

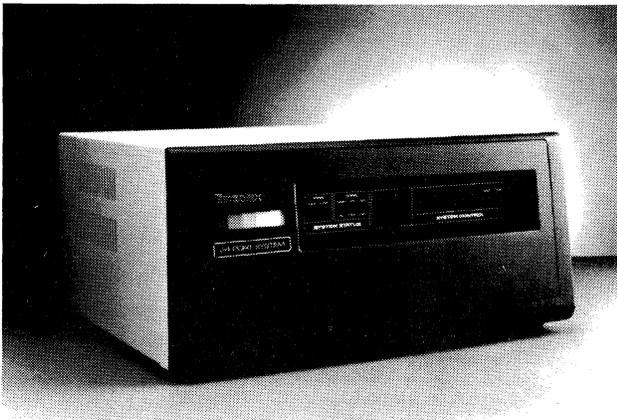
# Timeplex Microplexer X.25 Packet Assembler/Disassembler (PAD)

## MANAGEMENT SUMMARY

Timeplex, founded in 1969, established its initial position in the data communication equipment marketplace as a primary vendor of time division multiplexers. When the market for statistical multiplexers emerged in 1970, Timeplex responded by introducing the Microplexer family of products, which has been significantly upgraded since its first introduction. Today, the company's product line has expanded to include a full range of modems, the Link/1 Facilities Management System for T1 networks, the Prophet Network Management System for Link/1, and the Sentinel 424 Network Management Concentrator. A recent introduction, the Voplexer 56/64K bps Voice Data Multiplexer, fulfills a demand for products that can be used in an integrated voice/data network.

Despite the market doldrums that negatively influenced revenues of most data communications companies during the past year, Timeplex announced record earnings results for the 1985 fiscal year, ending on June 30. Revenues of \$96,043,000 increased 45 percent over fiscal 1984 revenues of \$66,022,000. The company's president predicts that the outlook for fiscal 1986 is good although revenue growth will slow somewhat during the year. Timeplex is placing a major emphasis now on designing customized communications systems for private data networks.

The basic function of the Microplexer X.25 PAD is to allow asynchronous devices to access public or private packet networks. In point-to-point applications, the device provides the interface between a variety of asynchronous devices and a computer with an X.25 interface. The unit also provides data concentration by allowing a number of asynchronous devices to share a synchronous network link. Designed to operate according to CCITT Recommendations for X.25 packet networks, the Microplexer incorporates three sets of commands for device operation. These include CCITT X.28 commands for setting and displaying X.3 control parameters, requesting status information, and



*The Microplexer X.25 PAD is available in 8-, 24-, and 48-port units. Each model is available with one or two network links.*

The Microplexer X.25 PAD allows asynchronous devices to access X.25 packet networks. It also serves a data concentration function by transmitting data from many low-speed devices onto one high-speed link. The Microplexer incorporates several security features and may be ordered with dual synchronous network links.

**MODELS:** MX81, MX82, MX241, MX242, MX481, and MX482. A "2" at the end of a model number indicates that the unit supports two synchronous links.

**CONVERSION:** Asynchronous to X.25.

**TRANSMISSION RATES:** 50 to 9600 bps on asynchronous ports; up to 4800 bps on computer ports; up to 19.2K bps on synchronous link.

**COMPETITION:** Amdahl, Dynapac, Memotec, Micom, GTE.

**PRICE:** From \$1,550 for the MX81 to \$3,280 for the MX482.

## CHARACTERISTICS

**VENDOR:** Timeplex, Inc., 400 Chestnut Ridge Road, Woodcliff Lake, NJ 07675. Telephone (201) 391-1111. In Canada: Timeplex Canada Inc., 90 Nolan Court, Unit 44, Markham, Ontario L3R 4L9. Telephone (416) 475-1961.

**DATE OF FIRST ANNOUNCEMENT:** September 18, 1984.

**DATE OF FIRST DELIVERY:** Fourth quarter, 1984.

**NUMBER INSTALLED TO DATE:** Information not available.

**SERVICED BY:** Timeplex, Inc.

## MODELS

The Microplexer X.25 Packet Assembler/Disassembler (PAD) is available in six models: the MX81 and MX82 support one and two synchronous data links, respectively, and up to two expander modules and eight ports; the MX241 and MX242 support one and two synchronous data links, respectively, and up to six expander modules and 24 ports; and the MX481 and MX482 support one and two synchronous data links, respectively, and up to 12 expander modules and 48 ports. The units may be desk- or rackmounted with the exception of the MX48 control unit with an MX48 expander unit, which is rackmounted only.

## CONFIGURATION

Each Microplexer X.25 PAD consists of a control unit mainframe, an expander unit mainframe, a main module, expander modules, and a power supply module. The main module and associated expander modules communicate with one another via a common bus.

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▷ setting up or clearing a virtual circuit to another network device; Timeplex Extended X.28 commands, which extend several X.28 commands and conventions that are only partially defined in the CCITT specification; and CCITT X.29 commands that allow users to set, set and read, and read the X.3 parameters of a destination port.

Physically, the Microplexer consists of a control unit mainframe, an expander unit mainframe, a main module, expander modules, and a power supply module. The control and expander mainframes provide mounting and connectors for the appropriate modules. The main module provides the primary microprocessor control for data flow between expander modules and the network link. It also provides storage for user programming and data buffers, as well as software for the supervisory port. Expander modules include a microprocessor that controls data flow to and from up to four external asynchronous ports and the main module, standard asynchronous port interfaces, and data buffers. The main module connects to expander modules via a common bus.

Six Microplexer models are available. Each supports a specific number of ports and either one or two synchronous network links with a maximum transmission speed of 19.2K bps. Models designated MX81/MX82, MX241/MX242, and MX481/MX482 include 8, 24, or 48 ports, respectively. Each asynchronous port handles a 50 to 9600 bps transmission speed. Computer ports operate up to 4800 bps. Interface support includes CCITT X.21 bis (RS-232-C), CCITT V.24/V.28, and MIL-STD-188-114 unbalanced. All units are certified for operation on the major public data networks, which include Tymnet, Telenet, Accunet, and Uninet.

Each Microplexer PAD includes a supervisory port that interfaces with a standard asynchronous ASCII terminal, through which users configure parameters, monitor system and network status links, and initiate diagnostic tests. This port may be password protected to prevent unauthorized users from accessing supervisory functions. Available through the port are a variety of statistics, accessed through a series of predefined commands. These include frame and packet statistics for the network links, packet statistics for local links, and port statistics. Diagnostic capabilities include start-up tests, local loopback tests, a pattern test that checks the output portion of the expander module, and tests to check the supervisory port. Front-panel LEDs monitor Microplexer operation.

The Microplexer X.25 PAD incorporates two features, mnemonic calling and auto connect, that facilitate the establishment of connections and provide an extra measure of security. Using the mnemonic calling feature, a terminal operator types in an easily remembered name, acronym, or word to access a specific computer. Through the auto-connect feature, designed for dedicated terminals that must always reach the same port, the Microplexer establishes a virtual circuit connection between the terminal and the port when the terminal raises the data terminal ready signal. The auto-connect feature provides security because

- ▶ • The control unit mainframe provides mounting and connectors for the main and expander modules and the power supply. Its rear panel contains data ports, one or two data links ports (depending on the model), a supervisory port, and an AC power connector.
- The expander unit mainframe provides mounting and connectors for expander modules and a power supply module. Data ports and an AC power connector are on the rear panel.
- The main module provides primary microprocessor control for data flow between expander modules and links, as well as storage for user programming, buffer storage for data, and software for supervisory port functions. Software in the main module includes CCITT X.25 Level 2 and 3 handlers and front-panel and supervisory port functions. Microprocessor programs are stored in PROM; database RAM stores configuration parameters that are selected or changed through the supervisory port. The supervisory port interface provides serial-to-parallel and parallel-to-serial data conversion, necessary for communication between the supervisory port and the main module. A link interface generates control signals and interface functions to the synchronous links.
- Expander modules include a microprocessor that controls the flow of data to and from up to four external asynchronous ports and the main module. The module also includes standard asynchronous port interfaces and data buffers. The microprocessor program is stored in PROM; port parameters and data buffers are stored in RAM. Expander module software provides CCITT X.28 and X.3 terminal-handling functions and X.29 control message functions. Front-panel control circuits activate controls and indicators on the expander module front panel and interface with the front-panel control circuits on the main module through its microprocessor.
- The power supply module provides power to the Microplexer X.25. It converts AC power to regulated +5 VDC and ±12 VDC power required by the PAD. Each module consists of separate regulator and transformer modules.

The MX81 and MX82 units provide up to 48K bytes of storage; 112K bytes are available on the MX241 and MX242 units; and the MX481 and MX482 devices support up to 208K bytes of storage. The Microplexer's database is protected by battery backup that will hold information in memory for 90 days without AC power.

Microplexers may be equipped with an optional alarm driver or internal modem. The alarm driver converts supervisory port alarm signals into relay contact closures that activate an alarm device. The internal modem provides a 2400, 4800, or 9600 bps synchronous transmission. It can be placed in any unused expander module position.

### TRANSMISSION SPECIFICATIONS

Microplexer asynchronous port speeds range from 50 to 9600 bps; computer ports can operate up to 4800 bps. The unit accommodates either one synchronous link with a maximum 19.2K bps data rate or two links with a maximum 9600 bps transmission speed on each link. Interfaces supported include CCITT X.21 bis (RS-232-C), CCITT V.24/V.28, and MIL-STD-188-114 unbalanced. Transmission mode is half- or full-duplex.

Link control on the Microplexer is synchronous X.25 Level 2 link access procedure balanced (HDLC LAPB), and link error control is accomplished through a 16-bit frame check sequence. The unit supports 5, 6, 7, or 8 data bits plus parity and 1, 1.5, or 2 stop bits. Flow control between data

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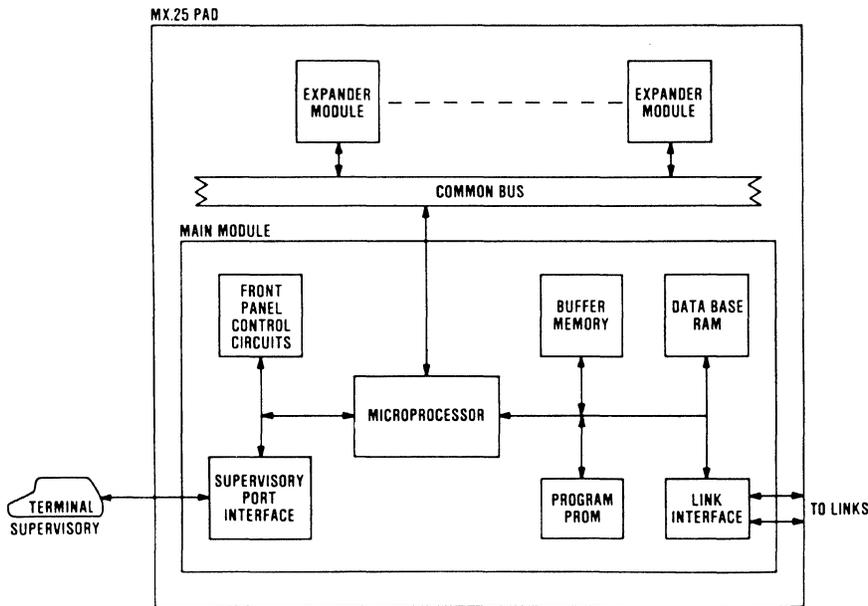


Figure 1. Main module functional block diagram. The main module and expander modules are linked via a common bus.

➤ it restricts connection to only one port and prevents any further exploration to other network destinations. Other Microplexer security features include password protection on the supervisory port, automatic disconnection after an idle time interval, and the ability to configure dial-in ports for automatic connection.

### COMPETITIVE POSITION

According to statistics published by the International Data Corporation, the PAD market is expected to grow at 30 percent until 1986, when a rapid market decline will occur as alternative products are introduced. Prices for PADs continue to fall as more vendors introduce these products and PAD functions are integrated into other devices, such as modems, or offered as add-on boards. However, as prices for PADs decline, the number of units shipped domestically will increase dramatically until the end of the decade because PAD vendors will reap the rewards of major overhauls in local data networks, in which PADs play an important part.

Presently, the U.S. PAD market is dominated by Amdahl, which has about 30 percent of the of overall market revenues, and Dynapac, with a 20 percent share. Amdahl specializes in high-end PADs that cost from \$7,000 to \$10,000, while Dynapac offers a broader line of products. In fact, Dynapac is the leading U.S. vendor for number of PADs shipped in 1984. Memotec, a Canadian PAD vendor with a large international market share, has been making increasingly strong inroads into the U.S. market, and its synchronous PAD, one of the few on the market, has given the company an edge on both domestic and international fronts. Timeplex shares third place for overall 1984 shipment revenues with GTE Telenet, each having about an 11 percent share. Other domestic vendors include Micom, Digital Communications Associates, and Cableshare. Gan-

➤ processing devices is via the EIA clear-to-send signal or in-band control signals, e.g., X-on/X-off. The Microplexer uses two types of system clocking. Each asynchronous data port uses a 5.0688MHz clock to derive the appropriate baud rate clock for receiving and transmitting data. The PAD also requires external send and receive clocks from DCE.

The Microplexer X.25 PAD is certified for use on the following public networks: Accunet, Datapac, GTE Telenet, Tymnet, and Uninet. Those interested in using the PAD on foreign or other domestic packet networks should contact Timeplex for more information concerning these applications.

### DEVICE CONTROL

The basic function of the Microplexer X.25 PAD is to provide the asynchronous-to-X.25 conversion function that allows asynchronous equipment to connect with public or private packet networks. To initiate a transmission through the network, a user at one of the asynchronous terminals attached to the PAD enters the address of a desired resource, which can be a remote device connected to the network via another Microplexer or a network-owned PAD, a local device connected to a Microplexer, or a remote computer port that contains an X.25 interface. The Microplexer handles all operations necessary to make a local connection between devices attached to it. In addition to providing PAD functions, the Microplexer also operates as a data concentrator by polling low-speed asynchronous ports for information that it constructs into data packets for transmission onto the network. Since data link rates to the network can be less than the sum of the rates of the input ports, the Microplexer concentrates the low-speed lines onto the high-speed (up to 19.2K bps) synchronous link.

➤ The Microplexer has been designed to operate according to CCITT Recommendations for packet networks. These include X.25 recommendations that define three levels of interface and protocol procedures for packet network communications; X.29 recommendations that define the control commands used by a remote host or DTE to control the local PAD and to control messages from the PAD to remote DTE; X.28 recommendations that define procedures for exchanging control information and user data between the PAD and

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Timeplex has a stronger presence in the international market than it does in the United States. The company is second only to Memotec in both total revenues for PADs and number of units shipped.

### ADVANTAGES AND RESTRICTIONS

Timeplex has designed the Microplexer to include several features that give the product a competitive edge. Connection requests to network devices are facilitated by a mnemonic name addressing feature that allows a terminal user to type in an easily remembered name or acronym to access a specific resource. This eliminates the need to manually enter a network address, which may be up to 15 digits long, each time the terminal initiates a connection request. Ease of use is also enhanced by an auto-connect feature that allows terminals that always access the same port to do so upon raising a data terminal ready signal at the interface connector or in response to a carriage return initiated by the terminal user. An added advantage of auto-connection is increased security as a terminal configured with the feature cannot support request connections to other ports in the network.

Password protection on the supervisory port and the ability to assign access codes to ports bolsters Microplexer security by preventing unauthorized personnel from accessing system commands and other resources in the network.

Microplexers with two synchronous network links provide flexibility in designing a network. The "extra" link may be used in a variety of ways: it can provide backup to the primary link, provide access to another packet network or computer, and provide the means to increase reliability by allowing the Microplexer to connect with two separate nodes of the same packet network. Users with a dual-link

start-stop mode DTE; and X.3 recommendations that define packet assembly/disassembly and the PAD's editing functions.

**ESTABLISHING CONNECTIONS:** Ports attached to the Microplexer will be configured as PVC (private virtual circuit), SVC (switched virtual circuit), autoconnect, or mnemonic calls. Users at ports connected to PVCs have a dedicated connection to another network location, and call request commands are not necessary to initiate data transfers. However, users at SVC ports will initiate calls via the call request command after ensuring that the terminal is in a service-ready state. Call requests made from a terminal are simplified by a mnemonic calling feature that allows a terminal operator to key in an easily remembered acronym, name, or word to access a desired resource. Ports also may be configured to automatically connect to a specific resource after a service request is initiated. In addition, any SVC port can be configured to transfer a call to or from another Microplexer port.

Terminals connected to the Microplexer will operate in one of three modes: offline, service ready, or data transfer. When offline, a port is temporarily unable to receive commands or transfer data. The PAD port changes this state upon receiving a service request or upon accepting an incoming call. In the service-ready mode, the PAD displays a banner and prompt in response to a service request signal. These signify that the terminal is ready to accept X.28 commands to make or transfer a call, display or set X.3 parameters, request a disconnection, or enter X.29 commands to read or set X.3 parameters in a remote device. Terminals connected to PVC ports are in data transfer mode once power is applied. When a call is established between a terminal connected to another type or port with another network device, the terminal displays a COM message signifying that the unit is in data transfer mode. Upon exiting from data transfer mode, the terminal returns to service-ready mode.

The terminal user communicates with the Microplexer PAD through an interactive terminal interface (ITI) that is functionally separate from circuitry that controls communications through the network to a remote device. The ITI is

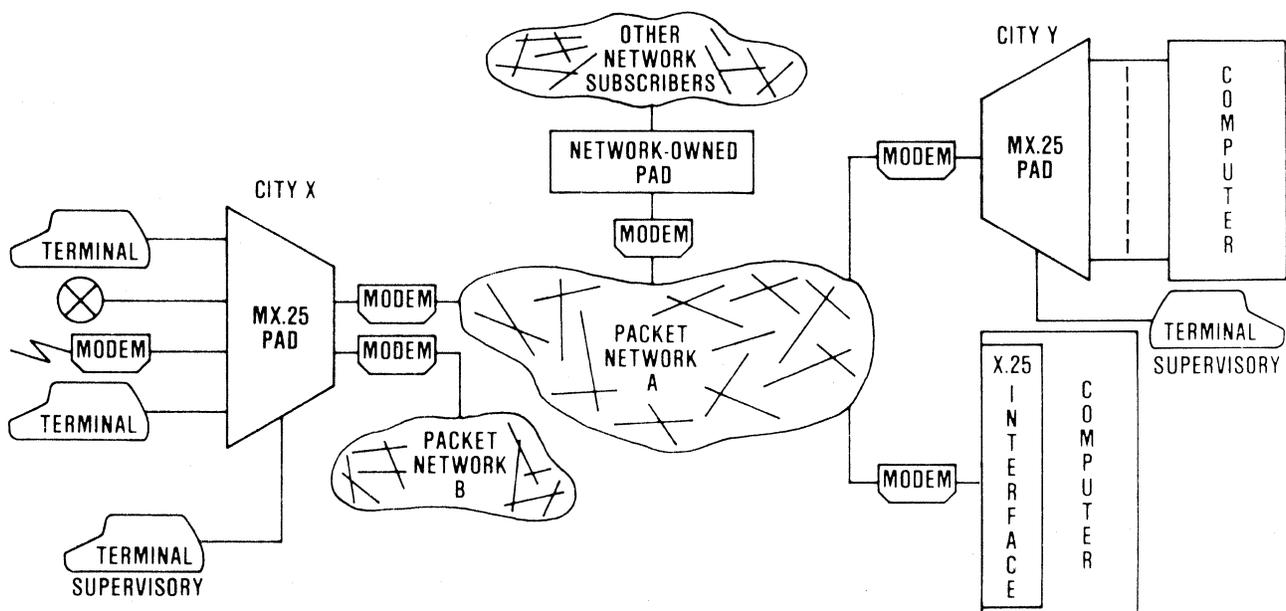


Figure 2. Typical Microplexer network application. If the unit is equipped with dual synchronous links, it can access more than one public data network.

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Microplexer have the ability to connect with two public data networks, e.g., Tymnet and Telenet, thus providing attached asynchronous equipment with more flexibility in accessing multiple resources.

Maximum transmission on the Microplexer's network link is 19.2K bps in contrast with several competing products that offer only a 9600 bps rate. The unit also offers a seven-packet window size per port, a feature that optimizes throughput by reducing the overall acknowledgment waiting during transmission sequences.

Preparing for the use of a Microplexer requires a great deal of preinstallation planning. Timeplex preprograms each unit according to specifications supplied by the customer, and if these parameters are not accurately established, the device may have to be reprogrammed. The Microplexer comes with complete documentation that, while fairly well written and organized, may be somewhat overwhelming to those without a sound knowledge of data communications. The device requires a significant amount of programming, and, therefore, requires the services of a competent technical engineer. □

divided into three sets of commands: CCITT X.28 commands, Timeplex Extended X.28 commands, and CCITT X.29 commands. The CCITT X.28 commands permit the user to set or display X.3 control parameters, to request status information, and to set up or clear a virtual circuit to another device in the network. Timeplex Extended X.28 commands are instructions that extend several X.28 commands and conventions that are only partially defined in the CCITT specification. The CCITT X.29 commands allow the user to set, set and read, and read the X.3 parameters of a destination port.

**SUPERVISORY PORT FUNCTIONS:** The supervisory port interfaces with an asynchronous ASCII terminal through which a user configures Microplexer parameters, monitors system and network link status, and initiates diagnostic tests. It is possible to configure remote Microplexers from the supervisory port of a central-site unit by cabling an input/output port to the supervisory port at each remote PAD. When ready to accept commands, the supervisory terminal displays a banner and prompt. When the supervisory port is password-protected, the user is prompted for an identification code after power is applied to the Microplexer. The user enters the code and presses the Return key. At this point, the unit is ready to accept commands. Supervisory port editing/control commands permit command line editing and control of the port.

The Microplexer's parameters are divided into five basic areas: X.3, physical, operational, system, and profile parameters. The Microplexer stores six sets (profiles) of X.3 parameters, which define the terminal interface. Profiles one and two are permanently stored, while profiles three through six are defined through the supervisory port. It is possible to temporarily change X.3 parameters for an individual port through the ITI without affecting stored profiles.

Physical parameters, i.e., additional port parameters not defined under X.3, govern a number of functions, including setting window and packet size, designating number of data and stop bits and parity, specifying interface type, selecting half- or full-duplex operation, enabling mnemonic calling and autoconnect, and so forth. Operational parameters define how the Microplexer responds to an incoming call and permit the assignment of contention groups. The device can be programmed to decline all calls, accept calls under

certain conditions, or decline incoming calls that request a reverse charge. System parameters define the Microplexer's configuration, including network and link parameters, number of ports, number of private virtual connections (PVCs) per link, number of logical channels per link, supervisory port password and access codes, the call address for each link, the type of facilities supported, as well as timers, retry counters, and link window size for the network lines. Profile parameters define the facility, mnemonic calling, and X.29 files.

Users can configure Microplexer ports into up to four contention groups. Several ports are assigned to one group, and incoming calls made to the group are directed to the first available port. A fifth contention group allows a request connection to any free port on a called Microplexer.

The Microplexer offers two types of network security features. The supervisory port can be protected by password to prevent unauthorized users from accessing system programming functions. The unit also can be programmed to allow users at selected ports to enter an access mode to initiate X.28 or X.29 commands.

**SYSTEM STATISTICS AND DIAGNOSTICS:** A variety of statistics, accessed through a series of predefined commands, are available via the supervisory port. These include Level 2 (frame) and Level 3 (packet) statistics for the network links, Level 3 statistics for the local link, and port statistics. The Microplexer provides a cumulative statistics report covering its operation from the last unit reset or Status Clear command. Microplexer diagnostic capabilities include start-up diagnostics, supervisory port diagnostics, and a supervisory port status display. Start-up diagnostics are performed automatically upon power-up or at the time of system reset, but they may be initiated at any time by pressing both front-panel Reset buttons simultaneously or by using the GO command on the supervisory terminal. Results of the start-up test are automatically stored until the next test is performed. Supervisory port diagnostics and status display are initiated through the supervisory terminal. These include a local loopback test and a pattern test that checks the output portion of the expander module.

The Microplexer's modules contain front-panel controls and indicators for initiating functions and monitoring system status. The main module front panel includes an INT Normal indicator that lights when the local PAD is operating, an INT Alarm that indicates a failure in internal hardware or software and lights during the start-up test, an EXT Carrier Fail to indicate loss of carrier on the network link, a Level 2 State indicator that lights when either or both links are not ready for data transmission, a Level 3 State indicator that lights when packet level is not ready for data transmission on either or both links, and Reset buttons that initiate a system reset or hardware and firmware tests.

The expander module's front panel includes a Normal indicator that lights when the module is on line and communicating with the main module; an Alarm indicator that lights when the expander module detects an internal failure, when the main module is inoperative, during system start-up, or when the expander module is not programmed for scanning; a Clear button that turns the Alarm indicator off; and a Test button that will initiate a reset of the expander module when simultaneously pressed with the Clear button. A reset condition initiates a hardware and firmware test and clears all data stored in the module.

The power supply module's front panel contains a Normal indicator that lights when the module is operating and an Alarm indicator that signals a failure in any regulated DC voltage output.

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► The Microplexer's rear panel contains 25-pin female connectors for interfacing asynchronous equipment, the supervisory port terminal, and the network links. On the MX48 models, two 50-pin female ribbon cable connectors link the control unit and expander unit. Other rear panel connectors and indicators include a preset voltage switch that indicates AC power line voltage, a power circuit breaker that controls the application of power to the unit and provides overload protection, an AC power connector, and a chassis ground.

### PRICING

Timeplex preprograms all Microplexer PADs according to configuration worksheets supplied by the customer at the time of ordering. Once the unit(s) is delivered, it is imperative that the customer check the unit's programming to ensure that it matches specifications entered on the worksheets.

Purchase prices (quantity one) for the Microplexer are as follows: MX81—\$1,550; MX82—\$2,150; MX241—\$2,360; MX242—\$2,960; MX481—\$2,680; and MX482—\$3,280. ■