bps; aggregate data rate of 4800, 7200, or 9600 bps • channels accommodate any mix of colocated terminals or tail circuits • CCITT V.29 compatible • standard feature, Model 4096/4+;

NC prch

Asynchronous to Synchronous Conversion • Micro5000 Series modems and Model M4024/ASYNC contain an integral asynchronous-to-synchronous converter • converts terminal asynchronous data into synchronous format for transmission over modem link • accepts ASCII and other 8-bit asynchronous codes • Micro5000 Series buffered modems include data compression; automatically encodes repeated ASCII characters, improving transmission efficiency; optionally strips start and stop bits • accepts asynchronous or clocked asynchronous input at channel rates of 110/300/600/1200/1800/2400/4800/9600 bps,

depending on model; synchronous output at 1200/2400/4800/9600 bps • reconstructs asynchronous data stream at opposite end of link • standard feature:

NC

Two Stop Bits Option • optional feature for Micro5000 Series modems strips asynchronous character start and stop bits from terminal/CPU ports before transmission over modem link; reconstructed at the opposite end of transmission • extra cost option:

100

Local Copy (Echoplex) • slave Micro5000 Series modems permit data to be echoed back to DTE for local printout • standard feature, Micro5000 Intelligent Modems:

NC

Split (Asymmetrical) Channel Speed Feature • selectable feature on Micro5000 Intelligent Modems supports terminal receive/transmit data rates of 600/75 or 1200/75 bps • applicable to videotex/viewdata networks • standard feature:

NC

Digital Interface • EIA RS-232C/CCITT V.24/V.28 • 25-pin electrical connector.

□ Control Functions

Alternate Voice/Data • all DialNet3000 models accommodate an external telephone handset with modular jack, switch-selectable voice, or data communication • standard feature:

NC prch

Failure Recovery • provides immediate recovery from dedicated line failures via Dial Backer unit at attended or unattended sites • manually or automatically switches modems between 4-wire dedicated line and 2 dial-up lines to restore communication interrupted by line failure/degradation.

Dial Backer • FCC-registered unit switches attended or unattended modem between 4-wire dedicated line and 2 DDD line pairs • automatic call disconnect by Dial Backer or by terminal/CPU, by loss of carrier/line current, or manual disconnect (pushbutton switch) • requires a standard rotary or tone dial telephone and 1 Dial Backer at each end of transmission • accommodates synchronous modems from 2400 to 9600 bps, from Micom or other vendors • available as an integral feature, Models M4048/DB+ and M4096/DB+, and in standalone or rackmounted versions.

M4002 Dial Backer • standalone version:

\$750 prch

M4202 Dial Backer • same as M4002 except contained on single PC card for rackmounting • fits Model 4200 card cage:

600

Auto-Answer (Automatic Answer) • all DialNet3000 models are equipped with switch-selectable automatic or manual answer • automatic speed detection in auto-answer mode • standard feature:

NC

Auto-Dial (Automatic Originate) • DialNet3000 Models M3012+ and M3212+ are equipped with a directory-driven auto-dial feature that stores up to 20 numbers • dialing is initiated from the attached DTE via a 1- or 2-digit command • directory also stores up to 7-digit mnemonic related to number, number retries, and alternative (linked) numbers to be dialed from directory after retries are exhausted • modem communicates with DTE with prompts and status • standard feature:

NC

Error Control • Micro5000 Series Intelligent Modems contain CRC-16 and ARQ error detection and correction logic • integral error detection algorithm appends 2 Cyclic Redundancy Check (CRC) characters to the end of each block of data, generates an Automatic Retransmission Request (ARQ) for blocks with data errors • standard feature:

NC

Micom Line Drivers & Switched/Dedicated Modems

Micro400 Line Drivers and DialNet3000, Micro4000 & Micro5000 Modems

Flow Control • Micro5000 Series Intelligent Modems support bidirectional flow control; guards against modem buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminating equipment at channel input by generating XON/XOFF (DC1/DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on the EIA RS-232C interface • detects and responds to XON/XOFF control characters or DTR, CTS, or RTS control signals by suspending/resuming data flow to channel input • integral 2K-character RAM buffer with flow suspension threshold set at 87 percent total buffer utilization; flow resumption threshold set at 62 percent buffer utilization • "data lost" message sent to terminal, in ASCII, in the event of buffer overflow • standard feature:

NC

Antistreaming Feature • detects modem or terminal streaming condition, modem disconnects itself from line • operates within remote modem when Request-to-Send (RTS) on EIA RS-232C interface remains high (present) for more than 30 seconds; modem transmitter mutes until RTS dropped • standard feature for Models M4048/V.27+ and M4096/V.29+ only:

NC

Diagnostics & Status Indicators

Loopback diagnostics isolate failures in local or remote modems

or dedicated lines; included in all Micom Modems, Line Drivers/Data Sets.

Loopback Tests • local analog and digital loopback; remote digital loopback; modem line tests • modem and line tests in 4 sequential steps: local modem test; local modem and line test; local modem, line, and remote modem test; full-duplex line test.

Test Pattern Generation • pseudo-random test pattern generator and error detector performs bit error rate test via analog and digital loopbacks.

TACT (Terminal Activated Channel Test) • terminal checks its own operation or link end-to-end operations • integral on controller module of Micro5000 Intelligent Modems.

Status Indicators • test mode; modem and line failures; error condition.

Link Outage Recover (LINK DOWN) • link down message sent to terminal equipment in response to ENQ when composite link is out • standard feature on Micro5000 Intelligent Modems:

NC prch

• END

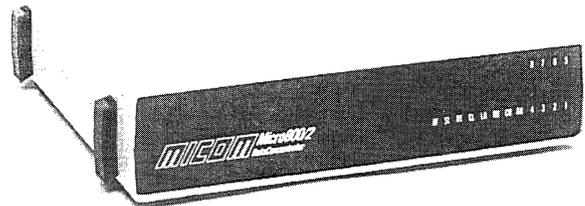
Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

■ PROFILE

Function • bit-interleaved TDM multiplexers (Micro700/750) • statistical multiplexers (Micro800/2, 800/2-NF, 800/2-HP) • multipoint statistical multiplexer (Micro900/2) • point-to-point and multipoint statistical multiplexers with integral modems (Micro8000) • statistical multiplexer/PAD for X.25 public or private packet-switched networks; Telenet, Tymnet, and Uninet certified (Micro800/X.25) • contention and selection switch for use with Micro800/2 statistical multiplexers (Micro860).

Communications/Networks • Micro700 supports up to 4 synchronous channels; Micro750 up to 38 synchronous channels; Micro800/2 up to 2/4/8/16 asynchronous channels or up to 1/2/4 synchronous channels; Micro800/2-NF and Micro800/2-HP up to 2/4/8 asynchronous channels; Micro800/X.25 up to 4/8/12/16 asynchronous channels; Micro900/2 up to 2/4/6/8/16 multipoint asynchronous channels; Micro8000 up to 2/4/8/12/16 point-to-point asynchronous, up to 1/2/4 synchronous, and up to 2/4/8/16 multipoint asynchronous channels • maximum aggregate channel rate of 38.4K bps (Micro700, Micro800/2-NF, Micro800/2-HP); 57.6K bps (Micro800/X.25); 256K bps (Micro750); 153.6K bps (Micro800/2); 38.4K/76K bps (Micro900/2 Slave/Master); Micro8000 identical to Micro800/2, Micro800/X.25, and Micro900/2 • supports single composite



link in point-to-point or multipoint configurations • modified SDLC link protocol (Micro800/2, Micro800/2-NF, Micro800/2-HP); X.25 Level III LAPB link protocol (Micro800/X.25); polling link protocol (Micro900/2) • optional channel selection (switching) and port contention for Micro800/2 via Micro860 switch.

First Delivery • Micro700: 1979 • Micro750: 1979 • Micro800/2: 1981 • Micro800/2-NF: 1981 • Micro800/2-HP: 1982 • Micro900/2: 1983 • Micro8000: 1980 • Micro800/X.25: 1983 • Micro860: 1983.

Systems Delivered • Micro700: 2,700 • Micro750: 1,100 • Micro800/2: 60,000 (including all variants) • Micro900/2: unknown • Micro8000: unknown • Micro800/X.25 and Micro860: over 250.

Comparable Systems • principal competition for Micro700 from Compre Comm Sprint; GDC 1253; Infotron Timeline 290 • for Micro750 from GDC 1256 Megamux; Infotron Timeline 280 • for Micro800/2 and 800/2-NF from Codex 6001/6005; DCC 9100; Infotron 380/480/600/680; Racal Milgo Omnimux • for Micro900/2 from Comdesign TC5/TC8; GDC Pollkat; Infotron Supermux 580 • for Micro800/X.25 from Dynapac DP-1000/Multipad X.25; Gandalf PIN 9101; Memotec Statpac; Timeplex Microplexer.

Vendor • Micom Systems, Inc; 4110 Los Angeles Avenue, Simi Valley, CA 93063 • 805-583-8600.

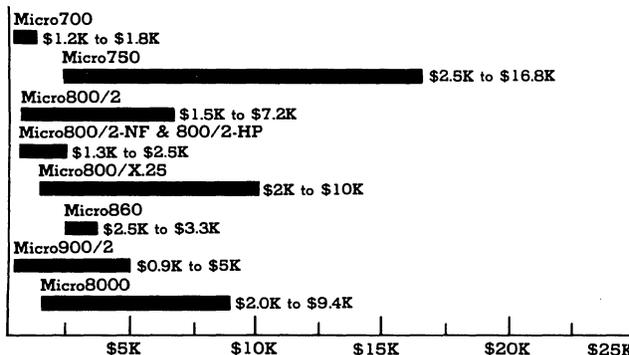
Distribution • nationwide and worldwide through factory authorized distributors and representative/distributors • Canada through ATELCO, Scarborough, Ontario; United Kingdom through Micom-Borer, Limited, Berkshire, England; Mexico through Transdata, Mexico City; Japan through ITS-Japan Co, Limited, Tokyo.

■ ANALYSIS

The Micom family of time-division (TDM) and statistical (STDM) multiplexers has not been significantly changed or enhanced over the past year. Although there have been no major announcements since last year's product introductions of the Micro900/2, Micro800/X.25, and Micro860, Micom has retained its competitive position by continuing to refine its mature product line. All statistical multiplexer models now support

PURCHASE PRICE RANGE

hardware



MICOM MULTIPLEXERS PURCHASE PRICING bar graphs cover price ranges between "small" and "large" configurations; Micom does not provide monthly maintenance contracts, on-call maintenance or overnight swapout only • **Micro700** small configuration consists of 4-channel mux; large of 4-channel mux with enhancements • **Micro750** small configuration consists of 4-card slot mux and 1 single- or dual-channel adapter; large of 19-card slot mux with redundant power and logic, enhancements, and 19 dual-channel adapters • **Micro800/2** small configuration consists of 2-channel async no-trills mux; large of 16-channel async mux with synchronous, bandsplitter, and other enhancements • **Micro800/X.25** small configuration consists of 4-channel async mux; large of 16-channel async mux, split data rate option, and network control system • **Micro860** small configuration consists of 4-composite link switch; large of 8-composite link switch with rackmounting • **Micro900/2** small configuration consists of single-channel async slave mux; large of 16-channel master mux plus auto-speed, rackmounting, and flow control option • **Micro8000** small configuration consists of single-channel async multipoint slave mux with integral 2400-bps modem; large of 16-channel point-to-point async mux with integral 9600-bps modem, synchronous channels, bandsplitter, auto-speed, and other enhancements.

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

protocol options for Wang, Perkin-Elmer, and Tandem devices at no extra cost. The Autobaud feature, which regulates asynchronous channel rate to rate of dial-up lines is now a standard feature included with all Micro900/2s, and the Extended Autobaud feature is provided with all Micro 800/2s for handling data rates from 50 to 9600 bps. A Satellite Transmission feature and a Channel Busy-Out feature are now standard features for all Micro800 models. Also, the Micro800/2 was enhanced to interface with CCITT X.21 switched digital networks. The Interconnect feature for the Micro860 announced last year was withdrawn. It is apparently still in development.

In addition to the availability of these no-cost options, Micom has reduced the purchase prices of selected Micro8000 models. Prices for these packaged versions of Micro800/2 statistical multiplexers with integral synchronous modems have been lowered to reflect Micro4000 modem price reductions. Furthermore, Micom is **no longer offering** Micro8000 models in No-Frills and Hewlett-Packard versions. According to a Micom spokesman, the absence of the command port in these versions detracted from their usefulness and was a factor in the decision to drop them. On the other hand, Micom is still supporting the Micro800/2 No-Frills and Hewlett-Packard models and has increased the purchase prices of these versions by \$250.

Micom's multiplexer family encompasses time division (TDM) and statistical multiplexers for a diversity of small-scale applications. The multiplexers are equipped for communication with prominent minicomputers and terminals and consist of fixed and expandable configuration packaged units for point-to-point and multipoint communication. Channel capacity is limited to 4, 8, or 16 channels on all models except the wideband Micro750 with up to 38 channels. Physically small, the standalone units are intended for tabletop use with a rackmount option.

The Micro700 bandsplitter eliminates the cost of 2 or more dedicated lines with high-performance modems by combining synchronous traffic at data rates up to 9600 bps on 1 line. All channels but the first on the basic model, and the first and second channels on the enhanced model, support tail circuit or dial-up modems for network extensions. These channels operate at reduced rates to support overhead functions. A voice-grade line can be used for composite link communications, but at a reduced rate of 9600 bps. Full performance at 19.2K bps or 38.4K bps can be achieved over a long distance via AT&T Communications DDS, Series 8000 service, or through an equivalent carrier service. High-speed communication over limited distances can be achieved through private lines with short-haul modems. Channel capacity can be expanded at reduced performance by cascading.

The Micro750 is a very flexible bit-interleaved TDM suitable for a variety of wideband applications. It can support dial-up lines or asynchronous channels through a Micro800/2 interfaced via a channel adapter. It can also support satellite links via delay buffer compensation, and wideband speed conversion through a single channel configuration to compensate for interconnection between digital, analog, and satellite circuits. The Micro750 can also combine separate DDS circuits on a single composite link without channel synchronization problems. A DDS Channel Slave Timing option phase locks the Micro750 clock to any selected channel clock.

The Micro800/2 point-to-point statistical multiplexer is an enhanced version of Micom's extremely successful Micro800. Micom boasts over 100,000 concentrator installations worldwide. The Micro800/2 is available in 2 versions, a no-frills model for users who want a basic asynchronous multiplexer without unnecessary extra-cost features, and an enhanced version loaded with extras. Options or models are also available that support Hewlett-Packard HP 3000 minicomputers with ENQ/ACK protocol. The Micro800/2 is a flexible, versatile unit that satisfies a host of applications at a cost-justifiable price. Packaged configurations combine as many as 16 and as few as 2 asynchronous lines or devices on a single high-speed link. Models other than the no-frills units and the standard 2-channel unit are expandable to meet growth requirements, with some limitations. Users with a mix of synchronous and asynchronous terminals, such as CRT terminals and teleprinters, should consider the standard version of the 800/2 with the synchronous

option. This extra-cost option is available for either channel of the standard 2-channel unit or the top 4 channels of standard units with 4 or more channels. The option has both protocol-dependent and protocol-transparent modes and therefore accepts most synchronous protocol applications.

Synchronous transmissions are statistically multiplexed with asynchronous channels, which could cause performance degradation on the asynchronous channels if traffic volume is heavy. (Improved flow control affects only active channels and should eliminate asynchronous flow restrictions from heavy synchronous traffic.) Users with heavy synchronous transmission requirements should consider the bandsplitter option, which combines 1 or 2 synchronous channels with the 800/2; channel bandwidth is user specified for operating flexibility.

Users with mixed CRT and printer installations can assign priority to the interactive CRT terminals to prevent response time degradation. The standard data compression feature can be combined with priority control to further reduce degradation. Users with port contention and channel switching requirements should consider using the separate Micro860 concentrator switch, a device that networks up to 8 Micro800/2s under central control.

Micom substantially increased the application flexibility of the 800/2, by combining its use with the Micro860 Concentrator Switch. Users can configure a network with as many as 8 Micro800/2s connected in a star arrangement to the Micro860 as the logical hub. This add-on arrangement gives users the flexibility to establish local as well as remote communication paths as needed to communicate among a multiplicity of devices, dedicate specific channels, group resources, switch between redundant devices, and reduce port requirements through contention. Since the Micro860 is a separate unit, users who do not need switching do not pay the extra cost of a combined capability, and can incorporate the switching unit as their needs dictate. In addition, the Micro860 acts as the centralized network manager of the attached Micro800/2s. With this advantageous facility, the network manager can configure and monitor up to eight Micro800/2s from the command port of the concentrator switch.

The Micro800/X.25 is a combined statistical multiplexer and PAD that connects to an X.25 packet-switched network. It can be used at both ends to support communication between remote asynchronous terminals and a host computer, and complies with CCITT Recommendations X.3, X.29, X.28, and X.121. In addition, the Micro800/X.25 provides the user with additional terminal handling capabilities not specified under X.3. User can also switch and contend for channels through an X.25 packet network, as well as switch channels locally through the multiplexer. Micom supplies many of its popular options for the Micro800/X.25, including auto-speed, channel priority.

The Micro900/2 multipoint statistical multiplexer can be a cost-effective alternative to separate dedicated lines and modems for geographically dispersed non-pollable asynchronous terminals. It is designed for small-scale applications that link a host computer with a maximum of 16 terminals at 16 different locations. Channel flexibility meets requirements for as few as 1 channel at a remote location to as many as 8. Teletype-compatible dumb terminals share a dedicated 4-wire line to the master Micro900/2 at the host site. The master unit, available in 4, 8, or 16 channel configurations communicates with the remote terminals via a polling protocol, eliminating the need for special software. Error-free communication is insured by CRC-16 and ARQ error detection and correction. Flexible transmission parameters allow either medium- to high-speed synchronous transmission between master and remote sites, or medium-speed asynchronous transmission to satisfy specific requirements and eliminate unnecessary operating costs. A supervisory port, auto-baud, and options for dynamic channel priority and optimized terminal response times are standard features.

The Micro8000 combines Micro800/2 standard point-to-point, Micro800/X.25 PAD, or Micro900/2 multipoint models with an integral link modem. The packaged configuration eliminates the added cost of a separate modem and puts service under 1 umbrella. Packaged configurations include 2400-bps, 4800-bps, and 9600-bps modems for all standard channel configurations.

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

Options available for the individual Micro800/2, Micro800/X.25, and 900/2 models are also available for the Micro8000.

Micom began operations in 1973 as a supplier of data communication products. It has addressed itself to what it calls the "link business" of providing data communications support for the minicomputer user, instead of competing for business involving large nationwide or global data communication networks. Micom manufactures, markets, and services computer port selectors, modems, multiplexers, local area network products, and other related data communication equipment, and is a leading vendor in the low end of the TDM and statistical multiplexer market. Micom's acquisition of Expander/Black Box Catalog, a mail order supplier of low-cost data communication equipment and accessories, adds an extra dimension to the Micom product line.

□ Strengths

The Micro700's strength lies in its operating flexibility. A user can save substantial line and modem costs by combining the composite links of 2 or more multiplexers on a single high-speed link. It can also serve to combine synchronous terminals with the composite link of a multiplexer. Users can benefit from the Dynamic Channel Assignment option where traffic volume is low to medium. The option improves link utilization by automatically assigning bandwidth to active channels. Applications that include tail circuits will benefit from the Auto Remote Configuration option, which passes 4 full-duplex control signals in order of priority as detected. This option also downline loads channel parameters from the master site. The unit's standard and optional composite link aggregate rates provide application flexibility and are adequate for virtually any application.

The Micro750 supports both small- and medium-scale applications. Configuration flexibility, ease of expansion, and redundancy are its most important benefits. Ease of expansion is facilitated by individual single- and dual-channel adapters that insert into slots within the card frame. Individual cards are easily removed, interchanged, or added for servicing, reconfiguration or expansion without disturbing rear cable connections. Optional redundant central logic with optional automatic switching and optional redundant power supply ensures rapid recovery from failure. Redundancy is an important benefit to applications such as online financial transactions. The optional Configuration Switching Module allows selection of 8 different channel combinations to be downline loaded to a remote Micro750.

The standard Micro800/2 is designed for operating convenience. Configuration and application flexibility, expandability, and ease of use are its principal benefits. The unit is expandable in 4-channel increments from 4 to 8 and 12 to 16 channels to accommodate growth. Standard and optional features support a variety of applications. Flexible synchronous communication support is provided to meet specific user applications. Extra-cost options support both statistically multiplexed synchronous channels and bandsplitter-combined channels with assigned bandwidths. Other benefits include standard satellite delay compensation for satellite network communication and optional switching and port contention (via the Micro860 Concentrator Switch).

The principal advantage of the Micro860 Concentrator Switch is that it allows the user to route data throughout a network according to the user's communication needs. It can be added to a network when needed and supports as many as 64 simultaneous connections. The Command Port and Log Port, key features of the Micro860, support centralized network control, resource allocation, and status reporting through a dial-up or dedicated terminal, or a computer port. The Interconnect feature, if and when it becomes available, will support grid type configurations, allowing alternate routing in the event of link failure.

The no-frills version of the Micro800/2 offers the user the advantages of statistical multiplexing without the added cost of unnecessary features. The basic package does provide important essentials such as flow control, diagnostic testing, and status monitoring. Special models are available for HP 3000 minicomputer support.

The principal benefits of the Micro900/2 are that it eliminates

multiple dedicated lines and modems between central site and remotely scattered terminals through multipoint multiplexing, and it allows dumb terminals to be polled via the multiplexer. Other benefits include the high line utilization efficiency of statistical multiplexing, CRC and ARQ error detection and correction, central supervisory control, and flow control to protect against buffer overflow and loss of data at the multiplexer, as well as overflow and loss of data at the terminal end. Configuration flexibility allows the user to configure a Micro900/2 network to satisfy the requirements of his particular application and to easily expand the configuration to accommodate growth.

The Micro800/X.25 supports both switched and permanent virtual circuits to satisfy applications that require sending data between source and a number of destinations, or between source and a single destination over a sustained path. Channel and link parameters are easily programmed and downline loaded through a dedicated supervisory port, and optional software is available to support downline loading to multiple remote multiplexers as well as diagnostics and traffic statistics reporting from a central site. The unit also supports more comprehensive terminal-parameter configurations than those specified in CCITT Recommendation X.3.

The principal benefit of the Micro8000 is that it eliminates the extra-cost service and cables associated with separate modems. The internal modem is supported as an integral component of the multiplexer. Other user benefits are those associated with the standard Micro800/2, Micro800/X.25, and Micro900/2.

The Micom long-haul multiplexers support the idiosyncrasies of flow control for prominent minicomputer and terminal vendors, including Hewlett-Packard, Data General, Digital Equipment, Perkin-Elmer, Tandem, and General Electric.

□ Limitations

The standard Micro700 assigns channel bandwidth according to switch-selectable channel rates. The user should be aware that unused channels occupy bandwidth that could be used by active channels. The Dynamic Channel Assignment option eliminates this limitation by assigning bandwidth only to active channels, but the Dynamic Channel Assignment and Automatic Remote Configuration options are mutually exclusive with the 38.4K-bps optional link interface.

The Micro750 does not support asynchronous channels; however, the Micro800/2 can be used to combine asynchronous channels on Micro750 synchronous channels. Synchronous channels are limited to factory-set rates unless the optional Configuration Switching Module is installed. This option is limited to 8 selectable channel rate combinations. The basic multiplexer overhead is 2 units; a unit is 1/128 of the composite data rate or 1/256 with the optional Configuration Switching Module. The unit rate is dependent on selected channel rates, which must all be divisible by the unit rate. A unit rate not divisible into all channels must be expanded until it is divisible.

The standard and no-frills Micro800/2 are limited to small-scale applications that do not exceed the unit's channel capacity. The no-frills version cannot be expanded to meet growth requirements, and must be replaced in order to provide increased capacity. It is also limited to 8 channels in contrast to the 16-channel limitation for the standard version. The no-frills version is not equipped with most of the standard features and options of the standard Micro800/2. No-frills versions are also limited to 4800 bps per channel when all 8 channels are in use. Transmission compatibility over a composite link **is not provided between the Micro800/2 and its no-frills version**, nor between the Micro800/2 and the older Micro800. The 8-channel versions of all Micro800/2s cannot be expanded to 12- or 16-channel models anymore. The synchronous channel bandsplitter option reduces the concentrated throughput rate of the statistical multiplexer and can cause intolerable delays for asynchronous channels or completely choke off asynchronous channel transmission depending on traffic volume loading. Asynchronous transmission over the composite link reduces the maximum aggregate channel rate by approximately 20 percent to accommodate transmission of start/stop bits.

The principal limitation of the star network formed by a hub-site

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

Micro860 Concentrator Switch and multiple attached Micro800/2s, hinges on the vulnerability of a star network. If the Micro860 becomes inoperative because of malfunction or loss of power, etc, all communication is interrupted. There are no alternate routes that can be established. Communication is also interrupted between source and destination if a line outage occurs. Since the network topology does not support alternate routing, communication is interrupted until the problem is resolved, unless a backup line is connected during the outage.

The Micro860 is limited to small-scale user requirements that do not exceed its link limit of 8 attached Micro800/2s with a maximum of 128 ports (64 simultaneous connections). Micom currently does not support expansion beyond this limit since Micro860s **cannot** be interconnected. Should Micom announce support for interconnecting Micro860 switches, it would be wise for Micom to implement nodal bypass remedial recovery to circumvent a failed Micro860 node.

Although additional terminal handling procedures provided by the Micro800/X.25 are beneficial to users now, adoption of revised or future PAD standards by the CCITT could make this unit incompatible with the mainstream of packet technology.

The Micro900/2 multipoint statistical multiplexer is limited to small-scale applications that do not exceed the channel capacity of the central site (master) multiplexer or the maximum number of drops—a function of master unit channel capacity and channels per drop. Asynchronous transmission over the composite link reduces the maximum aggregate channel rate by approximately 20 percent to accommodate transmission of start/stop bits.

The Micro8000's integral modem precludes the use of a spare modem for remedial recovery. This is an especially severe limitation for unattended remote sites. Other limitations are those associated with the standard of the Micro800/2 and the Micro900/2.

■ HARDWARE

□ Terms & Support

Terms • OEM purchase through Micom; end-user purchase or lease only through Micom distributors and representative/distributors; separate maintenance contracts not available • 1-year warranty on all models • quantity discounts for OEM purchase at 5% for 10 to 25 units; 10% for 25 to 50 units; 15% for 50 to 100 units; 20% for 100 plus units; end-user discounts set by individual distributors and distributor/ reps.

Support • all models except Micro750 installed by user; Micro750 installed by user or by Micom, installation charge \$1,250 or \$1,750, depending on leased line or DDD connection • maintenance available through factory swap-out arrangement, with overnight express service available; on-call maintenance available only for Micro750, 800/2, 800/2-NF, 900/2, and 8000 models • Fixed Price Factory Repair Plan provides turnaround typically within 10 days, with repair charges ranging from \$150 to \$675, depending on model and channel configuration; repair or replacement at no cost for equipment under warranty • Express Service swaps the user's defective unit for a working replacement overnight; swap-out charges range from \$100 to \$250 depending on the model; Federal Express shipping charges are extra; Express Service available for both in- and out-of-warranty equipment • Customer Service locations providing telephone assistance and factory repair located in Chatsworth, CA; Woodbridge, NJ; Boston, MA; and St. Louis, MO • on-call maintenance performed during Principal Period of Maintenance (PPM) 8:00 AM to 5:00 PM Monday through Friday except holidays; labor is billed at \$45 per hour portal-to-portal, plus \$0.25 per mile travel expenses; on-call maintenance outside the PPM, 6:00 PM to 12:00 AM plus Saturdays requires \$68 per hour labor charges plus travel; service during the hours of 12:00 AM to 8:00 AM, including weekends and Sundays, requires \$90 per hour labor charges plus travel • on-call service provided either from Micom Service locations or by sales distributor or representative, depending on the area; sales and service provided by over 40 major stocking distributors in the U.S., and by 35 international distributors in 40 territories.

□ Overview

The Micom Micro series multiplexers support a wide variety of small-scale applications except for small- to medium-scale wideband applications. The series consists of both time-division and statistical time-division models. Micom statistical multiplexers use a modified SDLC link protocol with CRC 16 and ARQ error detection and correction techniques. Flow control, which protects against buffer overflow by regulating data transmission to and from the data terminal equipment, is a standard feature. A host of useful standard and extra-cost options are available. Depending on the model, popular options such as auto-speed (auto-baud), synchronous bandsplitting, automatic speed conversion, and support for various minicomputers can be added.

The Micro700 is a bit interleaved, 4-channel synchronous time-division multiplexer (bandsplitter) designed for point-to-point network configurations. The Micro750 utilizes time-division multiplexing to funnel up to 38 synchronous channels on to 1 high-speed dedicated line, typically an AT&T DDS (Dataphone Digital Service) or wideband circuit.

The Micro800/2 and a stripped-down version, the 800/2 No-Frills, are both statistical multiplexers with maximum channel capacities of 16 and 8 channels, respectively. They are designed for point-to-point communications, with aggregate channel rates of 153.6K bps (Micro800/2) and 38.4K bps (Micro800/2-NF).

The Micro860 is a separate device that supports switching, contention, or dedicated connections between asynchronous channels located on separate Micro800/2 multiplexers (excluding No-Frills versions). Up to eight 800/2s can be networked and managed from a single Micro860 acting as the hub controller. With the interconnect option, a Micro860 can be linked to either eight other Micro800/2s **and/or** Micro860s.

Special Options/models can provide specific support for Hewlett-Packard HP 3000 minicomputers for both standard and No-Frills versions of the Micro800/2.

The Micro800/X.25 is a statistical multiplexer that serves as a PAD (packet assembly/disassembly) device for public or private packet-switched networks. It allows asynchronous terminals access to a service (packet switching) intended primarily for high-speed synchronous devices, and also provides channel switching, contention, or virtual dedicated connections for its users. The Micro800/X.25 is certified for operation on Telenet, Tymnet, Uninet, and other major domestic and international public packet networks, but can be employed in private packet facilities as well.

The Micro900/2 is a statistical multiplexer designed for multipoint communications between a host CPU and dumb asynchronous terminals. Its transparent polling protocol can accommodate up to 16 channels on a 4-wire full-duplex leased line, and the Micro900/2 is available as a 4-, 8-, or 16-channel master unit for central site communications with as many as 16 remotely located node (slave) units. Node units are equipped with 1, 2, 4, or 16 channels. The maximum aggregate channel rate is 38.4K bps for node units and 76.8K bps for master units.

The Micro8000 series are packaged versions of Micro800/2 standard point-to-point or Micro900/2 multipoint models with an integral link modem. The Micro8000 operates at 2400, 4800, or 9600 bps on standard, unconditioned leased lines and supports 2-, 4-, 8-, 12-, 16-, or 24-channel configurations. All standard and optional features available for the Micro800/2, Micro900/2, and Micro800/X.25 are also available for corresponding Micro8000 models. The International PTT Isolation Module, which provides increased line isolation to meet the requirements of international PTT administrations, is available.

Micro700 Configuration • 4-channel fixed-configuration standalone or optional rackmount unit • bandsplits synchronous channels at selectable rates to 9600 bps; 19.2K-bps maximum aggregate channel rate • single composite link; synchronous rates to 19.2K bps • passes 4 full-duplex control signals.

Micro750 Configuration • 4-/8-channel standalone unit, or 19-/38-channel rackmount or optional standalone unit • supports synchronous channels at submultiples of the composite rate of 250K bps; channel adapters provide dual synchronous channels,

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

or 1 synchronous channel with EIA control • single composite link • aggregate channel rate at 85 percent of the composite rate.

Micro800/2 Configuration • 2/4/8/12/16-channel standalone or optional rackmount unit • supports asynchronous channels at selectable rates to 9600 bps; up to 4 synchronous channels at data rates to 9600 bps • 153.6K-bps maximum aggregate channel rate • bandsplitter option accommodates 1 or 2 synchronous channels; channel rates selectable at 0.25/0.50/0.75 times composite rate • synchronous channel option accommodates 1 or 4 synchronous channels at rates to 9600 bps • channel switching/contention via Micro860 • single composite link; synchronous rates to 19.2K bps; asynchronous to 9600 bps.

Micro800/2-NF Configuration • 2/4/8-channel fixed-configuration standalone or optional rackmount unit • Micro800/2-HP version supports HP 3000 systems with ENQ/ACK protocol and View/3000 software • supports asynchronous channels at selectable rates to 9600 bps; 38.4K-bps maximum aggregate channel rate • single composite link; synchronous/asynchronous rates to 9600 bps.

Micro800/X.25 Configuration • 4/8/12/16-channel standalone or optional rackmount unit • supports asynchronous channels at selectable rates to 9600 bps; 57.6K-bps maximum aggregate channel rate • single composite link with X.25 Level III framing; Telenet, Tymnet, Uninet certified; synchronous rates to 19.2K bps.

Micro900/2 Configuration • expandable 4/8/16-channel master unit; 1 or 2/4/8-channel fixed-configuration node (slave) unit • standalone; rackmount optional • supports asynchronous channels at selectable rates to 4800 bps; maximum aggregate channel rate 38.4K bps for node units; 76.8K bps for master units • single composite link; synchronous rates to 9600 bps; asynchronous rates to 2400 bps.

Micro8000 Configuration • configuration identical to Micro800/2, 800/X.25, and 900/2 • units contain 2400-, 4800-, or 9600-bps synchronous composite link modems.

□ **Micro700 Bandsplitter**

Micro700 Central Control

Central control module contains central logic, power supply, integral channel adapters, and composite link module; supports optional downline loading of channel configuration parameters, optional dynamic channel assignment • standard 4-channel unit:

\$1,150 prch

Micro700 Rackmount Version • contains single Micro700 in rackmount configuration:

1,225

Micro700 Diagnostic Tests

Standard test feature of the Micro700 includes local composite link loopback only; option equipped units include local and remote composite link loopback tests • standard feature:

NC prch

Micro700 Status Reporting

LED status display panel indicates carrier detect; loss of synchronization transmit/receive data; and EIA control signals • option-equipped models include remote carrier detect, synchronization loss, and loopback indication; channel activity display for each data channel • standard feature:

NC prch

Micro700 Channels

Central control module packaged with 4 channels • synchronous channel rates selectable at 0.25/0.50/0.75/1.0 times composite rate; 8 rate combinations via front panel thumbwheel switch • overhead bits for synchronization claimed from channel 1; overhead is 0.39 percent composite rate • overhead channel not recommended for tail circuit • EIA RS-232C/CCITT V.24/V.28 interface • channel price included in cost of control unit:

NC prch

F700/AUTO Automatic Remote Configuration • downline loads selected channel parameters at master site to remote slave unit • passes 4 full-duplex control signals; signals passed in order of priority as change is detected; signals in order of priority include RLSD/RTS, CTS, DTR/DSR, Busy/RI; control signal delays range from 30 to 240 milliseconds • overhead bits for synchronization claimed from channels 1 and 2; overhead is 3.124 percent composite rate • mutually exclusive with F700/DYN dynamic channel assignment option and F700/384 38.4K-bps composite link option • extra-cost option:

550

F700/DYN Dynamic Channel Assignment • improves composite link utilization by automatically assigning only the active data channels for transmission • incorporates the same control signal, delay, and overhead characteristics as the F700/AUTO option; mutually exclusive with F700/AUTO Automatic Remote Configuration option and F700/384 38.4K-bps composite link option • extra-cost option:

550

Micro700 Composite Link

Central control module packaged with link • up to 19.2K bps synchronous full-duplex • external clock • RS-232C/CCITT V.24/V.28 electrical interface • standard feature:

NC prch

F700/384 38.4K-bps Composite Interface Option • boosts composite link data rate to 38.4K bps • mutually exclusive with F700/AUTO and F700/DYN options • extra-cost option:

100

□ **Micro750 Wideband Multiplexer (TDM)**

Micro750 Central Control

Control module contains central logic, channel adapters, link module, and power supply; Model 750/1 supports any combination of up to 4 single- and dual-channel adapters; Model 750/2 supports any combination of up to 19 single- and dual-channel adapters • channel parameters and optional features selected by internal straps • options include Configuration Switching Module for channel parameter selection via front-panel thumbwheel switch; automatic downline loaded channel parameters; redundant power supply; redundant common logic; automatic switchover to redundant common logic; composite link slaved timing; and wideband interfaces • diagnostic support standard.

Model 750/1 8-Channel Unit • standalone unit with 4 card slots for single- or dual-channel adapters and configuration switching module; space allotted for redundant power supply; redundant common logic requires channel adapter slot:

\$2,000 prch

Model 750/2 38-Channel Unit • rackmount unit with 19 card slots for single- or dual-channel adapters and configuration switching module; space allotted for redundant power supply and redundant common logic • F5301 Standalone Enclosure optional:

2,600

F5322 Redundant Power Supply • integral backup power supply for Model 750/1; automatically switched • extra-cost option:

450

F5323 Redundant Power Supply • integral backup power supply for Model 750/2; automatically switched • extra-cost option:

650

F5303 Redundant Common Logic • redundant multiplexer logic for Models 750/1 and 750/2; manually switched upon failure of primary common logic • requires card slot and

PRCH: single-unit purchase price; leasing available through distributors or representatives only. NC: no charge item. Prices are current as of November 1984.

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preempts channel adapter on Model 750/1 • occupies dedicated space on Model 750/2 • extra-cost option:

480

F5037 Automatic Switchover Module • automatically switches to Redundant Common Logic upon failure of primary common logic • requires card slot in central control unit • extra-cost option:

400

F5035-2 Configuration Switching Module, Type II • thumbwheel switch selection and storage of 8 channel configuration parameters • requires card slot in central control unit • automatically downline loads configuration parameters • extra-cost option:

550

F5304 Redundant Configuration Switching Module, Type II • redundant backup module for F5035-2; requires card slot • extra-cost option:

550

F5035-3 Configuration Switching Module, Type III • identical to F5035-2, but provides Automatic Switchover for Redundant Common Logic, and space to include option F5036 composite link slaved timing • extra-cost option:

650

F5036 Composite Link Slave Timing (DDS Channel Slave Timing) • slaves composite link timing to an external clock via either CCITT V.35 or RS-232C interface • allows Micro750 clock to be phase locked to AT&T DDS and other channels with native timing • requires Type III Configuration Switching Module • extra-cost option:

200

F5301 Standalone Enclosure • standalone, desktop enclosure for Model 750/2 • extra-cost option:

475

Micro750 Diagnostic Tests

Isolates failures in local/remote channels; local/remote link modules; or composite link through local/remote loopback of data transmitted from terminal equipment • central site test feature allows any terminal to check integrity of central site multiplexer without interfering with other terminals/channels • single channel adapter checks its own operation via a random bit pattern; pushbutton operation • self test of logic circuitry possible only through external hookup of a bit-pattern generator/tester (BERT) • standard feature:

NC prch

Micro750 Status Reporting

LED indicators on central logic module and individual channel adapters display status of performance monitoring • central logic display indicates normal operating mode, system and remote alarm, received/transmitted data, carrier loss, receive/transmit clock alarm, test and loopback modes • Single Synchronous Channel display indicates channel alarm condition, buffer over/underflow; EIA control signals, local and remote loopback • Dual Synchronous Channel displays, 1 for each channel, indicate channel alarm condition; buffer over/underflow, received/transmitted data, local/remote loopback • standard feature:

NC prch

Micro750 Channels

Model 750/1 accommodates any combination of up to 4 single and dual synchronous channel adapters with provision for 5 full-duplex control signals (TD/RD, channel busy/ring, DCD, RTS/CTS, and DSR/DTR); Model 750/2 accommodates any combination of up to 19 single and dual synchronous channel adapters • synchronous data rates fixed at the factory, or optionally switch selectable with up to 8 possible combinations of channel rates; channel data rates range from 1200 bps to 98 percent of the composite rate, typically in increments of 400, 800, or 1600 bps • overhead bits for synchronization claim 1.4 to 2.8 percent of the channel rate • units installed with optional

Configuration Switching Module require less overhead • standard 8-bit channel buffering • standard RS-232C/CCITT V.24/V.28 electrical interface, or optional CCITT V.35 or AT&T 300 Series interfaces.

F5310-3 Dual Synchronous Channel Adapter, Type II • dual-port, full-duplex synchronous channel adapter for Models 750/1 and 750/2 • requires card slot:

\$500 prch

F5311-3 Single Synchronous Channel Adapter • single-port, full-duplex synchronous channel adapter for Models 750/1 and 750/2 • passes 5 full-duplex EIA control signals • requires card slot:

450

F5319-C25 Channel Module V.35 Interface • integral electrical interface option • for wideband circuits, including AT&T 8000 Series and Dataphone Digital Service (DDS), at data rates of 48/56/64/72K bps • 1 required for each port converted to V.35 interface:

360

Micro750 Composite Link

Central control module packaged link • up to 256K-bps full-duplex synchronous operation over Type 3002, DDS, wideband, or satellite link • external clock • standard RS-232C/CCITT V.24/V.28 electrical interface.

F5321 Common Logic Buffer • integral 4096-bit buffer for compensation of propagation delay between Micro750s in a satellite link:

\$400 prch

F5305 Common Logic V.35 Interface • provides CCITT V.35 interface logic and connection for composite link, mutually exclusive with F5308 and F5309 options • extra-cost option:

300

F5308 Common Logic V.11 Interface • provides CCITT V.11 interface logic and connection for composite link, mutually exclusive with F5305 and F5309 options • extra-cost option:

285

F5309 Common Logic RS-449 Interface • provides EIA RS-449 interface logic and connection for composite link, mutually exclusive with F5305 and F5308 options • extra-cost option:

300

Micro800/2 Data Concentrator (STDM)

Micro800/2 Central Control

Control module contains central logic with 16K RAM buffer, composite link module, and power supply; available in a fixed 2-channel packaged configuration, or in 4/8/12/16-channel packaged configurations expandable to 16 channels maximum via 4-channel adapters • standard and extra-cost options selected by internal DIP switches • rackmount option for standard 19-inch equipment cabinet • operating parameters including asynchronous channel rates; character codes; line/form feeds (flyback control) selectable by DIP switches or user terminal.

Model 822 • standard non-expandable 2-channel standalone unit with 16K-byte RAM buffer:

\$1,450 prch

Model 824 • standard 4-channel standalone unit with 16K-byte RAM buffer:

1,850

Model 828 • standard 8-channel standalone unit with 16K-byte RAM buffer:

2,750

Model 8212 • standard 12-channel standalone unit with 16K-byte RAM buffer:

3,700

Model 8216 • standard 16-channel standalone unit with

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16K-byte RAM buffer:

4,600

U800/K4 Channel Expander Kit • plug-in board expands 4-channel Model 824 to 8-channel Model 828:

1,000

U800/K12 Channel Expander Kit • plug-in board expands 12-channel Model 8212 to 16-channel Model 8216:

1,000

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • configuration parameters stored in RAM at master multiplexer; default condition at slave unit reverts parameters to slave DIP switch settings • standard feature:

NC

F800/PTR Priority Control (Background Printer Feature) • assigns a higher priority to user-specified data channels; effectively, allows up to 7 printers to operate in background without impairing response time of interactive terminals • standard feature:

NC

F800/SAT Satellite Transmission Option • compensates for propagation delay between Micro800/2s in a satellite link • sends a response after 7, 14, or 21 information blocks (selectable); error retransmission only on individual blocks in error • standard feature:

NC

U800/RMK • rackmount option provides shelf for mounting single Micro800/2 in 19-inch equipment cabinet:

75

Micro800/2 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; most active ports disabled first • detects and responds to XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 87 percent total buffer utilization; flow resumption threshold at 62 percent buffer utilization • data lost message sent only to affected terminals on buffer overflow • standard feature:

NC prch

Firmware supports selected vendor flow control techniques; operation compatible with various minicomputers and terminals • accommodates varied usage of XON/XOFF, DTR, and CTS characters.

NC

F800/HPX Extended Hewlett-Packard Option • supports HP 3000 systems using ENQ/ACK protocol and 3000/VIEW software • extra-cost option:

100

F800/PE Perkin-Elmer Feature • accommodates Perkin-Elmer (Interdata) systems that use a special control function • mutually exclusive with Tandem, Wang, and Memorex (auto-speed) options • standard feature:

NC

F800/TAN Tandem Feature • accommodates "T-Pause" flow control technique for Tandem computers • mutually exclusive with Perkin-Elmer and Wang options • standard feature:

NC

Link Outage Recovery • link down message sent to terminal equipment in response to ENQ when composite link is out • standard feature:

NC

Micro800/2 Diagnostic Tests

Isolates failures in local/remote channels; local/remote loopback of data transmitted from terminal equipment • terminal-selected

test feature allows any terminal to check integrity of local node unit or complete end-to-end system without interfering with other terminals/channels; includes FOX message generator • standard feature:

NC prch

Micro800/2 Status Reporting

LED status display panel indicates results of performance monitoring; LEDs indicate normal/fault/loopback modes; loss of synchronization; retransmission request; line degradation when error rate is approximately greater than 1 in 1000 bits; buffer overflow; multiplexer logic error; and remote alarm condition • channel activity display indicates received or transmitted data activity for each channel • some options also add status indicators to basic unit • standard Command Port (F800/PORT) provides user-supplied terminal with traffic statistics and alarm/event reporting • standard feature:

NC prch

Micro800/2 Channels

Central control module packaged with 2/4/8/12/16 channels; all models except Model 822 expandable in 4-channel increments • asynchronous switch-selectable channel rates of 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; asynchronous split channel rates optional • synchronous channel rates optional • 16-channel parameter combinations selected via front-panel thumbwheel switch; includes data rates, CR/LF/FF character delays, and stop bits • theoretical aggregate input rate of 16 channels at 9600 bps per channel • 5 through 8 data bits • RS-232C/CCITT V.24/V.28 electrical interface:

NC prch

F800/ABR96 Autospeed (Autobaud) Feature • regulates asynchronous channel rate to rate of dial-up line using CR convention • switch selectable on individual channel basis • 50- to 9600-bps data rates • option price included in cost of central control unit:

NC

F800/SPD Speed Conversion Feature • supports Autospeed for CPUs with fixed-speed ports; performs automatic speed conversion when a channel is configured for a different speed at each end • disables downline loading of channel parameters capability • standard feature:

NC

F800/ASYM Split (Asymmetrical) Channel Speed Option • supports terminals operating at receive/transmit data rates of 1200/75, 1200/150 bps, or other standard data rate pairs • applicable to Viewdata and other public information networks • extra-cost option:

200

F800/SYNC Synchronous Channel Option • switch selects either channel in a 2-channel unit or any of the top 4 channels in 4-, 8-, 12-, or 16-channel units for asynchronous, clocked asynchronous, or synchronous operation • switch-selectable synchronous protocol-dependent mode supports IBM 3270/2780/3780 (ASCII or EBCDIC) and SDLC, HDLC, CDC UT200, Honeywell VIP 7700, Sperry Uniscope, and ICL CO3 protocols; discards all pad/delay characters and reconstructs them at opposite end • switch-selectable protocol transparent mode supports any other synchronous protocol; monitors channel interface(s) for RTS/CTS and fills a user-specified frame length up to 10K characters with the synchronous transmission; does not discard any characters • both modes statistically multiplex synchronous data along with the asynchronous aggregate • extra-cost option.

2-, 8-, 12-, or 16-Channel Unit Options:

400

4-Channel Unit Option:

550

F800/BAND Synchronous Bandsplitter Option • TDM multiplex 1 or 2 synchronous channels with composite link, using assigned bandwidth • extra-cost option:

800

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F800/PORT Control Terminal Port Support • dedicated port supports user-provided collocated or remote terminal for online system testing, channel parameter changes, message broadcast, performance monitoring, and statistics reporting • standard feature:

NC

F800/TICC Terminal-Initiated Channel Configuration • allows terminal operator to modify the channel configuration and activate local echo, change speed, or modify CR/LF/FF delays (flyback control) (1 through 99 characters), via operator keyboard • standard feature:

NC

F800/COMP Data Compression Feature • automatically compresses (encodes) repeated ASCII characters, improving transmission efficiency • selectable by individual channel • standard feature:

NC

F800/ECHO • echos terminal data from remote multiplexer instead of CPU, improving response time • selected via switch setting or operator terminal • standard feature:

NC

F800/WANGX Extended Wang Option • accommodates Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • also supports Wang flow control characters • mutually exclusive with Tandem and HPX options • extra-cost option:

100

F800/BUSY Remote Channel Busy Out Feature • permits remote busying of channels connected to dial-up modems; selected via Control Terminal Port • standard feature:

NC

F800/BOOT • supports automatic loading of all configuration parameters from either the central site or remote site concentrator • standard feature:

NC

F800/DG • ensures that clear-to-send signal works properly with Data General computers when controlling buffer overflow • works with similar systems that stop transmission instantly when clear-to-send is dropped • switch-selectable standard feature:

NC

F800/DEC • provides support for DECwriter printing terminals and similar terminals that transmit an XOFF control character • accommodates smooth scroll function used in DEC VT-100 display terminals • available in No-Frills models • switch-selectable standard feature:

NC

F800/GE & Terminet Feature • provides support for General Electric Terminet printing terminals and similar terminals that transmit an interface signal when busy or out of paper • busy signal can be converted to an XOFF control character before transmission • switch-selectable standard feature:

NC

U800/20-mA Current-Loop Adapter • external adapter for 20-mA current-loop devices; required per channel • extra-cost option:

95

Micro800/2 Composite Link

Central Control module packaged link • up to 19.2K bps full-duplex synchronous • external clock • optional asynchronous rates • modified SDLC protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • standard feature:

NC prch

F800/AS96 High-Speed Composite Asynchronous Feature • switch-selectable full-duplex asynchronous data rates of 9600/1800/1200 bps on composite link • applicable to asynchronous short-haul modems or line drivers • standard feature:

NC

F800/X.21 CCITT X.21 bis Composite Interface Option • allows attached terminals to operate over CCITT X.21 switched-digital networks; X.21 interface unit not supplied • extra-cost option:

200

Micro800/2 Call Routing Through Micro860 Concentrator Switch

When combined with a single Micro860 Concentrator Switch, up to 8 Micro800/2s can be interconnected to form a star network. Micro860 performs as an intermediate hub controller, allowing channel switching and port contention among interconnected Micro800/2s. Up to 128 channels can be interconnected through the Micro860 (up to 16 channels per each Micro800/2), allowing up to 64 simultaneous connections. Individual Micro800/2s can be attached to CPUs or terminal nodes in any arrangement; for instance, 2 of the multiplexers could be attached to 2 different CPUs, while 6 multiplexers could then support terminals that contend for the CPU ports attached to the other 2 multiplexers.

A path is established between source and destination channels (devices) only if the devices meet the same connection criteria, and the called device is not busy. If the called device is busy, the Micro860 will automatically inform the calling terminal and queue the call on a first-come, first-serve basis (if contending for a selectable resource class of channels). Forced connections can also be made between specified channels through the Micro860 Command Port (supervisory port). A forced connection does not follow normal connect/disconnect procedures, and remains in effect until cancelled by a disconnect command.

Security measures prevent unauthorized connections between network channels to secure sensitive information. This can be established by assigning passwords to any or all network channels. Unauthorized access to the Micro860 Command Port is also prevented via password protection.

Programmable channel connection assignments include the following 4 generic types of call routing: **matrix switching**, where a terminal operator requests a specific channel by its address code; **fixed destination switching** (dedicated channel access), where a device always connects to an assigned destination channel or channel group whenever that device is active; **local switching**, where 2 channels attached to the same Micro800/2 multiplexer are connected to each other; and **class selection**, where a device contends for a group of similar resources (ports), depending on availability.

Micro860 Concentrator Switch

A standalone or rackmount unit that interconnects composite links of up to 8 Micro800/2 Data Concentrators • supports dedicated channel assignments, channel switching, and contention among Micro800/2 asynchronous channels • supports asynchronous channel rates from 50 to 9600 bps; supports auto-baud (dial-in) channels, recognizing carriage return (CR) as the sign-on character at speeds from 110 to 9600 bps • asynchronous channel parameters selected via internal DIP switches • supports Micro800/2 composite links via external clock at synchronous rates up to 19.2K bps; can provide internal clock for synchronous rates at 2400, 4800, 9600, or 19.2K bps • aggregate composite data rate supported by Micro860 is 57.6K bps • includes network control facility comprised of Command and Log ports for centralized network control and supervision • front panel status display indicates error condition, composite link sync loss for each network multiplexer, and non-volatile memory battery low • includes 16K RAM buffer for network flow control • Micro860 configured as master unit; Micro800/2s configured as slaves, and can be collocated or remote from the Micro860 • EIA RS-232C/CCITT V.24/V.28 electrical interface for each composite link, command port, and log port.

Micro860 Model 864 • supports up to 4 composite links from Micro800/2 Data Concentrators:

\$2,550 prch

Micro860 Model 868 • supports up to 8 composite links from Micro800/2 Data Concentrators:

3,250

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Composite Link Expander Kit • plug-in board expands 4-composite link Model 864 to 8-composite link Model 868:

1,000

U860/RMK • rackmount option provides shelf for mounting 1 Micro860 in a 19-inch equipment cabinet:

75

Channel Class Selection • channels assigned to selectable class service can request any destination channel connected to the same multiplexer, a group of channels on a specific multiplexer, any destination channel in the network, or to 1 of 32 separate classes of channels via a Symbolic Class Name • Symbolic Class channels can provide secure access to user-defined groups of contention ports; groups can include any number of channels which do not have to be contiguous, and do not have to reside on the same multiplexer • channel classes defined by user each have an associated wait queue; waiting calls are sequentially queued and all users contend for resources on an equal basis • fallback switching can be programmed for channel classes, providing a secondary (alternate) class of channels for call routing in case all channels in a primary resource are busy; in case all secondary class channels are busy, incoming calls are queued for primary class channels:

NC

Fixed Class Channels • channels assigned to fixed class service are permanently connected to a destination channel • the destination channel is available to other users when not in use as a fixed connection • no future dialogue is required to make the connection, although normal protocol is still followed, including password control:

NC

User Messages • up to 8 messages of up to 30 characters each can be sent to users after a connection request is made from the Micro860 • messages will be sent to all terminals in a specific channel class when 1 is selected • standard Micro860 feature:

NC

TACT Feature • Terminal-Activated Channel Test (TACT) provides loopback testing for data channels or terminals • activated from Command Port terminal or any terminal attached to a remote multiplexer • user selects 1 of 4 tests • Local Test loops terminal data back to terminal • Terminal Test sends fox message from built-in Micro860 message generator to the terminal • Remote Test loops terminal data to the Micro860 and back to the terminal • System Test loops data from a network terminal to a remote multiplexer for loopback via the Micro860 • the Micro860 Command Port can also be tested via TACT by loopback to a remote multiplexer • the Micro860 will also act as the remote unit in a switch-activated (Micro800/2) remote composite loopback test • standard Micro860 feature:

NC

Command Port • provides complete network configuration control for all attached Micro800/2 multiplexers; all switch settings at node multiplexers can be overridden by the Command Port • provides call routing configuration and loopback testing functions • connected to a user-supplied dial-up or locally attached terminal or CPU port; operates at data rates up to 9600 bps with Autobaud access • each Micro800/2 can still use its own command port, although not all commands are available because of its status as a slave unit • can display all system parameters • can be password protected • standard Micro860 feature:

NC

Log Port • provides real-time message logging and traffic statistics analysis • connected to a user-supplied printer or CPU port, or routed through the Command Port • event messages generated for each connect, disconnect, failure to connect, queue entry, remote multiplexer reset, or system reset • alarms generated for flow control and buffer overflow, sync loss and acquire, and local and remote line alarms • provides periodic reports on multiple composite links statistics, remote buffer utilization for all channels, and link usage/quality for all multiplexers • statistics collected for flow control, sync and carrier loss times, composite link and buffer utilization, and frequency of event and alarm messages • standard Micro860 feature:

NC

Non-ASCII Terminal Support • supports asynchronous EBCDIC, Baudot, and other non-ASCII asynchronous terminals • does not support password protection • does not support all dialogue functions between Micro860 and remote terminal • standard feature:

NC

Micro800/2-NF & Micro800/2-HP No-Frills Data Concentrators

Micro800/2-NF & Micro800/2-HP Central Control

Control module contains central logic with 16K RAM buffer, composite link module, and power supply; available in fixed 2/4/8-channel packaged configurations • standard options selected by internal DIP switches • standard support for diagnostics; downline loaded channel parameters; HP models support HP 3000 systems using ENQ/ACK protocol and 3000/View software • **extra-cost options**, except for rackmount and current-loop interface, are **not available** • selectable channel parameters include asynchronous channel rates, character codes, and line/form feeds (flyback control).

Model 822-NF • standard non-expandable 2-channel unit with 16K-byte RAM buffer:

\$1,300 prch

Model 824-NF • standard non-expandable 4-channel unit with 16K-byte RAM buffer:

1,650

Model 828-NF • standard non-expandable 8-channel unit with 16K-byte RAM buffer:

2,450

Model 822-HP • standard non-expandable 2-channel unit with Hewlett-Packard ENQ/ACK support and 16K-byte RAM buffer:

1,300

Model 824-HP • standard non-expandable 4-channel unit with Hewlett-Packard ENQ/ACK support and 16K-byte RAM buffer:

1,650

Model 828-HP • standard non-expandable 8-channel unit with Hewlett-Packard ENQ/ACK support and 16K-byte RAM buffer:

2,450

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • configuration parameters stored in RAM at the master multiplexer; default condition at slave unit reverts parameters to slave DIP switch setting • standard feature:

NC

U800/RMK • rackmount option provides shelf for mounting 1 Micro800/2-NF in a 19-inch equipment cabinet:

75

Micro800/2-NF & Micro800/2-HP Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; most active ports disabled first • detects and responds to XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 87 percent total buffer utilization; flow resumption threshold at 62 percent buffer utilization • data lost message sent only to affected terminals on buffer overflow • standard feature:

NC prch

Firmware supports selected vendor flow control techniques; operation compatible with various minicomputers and terminals • accommodates varied usage of XON/XOFF characters:

NC

Link Outage Recovery • link down message sent to terminal equipment in response to ENQ when composite link is out • standard feature:

NC

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

Micro800/2-NF & Micro800/2-HP Diagnostic Tests

Isolates failures in local/remote channels; local/remote loopback of data transmitted from terminal equipment • terminal selected test feature allows any terminal to check integrity of local node unit or complete end-to-end system without interfering with other terminals/channels; includes FOX message generator • standard feature:

_____ NC prch

Micro800/2-NF & Micro800/2-HP Status Reporting

LED status display panel indicates results of performance monitoring; LEDs indicate normal/fault/loopback mode; loss of synchronization; retransmission request; line degradation when error rate is approximately greater than 1 in 1000 bits; buffer overflow; multiplexer logic error; and remote alarm condition • does not include channel activity display • standard feature:

_____ NC prch

Micro800/2-NF & Micro800/2-HP Channels

Central control module packaged with 2, 4, or 8 channels; units not expandable • asynchronous switch selectable channel rates of 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps • 16 channel parameter combinations selected via front-panel thumbwheel switch; includes data rates, CR/LF/FF character delays, and stop bits • maximum aggregate input rate of 38.4K bps • 5 through 8 data bits • RS-232C/CCITT V.24/V.28 electrical interface:

_____ NC prch

U800/20-mA Current-Loop Adapter • external adapter for 20-mA current-loop devices; required per channel • extra-cost option:

_____ 95

Micro800/2-NF & Micro800/2-HP Composite Link

Central control module packaged link • up to 9600 bps full-duplex synchronous • external clock • optional asynchronous rates • modified SDLC protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • standard feature:

_____ NC prch

F800/AS96 High-Speed Composite Asynchronous Feature • switch-selectable full-duplex asynchronous data rates of 9600/1800/1200 bps on composite link • applicable to asynchronous short-haul modems or line drivers • standard feature:

_____ NC

Micro800/X.25 Concentrator PAD

Micro800/X.25 Central Control

Control module contains central logic with 64K RAM buffer, composite link module, and power supply; available in standalone 4/8/12/16-channel packaged configurations expandable to 16 channels maximum via 4-channel adapters • operating parameters optionally entered via operator console and downline loaded to remote unit • rackmount option for standard 19-inch equipment cabinet.

Model 854 • standard 4-channel standalone unit with 64K-byte RAM buffer:

_____ \$2,050 prch

Model 858 • standard 8-channel standalone unit with 64K-byte RAM buffer:

_____ 2,750

Model 8512 • standard 12-channel standalone unit with 64K-byte RAM buffer:

_____ 3,700

Model 8516 • standard 16-channel standalone unit with 64K-byte RAM buffer:

_____ 4,600

U850/K4 Channel Expander Kit • plug-in board expands 4-channel Model 854 to 8-channel Model 858:

_____ 1,000

U850/K12 Channel Expander Kit • plug-in board expands 12-channel Model 8512 to 16-channel Model 8516:

_____ 1,000

U850/EX12 Channel Expander Kit • separate enclosure with ribbon connector expands 8-channel Model 858 to 12-channel Model 8512:

_____ 1,200

U850/EX16 Channel Expander Kit • separate enclosure with ribbon connector expands 8-channel Model 858 to 16-channel Model 8516:

_____ 2,100

U850/RMK • rackmount option provides shelf for mounting 1 Micro800/X.25 in a 19-inch equipment cabinet:

_____ 75

Micro800/X.25 Flow Control

Supports flow control according to CCITT X.3, parameters #12 and #5 or supports out-of-band RTS/CTS method; guards against multiplexer system overflow and against buffer overflow at terminals, resulting in loss of data; selectable on or off • controls data flow at channel inputs by generating XON/XOFF or CTS on EIA RS-232C interface • detects and responds to XON/XOFF (or user-defined) flow control characters from terminals by suspending/resuming data flow to channel inputs • system flow suspension threshold set at 87 percent total buffer utilization; flow resumption threshold at 62 percent buffer utilization • standard feature included in package price:

_____ NC prch

Link Outage Recovery • link down message sent to terminal equipment in response to ENQ when composite link is out • standard feature:

_____ NC

Micro800/X.25 Diagnostic Tests

Isolates failures in local channels; local/remote loopback FOX message or data transmitted from terminal equipment; remote loopback via virtual circuit at local node • terminal selected test feature allows any terminal operator to check integrity of local node unit without interfering with other terminals/channels; includes FOX message generator • standard feature:

_____ NC prch

Micro800/X.25 Status Reporting

LED status display panel indicates results of performance monitoring; LEDs indicate normal/fault/loopback modes; loss of synchronization; retransmission request; buffer overflow; multiplexer logic error; and remote alarm condition • channel activity display indicates received or transmitted data activity for each channel • standard Command Port (F850/PORT) provides user-supplied terminal with traffic statistics and alarm/event reporting; optional Network Control M850/NCS System provides the same capability for multiple Micro800/X.25 nodes • standard feature:

_____ NC prch

Micro800/X.25 Channels

Central control module packaged with 4/8/12/16 asynchronous channels, upgradeable in 4- or 8-channel increments • operating parameters are configured via DIP switches or keyed into the command port via user-supplied ASCII terminal, locally or remotely, for downline loading • asynchronous channel rates at 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; maximum aggregate input rate of 57.6K bps • 6, 7, or 8 data bits per character, including or excluding parity • 1, 1.5, or 2 stop bits • RS-232C/CCITT V.24/V.28 electrical interface • channels included in package price:

_____ NC prch

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

F850/ABR Autospeed (Autobaud) Feature • regulates asynchronous channel rate to rate of attached device using CR convention • selectable on an individual channel basis • 110/150/300/600/1200/2400/4800/9600-bps data rates • standard feature:

NC

F850/ASYM Split (Asymmetrical) Channel Speed Option • supports terminals operating at receive/transmit data rates of 1200/75 bps, 1200/150 bps, or other data rate pairs • applicable to Viewdata and other public information networks • extra-cost option:

200

F850/PRI Channel Priority Feature • selectable feature assigns high or normal priority on a per-channel basis • provides faster response time for interactive terminals • high-priority output queues serviced ahead of normal priority output queues • standard feature:

NC

F850/PORT Control Terminal Port Support • dedicated Command Port supports user-provided collocated or remote terminal for online system testing, downline loading of channel parameters (1 remote node only), message broadcast, performance monitoring, and statistics reporting • menu driven • operates up to 9600 bps with Autobaud access • standard feature:

NC

F850/BLOCK Block Transmission Option • supports block-mode devices transmitting up to 1920 characters at a time and that can be flow controlled only between block transmissions • extra-cost option:

150

F850/COPY Copy Option • allows data traffic being received on one channel to be copied on a device attached to another channel • extra-cost option:

150

F850/COMP Data Compression Feature • automatically compresses (encodes) repeated ASCII characters, improving transmission efficiency • standard for all channels • standard feature:

NC

Call Indication/Authorization • selectable feature enables channels to emulate AT&T 212 modem handshaking protocol on a per channel basis • supports transmission of EIA interface signals between DTE and DCE • standard feature:

NC

Switched Virtual Circuits • allows user-transparent communication from remote terminal (and remote PAD) to host CPU • terminal operators originate calls via manual long-form or short-form method, or via autoconnect call • manual long-form call method requires operator to enter remote X.25 DTE network address; optional class; any optional user facilities; and optional security access code • manual short-form call method only requires operator to enter a 2-character ID and optional class • autoconnect call feature automatically generates a call to remote X.25 DTE on detection of Data Terminal Ready (DTR) signal on EIA interface or data activity • standard feature:

NC

Channel Class Selection • assigns user groups of channels for any or all available channels • terminal users enter appropriate 2-digit code for access to a given group (channel class); can be used to restrict unauthorized access to secure network facilities • channel classes can contain any number of channels; any channel can be defined in more than 1 class • standard feature:

NC

Permanent Virtual Circuits • permanent virtual circuits can be established between remote terminals and host ports, allowing connections to appear as leased lines to user • does not allow port selection; does not require call origination or users to contend for ports • standard feature:

NC

Local Switching Feature • allows terminal operator to establish

a connection to a port on the local Micro800/X.25 without utilizing composite link/packet service connection • functions as a local data PBX, allowing local terminals to access a host computer without incurring packet service costs • standard feature:

NC

Micro800/X.25 Composite Link

Central control module packaged link • data rates up to 19.2K bps full-duplex synchronous • external clock • X.25 Level III link access protocol balanced (LAPB) • certified for use on Telenet, Tymnet, Uninet, and all major domestic and international public packet networks • does not support Datagram service under X.25 • EIA RS-232C/CCITT V.24/V.28 electrical interface • composite link included in package price:

NC prch

Link Parameters • X.25 link parameters established from internal DIP switches or via user-supplied terminal connected to Command Port • user-established N2, window, timer, and packet size • N2 is 1 to 20 value defining number of retries in case of error • T1 frame recovery time 1 to 15 • window is 1 to 7 value defining number of frames transmitted before acknowledgement is required • network packet size definable at 128 or 256 octets (characters) • standard feature:

NC

Packet Assembly/Disassembly (PAD) • conforms to all 20 CCITT X.3 PAD parameters; supports 18 additional terminal handling parameters not covered in the X.3 Recommendation • supports CCITT X.28 Recommendation for physical connectivity between PAD and DTE equipment • supports CCITT Recommendation X.29 specifying transport procedures for PAD parameters; allows downline loading of channel/PAD parameters to 1 remote Micro800/X.25; downline loading from central site to multiple remote multiplexers requires F850/NCS or F850/DLL options • standard feature included in package price:

NC

Enhanced Asynchronous Terminal Handling • supports 18 additional terminal functions not covered in the X.3 Recommendation • extended echo control supports specially formatted screens • can define XON/XOFF character different from ASCII code set • supports enhanced flow control via RTS/CTS • inactivity timer can clear a call after a user-specified period of inactivity • supports padding after form feed • accepts character format other than ASCII code set • supports temporary echo suppression; can suppress echo on certain user-defined characters • supports page handling; defines number of lines per page for line feed insertions (for dumb terminals) • special echo sequence supports formatted screen applications where a sequence of characters is echoed in response to a network command • supports parity conversion; can define device or network parity • supports packet forwarding based on user-defined character count • special handling of escape sequences • can define break character • allows Micro800/X.25 to initiate X.29 message • standard feature:

NC

M850-NCS Network Control System • for managing, controlling, and monitoring a network of Micro800/X.25 multiplexers from a central location • supports a menu-driven network generation facility for downline-loading configuration parameters to multiple Micro800/X.25 multiplexers through a packet-switched network • reports Micro800/X.25 alarm conditions or the failure to send routine status messages • reports individual multiplexer statistics including input/output link errors; buffer utilization; number of packets/segments sent and received; and call duration data • prints consolidated management reports at user request • does not require interaction with Micro800/X.25 Command Port; user interacts through NCS terminal • requires either F850/NCS or F850/DLL option installed at each remote Micro800/X.25 • extra-cost option:

15,000

F850/DLL Downline Load Option • firmware option required at each remote Micro800/X.25 site to implement network control system commands • downline loads code to remote PADs,

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

allowing remote PAD configuration • extra-cost option per remote unit:

100

F850/NCS Network Control System Support Option • supports network control and management of Micro800/X.25s through a packet-switched network, like F850/DLL, without supporting downline code loading • does not allow remote PAD configuration • extra-cost option per remote unit:

150

□ Micro900/2 Multidrop Concentrator

Control module contains central logic with battery-backed CMOS RAM buffer, composite link module, and power supply; available in 1/2/4/8/16-channel packaged configurations • standard and extra-cost options selected by internal DIP switches • standard support for diagnostics; flow control; asynchronous/synchronous composite link data rates; auto-speed (auto-baud); channel priority control; and automatically downline loaded channel parameters • rackmount for 19-inch equipment cabinets • selectable parameters include channel rates; character codes; line/form feeds (flyback control); and EIA control signal enable/disable • Master and 4-/8-channel Slave units include 16K RAM buffer.

Model 921 • single-channel standalone slave unit with 2.5K-character RAM buffer:

\$900 prch

Model 922 • dual-channel standalone slave unit with 2.5K-character RAM buffer:

1,050

Model 924 • 4-channel standalone slave unit with 16K-character RAM buffer:

1,750

Model 928 • 8-channel standalone slave unit with 16K-character RAM buffer:

2,450

Model 964 • 4-channel standalone master unit with 16K-character RAM buffer:

2,050

Model 968 • 8-channel standalone master unit with 16K-character RAM buffer:

2,750

Model 9616 • 16-channel standalone master unit with 16K-character RAM buffer:

4,600

U900/EX16 Channel Expander Unit • expands 8-channel Model 968 to 16-channel Model 9616 • separate enclosure with ribbon connector:

2,100

Downline Load • automatically downline loads channel configuration parameters from master to slave units • configuration parameters stored in RAM at master multiplexer; default configuration at slave unit reverts channel parameters to slave DIP switch setting • standard feature:

NC

U900/RMK • rackmount option provides shelf for mounting single Micro900/2 in 19-inch equipment cabinet:

75

Micro 900/2 Flow Control

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface • all ports disabled simultaneously • detects and responds to XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 87 percent total buffer utilization; flow

resumption threshold at 62 percent buffer utilization • data lost message sent to all terminals simultaneously • standard feature:

NC prch

Firmware supports selected vendor flow control techniques; operation compatible with various minicomputers and terminals • accommodates varied usage of XON/XOFF, DTR, and CTS characters:

NC

F900/HPL Hewlett-Packard Limited Support • supports the HP ENQ/ACK protocol in block/page mode only • doesn't support block/line on HPWORD applications for use with 4- or 8-channel nodes • extra-cost option:

100

F900/PE Perkin-Elmer Feature • accommodates Perkin-Elmer (Interdata) hosts using 2 stop bits and special control function • mutually exclusive with Wang option • standard feature:

NC

F900/PEX Perkin-Elmer Option • accommodates Perkin-Elmer (Interdata) terminals using 2 stop bits and special control function • mutually exclusive with Wang option • extra-cost option:

100

F900/TAN Tandem Feature • accommodates "T-Pause" flow control technique for Tandem computers • mutually exclusive with Perkin-Elmer and Wang options • extra-cost option:

NC

Link Outage Recovery • link down message sent to terminal equipment in response to ENQ when composite link is out • standard feature:

NC

Micro900/2 Diagnostic Tests

Isolates failures in local/remote channels; local/remote loopback of data transmitted from terminal equipment • terminal selected test feature allows any terminal to check integrity of local node unit or complete end-to-end system without interfering with other terminals/channels; includes FOX message generator • standard feature:

NC prch

Micro900/2 Status Reporting

LED status display panel indicates results of performance monitoring; LEDs indicate normal/fault/loopback modes; retransmission request; buffer overflow; line degradation when error rate is approximately greater than 1 in 1000 bits; and multiplexer logic error • master unit displays status of slave units; slave units indicate no-response from master unit • standard Command Port (F900/PORT) provides user-supplied terminal with traffic statistics and alarm/event reporting • standard feature:

NC prch

Micro900/2 Channels

Central control module packaged with 1/2/4/8/16 channels; 2/4/8-channel node (slave) units; 4/8/16-channel master units • asynchronous switch-selectable channel rates of 110/300/600/1200/1800/2400/4800 bps; 8 rate combinations and CR/LF/FF character delays (flyback control) via internal DIP switches; maximum aggregate channel rate 38.4K bps for node units; 76.8K bps for master units • 8 data bits • EIA RS-232C electrical interface:

NC prch

F900/ABR Autospeed (Autobaud) Feature • regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 110/134.5/150/300/600/1200-bps data rates; user-defined substitute rates set at factory on request • requires 2 positions of 8-position data rate switch • standard feature:

NC

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

F900/UNB Split Data Rates (Unbalanced Rate Feature) • supports terminals operating at receive/transmit data rates of 1200/75 bps, 1200/150 bps, or other standard data rate pairs • master channels operate at different rate than corresponding node channels • applicable to Viewdata and other public information networks • standard feature:

NC

F900/BUSY Remote Channel Busy Out Feature • permits Command Port operator to "busy out" remote channels connected to dial-up tail circuits • standard feature:

NC

F900/PTRX Priority Control (Background Printer Feature) • provides optimum response time for user-selected channels • selects optimum frame size and channel rate • user can select optimized response for interactive terminals; printers; composite link operation at 2400 bps; or provide equal response times for all channels • standard feature:

NC

F900/PRI Dynamic Channel Priority Feature • selectable feature automatically determines which active channels have high or low priority, dynamically allocating faster response times to interactive terminals • provides better throughput for batch transmissions when interactive terminals are inactive • standard feature:

NC

F900/PORT Control Terminal Port Support • dedicated port supports user-supplied colocated or remote terminal for online system testing, channel parameter changes, message broadcast, performance monitoring, and statistics reporting • standard feature:

NC

F900/ECHO • echos terminal data from remote multiplexer instead of from CPU, improving response time • selected via switch setting or operator terminal • standard feature:

NC

F900/WANG Wang Feature • accommodates Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • mutually exclusive with F900/PE option • standard feature:

NC

F900/HPL Hewlett-Packard Limited Option • supports HP ENQ/ACK protocol in block/page mode only • does not support block/line on HPWORD applications for use with 4 or 8 channel nodes • extra-cost option:

100

F900/PE Perkin-Elmer Feature • supports Perkin-Elmer (Interdata) hosts using 2 stop bits • mutually exclusive with Wang option • standard feature:

NC

F900/PEX Perkin-Elmer Option • supports Perkin-Elmer (Interdata) terminals using 2 stop bits • mutually exclusive with Wang option • extra-cost option:

100

Micro900/2 Composite Link

Central control module packaged link • up to 2400/4800/9600 bps full-duplex synchronous • external clock • full-duplex asynchronous at 1200/1800/2400 bps switch selectable • asynchronous link communications reduce maximum aggregate channel rate by 20 percent to accommodate start/stop bits • polling protocol • CRC 16 and ARQ error detection and correction • RS-232C/CCITT V.24/V.28 electrical interface • standard feature:

NC prch

Micro8000 Concentrator Modem—Point-To-Point, Multipoint & X.25 PAD Models

Micro8000 Central Control—Point-To-Point Models

Micro8000 series Concentrator Modems for point-to-point

network configurations are packaged versions of Micro800/2 statistical multiplexers with integral synchronous modems • point-to-point multiplexer characteristics of Micro8000 models are identical to corresponding Micro800/2 models; the integral modem adds diagnostic capabilities and status indicators to the basic unit.

Model 8822/24 • standard 2-channel Micro800/2 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

\$2,050 prch

Model 8824/24 • standard 4-channel Micro800/2 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

2,450

Model 8828/24 • standard 8-channel Micro800/2 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

3,350

Model 88212/24 • standard 12-channel Micro800/2 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

4,300

Model 88216/24 • standard 16-channel Micro800/2 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

5,200

Model 8822/48 V.27 • standard 2-channel Micro800/2 with integral 4800-bps modem • CCITT V.27 bis compatible:

3,200

Model 8824/48 • standard 4-channel Micro800/2 with integral 4800-bps modem CCITT V.27 bis compatible:

3,600

Model 8828/48 • standard 8-channel Micro800/2 with integral 4800-bps modem CCITT V.27 bis compatible:

4,500

Model 88212/48 • standard 12-channel Micro800/2 with integral 4800-bps modem CCITT V.27 bis compatible:

5,450

Model 88216/48 • standard 16-channel Micro800/2 with integral 4800-bps modem CCITT V.27 bis compatible:

6,350

Model 8822/96 • standard 2-channel Micro800/2 with integral 9600-bps modem CCITT V.29 bis compatible:

3,900

Model 8824/96 • standard 4-channel Micro800/2 with integral 9600-bps modem • CCITT V.29 bis compatible:

4,300

Model 8828/96 • standard 8-channel Micro800/2 with integral 9600-bps modem • CCITT V.29 bis compatible:

5,200

Model 88212/96 • standard 12-channel Micro800/2 with integral 9600-bps modem • CCITT V.29 bis compatible:

6,150

Model 88216/96 • standard 16-channel Micro800/2 with integral 9600-bps modem • CCITT V.29 bis compatible:

7,050

Downline Load • automatically downline loads channel configuration parameters from master to slave unit • configuration parameters stored in RAM at master multiplexer; default condition at slave unit reverts parameters to slave DIP switch settings • standard feature:

NC

F8800/PTR Priority Control (Background Printer Feature) • assigns a higher priority to user specified data channels; effectively, allows up to 7 printers to operate in background without impairing response time of interactive terminals •

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

standard feature:

NC

F8800/SAT Satellite Transmission Option • compensates for propagation delay between point-to-point Micro8000s in a satellite link • sends a response after 7, 14, or 21 information blocks (selectable); error retransmission only on individual blocks in error • standard feature:

NC

U8800/RMK • rackmount option provides shelf for single Micro8000 unit (Micro800/2 based) in 19-inch equipment cabinet:

75

Micro8000 Central Control—Multipoint Models

Micro8000 series Concentrator Modems for multipoint network configurations are packaged versions of Micro900 statistical multiplexers with integral synchronous modems • Micro8000s based on Micro900/2 multiplexers are packaged in 4-, 8-, or 16-channel master units and 1-, 2-, 4-, or 8-channel node (slave) units with a choice of either a 2400-bps or 4800-bps integral composite link modem • multipoint multiplexer characteristics of Micro8000 models are identical to corresponding Micro900/2 models; the integral modem adds diagnostic capabilities and status indicators to the basic unit.

Model 8921/24 • standard single-channel Micro900/2 node unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

\$1,650 prch

Model 8922/24 • standard 2-channel Micro900/2 node unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

1,750

Model 8924/24 • standard 4-channel Micro900/2 node unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

2,450

Model 8928/24 • standard 8-channel Micro900/2 node unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

3,100

Model 8964/24 • standard 4-channel Micro900/2 master unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

2,650

Model 8968/24 • standard 8-channel Micro900/2 master unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

3,350

Model 89616/24 • standard 16-channel Micro900/2 master unit with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

5,200

Model 8921/48 V.27 • standard single-channel Micro900/2 node unit with integral 4800-bps modem • CCITT V.27 bis compatible:

2,900

Model 8922/48 V.27 • standard 2-channel Micro900/2 node unit with integral 4800-bps modem • CCITT V.27 bis compatible:

3,000

Model 8924/48 V.27 • standard 4-channel Micro900/2 node unit with integral 4800-bps modem • CCITT V.27 bis compatible:

3,500

Model 8928/48 V.27 • standard 8-channel Micro900/2 node unit with integral 4800-bps modem • CCITT V.27 bis compatible:

4,200

Model 8964/48 V.27 • standard 4-channel Micro900/2

master unit with integral 4800-bps modem • CCITT V.27 bis compatible:

3,800

Model 8968/48 V.27 • standard 8-channel Micro900/2 master unit with integral 4800-bps modem • CCITT V.27 bis compatible:

4,500

Model 89616/48 V.27 • standard 16-channel Micro900/2 master unit with integral 4800-bps modem • CCITT V.27 bis compatible:

6,350

Downline Load • automatically downline loads channel configuration parameters from master to slave units • configuration parameters stored in RAM at master multiplexer; default configuration at slave unit reverts channel parameters to slave DIP switch setting • standard feature:

NC

F8900/PRI Priority Control (Background Printer Feature) • assigns a higher priority to user specified data channels; effectively allows up to 15 printers to operate in background without impairing response time of interactive terminals • standard feature:

NC

U8900/RMK • rackmount option provides shelf for 1 Micro8000 unit (Micro900/2 based) in 19-inch equipment cabinet:

75

Micro8000 Central Control—X.25 PAD Models

Micro8000 Series Concentrator Modems for X.25 packet-switched network configurations are packaged versions of Micro800/X.25 Concentrator PADs with integral synchronous modems • Micro8000s based on 800/X.25 multiplexers are packaged in 4-, 8-, 12-, or 16-channel configurations with a choice of 2400-, 4800-, or 9600-bps composite link modems • multiplexer and PAD characteristics of Micro8000 models are identical to corresponding Micro800/X.25 models; the integral modem adds diagnostic capabilities and status indicators to the basic unit.

Model 8854/24 • standard 4-channel Micro800/X.25 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

\$2,650 prch

Model 8858/24 • standard 8-channel Micro800/X.25 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

3,350

Model 88512/24 • standard 12-channel Micro800/X.25 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

4,300

Model 88516/24 • standard 16-channel Micro800/X.25 with integral 2400-bps modem • AT&T 201 and CCITT V.26 compatible:

5,200

Model 8854/48 • standard 4-channel Micro800/X.25 with integral 4800-bps modem • AT&T 201 and CCITT V.26 compatible:

3,800

Model 8858/48 V.27 • standard 8-channel Micro800/X.25 with integral 4800-bps modem • CCITT V.27 bis compatible:

4,500

Model 88512/48 V.27 • standard 12-channel Micro800/X.24 with integral 4800-bps modem • CCITT V.27 bis compatible:

5,450

Model 88516/48 V.27 • standard 16-channel Micro800/X.25 with integral 4800-bps modem • CCITT V.27 bis compatible:

6,350

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

Model 8854/96 • standard 4-channel Micro800/X.25 with integral 9600-bps modem • CCITT V.29 bis compatible:

4,500

Model 8858/96 • standard 8-channel Micro800/X.25 with integral 9600-bps modem • CCITT V.29 bis compatible:

5,200

Model 88512/96 • standard 12-channel Micro800/X.25 with integral 9600-bps modem • CCITT V.29 bis compatible:

6,150

Model 88516/96 • standard 16-channel Micro800/X.25 with integral 9600-bps modem • CCITT V.29 bis compatible:

7,050

U8850/RMK • rackmount option provides shelf for mounting a single Micro800/X.25 Concentrator PAD in a 19-inch equipment cabinet:

75

Micro8000 Flow Control—Point-To-Point & Multipoint Models

Guards against multiplexer buffer overflow and against buffer overflow at terminals resulting in loss of data • controls flow of data from data terminal equipment at channel inputs by generating XON/XOFF (DC1/DC3) control characters, or by lowering/raising Clear-To-Send (CTS) on EIA RS-232C interface; most active ports are disabled first on units with Micro800/2 and 800/2-NF; all ports disabled simultaneously on units with Micro900/2 • detects and responds to XON/XOFF flow control characters from terminals by suspending/resuming data flow to channel inputs • buffer flow suspension threshold set at 87 percent total buffer utilization; flow resumption threshold at 62 percent buffer utilization • data lost message sent only to affected terminals on buffer overflow; data lost message sent to all terminals on units with Micro900/2 • standard feature:

NC prch

Firmware supports selected vendor flow control techniques; operation compatible with various minicomputers and terminals • accommodates varied usage of XON/XOFF, DTR, and CTS characters:

NC

F8900/PE Perkin-Elmer Feature • accommodates Perkin-Elmer (Interdata) systems that use a special control function • mutually exclusive with Tandem, Wang, and Memorex (auto-speed) options • standard feature:

NC

F8900/PEX Perkin-Elmer Option • accommodates Perkin-Elmer (Interdata) terminals using 2 stop bits and special control function • mutually exclusive with Perkin-Elmer, Wang, and auto-speed options • extra-cost option:

100

F8900/TAN Tandem Option • accommodates "T-Pause" flow control technique for Tandem computers • mutually exclusive with Perkin-Elmer, Wang, and Memorex (auto-speed) options • standard feature:

NC

Link Outage Recovery • link down message sent to terminal equipment in response to ENQ when composite link is out • standard feature:

NC

Micro8000 Flow Control—X.25 PAD Models

See Micro800/X.25 Flow Control for details.

Micro8000 Diagnostic Tests—Point-To-Point & Multipoint Models

Multiplexer Initiated Diagnostics • isolates failures in local/remote channels; local/remote loopback of data transmitted from terminal equipment • terminal selected test feature allows any terminal to check integrity of local node unit or complete end-to-end system without interfering with other

terminals/channels; includes FOX message generator.

Modem Initiated Diagnostics • isolates failures in local/remote modems and/or analog line; local/remote analog and digital loopbacks and analog line test via pseudo-random bit pattern generator.

Micro8000 Diagnostic Tests—X.25 PAD Models

See Micro800/X.25 Diagnostic Tests for details.

Micro8000 Status Reporting—Point-To-Point & Multipoint Models

Multiplexer Status Reporting • LED status display panel indicates results of performance monitoring; LEDs indicate normal/fault/loopback modes; loss of synchronization; retransmission request; line degradation when error rate is approximately greater than 1 in 1000 bits; buffer overflow; multiplexer logic error; remote alarm condition • channel activity display indicates receive and transmit data activity for each channel • some options also add status indicators to basic unit.

Modem Status Reporting • LED status display panel indicates EIA signal activity • 4800-bps modems indicate error and retrain conditions; 9600-bps modems indicate line degradation when error rate is less than or greater than 1 in 100,000, and subsequently, when error rate is less than or greater than 1 in 10,000.

Micro8000 Status Reporting—X.25 PAD Models

See Micro800/X.25 Status Reporting for details.

Micro8000 Channels—Point-To-Point Models

Central control module for Micro8000 models equipped with Micro800/2 packaged with 2/4/8/12/16 channels; all models except 2-channel model expandable in 4-channel increments • central control module for Micro8000 models equipped with Micro800/2-NF and Micro800/2-HP packaged with 2/4/8 channels; units not expandable • asynchronous switch-selectable channel rates of 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; asynchronous split channel rates optionally available for 800/2 based models • synchronous channel rates optional for 800/2 based models • 16 channel parameter combinations selected via front-panel thumbwheel switch; includes data rates, CR/LF/FF character delays (flyback control), and stop bits • aggregate input rate of 16 channels at 9600 bps per channel for Micro800/2 equipped units; 38.4K bps for Micro800/2-NF and Micro800/2-HP equipped units • RS-232C/CCITT V.24/V.28 electrical interface:

NC prch

The following options, except for current-loop interface, apply to Micro800/2-based models only.

F8800/ABR96 Autospeed (Autobaud) Option • regulates asynchronous channel rate to rate of dial-up line using CR convention • switch selectable on individual channel basis • 50- to 9600-bps data rates • requires 2 positions of 8-position data rate switch • option price included in cost of central control unit:

NC

F8800/SPD Speed Conversion Feature • supports Autospeed for CPUs with fixed-speed ports; performs automatic speed conversion when a channel is configured for a different speed at each end • disables downline loading of channel parameters capability • standard feature:

NC

F8800/ASYM Split (Asymmetrical) Channel Speed Option • supports terminals operating at receive/transmit data rates of 1200/75 bps, 1200/150 bps, or other standard data rate pairs • applicable to Viewdata and other public information networks • extra-cost option:

200

F8800/SYNC Synchronous Channel Option • switch selects either channel in a 2-channel unit or any of the top 4 channels in 8-, 12-, or 16-channel units for asynchronous, clocked asynchronous, or synchronous operation • switch-selectable synchronous protocol-dependent mode supports IBM

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

3270/2780/3780 (ASCII or EBCDIC) and SDLC, HDLC, CDC UT2000, Honeywell VIP 7700, Sperry Uniscope, and ICL CO3 protocols; discards all PAD/delay characters and reconstructs them at the opposite end • switch-selectable protocol-transparent mode supports any other synchronous protocol; monitors channel interface(s) for RTS/CTS and fills a user-specified frame length up to 10K characters with the synchronous transmission; does not discard any characters • both modes statistically multiplex synchronous data along with the asynchronous aggregate • extra-cost options.

2-, 8-, 12-, or 16-Channel Unit Options: _____
400

4-Channel Unit Option: _____
550

F8800/BAND Synchronous Bandsplitter Option • TDM multiplexes 1 or 2 synchronous channels with composite link, using assigned bandwidth • extra-cost option: _____
800

F8800/PORT Control Terminal Port Support • dedicated port supports user-provided collocated or remote terminal for online system testing, channel parameter changes, message broadcast, performance monitoring, and statistics reporting • standard feature: _____
NC

F8800/TICC Terminal-Initiated Channel Configuration • allows terminal operator to modify his channel configuration and activate local echo, change speed, or modify CR/LF/FF delays (flyback control) (1 through 99 characters), via operator keyboard • standard feature: _____
NC

F8800/COMP Data Compression Feature • automatically compresses (encodes) repeated ASCII characters, improving transaction efficiency • selectable by individual channel • standard feature: _____
NC

F8800/ECHO • echos terminal data from remote multiplexer instead of CPU, improving response time • selected via switch setting or operator terminal • standard feature: _____
NC

F8800/WANGX Extended Wang Option • accommodates Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • also supports Wang flow control characters • mutually exclusive with Tandem and HP options • extra-cost option: _____
100

F8800/BUSY Remote Channel Busy Out Feature • permits remote busying of channels connected to dial-up modems; selected via Control Terminal Port • standard feature: _____
NC

U800/20-mA Current-Loop Adapter • for 8000 series models equipped with Micro800/2 and Micro800/2-NF • external adapter for 20-mA current-loop devices; required per channel • extra-cost option: _____
95

Micro8000 Channels—Multipoint Models

Central control module packaged with 1/2/4/8/16 channels; 2/4/8-channel node (slave) units; 4/8/16-channel master units • asynchronous switch-selectable channel rates of 110/300/600/1200/1800/2400/4800 bps; 8 rate combinations and CR/LF/FF character delays (flyback control) via internal DIP switches; maximum aggregate channel rate 19.2K bps for node units; 76.8K bps for master units • 8 data bits • EIA RS-232C electrical interface: _____
NC prch

F8900/ABR Autospeed (Autobaud) Feature • regulates asynchronous channel rate to rate of dial-up line • switch selectable on individual channel basis • 110/134.5/150/300/600/1200-bps data rates; user-defined substitute rates set at

factory on request • requires 2 positions of 8-position data rate switch • standard feature: _____
NC

F8900/UNB Split Data Rates (Unbalanced Rate Feature) • supports terminals operating at receive/transmit data rates of 1200/75 bps, 1200/150 bps, or other standard data rate pairs • master channels operate at different rate than the corresponding node channels • applicable to Viewdata and other public information networks • standard feature: _____
NC

F8900/BUSY Remote Channel Busy Out Feature • permits Command Port operator to "busy out" remote channels connected to dial-up tail circuits • standard feature: _____
NC

F8900/PTRX Priority Control (Background Printer Feature) • provides optimum response time for user-selected channels • selects optimum frame size and channel rate • user can select optimized response for interactive terminals; printers; composite link operation at 2400 bps; or provide equal response times for all channels • standard feature: _____
NC

F8900/PRI Dynamic Channel Priority Feature • selectable feature automatically determines which active channels have high or low priority, dynamically allocating faster response times to interactive terminals • provides better throughput for batch transmissions when interactive terminals are inactive • standard feature: _____
NC

F8900/PORT Control Terminal Port Support • dedicated port supports user-supplied co-located or remote terminal for online system testing, channel parameter changes, message broadcast, performance monitoring, and statistics reporting • standard feature: _____
NC

F8900/ECHO • echos terminal data from remote multiplexer instead of from CPU, improving response time • selected via switching setting or operator terminal • standard feature: _____
NC

F8900/WANG Wang Feature • accommodates Wang 2200 computer systems using 9-bit synchronous or 11-bit asynchronous character codes for special function keys • mutually exclusive with F900/PE option • extra-cost option: _____
NC

F8900/HPL Hewlett-Packard Limited Option • supports HP ENQ/ACK protocol in block/page mode only • does not support block/line on HPWORD applications for use with 4- or 8-channel nodes • extra-cost option: _____
100

F8900/PE Perkin-Elmer Feature • supports Perkin-Elmer (Interdata) hosts using 2 stop bits • mutually exclusive with Wang option • standard feature: _____
NC

F8900/PEX Perkin-Elmer Option • supports Perkin-Elmer (Interdata) terminals using 2 stop bits • extra-cost option: _____
100

Micro8000 Channels—X.25 PAD Models

Central control module packaged with 4/8/12/16 asynchronous channels, upgradeable in 4- or 8-channel increments • operating parameters are configured via DIP switches or keyed into the command port via user-supplied ASCII terminal, locally or remotely, for downline loading • asynchronous channel rates at 50/75/110/134.5/150/200/300/600/1200/1800/2400/4800/9600 bps; maximum aggregate input rate of 57.6K bps • 6, 7, or 8 data bits per character, including or excluding parity • 1, 1.5, or 2 stop bits • RS-232C/CCITT V.24/V.28 electrical interface • channels included in package price: _____
NC prch

Micom Multiplexers & Switch

Micro700, 750, 800, 900 & 8000 Series Multiplexers & Micro860 Switch

F850/ABR Autospeed (Autobaud) Feature • regulates asynchronous channel rate to rate of attached device using CR convention • selectable on an individual channel basis • 110/150/300/600/1200/2400/4800/9600-bps data rates • standard feature:

NC

F850/ASYM Split (Asymmetrical) Channel Speed Option • supports terminals operating at receive/transmit data rates of 1200/75 bps, 1200/150 bps, or other data rate pairs • applicable to Viewdata and other public information networks • extra-cost option:

200

F850/PRI Channel Priority Feature • selectable feature assigns high or normal priority on a per-channel basis • provides faster response time for interactive terminals • high-priority output queues serviced ahead of normal priority output queues • standard feature:

NC

F850/PORT Control Terminal Port Support • dedicated Command Port supports user-provided collocated or remote terminal for online system testing, downline loading of channel parameters (1 remote node only), message broadcast, performance monitoring, and statistics reporting • menu driven • operates up to 9600 bps with Autobaud access • standard feature:

NC

Call Indication/Authorization • selectable feature enables channels to emulate AT&T 212 modem handshaking protocol on a per channel basis • supports transmission of EIA interface signals between DTE and DCE • standard feature:

NC

Switched Virtual Circuits • allows user-transparent communication from remote terminal (and remote PAD) to host CPU • terminal operators originate calls via manual long-form or short-form method, or via auto-connect call • manual long-form call method requires operator to enter remote X.25 DTE network address; optional class; any optional user facilities; and optional security access code • manual short-form call method only requires operator to enter a 2-character ID and optional class • auto-connect call feature automatically generates a call to remote X.25 DTE on detection of Data Terminal Ready (DTR) signal on EIA interface or data activity • standard feature:

NC

Channel Class Selection • assigns user groups of channels for any or all available channels • terminal users enter appropriate 2-digit code for access to a given group (channel class); can be used to restrict unauthorized access to secure network facilities • channel classes can contain any number of channels; any channel can be defined in more than 1 class • standard feature:

NC

Permanent Virtual Circuits • permanent virtual circuits can be established between remote terminals and host ports, allowing connections to appear as leased lines to user • does not allow port selection; does not require call origination or users to contend for ports • standard feature:

NC

Local Switching Feature • allows terminal operator to establish a connection to a port on the local Micro800/X.25 without utilizing composite link/packet service connection • functions as a local data PBX, allowing local terminals to access a host computer without incurring packet service costs • standard feature:

NC

Micro8000 Composite Link—Point-To-Point, Multipoint & X.25 PAD Models

All models in the Micro8000 series come packaged with integral modems which allow them to operate on 4-wire dedicated Type 3002 facilities • 4800-bps modems conform to CCITT V.27 Recommendation • operation is synchronous full-duplex; Micom recommends C2 conditioning for its 9600-bps modems • EIA RS-232C/CCITT V.24 electrical interface.

Models 88XX/24, 88XXX/24, 89XX/24 & 89XXX/24 • includes integral 2400-bps modem • DPSK modulation • statistical (compromise) equalization.

Models 88XX/48 V.27, 88XXX/48 V.27, 89XX/48 V.27 & 89XXX/48 V.27 • includes integral 4800-bps modem • PSK modulation • automatic adaptive equalization.

Models 88XX/96 & 88XXX/96 • includes integral 9600-bps modem with fallback rate of 4800 bps; strap-selectable primary/fallback rates of 9600/7200 bps or 7600/4800 bps • QAM modulation • automatic adaptive equalization.

• END

Micom-Interlan Instanet/Plus

Baseband Local Area Network & Data PBX

PROFILE

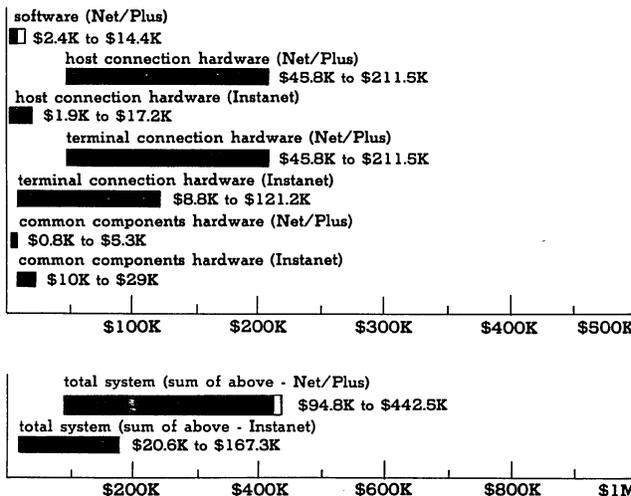
Architecture • Instanet/Plus based on Interlan Net/Plus and Micom Instanet data PBX with gateway between them; Net/Plus implements Ethernet/IEEE 802.3 Local Area Network; Micom Instanet centered around the Micro600 data PBX • Net/Plus provides over 20 LAN networking products • Micom provides an equal number of products for Instanet • see **Figure 1**.

Type • Net/Plus is baseband, packet-switched network using coaxial cable; bus topology.

Transmission Speed • 10M bps (Net/Plus).

Cable Length • Net/Plus: 500 meters between repeaters, 2,500 meters end-to-end between stations for point-to-point communication; 50 meters station-to-transceiver.

PURCHASE PRICE RANGE hardware & software 5-year maint/serv fee



INSTANET/PLUS PURCHASE PRICE • SMALL SYSTEM includes all basic components to interface 100 terminals to 2 host computers • Net/Plus configuration includes Initial Load Unit with NTS 10 software, 24 NTS10 8-port and 2 NTS-10 4-port Network Terminal Servers, 26 Ethernet transceivers, 26 transceiver cables, 1 transceiver installation kit, 230-foot Ethernet cable, and two 50-ohm terminators • Instanet configuration includes Micro600/2 Port Selector data PBX, 5 Quad Asynchronous Modules (4 lines/ports each at 9600 bps), 25 Quad Asynchronous Modules (4 lines/ports each at 2400 bps); firmware included with units • **LARGE SYSTEM** includes all basic components to interface 500 terminals to 4 host computers • Net/Plus configuration includes Initial Load Unit with NTS10 software, 124 NTS10 8-port and 2 NTS10 4-port Network Terminal Servers, 126 Ethernet transceivers, 126 transceiver cables, 1,000 feet of Ethernet cable, NR10 Ethernet repeater, and two 50-ohm terminators • Instanet configuration includes Micro600/2 Port Selector (includes 120 lines/ports), two 120-line/port, and two 128-line/port card bays, 2 gateways to IBM hosts (16 channels each), 17 Quad Asynchronous Modules (4 lines/ports each at 9600 bps), 3 Instatrunk Modules, three 4648T Central Site Voice/Data Multiplexor Units, 384 single-line Voice/Data Terminal Units, and 29 Quad Asynchronous Modules (4 lines/ports each at 2400 bps). Note: Net/Plus configuration requires no host software changes; NTS10 provides an RS-232C host port for each RS-232C terminal port. Instanet configuration provides 1 host port for 5 terminals; also requires no changes to host software. Both Net/Plus and Instanet are primarily serviced by sparing parts and sending boards back to vendor for repairs. Micom has a service organization for the Micro600; also serviced by Digital Equipment.

Applications • multivendor environment for host-to-host, terminal-to-host, and device-to-device communication, and personal computer networking.

Configuration • up to 100 stations per segment, up to 1,024 stations per network; infinite number of stations using internetwork connections.

Interface • through NT100 Ethernet/IEEE 802.3 transceiver connected to Interlan communications controller or Network Terminal Server which contain an Ethernet Protocol Module.

Gateways • through Internet Transport Protocol (ITP) (software) modules at Ethernodes to other Ethernets.

Support of Foreign Devices • through Ethernet Communications Controllers for various minicomputers and microcomputers; through NTS10 Terminal Server to various personal computers including IBM PC.

Communications Management • distributed among all stations connected to Ethernet cable • NETMGR is Internet Transport Protocol's (ITP) package.

Protocols • Carrier System Multiple Access with Collision Detection (CSMA/CD) used to control access to network; Xerox Network System (XNS) Internet Transport Protocols (ITP) for network and internet traffic; IP/TCP for DOD networks.

Distributed Functions • network control, internetwork routing, and file transfer facilities.

Support Software • device drivers, Ethernode, multivendor personal computer networking software, and NETMGR for network control.

First Delivery • January 1982 for first communication controller.

Systems Delivered • 6,000 nodes (estimated); 80 percent of which are active; 20 percent are used for spares.

Comparable Systems • Three Rivers Packet Stream, Ungermann-Bass Net/One baseband, and 3COM UNET are Ethernet compatible • Sytek and Ungermann-Bass also provide interfaces to DEC computers • other vendors also network personal computers, such as Corvus Omninet and DESKTEK Group's DESNET.

Vendor • Micom-Interlan, Inc, a wholly owned subsidiary of Micom Systems, Inc; 155 Swanson Road, Boxboro, MA 01719 • 1-800-LAN-TALK.

Canadian Headquarters • Signatel Limited; 195 Rivera Drive, Markham, ON L3R 2L6 • 416-477-9977.

Distribution • through Micom Sales Division for all products; through direct-sales force for all cable-based LANs and in cooperation with Representatives for Data-PBX-oriented LANs • 3 regional sales offices and through 18 sales representatives in United States; through 11 distributors in Canada, Western Europe, and Japan.

GSA Schedule • unlisted.

ANALYSIS

Interlan was founded in 1981 to produce Ethernet-compatible products. The first product was shipped in January 1982. Since then, the company has shipped over 6,000 communication controller boards for nodes on Ethernet LANs. Some of these (up to 20 percent) are used as spares because Interlan currently offers no on-call maintenance; faulty boards are returned to the company for repairs. Perhaps as many as 4,800 boards are operating as active Ethernet nodes.

The products Interlan introduced fill gaps in the marketplace for Ethernet-compatible products. When the Ethernet specifications

Micom-Interlan Instanet/Plus Baseband Local Area Network & Data PBX

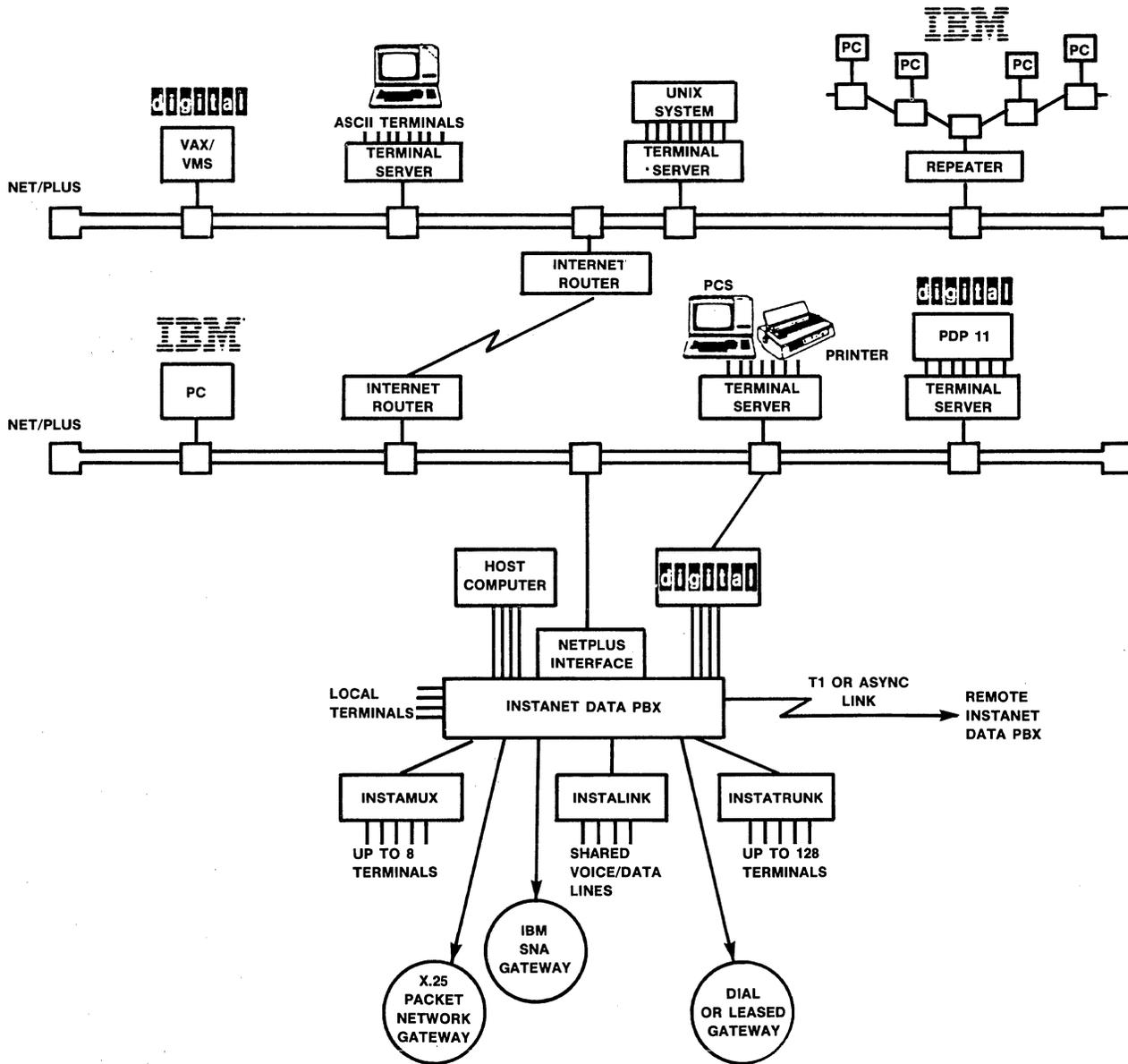


Figure 1 • Instanet/Plus integrates Micom's data PBX with Interlan's cable-based LAN.

were announced by DEC, Intel, and Xerox, only Xerox offered any Ethernet products and those products were tied specifically to Xerox's own automated office equipment. Interlan offered hardware and software to connect DEC, Data General, and Multibus-based computers to Ethernet.

Xerox announced Internet Transport Protocols (ITP) specifications for its Xerox Network System (XNS) architecture and offered products for its own systems. Interlan has developed ITP networking software for various DEC systems as well as Multibus-/UNIX-based systems.

Interlan has a Network Terminal Server to connect personal computers to Ethernet. All the personal computer needs is an RS-232C interface. Interlan is marketing the Polygon Associates file transfer and terminal emulation software for many major personal computer systems to use with the NTS10 terminal server.

The combination allows the networking of personal computers in a multivendor environment without requiring changes to the personal computer's software.

Although Net/Plus initial products were heavily DEC oriented, products now support other vendors' computers. Interlan moved into the multivendor environment, especially for personal computers.

Interlan provides support for the Department of Defense (DOD) TCP/IP protocols. Also, the company supports connection of personal computers (PCs) to their Ethernet cable.

Micom was founded in 1973 to produce data communication products that would reduce line costs, eliminate transmission errors, and improve computer port utilization. Micom's early success came from its Micro800 line of concentrators/statistical multiplexers. Micom also produced a data PBX called the

Micom-Interlan Instanet/Plus Baseband Local Area Network & Data PBX

Micro600 Port Selector. Realizing the Micro600 could operate as the basis for LANs, Micom developed a series of products to use with the Micro600 to provide a LAN called Instanet. These products are Instamux, Instalink, Instatrunk, Gateways (IBM, SNA, X.25, and dial or leased line, Gateways) and Interconnect Facility for routing to remote Micro600s. One advantage of Instanet is that it is instantly available; it can use twisted-pair telephone wire usually already in place. Connection cost for computers and terminals is \$100 to \$150 each as compared to \$350 to \$1,200 for cable-based LANS.

Instanet provides the connectivity needed for LANs, but it does not offer the high-speed data rates and file transfer facilities provided by the Interlan Net/Plus and other cable-based LANs. Micom could have developed its own cable-based LAN, but elected to merge with a smaller company that already had such a product.

Micom chose to approach Interlan because the company's Net/Plus is Ethernet compatible and Interlan had interfaces to Digital Equipment Corporation (DEC) equipment. DEC is committed to Ethernet. Micom sees DEC as the leading computing vendor in the multivendor environment, the main opportunity for independent LAN vendors.

Instanet/Plus provides users with the advantages of both cable-based LANs and data PBX LANs; low-cost connectivity and effective file transfers in a mixed vendor environment.

Interlan was receptive to Micom's offer of a merger. Although it was a 4-year-old successful company, with revenues of \$18M in 1984, Interlan was still a small company in comparison to other vendors entering the LAN marketplace, such as AT&T and IBM. Micom's revenues were \$132.5M in 1984 and estimated to be about \$170M in 1985. Interlan plus Micom revenues exceed \$200M. Net/Plus and Instanet complement each other. Thus, the 2 companies merged to form Micom-Interlan and to produce Instanet/Plus, the first joint product.

One area of confusion is the marketing and sales strategy the merged company will follow. Interlan has a direct-sales force. Micom sells its products through stocking sales representatives. These representatives have exclusive geographic territories; they buy and sell products from Micom as a distributor.

Micom also has nonrepresentative distributors, and also owns the Black Box Corporation, which runs a successful catalog data communication business.

The announced scheme is for Micom-Interlan's direct-sales force to sell cable-based LANs with support from the representatives/distributors who will continue to sell Micom products. The sales commission scheme will be structured so that the representatives/distributors compensated for sales in specific territories. The goal is to encourage the direct and indirect sales organizations to operate as a team. On the surface, it appears confusing, but stranger arrangements have worked in specific situations.

Paul Severino, founder of Interlan, is Chairman of the Board of Micom-Interlan, a wholly owned subsidiary of Micom. The president of Micom-Interlan comes from Micom. He is Ashok Dhawan, the key architect of Instanet. He has executive responsibility for development of Instanet/Plus.

□ Strengths

Interlan's biggest strength has been in its integration of hardware and software in its product offerings. If another company has the software needed to support Interlan's hardware, Interlan will form a cooperative marketing arrangement to provide a complete package. The poly-XFR/TRM software to support the NTS10 facility in multivendor personal computer networking was developed by Polygon Associates.

The company has implemented the first 4 levels of the OSI Recommendation of ISO for networking. The physical and data link levels are implemented in its communication controllers. The transport and network levels are implemented in the ITP software.

Micom's biggest strength has been its low-cost solutions to data communication problems. Micom is one of the leading suppliers of low-cost multiplexers. It is also well-known for its Micro600 Port Selector (data PBX). Instanet is a relatively new product, but offers

a very low cost per connection. It is quite versatile with its base unit providing 32 ports/lines. It can be expanded to provide up to 1,504 asynchronous lines/ports. Other versions can provide up to 126 synchronous lines or ports. Instanets can be interconnected using a Micom T1 multiplexer with 1.544M-bps bandwidth to provide an almost unlimited expansion capability for Instanet.

Instanet/Plus integrates the cable-based Net/Plus LAN with the PBX-based Instanet LAN. It will provide a cost-effective solution for many users. Both Interlan and Micom are profitable companies, growing at a rapid rate. Their combined revenues for 1985 should exceed \$200M, making the combination quite a substantial company.

The 2 companies should operate in a synergistic relationship with each other. Interlan offers no X.25 or IBM SNA gateways for Net/Plus; Micom offers both for Instanet. Interlan provides file transfer capability in a multivendor environment for Net/Plus. Micom strictly supports data communication on its Instanet, which accommodates many ports/lines; also, it can spread over almost any size facility with its Instatrunking facilities that can use almost any link to support T1 bandwidth.

□ Limitations

The biggest problem with mergers is getting the merged companies to work together in a synergistic way. An all-too-familiar result is that the larger one kills off the smaller one after conflicts arise over development, sales, marketing, and/or personnel. Micom has set up Micom-Interlan as a wholly owned subsidiary with total responsibility for developing Instanet/Plus products. The subsidiary was set up with the former Interlan president as Chairman of the Board and a former Micom vice president as president. Headquarters for Micom-Interlan will remain at the Interlan site in Massachusetts.

The sales organization for Instanet/Plus is somewhat complex. A direct-sales force will sell Instanet/Plus and representatives/distributors will sell Micom products.

Representatives have worked well for Micom, but the company realizes that customers of cable-based LANs expect almost turnkey installations and require a direct-sales force. Micom's products are usually customer installed. Sales commission schedules have been designed to reinforce a habit of cooperation between the direct salesmen and representatives. Company spokesmen say they are confident it will succeed.

■ NETWORK SUMMARY

NET/PLUS is a collection of software and hardware products that provide an Ethernet-compatible multivendor local area network. Interlan initially provided an Ethernet Protocol Module board to control communication over an Ethernet LAN, see **Figure 2**. This board became the basis for a group of Ethernet communication controllers for interfacing DEC Unibus and Qbus systems to Ethernet. Other controllers interface Multibus-based computers and Data General systems to Ethernet. In addition to the hardware, Interlan developed device drivers for the communication controllers; the drivers run under the attached computer system's operating system. Users can access the drivers through standard system calls.

Interlan also markets the software to implement the Internet Transport Protocols (ITP) of the architecture. The Interlan ITP software implements transport and network level protocols to allow DEC RSX-11, VMS, and UNIX systems to operate as Ethernet nodes and communicate with each other over single or multiple Ethernet networks.

In 1983, Interlan introduced the NTS10 Network Terminal Server, which connects up to 8 RS-232C devices to an Ethernet-compatible network with the poly-XFR/TRM software running under the operating system of an attached personal computer. Net/Plus can provide multivendor personal computer networking; see **Figure 3**. Interlan now provides an integrated NTS10 for the host side of the connection, allowing multiple "virtual" ports on the host side using one connection.

Interlan also supports the IBM PC running under MS-DOS with the XNS/ITP protocols for connection to Ethernet. At the application level, the IBM PC implements the File Server Protocol

Micom-Interlan Instanet/Plus Baseband Local Area Network & Data PBX

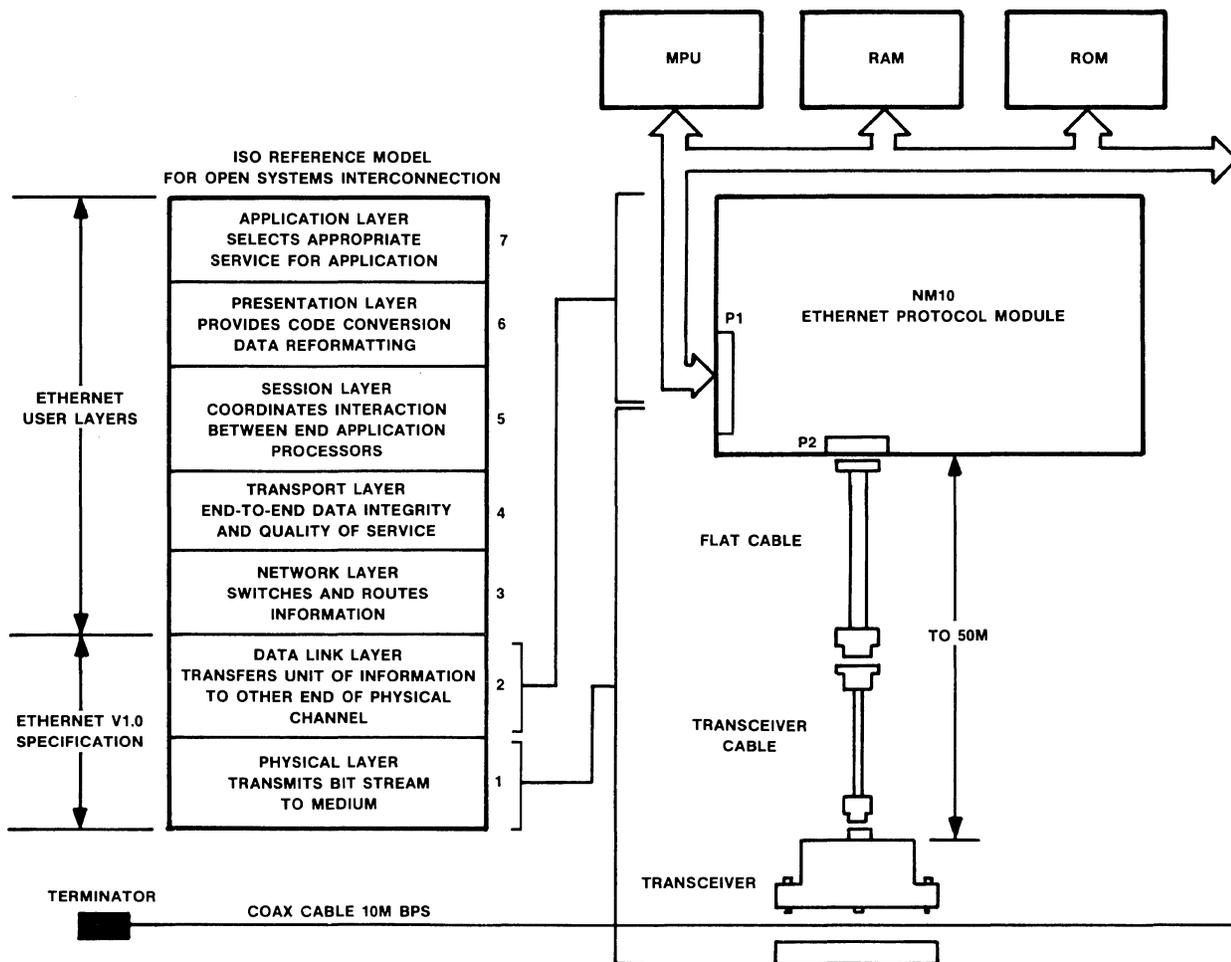


Figure 2 • Ethernet architecture and implementation.

(FSP) so it can exchange files over Ethernet with other systems implementing FSP. The Ethernet can be implemented with either standard or thin cable. The FSP software is now available for VAX/VMS, UNIX-based systems, and IBM PC.

In addition, Interlan now supports the TCP/IP communication protocols for DOD as well as the XNS/ITP protocols from Xerox.

Interlan has announced that it will support the Microsoft Networks (MS-NET) from the Microsoft Corporation. MS-NET provides an Application interface, Presentation and Session layers, and an interface to the Transport layer in relationship to the ISO's Open System Interconnect (OSI) model. Ethernet/IEEE 802.3 provides the Physical and Data Link layers. Interlan provides the Network and Transport layers with the XNS software.

Products supporting MS-NET will probably be announced by the fourth quarter 1985.

Interlan also supplies a full line of Ethernet components: transceivers, cables, and connectors. Interlan generally does not install the backbone network, which is usually installed through a third party.

Instanet is composed of Micom's standard products that have been combined to form a LAN. Built around the Micro600, Instanet is configured with plug-in modules designed for convenient and low-cost connection of terminals and computers to the Micro600. These products are called Instalink, Instamux, and Instatrunk multiplexers, Instalink multiplexers, piggyback

data transmissions onto voice transmissions using high-frequency bandwidth above the range of a person's hearing. The data transmissions are routed to the Micro600 while the voice transmissions are routed to a voice PBX. Instamux multiplexers connect small local clusters of terminals to the Micro600. Instatrunk multiplexers connect large local clusters of terminals to host computers or to the Micro600 using private or public T1 links. The Instatrunk Multiplexer supports up to 128 channels operating at up to 9600 bps.

The multiplexer can also be used with an Interconnect Facility to interconnect Micro600 Port Selectors using a private or public T1 facility.

Micom also provides a gateway to IBM hosts through emulation of IBM 3271 or 3274 control unit, IBM 3278 Display Unit, and IBM 3287 Printers. The protocol converter supports IBM BSC or SNA/SDLC protocols. Micom also offers a program that allows an IBM PC to emulate an IBM Display Station and Printer.

Micom also offers the Micro800/X25i plug-in module for the Micro600 to provide a gateway between Instanet and an X.25 Public Data Network (PDN). The module supports up to 16 virtual circuits bidirectionally between terminals and computer systems. The PDN can be a private or public X.25 network.

Micom also offers a short-haul data transmission device for in-house use over 2 twisted-pair cables. It includes a line driver and local dataset.

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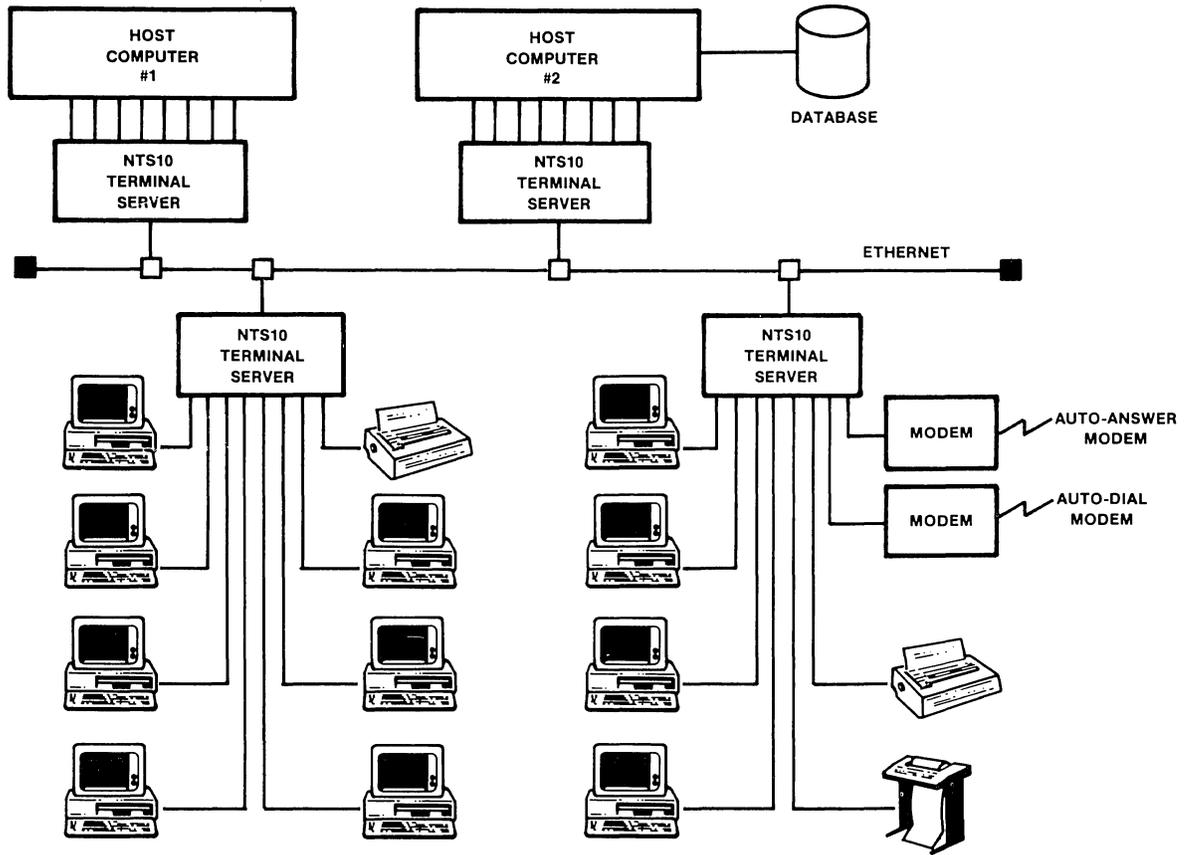


Figure 3 • With poly-TRM and poly-XFR, the NTS10 Terminal Server provides PC-to-Host, PC-to-PC, and PC-to-Device communication.

Micom does not offer any software for its devices. All are firmware controlled.

Micom and Interlan are working on a gateway between Net/Plus and Instanet. Functional specifications and pricing of the Gateway should be announced in second quarter 1985.

■ SOFTWARE

□ Terms & Support

Terms • Net/Plus available under a one-time license fee; license fee for additional host considerably reduced • Instanet is firmware driven.

Support • sometimes included in one-time license fee; other times charged for separately; software running on an additional host is supported at reduced rate • support includes automatic receipt of new releases.

□ Net/Plus System Software

Interlan Ethernet software includes device drivers for the communication controller boards, device drivers for DECnet communication controller boards, networking software for implementing the Internet Transport Protocols (ITP) defined by Xerox Network System (XNS) architecture, TCP/IP Department of Defense protocols, multivendor personal computer networking software, the network terminal server software, and network management utilities. Interlan also offers a File Server Protocol (FSP) for transferring files among systems. Interlan has also announced it intends to support Microsoft Networks (MS-NET).

Interlan systems require a DEC TU58 cartridge tape to IPL the system.

Net/Plus Device Drivers

The network interface device drivers (NIDRVs) support communication controllers to connect computer systems to Ethernet-compatible networks. The NIDRV runs under the computer's operating system. The NIDRV can be accessed directly by a user's application program or from a user-written Ancillary Control Processor (ACP). The drivers are sysgened with the system using selected parameters of the operating system's own SYSGEN procedure.

The device drivers combined with the communication controller boards and the Ethernet transceiver implement the 2 lower levels of the Open System Interconnection (OSI) Model of ISO: physical and data link levels.

SDK-NS2010 RSX-11M/S Device Driver • Source Distribution Kit for RSX-11M/M+ device-driven utilities for NI1010A and NI2010A Qbus Ethernet Communication Controller Boards; includes user manual, source code on RX01 diskette or TU58 cartridge tape with Files-11 file structure and supported software license:

\$1,000 prch

SU-NS2010 Source Update Service • for RSX-11M/11M+ Device Driver; 12-month subscription service with automatic update and user manual:

100

SDK-NS2020 RT-11 V4.0 Device Driver • Source Distribution Kit for RT-11 Device Driver • for NI1010A and

PRCH: purchase price. Prices current as of April 1985.

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NI2010A boards; includes user manual, source code with RT-11 file structure on RX01 diskette or TU58 magnetic tape, and supported software license:

500

SU-NS2020 Source Update Service • for RT-11 Device Driver; 1-year subscription service with automatic update and user manual:

100

SDK-NS2030 VMS Device Driver & Diagnostic Programs • for NI1010A board; includes user manual, source code in VMS Files-11 file structure on RX01 diskette or TU58 cartridge tape, and supported software license:

1,000

SU-NS2030 Source Update Service • for VMS Device Driver and Diagnostic Programs for 12 months and user manual:

100

SDK-NS2040 UNIX V7 Device Driver • Source Distribution Kit for UNIX V7 and System Device Driver • for NI1010A and NI2010A boards; compatible with VAX-11, PDP-11, and LSI-11 hosts; includes user manual, source code in C language on RX01 diskette or 1600-bpi magnetic tape, and supported software license:

500

SU-NS2040 Update Service • for UNIX V7 and System III Device Driver for 12 months and user manual:

100

SDK-NS2042 UNIX V7 Device Driver • Source Distribution Kit for the UNIX V7 Device Driver for NI3010A Multibus Ethernet Communication Controller Board; 68000, Z8000, and 8086 host compatible; includes user manual, source code in C with tar format and supported software license:

500

SU-NS2042 Source Update Service • for the UNIX V7 Device Driver; 1-year subscription service for automatically receiving updates and user manual:

100

SDK-NS2044 UNIX System V7 Device Driver • Source Distribution Kit for UNIX V7 Device Driver for NI3210 Multibus Ethernet Communications Controller board; includes user manual, source code in C language on 1600-bpi magnetic tape, and supported software license:

1,000

SU-NS2044 Source Update Service • for NS2044 driver for 12 months and user manual:

100

SDK-NS2050 RMXi 86 Device Driver • Source Distribution Kit for the iRMX-86 Device Driver for NI3010A Multibus Board; includes user manual, source code in PL/M language in ISIS/iRMX-86 format, and supported software license:

500

SU-NS2050 Source Update Service • for iRMX-86 Device Driver; 1-year subscription service for automatically receiving updates and user manual:

100

SDK-NS2060 RDOS .IDEF Device Driver • Source Distribution Kit for RDOS ".IDEF" Device Driver • for NI4010A board; compatible with Data General NOVA and ECLIPSE computers; includes user manual, source code, and supported software license:

1,000

SU-NS2060 Source Update Service • for RDOS driver for 12 months:

100

SDK-NS2070 AOS .IDEF Device Driver • Source Distribution Kit for AOS Device Driver • for NI4010A board; compatible with Data General ECLIPSE and MV Series; includes user manual, source code, and supported software license:

1,000

SU-NS2070 Update Service • for AOS Device Driver for 12 months; includes user manual:

100

SDK-NS2080 AOS/VMS .IDEF Device Driver • Source Distribution Kit for AOS/VMS Device Driver • for NI4010A board; compatible with Data General MV Series; includes user manual, source code, and supported software license:

1,000

SU-NS2080 Source Update Service • for AOS/VMS Device Driver board for 12 months:

100

SDK-NS2090 MS-DOS Device Driver • Source Distribution Kit for MS-DOS Device Driver for NI5010 board; includes user manuals, driver source and object, diagnostics object, and supported license; copies may be made for additional processors at no further cost:

250

SU-NS2090 Source Update Service • for MS-DOS Device Driver for 12 months and user manual:

250

NS4200 Networking Software

The NS4200 family of networking software is used with the Interlan Series of DEC and Multibus Ethernet communication controllers and the Interlan NT100 Ethernet Transceiver to provide a complete Ethernet network node called Ethernode. The NS4200 series is based on the Xerox Network System (XNS) architecture. The Internet Transport Protocols (ITP) packages provide reliable flow-controlled task-to-task communication between systems that reside on Ethernet local area network or on different Ethernets interconnected by long-haul channel or network. User application programs can access the networking software through standard system calls.

The ITP networking software has been developed for use with DEC LSI-11, PDP-11, VAX-11, and Multibus computers.

NETMGR, a menu-driven utility program for a network manager, is included in the ITP package. A network manager can use NETMGR to identify stations on the Internet, detect congestion and flow control bottlenecks, determine traffic flow patterns, evaluate the performance of virtual circuits, and access network service quality.

An Ethernode implements the 4 lower levels of the Open Systems Interconnection model of ISO: physical, data link network, and transport levels.

The ITP package includes the NIDRV Device Driver as well as the software implementation of the network and transport protocols, a pseudo-device driver to accept standard system calls, and NETMGR, see **Figure 4**.

DK-NS4210 Distribution Kit for ITP/RSX Package • compatible with DEC PDP-11 and LSI-11 systems running RSX-11M/M+; includes user manual, ITP/RSX binaries, device driver for Interlan NI1010A Unibus and NI2010A Qbus Ethernet Communication Controller Boards, installation command file, and supported software license for use on 1 host processor system:

\$2,500 prch

SL-NS4210 Software License • right to use ITP/RSX on single-host system; unsupported:

800

BU-NS4210 Binary Update Service • for ITP/RSX package for 12 months:

1,895

SDK-NS4210 Source Distribution Kit • source for ITP/RSX-11M/M+ package; written in C language:

25,000

SU-NS4210 Source Update Service • for ITP/RSX-11M/M+ package for 12 months:

1,895

DK-NS4230 Distribution Kit for ITP/VMS Package •

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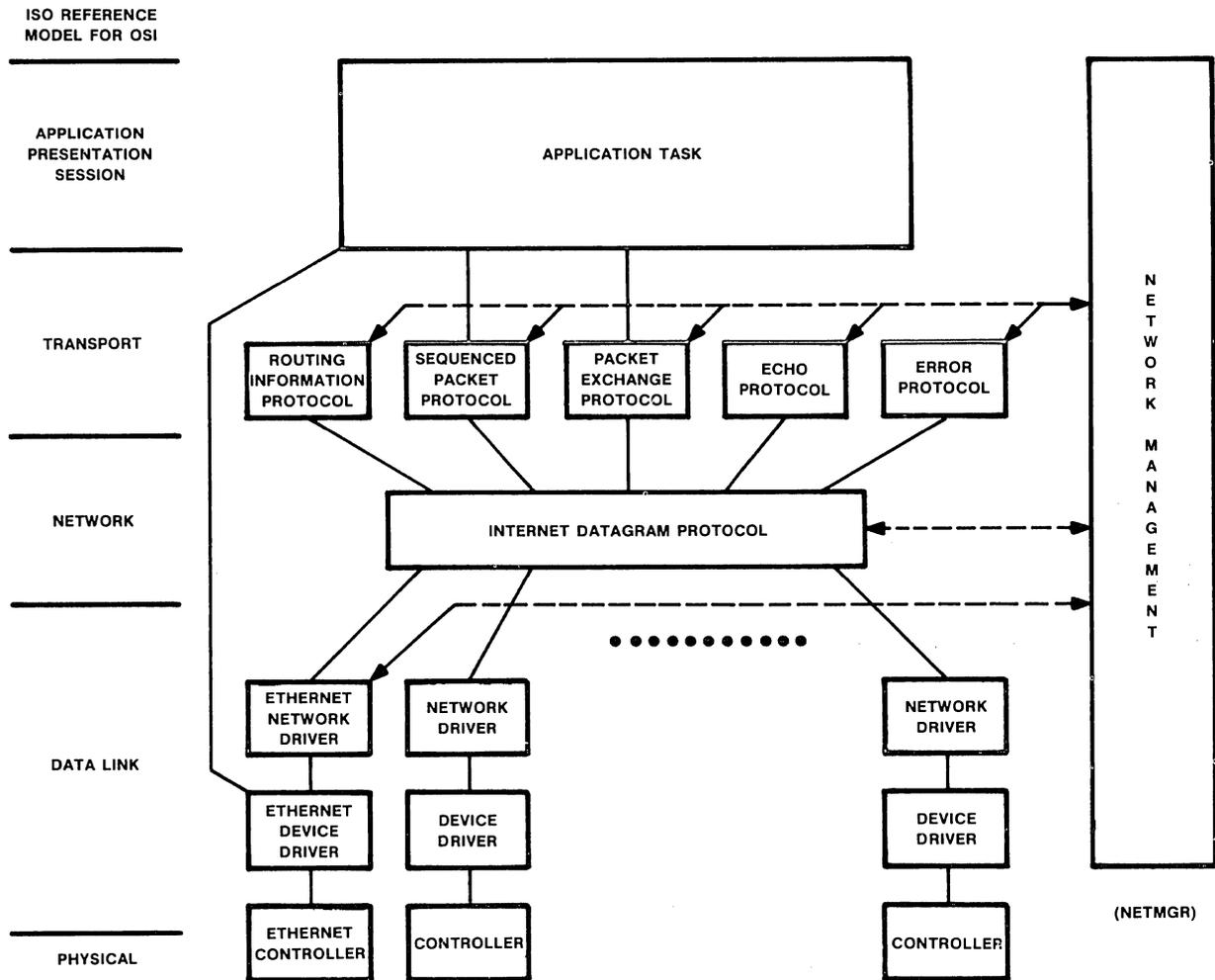


Figure 4 • Architecture of the ITP protocol packages.

compatible with DEC VAX-11 systems running VMS; includes user manual, ITP/VMS binaries, device driver for NI1010A Unibus Ethernet Communication Controller Board, installation command file, and supported software license for use on one host processor system:

2,500

SL-NS4230 Software License • for right to use ITP/VMS package on single-host processor; unsupported:

800

BU-NS4230 Binary Update Service • for ITP/VMS package for 12 months:

1,895

SDK-NS4230 Source Distribution Kit • source for ITP/VMS package written in C language:

25,000

SU-NS4230 Source Update Service • for ITP/VMS package for 12 months:

1,895

DK-NS4244 Distribution Kit for ITP/UNIX System V Package • compatible with Multibus-based systems running UNIX System V; includes user manual, ITP/UNIX binaries device driver for NI3210 Multibus Ethernet Communication Controller Board, installation command file, and supported software license

for use on 1 host processor system:

2,500

SL-NS4244 Software License • for right to use ITP/UNIX package on single host processor:

800

BU-NS4244 Binary Update Service • for ITP/UNIX System V package for 1 year:

1,895

SDK-NS4244 Source Distribution Kit • source for ITP/UNIX System V package:

25,000

SU-NS4244 Source Update Service • for ITP/UNIX package for 12 months:

1,895

DK-NS4290 Distribution Kit for ITP/MS-DOS Package • for NI5010 IBM PC Ethernet/IEEE 802.3 Controller Board; includes ITP/MS-DOS binaries; device driver source and object, diagnostic program binaries; user manuals and supported software license for single processor; distributed on dual-sided, double-density floppy diskette • requires Interlan software license agreement and BD-NI5010:

500

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SL-NS4290 Software License • for right to use on 1 additional processor • requires DK-NS4290 or SDK-NS4290:

50

BU-NS4290 Binary Update Service • for 1 year • requires NS4290:

500

SDK-NS4290 Source Distribution Kit for ITP/MS-DOS Package • same as DK-NS4290 except includes ITP/MOS-DOS source instead of binaries:

25,000

SU-NS4290 Source Update Service • for 1 year • requires NS4290:

500

Other Networking Software

Personal Computer Network Management (PCNM) Utilities • allows a network manager to control all Interlan servers from an IBM PC • allows PC to function as primary boot server; includes a single-user Network Terminal Server (NTS) program giving the network manager full access to NTS user commands to configure and control network servers; provides facilities to log network events and to record information (date, time, and node number) • also provides an integrated VT100 Terminal Emulator to interface to other NTSs on the network • includes a PC-compatible Ethernet controller board and diagnostic software:

\$1,000 prch

DK-NP111 Software Distribution Kit • with user documentation for NP100 XNS/ITP Protocol Package under VAX/VMS:

1,000

SDK-NP111 • same as DK-NP111 with source code for ITP Protocol Object Module:

25,000

DK-NP123 Software Distribution Kit • for NP100 DOD IP/TCP Protocol Package under 4.2BSD UNIX:

1,000

SDK-NP123 • same as DK-NP123 with source code for DOD IP/TCP:

25,000

DK-NP212 Software Distribution Kit • with user documentation for NP200 XNS/ITP Protocol Package under RSX-11M/M+:

1,000

SDK-NS212 • same as DK-NP212 but with source code for XNS/ITP Protocol Object Module:

25,000

DK-NP311 Software Distribution Kit • with user documentation for NP300 XNS/ITP Protocol Package under UNIX System V:

1,000

SDK-NP311 • same as DK-NP311 but with source code for XNS/ITP Protocol Object Module:

25,000

DK-NP321 Software Distribution Kit • with user documentation for NP300 DOD IP/TCP Protocol Package under UNIX System V:

1,000

SDK-NP321 • same as DK-NP321 with source to DOD IP/TCP code:

25,000

Network File Server Protocols

DK-NS7430 Distribution Kit • for NFS/VMS Network File Server Protocols; includes NFS/VMS binaries, NFS/VMS user manuals, installation procedures, and supported software license for use on 1 host processor • requires DK-NS4230, DK-NP111, or

SDK-NP111:

\$1,195 prch

SL-NS7430-U Software License • for right to use NFS/VMS on 1 host; unsupported software license:

995

BU-NS7430 Binary Update Service • for NFS/VMS Network File Server Protocols; update service for 12 months • requires DK-NS7430:

995

DK-NS7444 Distribution Kit • for NFS/UNIX System V (68000/Multibus) Network File Server Protocols package; includes NFS/UNIX binaries, user manuals, and supported software license for use on 1 host system • requires DK-NS4244, DK-NP311, or SDK-NP311:

895

SL-NS7444-U Software License • for right to use NFS/UNIX on 1 host; includes unsupported software license • requires DK-NS7444:

695

BU-NS7444 Binary Update Service • for NFS/UNIX Network File Server package for 12 months • requires DK-NS7444:

695

DK-NS7490 Distribution Kit • for NFS/MS-DOS Network File Server Protocols package; includes NFS/MS-DOS binaries, user manuals, and unsupported license for use on 1 host:

195

SL-NS7490 Software License • for NFS/MS-DOS Network File Server Protocols on 1 system • requires DK-NS7490:

95

Network Terminal Server

NTS10 Terminal Server • includes interface to Ethernet-compatible network for up to 8 terminals and from Ethernet to up to 8 ports on a host computer • provides virtual circuit communication: emulates physical connections between devices, resolves incompatibilities between sending and receiving devices, responds to user commands for connecting/disconnecting devices, supports port switching and contention for sharing devices, handles logical naming of ports, implements password-based network management and service, performs comprehensive network and system diagnostics, and downline boot loads RAM-resident software • virtual circuits can be switched or permanent • can function with Interlan Ethernode package, so that devices attached to NTS10 can communicate transparently with devices on multiple Ethernets.

TU58-EA-NTS10 Cartridge Tape Initial Load Unit • includes user manual, TU58-K cartridge tape with NTS10 system software, 2 blank TU58-K cartridge tapes, and 3-foot EIA RS-232C cable:

\$1,950 prch

SS-NTS10-TU58 1-Year NTS10 Software Support Service • provides automatic receipt of new NTS10 system software on TU58-K cartridge tape:

2,400

INTS/VMS • hardware/software product that integrates Network Terminal Server in VAX/VMS system • includes NP100 Unibus Ethernet Protocol Processor board, 10-foot flat transceiver cable with VAX-11 mounting assembly, INTS/VMS software license and distribution media, and user manual • multiplexes 32 VAX/VMS ports onto Ethernet/IEEE 802.3 LAN • provides DMA access to VAX/VMS system and can replace DMF 32 or DZ11 asynchronous controllers with a 32-port direct connection to Ethernet; fully compatible with NTS10 thus remote EIA RS232-C asynchronous devices can communicate with VAX/VMS hosts through NTS10 connection to Ethernet and to INTS in VAX system • executes same application-level protocol software as in NTS10 • also includes software routines to provide efficient handling of terminal traffic; Terminal Port Driver works in conjunction with the VMS terminal handler; NP100 Program Boot Loader automatically loads the program from a local file on the host; Local Console Access Program allows VAX/VMS console to

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communicate with INTS/VMS and issue NTS network commands, and Network Down-Line Bootserver Program allows VAX/VMS host to service downline host load requests from other NTS10 Terminal Servers on the network • each of the 32 "virtual ports" can be configured individually or on a group basis • INTS/VMS contains a "cascade" connector that allows 128 asynchronous terminal ports (4 INTS/VMS units) to share 1 transceiver connection to Ethernet:

6,190

XW-INTS/VMS Extended Warranty Support Contract • provides remedial service for NP100 hardware and new software releases for 1 year; per board:

290

Multivendor Personal Computer Networking Software

Software includes 2 kinds of packages that support inter-communications between personal computers equipped with standard RS-232C asynchronous communication hardware. The packages are the poly-TRM Terminal Emulation software and the poly-XFR File Transfer software developed by Polygon Associates and marketed by Interlan. The packages are compatible with Interlan NTS10 Terminal Server to attach the PC to the NTS10 which can then connect to an Ethernet-compatible network. Packages are available for 14 different PCs and 4 minicomputer systems. The minicomputers are all DEC PDP-11 or VAX-11 systems.

The packages can be licensed together, when both are available for the same PC. The poly-XFR version is available for local use on a multiuser minicomputer system. The PCs are all single-user systems.

poly-TRM Terminal Emulation Software • permits PC to emulate VT100 terminal; converts user's PC into a terminal so it can attach to the NTS10 for connection to a network to log-on to host computers or to communicate with modems, printers, or other devices attached to the network • supports the transfer of ASCII files between a host computer and the PC • includes configuration facility (set-up menu) for setting up communication port • requires NTS10 for connection to Ethernet-compatible network • provided only combined with poly-TFR.

poly-XFR File Transfer Facility • provides error-free transfer of ASCII and binary files among personal computers, development systems, and DEC minicomputers • a local system makes a connection to a host system and initiates a file transfer; a host system can accept commands from a local system on the other end of a communication line; a poly-XFR "switch" program lets local PCs operate as hosts. DEC's VAX/VMS and RSTS/E systems are the only systems that cannot function as host systems • requires NTS10 to connect systems to Ethernet-compatible network.

XFR-04105-FK poly-XFR • for Apple II under CP/M Softcard R.2.2:

\$150 prch

XFR-0516-FK poly-XFR • for Apple II under DOS R.3.3:

150

FR-03104-FH poly-XFR • for DEC P350 under P/OS R.1.0:

150

COMBined poly-TRM & poly-TFR Facilities • both terminal emulation and file transfer facilities packaged together.

COM-14128-FH poly-COM • combined XFR and TRM for DECmate II under CP/M R.2.2:

200

COM-02125-FH poly-COM • for DEC Rainbow 100 under CP/M R.2.2:

200

COM-07120-FL poly-COM • for IBM PC under PC-DOS R.1.1:

200

poly-XFR File Transfer for Multiuser Systems • available in 2 versions: allows system to operate as host only to multiple users connected through NTS10 and Ethernet-compatible network; the other allows multiuser system to function as local devices and

initiate file transfers • available on TU58 cartridge tape, RX01 Floppy Disk, or 1600-bps mag tape.

XFRH-99907 poly-XFR/HOST • for DEC VAX under VMS on RS01:

585

XFRH-98906 poly-XFR/HOST • for DEC PDP-11 under RSX-11M and RSX-11M PLUS on RX01:

585

XFRH-97905 poly-XFR/HOST • for DEC PDP-11 under RSTS/E on RX01:

585

XFRH-96904 poly-XFR/HOST • for DEC PDP-11 under RT-11 on RX01:

585

XFRH-949-02 • for DEC TOPS-20 on mag tape:

635

XFRL-98917 poly-XFR/LOCAL • for DEC PDP-11 under RSX-11M or RSX-11M PLUS on RX01:

585

XFRL-96915 poly-XFR/LOCAL • for DEC PDP-11 under RT-11 on RX01:

285

■ HARDWARE

Terms & Support

Terms • Instanet/Plus available for purchase only; quantity discounts available through direct-sales force • details still being worked out.

Support • 1-year warranty on hardware; users replace faulty components with spares and return faulty boards to factory for repair • supported through 9 regional offices and combined Micom-Interlan support teams.

Net/Plus System Components

The basic Interlan unit is the NM10 Ethernet Protocol Module which implements the Ethernet Version 1.0 Specifications. The NM10 is incorporated in all of Interlan's communication controller boards so they can connect directly to the NT10 Ethernet transceiver unit for connection to the Ethernet cable. Interlan provides all the Ethernet hardware as well as its controllers and network terminal server products.

BD-NM10A Ethernet Protocol Module • implements Ethernet V.1.0 specifications • performs data link layer functions; performs physical channel functions; collects network statistics; includes compatible interface to 8-bit and 16-bit microprocessor families; supports high station performance with 16K-byte FIFO buffer for frame reception and 2K-byte FIFO buffer for transmission; performs extensive diagnostics:

\$1,290 prch

Ethernet Communication Controllers

The Ethernet Communication Controllers interface the I/O bus of various computer systems to an Ethernet-compatible network. The controllers require the support of a device driver running under the attached computer's operating system. When used with the Etherway DECnet Phase III Device Driver, the DECnet VAX and RSX-11/M systems can communicate over an Ethernet-compatible network. Further, the controllers can be used with Internet Transport Protocols (ITP) networking software to provide task-to-task communication between systems on the same Ethernet or on different Ethernets connected by a long-haul channel. The controllers combined with ITP software and an NT10 Ethernet Transceiver form a complete data communications hardware/software package called an **Ethernode**.

PRCH: purchase price. Micom offers no on-call maintenance contracts but provides factory service on returned components. NC: no charge. Prices current as of April 1985.

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BD-NI1010A Unibus Ethernet Communication Controller Board • includes NM10 Ethernet protocol module to interface to Ethernet and contains all the logic required to interface to DEC VAX-11 and Unibus-based PDP-11 computers; requires appropriate software driver for computer's operating system:

\$3,190 prch

BD-NI2010A Qbus Ethernet Communication Controller Board • includes NM10 Ethernet protocol module for interfacing to Ethernet and contains all the logic required to interface to DEC LSI-11 and Qbus-based PDP-11 computers; requires appropriate software driver for the computer's operating system:

2,290

BD-NI3010A Multibus Ethernet Communication Controller Board • includes NM10 Ethernet protocol module for interfacing to Ethernet and contains all the logic required to interface to a Multibus system • requires appropriate software driver for computers operating system:

1,390

BD-NI3210 Multibus Ethernet/IEEE 802.3 Compliant Communication Controller Board • includes NM10 Ethernet Protocol module to interface to Ethernet/IEEE 802.3 network and contains all logic required to interface to a multibus system; requires appropriate software driver for the computer's operating system:

1,290

BD-NI4010A Data General Ethernet Communication Controller Board • includes NM10 Ethernet protocol module to interface to Ethernet network and contains all the logic required to interface to a 16-bit NOVA/ECLIPSE or 32-bit ECLIPSE/MV computer; requires appropriate driver for the computer's operating system:

2,490

BD-NI5010-1 IBM PC Ethernet/IEEE 802.3 Controller • includes integrated on-board transceiver with a BNCT connector for thin cable Ethernet:

725

BD-NI5010-2 • same as -1 but without on-board transceiver; for use with standard Ethernet:

575

SK-NI5010-1 Starter Kit for NI5010 Thin Ethernet • includes 5 NI5010 IBM PC Ethernet Controller Boards, four 20-foot segments of Thin Ethernet cable, 2 terminators, 1 ITP/MS-DOS Distribution Kit, and 4 ITP/MS-DOS additional software licenses • nondiscountable:

4,000

SK-NI5010-2 Starter Kit for NI5010 Thin Ethernet • same as SK-NI5010-1 but for regular Ethernet cable; includes 5 external transceivers and five 10-foot Ethernet transceiver cables:

5,000

Ethernode Systems Products

EN1110 Ethernode for ITP/RSX/Unibus Systems • includes NS4210 ITP/RSX supported software license, NI1010A Unibus Ethernet Communication Controller Board; NT10 transceiver, 10-foot cable with connectors; and 10-foot transceiver cable with connectors • requires single Ethernode ESK1110 site kit:

\$4,435 prch

ESK1110 Ethernode Site Kit • for ITP/RSX/Unibus systems; includes DK-NS4210 ITP/RSX distribution kit, user manuals, standalone PDP-11 diagnostics, and NT10 installation kit • requires Interlan software license agreement:

1,895

EN1120 Ethernode for ITP/RSX/Qbus Systems • includes NS4210 ITP/RSX-11M/11M+ supported software license, NI2010A Qbus Ethernet Communication Controller Board, NT10 transceiver, 10-foot cable with connectors, and 10-foot transceiver cable with connectors • requires ESK1120 site kit:

3,335

ESK1120 Ethernode Site Kit • for ITP/RSX/Qbus systems;

includes NS4210 distribution kit, user manuals, standalone PDP-11 diagnostics, and NT10 installation kit • requires Interlan Software License Agreement:

1,895

EN1310 Ethernode for ITP/VMS/Unibus Systems • includes NS4130 ITP/VMS Supported Software License • NI1010A Unibus Ethernet Communication Controller Board, NT10 Transceiver, 10-foot flat cable with connectors, and 10-foot transceiver cable with connectors • requires ESK1310 Ethernode Site Kit:

4,435

ESK1310 Ethernode Site Kit • for ITP/VMS/Unibus systems; includes NS4230 Distribution Kit for ITP/VMS, user manuals, VMS Device Driver and Diagnostic Programs for NI1010A board and installation kit for NT10 • requires Interlan Software License Agreement:

1,895

EN1432 Ethernode for ITP/UNIX/Multibus Systems • includes NS4244 ITP/UNIX Supported Software License (SL-NS4224-S), NS3210 Multibus Ethernet Communications Controller Board (BD-NI3210), NT10 Network Transceiver (UN-NT10), 10-foot flat cable with connectors, and 10-foot transceiver cable with connectors • requires ESK-1432:

2,435

ESK-1432 Ethernode Site Kit for ITP/UNIX/Multibus Systems • includes Distribution Kit for NS4244 ITP/UNIX Internet Transport Protocol (DK-NS4244), User Manual for NI3210 Multibus Ethernet Communications Controller Board (UM-NI3210), Installation Kit for NT10 Ethernet Transceiver Unit (IK-NT10) • requires Interlan Software License Agreement:

1,895

NTS10 Terminal Server

The NTS10 can operate as a network terminal server connecting 4 or 8 RS-232C-interfaced devices to an Ethernet local area network. Without the Ethernet connector, it can be used as a dataswitch. Four NTS10s can be cascaded to interconnect up to 32 units. The distance between connected devices can be up to 500 feet for transmission at 9600 bps. Interlan for its NTS10 was Intel's first customer for the Ethernet Controller Chip which became available in August 1983.

The NTS10 provides for sharing the Ethernet connection, virtual circuit communication, logical naming of ports, password-based network management, and security and comprehensive network and system diagnostics. The software is RAM-resident with automatic downline host load. The virtual circuit connections can be either switched or permanent.

The NTS10 can be used for port switching, port contention, or resource sharing applications. It can also be used for personal computer networking. When connected to an auto-dial/auto-answer modem, statistical multiplexer or X.25 PAD unit, the NTS10 can interconnect remote devices. When used with Interlan's Ethernode packages, devices attached to NTS10 can access devices on multiple Ethernets, see Figure 3. Up to 4 NTS10s can be interconnected to allow up to 32 devices to share a transceiver connection to Ethernet.

NTS10/8 8-Port Network Terminal Service Unit • includes power cord and user manual:

\$3,200 prch

NTS10/4 4-Port Network Terminal Server Unit • includes power cord and user manual:

2,500

US-NTS10 Upgrade Service • converts 4-port NTS10 to 8-port unit:

800

SK-NTS10 Starter Kit for NTS10 Network Terminal Server • for evaluation and initial installation; includes two 8-port NTS10 units, one TU58EA-NTS10 Cartridge Tape Initial Load Unit, 2 NA1040 10-foot Ethernet Transceiver cables, 2 U1-NT100 Ethernet Transceiver Units, one IK-NT100 Transceiver

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Installation Kit, one NA10200 77-foot Ethernet coaxial cable, two 50-ohm Terminators, one NTS10 User Manual, and one RM-NTS10 Network Manager's Reference Manual • nondiscountable:

8,200

INTS/VMS-RX01 Integrated Network Terminal Server for VAX/VMS Systems • plugs into single Unibus slot; identical to 4NTS10 units attached to 32 DMF32 or DZ11 ports; includes Unibus Ethernet Network Processor Board (NP100-2), INTS Supported Software License, User Manuals, and 10-foot Flat Transceiver Cable • requires VAX/VMS Version 3.4 or later • software on RX01 disk:

6,190

INTS/VMS-TU58 Integrated Network Terminal Server for VAX/VMS • same as INTS/VMS-RX01 except software is on TU58 tape:

6,190

XW-INTS/VMS-RX01/TU58 Extended Warranty Support for INTS/VMS • includes 1-year express remedial service for NP100 hardware and subscription service on INTS/VMS software; nondiscountable • per year:

619

SS-INTS-VMS-RX01/TU58 Software Support for INTS/VMS • includes 1-year software support for automatically receiving latest INTS/VMS release:

2,400

PC NM-DISQ Personal Computer Network Management Utilities • allows IBM PC, PC/XT, PC/AT, and Compaq to boot NTS 10 and NCS/IR and manage servers (NTS10, NCS/IR, and INTS/VMS) • includes IBM PC Ethernet Communications Controller (BD-NIS010-2), diagnostics, all application software, server load images, PC Network Manager's Guide, IBM PC Controller Installation/Programming Guide, NTS10 Reference Manual for the Network Manager, and software license:

1,000

BU-PCNM-DISQ Binary Update Service • for PCNM-DISQ; includes 1-year subscription service for automatically receiving latest releases of software and manuals:

250

SS-NTS10-DISQ Software Support • for NTS10; includes 1-year software support for automatically receiving release of NTS10 software:

2,400

TU58EA-NTS10 TU58EA Cartridge Tape Initial Load Unit • includes TU58-K Cartridge Tape Drive with NTS10 software, TU58 Tape Copy User's Guide, blank TU58-K Cartridge Tape, TU Copy Utility, and 10-foot EIA RS-232C cable:

1,950

TU58DA-NTS10 TU58EA Cartridge Tape Initial Load Unit • same as TU58EA-NT10 except with 19-inch rackmounting kit:

2,250

Ethernet Network Processor Boards

BD-NP100-1 NP100 Unibus Network Processor Board • with 128K-byte RAM:

\$3,590 prch

BD-NP100-2 • same as BD-NP100-1 but with 256K-byte RAM:

3,990

IC-NP100 Cascade Interconnect Cable:

30

NP100-1 NP100 Unibus Ethernet Network Processor • board with software license for NCX100 Network Communications Executive; includes 10-foot transceiver cable with bulkhead mounting assembly:

3,790

NP100-2 • same as NP100-1 with 256K-byte RAM:

4,190

NP110-1 • same as NP100-1 but with XNS/ITP Protocol Object Module in place of NCX100:

4,290

NP110-2 • same as NP110-1 with 256K-byte RAM:

4,690

DK-NP111 Distribution Kit • for the XNS ITP/VMS package for the NP110 Board; includes user manuals, NP100 Device Driver, Hardware Diagnostic, Program Boot Loader, and supported software license for use on 1 host • requires NP110 Unibus Board, VAX/VMS Version 3.4 or later, and Interlan software agreement:

1,000

SDK-NP111 Source Distribution Kit • for the XNS ITP/VMS for NP110 Board; includes user manuals, source code, and unsupported software license for use on 1 host:

25,000

DK-NP112 Distribution Kit • same as DK-111 except for XNS ITP/RSX-11M/M+ package • requires RSX-11M Version 4.1 or later; RSX-11M+ Version 2.1 or later, and Interlan software license agreement:

1,000

SDK-NP112 Source Distribution Kit • same as SDK-NP111 except for XNS ITP/RSX-11M/M+ package:

25,000

NP120-1 • same as NP100-1 with software license for Department of Defense (DOD) TCP/IP Protocol Object Module instead of NCX100:

4,290

NP120-2 • same as NP120-1 with 256K-byte RAM:

4,690

DK-NP123 Distribution Kit • for the DOD IP/TCP under 4.2 BSD UNIX package for the NP120 Board; includes user documentation, NP100 Device Driver, Program Boot Loader, and supported software license for use on 1 host processor • requires NP120 Unibus Board and Interlan software license agreement:

1,000

SDK-NP123 Source Distribution Kit • for the DOD IP/TCP under 4.2 BSD UNIX package for NP120 Board; includes user documentation, source code, and unsupported software license for use on 1 host • requires NP120 Unibus Board and Interlan source code license:

25,000

SDK-NP101 Source Distribution Kit • for NP100 Protocol Development Toolkit under VAX/VMS; includes NCX100, host-resident Device Driver, RS-232C port Module with cable, NP100 ROM-resident Interactive Debugger, and user documentation • requires NP100 Unibus board, VAX/VMS Version 3.4 or later, and Interlan license agreement:

2,000

SDK-NP102 Source Distribution Kit • same as SDK-NP101 except under RSX-11M/M+:

2,000

SDK-NP103 Source Distribution Kit • same as SDK-NP101 except under 4.2 BSD UNIX:

2,000

BD-NP200-1 Qbus Ethernet Network Processor Board • with 128K-byte RAM:

2,090

BD-NP200-2 • same as BD-NP200-1 with 256K-byte RAM:

2,490

NP200-1 Qbus Ethernet Network Processor Board • with 128K-byte RAM and supported software license for NCX200 Network Communications Executive:

2,190

NP200-2 • same as NP200-1 with 256K-byte RAM:

2,590

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SDK-NP202 Source Distribution Kit • for the NP200 Protocol Development Toolkit under RSX-11M/M+; includes NCX200, host-resident Device Driver and loader/dumper, RS-232C Port Module, NP200 ROM-resident Interactive Debugger, and user documentation • requires NP200 Qbus Board, RSX-11M Version 4.1 or later or RSX-11M+ Version 2.1 or later and Interlan software license agreement:

2,000

NP210-1 • same as NP200-1 but with XNS/ITP Protocol Object Module:

2,690

NP210-2 • same as NP210-1 with 256K-byte RAM:

3,090

DK-NP212 Distribution Kit • for XNS ITP/RSX-11M/M+ package for NP210 Board; includes user documentation, NP200 Device Driver, and supported software license for use on 1 host • requires NP210 Qbus Board, RSX-11M Version 4.1 or later or RSX-11M+ Version 2.1 or later; and Interlan software license agreement:

1,000

SDK-NP212 Source Distribution Kit • for XNS/ITP/RSX-11M/M+ package MNP 210 Board; includes user documentation, source code, NP200 Device Drive, and supported software license for use with 1 host processor • requires NP210 Qbus Board, RSX-11M Version 4.1 or later or RSX-11M+ Version 2.1 or later, and Interlan software license agreement:

1,000

SDK-NP212 Source Distribution Kit • for the XNS ITP/RSX-11M/M+ package for NP210 board; includes user documentation, source code, and unsupported software license for use on 1 host processor • requires NP210 Qbus Board, RSX-11M Version 4.1 or later or RSX-11M+ Version 2.1 or later, and Interlan source code license:

25,000

BD-NP300-1 Multibus Ethernet Network Processor Board • with 128K-byte RAM:

2,090

BD-NP300-2 • same as BD-NP300-1 with 256K-byte RAM:

2,490

NP300-1 NP300 Multibus Ethernet Network Processor Board • with 128K-byte RAM and software license for NCX300 Network Communication Executive:

2,190

NP300-2 • same as NP300-1 with 256K-byte RAM:

2,590

SDK-NP301 Source Distribution Kit • for the NP300 Protocol Development Toolkit under UNIX System V; includes NCX300, host-resident device driver and loader/dumper, RS-232C Port Module, NP300 ROM-resident Interactive Debugger, and user documentation • requires NP300 Multibus Board, UNIX System V Version 5.0 or later, and Interlan software license agreement:

2,000

NP310-1 • same as NP300-1 but with software license for XNS/ITP Protocol Object Module instead of NCX300:

2,690

NP310-2 • same as NP310-1 with 256K-byte RAM:

3,090

DK-NP311 Distribution Kit • for XNS ITP/UNIX System V for NP310 Board for CALLAN UNISTAR 300 Systems; includes user manuals, NP300 Device Driver, Program Boot Loader, and supported software license for use on 1 host • requires NP310 Multibus Board, UNIX System V Version 5.0 or later, and Interlan software license agreement:

1,000

SDK-NP311 Source Distribution Kit • for the XNS ITP/UNIX System V for NP310 Board for CALLAN UNISTAR 300 Systems; includes user documentation, source code, and unsupported software license for use on 1 host • requires NP310 Multibus

Board, UNIX System V Version 5.0 or later, and Interlan source code license:

25,000

DK-NP312 Distribution Kit • same as DK-NP311 but for MASSCOMP Systems instead of CALLAN UNISTAR 300:

1,000

SDK-NP312 Source Distribution Kit • same as SDK-NP311 except for MASSCOMP Systems instead of CALLAN UNISTAR 300:

25,000

NP320-1 • same as NP300-1 with 128K-byte RAM and software license for DOD IP/TCP instead of NCX300:

2,690

NP320-2 • same as NP320-1 with 256K-byte RAM:

3,090

DK-NP321 Distribution Kit • for DOD IP/TCP package under UNIX System V for NP320 Board; includes user documentation, NP30 Device Driver, Program Boot Loader, and supported software license for use on 1 host • requires NP320 Multibus Board, UNIX System V Version 5.0 or later, and Interlan software license agreement:

1,000

SDK-NP321 Source Distribution Kit • for IP/TCP under UNIX System V Protocols package for NP320 Board; includes user documentation, source code, and unsupported license for use on 1 host processor • requires NP320 Board, UNIX System V Version 5.0 or later, and Interlan source code license:

25,000

Network Communications Server/Internet Router

NCS/IR Network Communications Server/Internet Router Unit • standalone unit; operates like an NTS but for internetwork provides transparent, reliable transmission between 2 physically separate Ethernets across 1 or 2 dedicated synchronous data links using XNS/ITP protocols; 1 required in each network • includes power cord, two 10-foot RS-232C synchronous modem interface cables, NCS/IR Manager's Guide, Reference Manual for NTS10, NCS/IR software, and supported software license • requires Personal Computer Network Management (PCNM) Utilities:

\$6,500 prch.

RMK-NTS10 Rackmounting Kit • for NCS/IR:

125

TU58EA-NCS Cartridge Tape Initial Load Unit • includes TU58-K Cartridge Tape Drive with NCS/IR software, documentation, blank tape, copy utility, and EIA RS-232C cable:

1,950

TU58DA-NCS Cartridge Tape Initial Load Unit • same as TU58EA-NCS except with 19-inch rackmounting kit:

2,250

SS-NCS/IR Software Support for NCS/IR • for 1 year:

2,400

SW-NCS/IR Software for NCR/IR • replacement copy only:

250

C6-NTS10-EIA RS-232C Modem Interface Cable • for NCS/IR. 10 Feet:

60

25 Feet:

75

50 Feet:

100

Network Components

UN-NT10 Ethernet Transceiver Unit • with nonintrusive tap that complies with Xerox-Intel-Digital-Ethernet specifications; does not interrupt Ethernet operation during installation or

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removal:

	\$290 prch
1K-NT10 Installation Kit • includes user manual, drill fixture for coaxial cable, drill bit, Allen wrench, 10 sets of braid picks, and 10 stationary probes:	275
BPNT10 Braid Picks • for NT10:	100
U1-NT100 Ethernet/IEEE 802.3 Transceiver Unit • with nonintrusive piercing cable tap:	320
U2-NT100 • with cable tap and female N-type connectors:	320
U3-NT100 • with cable tap and female BNC connectors:	320
UX-NT100 • with no tap:	270
T1-NT100 • piercing tap only:	50
T2-NT100 • N-type tap only:	50
T3-NT100 • BNC tap only:	50
IK-NT100 Installation Kit • for U1-NT100:	100
RK-NT100 Piercing Tap Replacement Kit • containing 5 sets of replacement braid picks and center probes:	15
NR10 Ethernet Repeater Unit (NR10) • includes user manual and power cord • requires 2 Ethernet NT10 Transceiver Units and 2 transceiver cables:	2,000
FC-NP100 Flat Transceiver Cable • with VAX bulkhead mounting assembly; for use with NP100 Network Processor Board and VAX-11. 5A • 5 feet:	100
10A • 10 feet:	100
FC-NP200-1A Flat Transceiver Cable • with micro PDP-11 mounting bracket; for use with NP200 Network Processor Board • 10 feet:	65
AC-NM10-3/-10 Flat Cable With Connectors • for use with NM10A, N11010A, NI2010A, NI3010A, and NI3210 Ethernet Communication Controllers; NP200 and NP300 Network Processor Boards, and INTS/VMS; 3 or 10 feet long:	65
AC-NA4010A-3 Flat Cable With Connectors • for use with NI4010A Ethernet/IEEE 802 CSMA/CD Communication Controllers; 3 feet long:	65
AC-NA 4010B-3 Flat Transceiver Cable • with FCC bulkhead mounting assembly for MV Series I/O Panels; for use with NI4010A Ethernet Communications Controllers • 3 feet:	65
NA1020 Ethernet Coaxial Cable (PVC) • N-type male connector on each end.	
NA1020-77 Ethernet Coaxial Cable • 77-foot cable:	225
NA1020-230 Ethernet Coaxial Cable • 230-foot cable:	525

NA1020-384 Ethernet Coaxial Cable • 384-foot cable:	825
NA1030 Ethernet Cable Hardware • various components.	
NA1032 N-Type Barrel Connector • for attaching cable segments together:	18
NA1033 N-Type Male Connector • for nonstandard cable lengths:	12
NA1034 Crimp Tool • for N-type male cable connector:	412
NA1035 N-Type Cable Terminator • 50 ohm:	25
NA2020 Thin Ethernet Coaxial Cable • RG-58, 50 ohms, fully assembled with male BNC connectors at each end.	
NA2020-20 Thin Ethernet Coaxial Cable • 20 feet:	30
NA2020-60 Thin Ethernet Coaxial Cable • 60 feet:	40
NA2020-100 Thin Ethernet Coaxial Cable • 100 feet:	50
NA2020-XXX custom length at \$0.20 per foot.	
NA2032 Female BNC Barrel Adapter • for combining 2 lengths of thin Ethernet cable:	6
NA2033 BNC Adapter • for connecting NI5010 to the thin Ethernet:	10
NA2034 Male BNC Terminators • 1 set of 2 for the thin Ethernet network:	30
NA1040 Ethernet Transceiver Cable (PVC) • with 15-pin D sub-miniature connector on each end; 1 male, 1 female.	
NA1040-10 Ethernet Transceiver Cable • 10-foot cable:	90
NA1040-50 Ethernet Transceiver Cable • 50-foot cable:	190
NA1040-150 Ethernet Transceiver Cable • 150-foot cable:	390
NA2020 Thin Ethernet Coaxial Cables • with terminators (Custom Lengths 20 Cents Per Foot):	
20 Feet:	30
60 Feet:	40
100 Feet:	50
NA2032 Female BNC Barrel Adapter • for combining 2 lengths of Thin Ethernet Cable:	6
NA2033 BNC T Adapter • for connecting NI5010-1 to the Thin Ethernet:	10
NA2034 Male BNC Terminators • for end of Thin Ethernet network; set of 2:	30
NTS10 EIA RS-232C Cable With Connectors • available with various connectors for connecting DTE device, asynchronous modem, or DEC DH11 port to NT310 port.	

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10-Foot Length:	60
25-Foot Length:	75
50-Foot Length:	100
IC-NTS10 Interconnect Cable • connects 2 NTS10s together so they can share one transceiver:	50

Instanet Components

The nucleus of the Instanet system is the Micro600 Port Selector (data PBX). Modules plug into the Micro600 chassis to provide ports to connect RS-232C devices, a voice/data multiplexer, a T1 local multiplexer, a multiplexing line driver, an X.25 gateway, a data concentrator/multiplexer, and an IBM gateway.

Components of Instanet are interconnected with twisted-pair wiring, that is usually already available on the in-building telephone wiring. Micom approaches local networking as an add-on to a company's existing facilities. Micom provides no high-speed transmission speeds even though T1 bandwidth is available. Standard data rates are up to 9600 bps on up to 128 channels. The data rate can be extended to 19.2K bps with a corresponding reduction in the number of channels to 64.

The Micro600 acts as the network manager, controlling access for large number of terminals to smaller numbers of computer ports. Access to computer is on the basis of priority or security assignment. Micro600 provides fallback switching for critical applications.

Micro600 Port Selector, Series 2A

Available in 2 models: M600/1 limited to 60 lines/ports and M600/2 supports from 100 to 1,504 lines/ports.

M600/1 Micro600 Model 1 • table-top version for up to 60 lines/ports:

\$6,000 prch

M600/2 Micro600 Model 2 • floorstanding model for 120 lines/ports; provides single 25-pin EIA connection per line/port:

10,000

M600/2GR Micro600 Model 2 • same as M600/2 but provides group termination and full redundancy:

11,500

M600/2G Micro600 Model 2 • same as M600/2 except provides single 50-pin connector for 6 lines/ports:

9,000

Line/Port Expansion

F1502 2nd Card-Bay • for M600/2; supports 128 additional lines/ports; single 25-pin EIA connection per line/port:

\$3,500 prch

F1502G 2nd Card Bay • for M600/2G; supports 128 additional lines/ports; supplies one 50-pin connector for 6 lines/ports:

2,500

F1503 3rd Card Bay • for M600/2; supports 120 additional lines/ports; single 25-pin EIA connection per line/port:

5,000

F1503G 3rd Card Bay • for M600/2; same as F1503 except provides 50-pin connector for 6 lines/ports:

3,000

1504 4th Card Bay • for M600/2; supports 128 lines/ports; single 25-pin EIA connection per line/port:

3,500

1504G 4th Card Bay • same as F1504 except provides 50-pin connector for 6 ports/lines:

2,500

1505 5th Card Bay • for M600/2; supports 12 ports/lines; single

25-pin EIA connection per line/port: 7,000

1505 G 5th Card Bay • same as 1505 except provides 50-pin connector for 6 ports/lines:

6,000

1506 6th Card Bay • for M600/2; supports 128 additional ports/lines; single 25-pin EIA connection per line/port:

3,500

1506 G 6th Card Bay • same as 1506 except provides single 50-pin connector for 6 ports/lines:

2,500

1507 7th Card Bay • for M600/2; supports 120 additional lines/ports; single 25-pin EIA connection per line/port:

5,000

1507 G 7th Card Bay • same as 1507 except provides single 50-pin connector for 6 ports/lines:

4,000

1508 8th Card Bay • for M600/2; supports 128 additional lines/ports; single 25-pin EIA connection per line/port:

3,500

1508G 8th Card Bay • same as 1508 except provides single 50-pin connector for 6 ports/lines:

2,500

1509 9th Card Bay • for M600/2; supports 128 additional lines/ports; single 25-pin connector per line/port:

7,000

1509G 9th Card Bay • same as 1509 except provides single 50-pin connector for 6 lines/ports:

6,000

1510 10th Card Bay • for M600/2; supports 128 additional lines/ports; single 25-pin connector per port/line:

3,500

1510G 10th Card Bay • same as 1510 except provides single 50-pin connector for 6 lines/ports:

2,500

1511 11th Card Bay • for M600/2; 128 additional lines/ports; single 25-pin EIA connection per line/port:

5,000

1511 G 11th Card Bay • same as 1507 except provides single 50-pin connector for 6 ports/lines:

4,000

1512 12th Card Bay • for M600/2; supports 128 additional lines/ports; single 25-pin EIA connection per line/port:

3,500

1512G 12th Card Bay • same as 1508 except provides single 50-pin connector for 6 ports/lines:

2,500

Line/Port Modules

Line/port modules each provide 4 ports to support up to 4 lines. Each module plugs into the M600/1 or M600/2 chassis or in the expansion card bays in the M600/2.

F1531-1 Quad Asynchronous Line/Port Module • to 2400 bps; 4 lines/ports:

\$350 prch

F1531-2 Quad Asynchronous Line/Port Module • to 9600 bps; 4 lines/ports:

450

F1531-3 Quad Asynchronous Module • with character disconnect; 4 lines/ports:

550

F1533-1 Quad Asynchronous Current-Loop Module • to

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2400 bps; 4 lines/ports:

450

F1533-2 Quad Asynchronous Current-Loop Module • to 9600 bps; 4 lines/ports:

550

F1534-1 Quad Asynchronous 43401 Module • to 2400 bps; 4 lines/ports:

450

F1534-2 Quad Asynchronous 43401 Module • to 9600 bps; 4 lines/ports:

550

F1535-2 Quad Clocked Asynchronous Module • to 9600 bps; 4 lines/ports:

650

F1536-1 Quad Asynchronous Module • to 2400 bps; data only; EIA; 4 lines/ports:

245

F1536-2 Quad Asynchronous Module • to 9600 bps; data only; EIA; 4 lines/ports:

330

F1537-1 Quad Asynchronous Module • to 2400 bps; no controls; 4 lines/ports:

275

F1537-2 Quad Asynchronous Module • to 9600 bps; no controls; 4 lines/ports:

375

F1538 Quad Asynchronous Party Line Module • 4 lines/ports:

450

F1539 Quad Local Synchronous Line/Port Module • 4 lines/ports:

550

Instamux

Instamux is a local multiplexer designed specifically for local networks, allowing each terminal to operate as if it had a dedicated link to a computer. All terminals can operate simultaneously without interference. Terminals can operate at speeds up to 19.2K bps and can change speed without reconfiguring the multiplexer.

Instamux incorporates a high-speed line driver so each terminal does not require an individual modem or line driver. For Instanet, the Instamux is available as a plug-in module for the Micro600.

M474i Instamux 470i Module • 4-channel asynchronous: \$650 prch

M478i Instamux 470i Module • 8-channel asynchronous: 850

U470i/K4 4-Channel Expansion Kit • for M474i: 250

Instatrunk

Designed for local networking, Instatrunk is a TDM T1 multiplexer that provides an aggregate 1.544M-bps data rate. Instatrunk provides up to 128 data channels, each operates at up to 9600 bps. The remaining bandwidth is used to carry control and timing signals to retain T1 multiplexer synchronization. It uses the same twisted-pair wiring as Instamux and operates over a distance of 1 or 2 miles. Using radio or microwave links, the distance can be extended to 5 to 10 miles. Instatrunk can also use Telco's T1 facility.

Instatrunk is available as a standalone unit or as a plug-in module for the Micro600. Plug-in modules can provide a direct connection between 2 Micro600s or a single module can provide a connection to a remote Instatrunk. Instatrunks with either the Expandable Remote Bay (ERB) or High-Speed (HS) option can drop and insert data to distributed clusters of ports/terminals

forming a ring structure; see **Figure 5**.

The firmware package in the Micro600 that supports the Interconnect Facility; allowing up to 16 routes between Micro600s. The firmware is independent from the trunking hardware, thus multiple routes can be established for redundancy or for load distribution. Each route can contain multiple trunks.

The Micro600 has a symbolic name feature that allows 2 equivalent classes to be assigned the same user-entered names. The classes can be assigned to 2 different routes establishing equivalent resource classes. When a primary route is busy or down, the secondary route is automatically selected to route a call.

The Micro600 attempts to satisfy a user's request with a local connection.

If unsuccessful, the Micro600 node attempts to find a route to the requested service and assigns a circuit to the route. The remote node then accepts the request and attempts to grant it. If the resource is at still another node, the request is sent on extra until the proper destination node is reached and the resource found.

Resource classes can be defined on a network-wide basis, thus the location of the resource is transparent to the user. This allows users to access remote resources. Network-wide class definition and the ability to assign the same class definition to multiple resources provides back-up and load sharing on different Micro600s in a network.

A standard Micro600 feature is an inclusion/exclusion table mechanism that specifies user access rights. A user can be restricted to a local Micro600 or can be allowed access to remote resources.

The Instatrunk module that plugs into the Micro600 occupies 2 slots in a card bay. The first 8 channels are assigned to the Micro600 channel positions in the card bays where the modules are installed. Additional 8-channel increments are automatically assigned sequentially in ascending order.

The Instatrunk passes all data formats unchanged. A single control signal per channel is passed between interconnected modules. It is T1 compatible with the AT&T DSX-1 signal format. Interface is strap selectable at standard T1 or EIA RS-422 levels.

M481i Asynchronous Instatrunk Module • 128 channels: \$1,500 prch

M481i/S Asynchronous Instatrunk Module • same as M481i except for slave Micro600s: 1,600

M481i/SG Asynchronous Instatrunk Module • same as M481i except for group termination, single 50-pin connector for 6 lines/ports: 1,800

Micro800 Data Concentrator Modules

The Micro800 is available in different versions as plug-in modules to the Micro600.

The Micro800/2i in conjunction with Micro800/2 Micro8000 concentrator can connect up to 16 terminals to a Micro600 over a single telephone line. A pair of Micro800/2is connected by a telephone line can be used to interconnect 2 Micro600s using the same Micro600 Interconnect Facility as the Instatrunk asynchronous data rates are 75 to 9600 bps per channel fixed speed or up to 9600 bps using autobaud detection. Synchronous data rate up to 19.2K bps using external clocking. An optional feature provides special support for the HP 3000 using ENQ/ACK protocol and block mode transmission.

The Micro800/X.25i is a plug-in PAD module for the Micro600 that provides a gateway between Instanet and an X.25 Packet Data Network. It supports up to 16 Switched/Permanent Virtual Circuits (S/PVCs). The Micro800/25i is compatible with the 1980 CCITT Recommendation X.25 LAPB/HDLC, and it implements X.3, X.28, and X.29 protocols. Data rates on the Micro600 side are 75- to 9600-bps asynchronous fixed speed or up to 9600 bps with autobaud detection. On the X.25 channel side, the interface is RS-232C. Synchronous, full-duplex data

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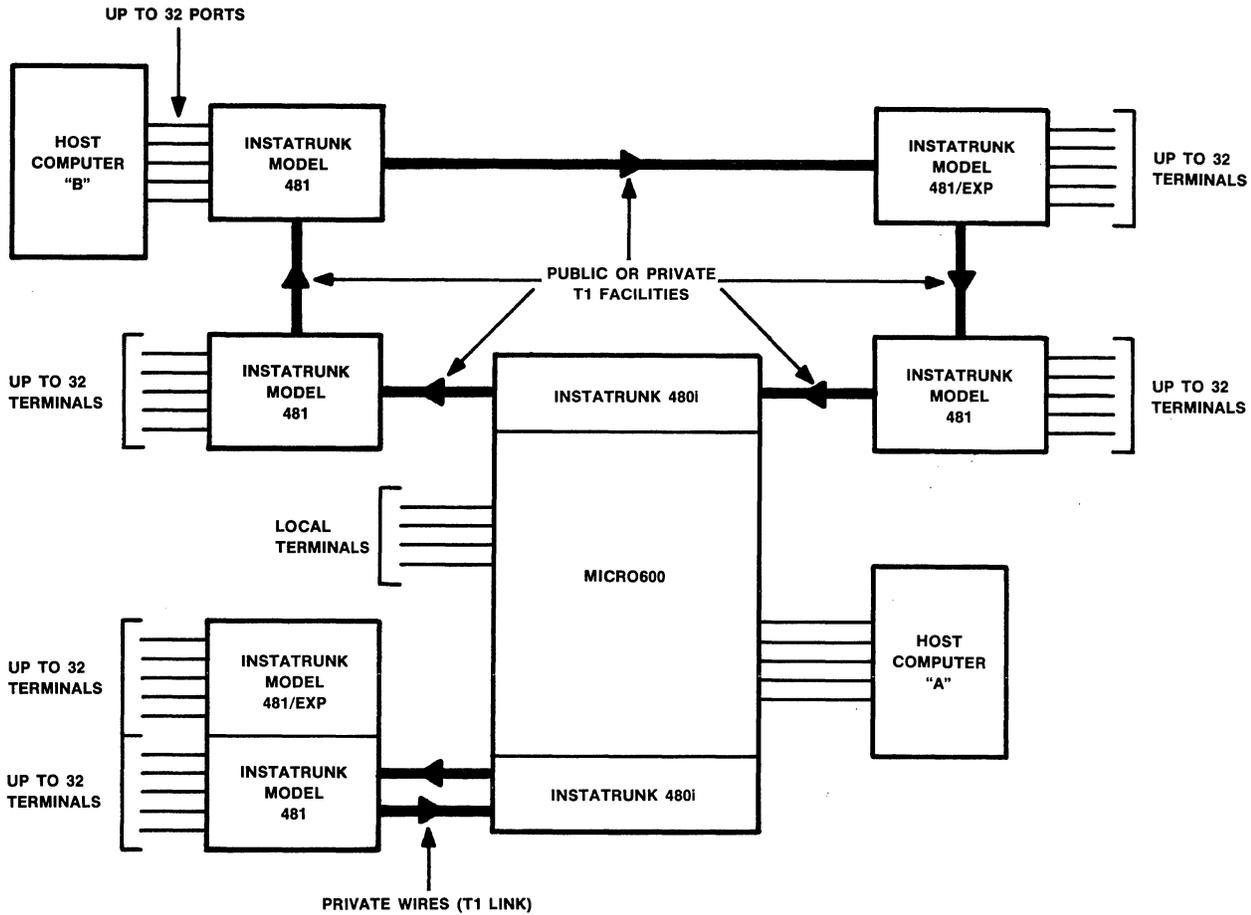


Figure 5 • Instatrunk remote bay/ring configuration.

rates up to 9600 bps are supported; flow control is XON/XOFF. The Micro800/25i Command Facility is available to users through an external connector for dedicated access, through a PAD channel without dedicating a channel to it, or through the PDN and X.25 line. The command facility is protected by an operator-defined password. All configuration parameters are stored in battery-backed-up CMOS.

M828i 8-Channel Micro800/2i Module • provides 8 asynchronous channels: \$1,500 prch

M8216i 16-Channel Micro800/2i Module • provides 16 asynchronous channels: 4,200

F800i/HPX Extended Hewlett-Packard Option • for M828i or M8216i: 100

M858i 8-Channel Micro800/X.25i Module • provides 8 asynchronous channels on Micro600 side: 2,500

M8516i 16-Channel Micro800/X25i Module • provides 16 asynchronous channels on Micro600 side: 4,200

IBM Gateway Module

The Micom Micro7400i is a plug-in protocol converter for the

Micro600 that provides a gateway between the Instanet LAN and IBM BSC and SNA/SDLC networks. The user can access IBM 3270 applications on an IBM S/370-compatible host. Users contend for the IBM host ports in the same way as they do for the asynchronous resource ports on the network. The user selects the resource class name for the IBM gateway ports, and the Micro600 searches for an idle channel on the Micro7400i and connects the user to the gateway port. If no gateway ports are available, the Micro600 places the user in a queue for the next available channel.

The Micro7400i replaces an IBM 3271 or 3274 Control Unit and allows asynchronous terminals to emulate the IBM 3278 Display Stations and IBM 3287 Printers. IBM PC users receive special support through a Micom program that allows the IBM PC to emulate an IBM Display Station and Printer.

The gateway supports both BSC and SNA/SDLC protocols. It provides security safeguards, banner and broadcast messages, automatic logon to host, an easy-to-use and powerful command port, a terminal support package, and user-friendly diagnostics.

The Micro600 allows dial-up access to the IBM 3270 applications from asynchronous auto-answer modems and dial lines. Several Micro7400i modules can be installed in a Micro600 to allow users access to multiple IBM host applications. Each host can operate under a different protocol.

Data rates are 300 to 9600 bps fixed rates, autobaud, or individually configurable. It provides an RS-232C asynchronous full-duplex interface and XON/XOFF flow control.

Micom-Interlan Instanet/Plus Baseband Local Area Network & Data PBX

M7408i IBM Gateway Module • provides 8 asynchronous channels:
\$3,600 prch

M74016i IBM Gateway Module • provides 16 asynchronous channels:
5,400

Instalink

The Instalink 460 Voice/Data Multiplexor piggybacks data over voice. It allows a user to connect a terminal and the telephone to a single line through an Instalink Model 461 Terminal Unit. At the central site, an Instalink Central Unit separates the voice and data channels sending the data channels to the Micro600 and the voice channels back to the voice PBX, see **Figure 6**. The Instalink Central Unit can connect directly to the Micro600 if they are collocated; if not, it connects to the Micro600 through a T1 link to the M480i Instatrunk module. Instalink is modular and can support from 1 to 128 terminals. Channel speed is up to 19.2K bps.

M461 Single Voice/Data Link • terminal unit that connects a telephone and a terminal to a single telephone line:
\$250 prch

M461/ML Voice/Data Link • for multiline telephone:
275

M4601 Single Voice/Data Chassis • central unit chassis for PBX/computer:
300

M4612 12-Line EIA Central Chassis • for PBX/computer:
1,000

M4624 24-Line EIA Central Chassis • for PBX/computer:
1,360

M4636 36-Line EIA Central Chassis • for PBX/computer:
1,700

M4648G 48-Line Group Termination Chassis • for PBX/computer:
1,700

4648T 128-Line Group Termination Chassis • for PBX/computer:
3,500

M4600 4-Line Bypass Central Module • 1 required for each set of 4 telephones not equipped with terminal units:
60

M4641 4-Line Voice/Data Multiplexor Central Module • 1 required for each set of 4 telephones equipped with M461 or

M461ML terminal units:
675

F460/PS2 Redundant Power Supply • for central chassis:
550

U460/K12 EIA 12-Channel Expansion • for M4612 or M4624:
400

Other Instanet Components

F1504-2 Redundant Common Logic • for M600/2:
\$3,500 prch

F1504-3 Redundant Scan Control Module • for each extra card bay:
450

F1505-1 Redundant Power Supply • for 1st, 5th, or 9th card bay:
1,200

F1505-2 Redundant Power Supply • for 3rd, 7th, or 11th card bay:
1,200

F1580-5 Interconnect Firmware • one required for each interconnect Micro600:
800

F1585 Battery Back-Up Feature • included:
NC

F1586 Clock Slave Module • for slave Micro600 nodes:
500

F1587 Dual Access Command Port • for Micro600:
200

F1588 Redundancy Management Option • for Micro600:
1,000

M6210 Rackmount Chassis • for 16 modem modules:
750

M6212 Automatic Outdial Modem Module • for M6210 chassis:
645

■ SPECIFICATION FOR INSTANET/PLUS

Instanet is protocol-transparent. The Micro600 operates as the network controllers and passes data without regard to its format. The Net/Plus portion of Instanet/Plus uses Ethernet protocols. Instanet uses ordinary telephone wire for data transmission. Net/Plus uses Ethernet cable.

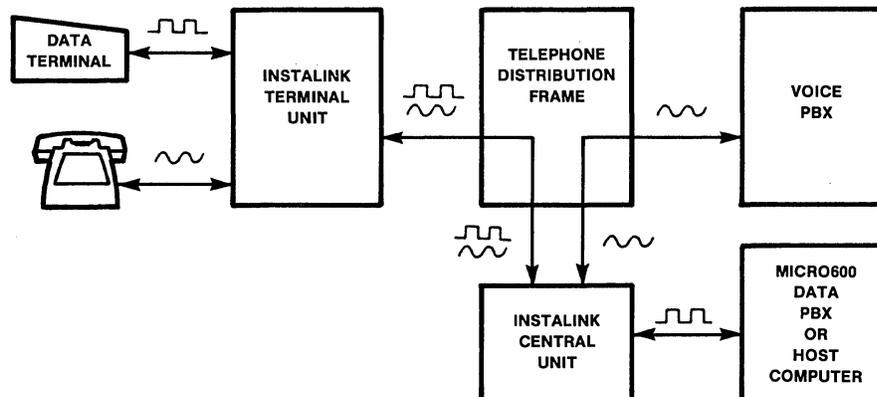


Figure 6 • Instalink 460 voice/data multiplexer.

Micom-Interlan Instanet/Plus

Baseband Local Area Network & Data PBX

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. Interlan provides these higher level services in its hardware/software products.

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 or terminal servers. Peripheral devices and terminals connect to the channel through computers and the network terminal server.

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 controller board.

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 Interlan implementation, the controller connects to the transceiver in the transmission system.

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.

Ethernet 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 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 • maximum round-trip end-to-end delay is 51.2 microseconds.

Ethernet 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 of 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.

Ethernet 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 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 14, 2 raised to the nth power is truncated to 1023 • time interval before transmission is 51.2 microseconds times random number generated.

Ethernet Transmission Medium

Ethernet uses either thin or regular 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.

□ Instanet/Plus Use

Initially, most Net/Plus customers were DEC computer users. Recent customers, however, also use Multibus systems. Personal computer users are now using NTS10 and the poly-XFR/TRM software. Net/Plus offers considerable support for the multivendor network, interfacing to both popular minicomputer and microcomputer systems and personal computers as well as to DOD networks.

Instanet provides an inexpensive way to connect many local asynchronous terminals to multiple hosts using the excess twisted-pair wire capacity most companies have in their telephone system. It is quick and easy to implement, especially in multivendor, non-IBM environments.

• END

Morino Associates TSO/MON

TSO Performance Monitor

■ PROFILE

Function • TSO utilization and performance monitor/reporting system.

Computers/Operating Systems Supported • any IBM System/370, 3000, 4341, or compatible computer; OS/VS2(MVS) or MVS/XA with TSO.

Communications Interface • TSO.

TP & File Access Methods • TCAM, VTAM, TSO/VTAM; all standard IBM access methods.

Special Features • TSO/MON ONLINE option; SPF (Structured Programming Facility) interface; exit to user-developed report formats.

Logging/Accounting • TSO/MON console log.

Failure/Recovery • Command Record Checkpoint facility.

Current Version • 4.2.

Installations • over 600.

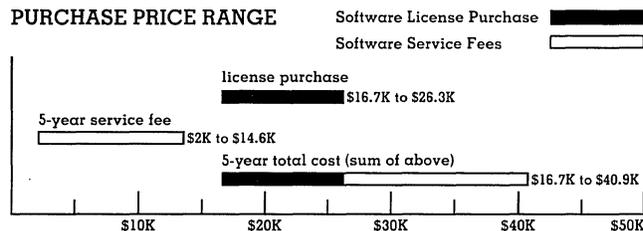
Comparable Systems • similar features are options in Candle Corp OMEGAMON/MVS.

Vendor • Morino Associates, Inc; 8615 Westwood Center Drive, Vienna, VA 22180 • 703-734-9494.

■ ANALYSIS

TSO/MON is a comprehensive TSO performance monitoring and reporting system. It is a continuously running operation that is appended to the operating system's master scheduling facility. It intercepts TSO command activity to the SRM (System Resource Management) module and records the activity to the SMF (System Management Facility) log. The summary information is recorded on a special TSO/MON utilization file, where user-defined criteria and sampling intervals determine the amount and content of the data to be measured. TSO/MON provides DP management control, utilization, and performance reports based on information in the TSO Utilization File (TUF). These reports provide activity details and supply management profiles of usage history. Simulation and comparison analysis is simplified through the many reports generated by TSO/MON, and a user exit allows users to write special summary reports, to modify data on the TUF, or to write records to the file. TSO/MON can be used to display information on selected users with their associated periods of operation, to

PURCHASE PRICE RANGE



MORINO ASSOCIATES TSO/MON PRICING • solid bar shows typical min/max configuration price range for the initial year of implementation; includes maintenance for that year; open bar shows the cost of license renewal fees (which cover maintenance) for the 5-year period, but is computed for 4 years (48 mos) because maintenance is included in the initial license purchase agreement • **MINIMUM CONFIGURATION** is TSO/MON • **MAXIMUM CONFIGURATION** is TSO/MON with both the SPFI and TSO/MON ONLINE options.

rank users by up to 12 profile criteria, and to produce a summary report on application performance under TSO. An audit report is also available on an "as-required" basis to do an in-depth study of TSO activity. For users with the IBM SPF facility, the SPFI option can generate performance information on primary command usage and other SYSEVENT data. Almost any TSO element or command can be identified and measured with TSO/MON.

With the addition of the new online facilities (TSO/MON ONLINE) in the Spring of 1984, Morino Associates has provided a viable resolution of the need for immediate information and action for the TSO environment. The growing use of TSO in the IBM MVS configuration has posed many additional performance problems in data centers throughout the world. TSO/MON ONLINE provides an interactive method of control in the TSO environment, and together with TSO/MON, serves as a real-time performance monitor and throughput improvement tool.

□ Strengths

TSO/MON effectively pinpoints causes of poor response time, identifies violators of any system standards, and even helps to structure standards if none exist at an installation. It provides management with a complement of standard reports to support work load planning, scheduling, and expansion plans. Unusual usage of specific command sequences can be easily spotted to help formulate additional usage rules. Capacity planning is serviced by allowing management to simulate conditions that affect the hardware resources of the system. TSO/MON enables the user to schedule the reporting intervals to best meet each installation's needs for monitoring TSO operations. TSO/MON can rapidly pay for itself on systems with large-scale TSO operations, especially with the addition of the online option.

□ Limitations

TSO/MON identifies all areas of TSO activity that it measures and reports on, and few areas are excluded from monitoring. TSO/MON thus meets its advertising claims flawlessly. There are, however, a few operational points users should be aware of. First, TSO/MON must be started at IPL time. Although it can be restarted under special circumstances, it cannot be initialized dynamically during system operation. Also, note that only one command record can be active at a time when performing command analysis, so any subcommand measurement requests are ignored. Although a command record may contain associated program name or data set name information, this information is not captured during subcommand processing. Finally, large overhead costs can be incurred if interval and command selection criteria are selected carelessly. The size of the detail record grows significantly according to the number of users on the system and the number of commands detailed in the command table, and the frequency of command recording puts an additional performance load on the monitor. It will definitely pay to follow some of the hints and recommendations offered by the vendor's documentation.

■ OVERVIEW

□ Terms & Support

Terms • available with an initial license purchase agreement for one year, with annual, renewal license fee charged thereafter; license is issued on a single-site address basis • multisite discounts are available if multiple system is licensed, installed, and accepted within a 6-month period from initial site installation.

Support • annual license fee (initial or renewed) includes the rights to use the system, technical documentation, and maintenance.

Morino Associates TSO/MON TSO Performance Monitor

nance • membership in the Performance Statistics Program costs \$750 per computer system per year.

Component Summary

Except for the extra-cost SPF Interface option for users with the IBM Structured Programming Facility program product, and the online facilities afforded TSO users, all the components of the TSO/MON system are integrated operating modules. The system consists of a data collection component and 2 reporting subsystems: the detail reporting subsystem and the summary subsystem. All measurements and recordings are standardized and can be selected by the user when the system is implemented. The reports produced by the system are derived from a standard list of reports, but users can incorporate optional reports through the use of a user-exit routine. The monitor operates as an integral part of the operating system environment and interfaces with the SRM and SMF facilities of the operating system as they, in turn, interface with the TSO communications facility. The SPFI facility monitors TSO/SPF activities and reports on SPF split-screen operations as well as command and user activities. The TSO/MON ONLINE option provides real-time control for MVS/TSO users.

Host Computers & Operating Systems

TSO/MON and TSO/MON ONLINE can be installed on any IBM System/370, 3000, 4341, or compatible computer capable of running under MVS or MVS/XA with TSO. TSO/SPF/ISPF are also supported.

Minimum Operational Configuration

TSO/MON requires a region or partition of 128K to 320K bytes of virtual memory for the reporting processor. The data collection facility requires about 18K bytes of memory in the fixed linkpack area. Each command record created requires a minimum of 180 bytes to a maximum of 240 bytes. Detail records can be any size up to one-half the size of the SMF buffer less 4. Larger detail records are segmented automatically. The monitor library file requires approximately 55 tracks of online disk storage on an IBM 3330-1 DASD unit and 365 tracks of off-line storage. All terminals and devices supported by the operating system and by TSO are supported under TSO/MON.

■ TSO PERFORMANCE MONITORING/REPORTING FACILITIES

TSO/MON consists of 2 major parts: a data gathering/storage facility and an integrated report writer. The heart of the data storage function is the TSO Utilization File (TUF). TSO/MON stores 13 months of historical information in the file. The TUF is constructed as a partitioned data set (PDS) in which each month's data set becomes a member of the PDS. Records in the TUF can be accessed by retrieval programs written in COBOL, FORTRAN, PL/1, or assembly language and can also be accessed by many of the popular commercial report writer programs. When detail records are created, they are passed on to a summary analysis operation, which interfaces with the TUF. All TUF updating is handled through a series of system commands. Within each month's summary, information is further segmented through a user-defined "time zone" facility. This facility enables the user to define up to 3 service periods according to which TSO/MON measurements are to be accumulated. The time periods are labeled: prime time, second level time, and offshift (or low priority) time. The TSO/MON reports are separated into 2 distinct groups: detailed reporting operations and summary report preparation. The detail reporting facility generates 8 distinct reports: a TSO Activity Report, a TSO Command Activity Report, a TSO Profile Report, a TSO Program Activity Report, a TSO Command Use Counts Report, a TSO User Ranking Report, the TSO Audit Report, and the TSO Malfunction Analysis Report. The summary subsystem generates 4 reports: the TSO System Summary Report, the TSO Application Summary Report, the TSO User Summary Report, and the TSO Group Summary Report.

TSO/MON • for all IBM systems capable of supporting TSO:
\$16,700/\$2,000 lcns NA mo NA serv

Integrated Reporting Facilities

All TSO/MON report titles have common data elements. These include: installation header, title of report, date range selection, current date/time, a list of the report options selected, the report date (for the TSO Activity Report only), and data level (level of the TSO/MON Data Collection system that produces the data).

Detail Reports

TSO Activity Report • recommended reporting increment is 15 minutes or greater; identifies periods of degraded response time isolated to specific TSO performance groups; quantifies TSO utilization and performance, compares the service given by differing performance groups, identifies peak loading periods, and provides base for evaluation of system performance changes; selection is performed by time/date range, user ID, or system ID; detailed TSO performance group activity, length of time interval to be summarized, and response frequency distribution times can be defined • response time is measured as average trivial, average nontrivial, or average long periods; total time is the average of all response times.

TSO Profile Report • run on a weekly basis; detail data for the week is sorted into time order; quantifies TSO utilization and performance; identifies varying service provided by different performance groups; identifies usage patterns; quantifies workload profile • report options provide selection by time/date range or system ID, by the length of the time increment to be summarized, and by response frequency distribution times.

TSO Command Use Counts Report • provides list of TSO commands and subcommands ordered by frequency of use within selected reporting period; produces use counts for TSO, EDIT, and TEST commands; each report lists the commands and subcommands by use in descending order starting with the highest frequency; indicates the response category (trivial, nontrivial, or long); displays user-selected response categories as defined in the Command Table; identifies commands for which no command table entry exists.

TSO Program Activity Report • gives detail and summary information on interactive applications; can be run daily or weekly; identifies potential problem applications; quantifies application workload at the user level; quantifies application workload at the system level; analyzes interactive program performance; selection can be made by time/date range, user ID, or system ID; summarization is performed by user ID and/or program name within user ID; can be summarized by program name only; definition of response frequency distribution times is optional; can display summary information.

TSO Command Activity Report • can be run daily or weekly; summarizes by command to identify command resource consumption; summarizes by user ID to pinpoint user resource consumption; identifies potential problems with specific TSO commands; quantifies CLIST activity; quantifies command workload at system level; analyzes command performance.

TSO User Ranking Report • tracks "n" number of users' performance by time period increment; recommended increment is 15 minutes; measures highest or lowest (frequency) TSO users in 12 categories of resource utilization; highest and lowest are designated within category • categories measured are: average trivial response time, average nontrivial response time, average long response time, average total response time, total response events, total CPU time, total EXCPs, total terminal I/O, total swaps, total commands, total service units, and total transactions.

TSO Audit Report • provides more detailed information on the TSO session and/or commands executed during that session; run on an "as needed" basis and can be tailored to display selected

LCNS: first figure is license fee for initial year of license; second figure is the annual renewal fee of the license; both figures represent single-site address installation. NA: no rental or lease fees are applicable (MO), and maintenance (SERV) is included in the license renewal figures. Prices are effective as of June 1984.

Morino Associates TSO/MON

TSO Performance Monitor

data elements and statistics; selected elements are designated by the user; selection can be designated by global parameters, such as time/date ranges, user ID, system ID, or group user ID prefix; actual user session activity can be selected by the following keywords: Logonoff, a display of user logon and logoff time and date, connect time, and total CPU time for the TSO session; Commands, displays command usage (execution and frequency) during the recording interval; Response, displays user response time measures, the number of response events, average response time, and response distribution percentages for all response time measures; Resources, displays user resource consumption and execution characteristics for more than 20 different resource measures; and Ratios, displays user resource usage ratios for many of the 20 measures compared to one another • selection can also be designated for the user interactive activity at the command level, by functional session activity, or by functional interactive activity at the command level.

TSO Malfunction Analysis Report • provides a detailed listing of 17 malfunctions that are considered the most critical system functions; among these are system IPL (Initial Program Load), TCAM/VTAM outage, and paging I/O errors • report identifies each malfunction and the number of times it occurred within the user-specified time increment.

Summary Reports

TSO Application Summary • provides management with in-depth information that quantifies the utilization and performance of TSO service for a user-defined application; summarizes data accumulated over a 4-month period and enables management to evaluate the results on a monthly or quarterly basis; includes information on resource load and access on a monthly, month-to-date, and quarterly basis for key systems; also identifies usage patterns by application system and provides data for long-range application planning; measure selection criteria are set by application system, by month, by time zones, by definition of response distribution times, or by definition of management indicators to be displayed; normally produced as a one-page document, but a short form option is available.

TSO System Summary • displays service provided, system load, and availability; should be run on a monthly basis; saves past 3 months of data for trend evaluation; quantifies TSO utilization and performance; identifies usage patterns; selection is designated by month, by time zones, by definition of response distribution times, by definition of targeted monthly TSO availability, or by definition of report elements to be displayed.

TSO User Group Summary • displays service received, load, and access for individual TSO users and groups of users; saves past 3 months of data for trend evaluation; analyzes usage patterns by user • TSO User Summary is the same as the Group Summary except for selection criteria.

Extended SPF Facilities

SPFI • intercepts SPF Menu Handler data for command usage; transmits SYSEVENT data via SVC (Supervisor Call) to TSO/MON; TSO/MON generates command count information for SPF primary commands and TSO primary and subcommands issued while under the control of SPF; split-screen displays are permitted only with SPFI:

_____ \$3,100/\$360 lcns NA mo NA serv

TSO/MON ONLINE Option

TSO/MON ONLINE is an optional feature, available with the TSO/MON product. It is an interactive TSO monitor, providing real-time access to the current status and utilization of TSO sessions. Using terminal displays, TSO/MON ONLINE assists the data center manager, operations personnel, and systems programmers in tracking TSO performance, service, and workload-related problems. It establishes an interface with the TSO/MON Data Collection Facility in order to provide structured data for real-time analysis of TSO, ISPF, or MVS performance degradation problems recorded by TSO/MON and the SPF Interface (ISPF):

_____ \$6,500/\$1,300 lcns NA mo NA serv

TSO/MON ONLINE Displays

TSO System Summary Display • shows workload and service information at the system level and for the top 5 users by number of commands executed, response events, service consumed, as well as average short and average total response time.

TSO Response Analysis Display • provides response-related statistics, including the total, short, medium, and long response time averages and the number of response events that constitute each average; MVS elements which affect response are also displayed.

TSO Workload Analysis Display • quantifies the current TSO resource utilization; all users, a specific user, or a user group may be selected on this display; any time-range within the previous 24 hours may be selected.

TSO Command Summary Display • displays command information for all TSO users, a specific user, or a user group; any time-range within the previous 24 hours may be selected for the display; the full command name, the number of invocations, and the percentage of command use relative to the total command count is displayed.

MVS Malfunction Analysis Display • reports 17 critical system functions monitored by TSO/MON that can cause system performance degradation; functions are categorized into 3 classes: warning, performance, and critical; any one or all classes may be selected for display.

Primary Options Display • a menu screen listing the display options supported by TSO/MON ONLINE.

TSO User Display • identifies which users are currently logged on to TSO and all users who have been logged on during the time span maintained by TSO/MON ONLINE.

TSO Error Display • entered when a TSO/MON ONLINE processor encounters an error situation or abnormally terminates.

■ USER INTERFACES

User Exit Facility

A user exit is provided in the update phase of the Summary Subsystem. If a user exit is specified in the update statement, the exit receives control before the TSO Utilization File and the associated summary records are updated. The exit can be used to provide additional selection criteria, to write records to a user file for later processing, to modify records before update, or to produce additional user reports.

■ USER REFERENCE LIST

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

- Mr. Steve Jennette
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- Mr. Bob Schwartz
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Morino Associates TSO/MON

TSO Performance Monitor

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-

• END