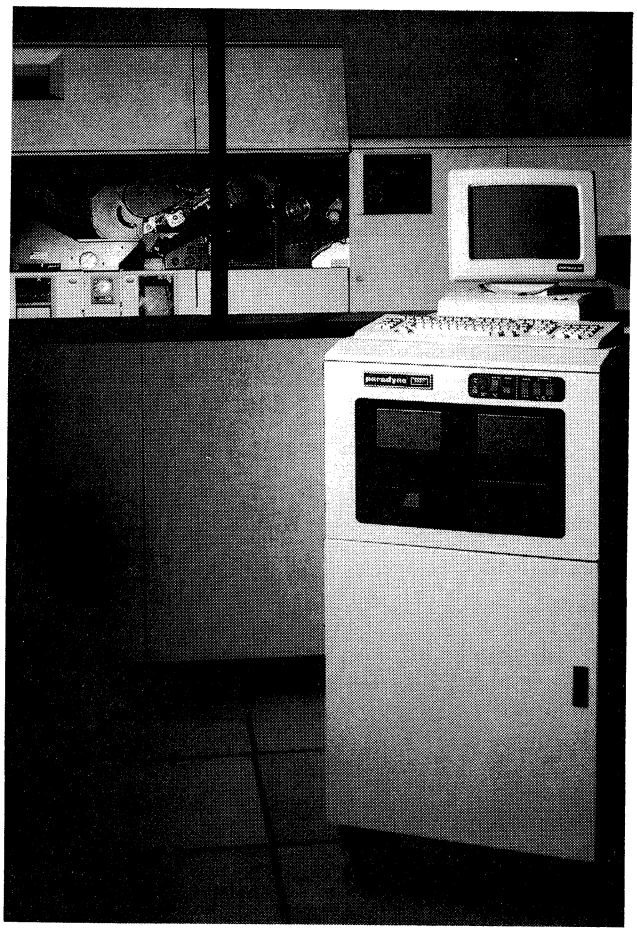
Paradyne PIXNET Communications Systems

datapro ANALYSIS

UPDATE: *Paradyne has enhanced its PIXNET line with the introduction of PIXNET/FX, a fiber optic channel extender that supports local control units located beyond the recommended channel distance via fiber optic cable. Also, the PIXNET/XL system now supports 512 terminals.*

Paradyne, by reputation an innovator in processor and modem technology, is a leading supplier of communications network equipment. Paradyne offers direct service operations throughout the United States, Canada, the United Kingdom, Japan, and Germany. The company provides a broad range of data communications and networking products that includes modems, statistical multiplexers, T1 multiplexers, network management systems, and host channel extension products.



Paradyne's PIXNET/XL system can simultaneously attach to two separate hosts and support 512 terminals.

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33541. Telephone (813) 530-2000. In Canada: Paradyne Canada Ltd., 200 Consumers Road, Fifth Floor, North York, Ontario M2J 4R4. Telephone (416) 494-0453.
MODEL(S): PIX; PIXNET; PIXNET/XL.
FUNCTION: Supports high-speed applications such as remote printing, check processing, CAD/CAM processing, and CPU-to-CPU data transfer.
HOST COMPUTERS SUPPORTED: IBM and compatible mainframes.
ARCHITECTURE SUPPORTED: Multiple processor architecture using nodes.
OPERATING SOFTWARE: Depends upon the configuration.
COMPETITION: Amdahl 4705E and 4705T, and IBM 3705 and 3725.
PRICE: Prices range from $50,000 to $150,000, depending upon the configuration.

REPORT HIGHLIGHTS PAGE

Over the last few years, the company introduced a variety of new products including PIXNET/XL, an intelligent high-speed channel extension processor; PIXNET/FX, a fiber optic channel extender; 3450 and 3470 diagnostic modems, which operate at speeds from 14.4K bps to 19.2K bps; 3056 BSU, a combined DSU/CSU for Digital Data Service up to 56K bps; FDX 2400, a 2400 bps full-duplex dial modem; and the 3230 T1 Nodal Processor for larger complex T1 networks. In addition, the company introduced Netcare, a customer service program providing technical and management services for data communication network daily operations.

PIXNET is a networking control unit that allows local peripherals in remote locations to interact with one or more computers in a "local device" access method. This channel extension technique does not require front-end

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processor hardware or software, nor does it require remote host telecommunications software, such as VTAM or BTAM.

PIXNET refers to an entire family of Paradyne products designed to support a wide range of user requirements. Communication link speeds from 4800 bps to 1.4M bytes per second are available in point-to-point configurations. Full networking functionality supports multiple hosts and/or multiple users.

The PIXNET product family consists of the following products:

PIX: A Local Control Unit (LCU), attaches to the byte multiplexer channel of an IBM or compatible mainframe to provide host attachment. A Remote Control Unit (RCU) provides the peripheral device interfaces required to support a wide range of local devices. PIX supports point-to-point configurations at speeds from 4800 bps to 56K bps.

PIXNET: A Master Network Control Unit (MNCU), provides both application and CPU switching functions for networking requirements. The MNCU supplies ports to communicate with either additional Network Control Units (NCUs) or PIX Control Units. The MNCU serves as network monitor, connecting various devices to the requested host and application, and monitors the configuration file.

PIXNET/XL: A PIXNET/XL system can simultaneously attach to two separate hosts (byte or block multiplexer channels) and support 512 terminals and high-speed devices such as Xerox 9700 and IBM 3800 laser printers. In addition, high-speed host-to-host communications can be accomplished via PIXNET/XL and IBM's CTCA without concern for IBM's normal distance limitation. A PIXNET/XL unit supports a T1 communications link, eight 56K bps links, or sixteen RS-232 links, grouped together and appearing logically as a single communications facility. Each microprocessor-based PIXNET/XL control unit can have 4 million bytes of global memory. PIXNET/XL Networking, a function of the nodal software, allows both application switching and CPU switching functions among nodes. This allows a single, remote printer to receive data from multiple hosts, or central terminals to switch sessions between hosts in various locations.

PIXNET/FX: A PIXNET/FX fiber optic channel extender lengthens the IBM (plug compatible) byte or block multiplexer channel to 1.24 miles (2 kilometers) via fiber optic cable. It maintains Paradyne's tradition of host transparency—no software or hardware modifications—while providing transmission speeds up to 1.4M bps. PIXNET/FX supports the same channel-attached devices as PIXNET/XL.

The communications links between the PIX/PIXNET control units operate synchronously, half or full duplex, at speeds to 56K bps. The communications links between the PIXNET/XL nodes operate synchronously, full duplex, at speeds up to 1.544M bps. PIXNET/XL nodes communicate by an exclusive technique called Multi-Link Protocol (MLP), which utilizes multiple communications circuits between nodes to attain a given bandwidth. For a user who needs 112K bps of bandwidth, two circuits are installed between PIXNET/XL nodes. If one of the circuits fails, the user loses only that portion of bandwidth. Graceful degradation occurs, and total bandwidth restoration occurs when the circuit comes back into service. Both RS-232 and V.35 interfaces are supported, as well as twisted pair, Telco T1 Service, microwave, satellite, coax, and fiber optic.

MARKET POSITION

The Paradyne PIXNET/XL systems perform VTAM-like functions without front-end processor expansion or multisystem networking software. Competitive communications processors that perform similar functions with appropriate software include the IBM 37X5 and the Amdahl 47X5 products.

IBM's 3737 announcement in June 1987 further validated the channel extension technology developed by Paradyne. The IBM 3737, a wide area channel extender, provides host-to-host communications. PIXNET/XL supports not only VTAM-CTC, but native JES2, JES3, and RSCS as well. For communications between hosts in different SNA networks, Paradyne's software, XL/XPRESS, provides bidirectional data transfer at speeds above those of front-end processors.

PRODUCT EVALUATION

Paradyne's PIXNET/XL system offers one major advantage: VTAM-like switching functions, enabling users to switch from one application to another without the expense and complexity of adding VTAM, TCAM, or BTAM software to the host. In addition, NCP is not required in the front end, therefore eliminating the need for additional front-end processors, equipped with NCP software, to support remote terminals. Unlike traditional front-end processors, PIXNET/XL supports high-speed laser printers, item processors, tape drives, card readers, and punches.

The PIX and PIXNET systems use Paradyne's version of IBM's Synchronous Data Link Control (SDLC) protocol. Data compression/compaction techniques enhance high-speed line efficiency; built-in error control and recovery procedures are standard.

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PIXNET/XL utilizes an X.25-like HDLC communication method between nodes. This bit-oriented, full-duplex protocol packages data into packets for transmission to other nodes. Packet sizes vary from 512 to 4K bytes depending on devices supported and throughput requirements. The frame control procedures reflect the CCITT X.25 LAPB standard. Multi-Link Protocol (MLP) software allows PIXNET/XL to utilize 16 communications lines as one transmission group. Sixteen lines or T1 ports may be connected in parallel. If a link fails, traffic is automatically retransmitted using other available links until the problem link becomes operational.

Transparency enhances the PIXNET/XL advantage. Its communications functions are transparent to both the user and the host(s); the system sees various peripherals as local devices, addresses them individually, and achieves virtual simultaneous operation.

The PIXNET RCU replaces an IBM-compatible device controller (e.g., an IBM 3274 terminal controller) when Paradyne peripherals and CRTs are used. PIXNET system users must configure all applicable device controllers, used in a traditional IBM environment, when non-Paradyne devices are required.

SPECIFICATIONS

DATE OF ANNOUNCEMENT: PIX—March 1976 (as PIX I); PIXNET—fourth-quarter 1979; PIXNET/XL—December 1984; PIXNET/FX—November 1987.
DATE OF FIRST DELIVERY: PIX—April 1976 (as PIX I); PIXNET—February 1980; PIXNET/XL—March 1985; PIXNET/FX—December 1987.
NUMBER DELIVERED TO DATE: Over 6,000.
SERVICED BY: Paradyne Corporation.

CONFIGURATION

The Local Control Unit (LCU) and the Remote Control Unit (RCU) comprise the primary components of the PIXNET/XL virtual data link system. The design is flexible; each node can be configured to serve as both an LCU and an RCU simultaneously.

The LCU is co-located with the host computer and connects to the clock or byte multiplexer channel of an IBM System/360, 370, 303X, 308X, 309X, 4300, or compatible computer. Simple sign-on/sign-off procedures direct application switching. Multiple LCUs can attach to the same mainframe, or multiple mainframes can attach to the same LCU. An LCU-to-LCU configuration, utilizing IBM's CTCA or Paradyne's XL/XPRESS software, facilitates host-to-host communications.

The RCU, positioned remotely from the host, supports remote devices. A synchronous link of 4800 bps to 2,048M bps between the RCU and LCU provides host communication. Multiple RCUs connect to a single LCU, or multiple LCUs connect to a single RCU.

The PIXNET products allow remote peripherals to communicate with the host as if they were channel connected. Each peripheral has its own system address, and communications are interrupt driven. The system, a virtual data link, provides a transparent interface between the host and remotely located card readers/punches, line printers, laser printers, magnetic tape units, and clustered CRTs/printers emulating 3270s. Paradyne's own line of peripherals or IBM peripherals (or compatibles) can be used.

In addition to the microprocessor and memory, each control unit comes equipped with a control panel, a cassette or diskette and fixed disk drives for program loading, a terminal for network management, and various communications adapters. The communications lines use external modems or T1 multiplexers, also manufactured by Paradyne and supplied as part of the system, if desired.

The Networking Release 1 software provides both CPU and application switching; multisystem networking software is not necessary.

TRANSMISSION SPECIFICATIONS

The PIX and PIXNET systems use Paradyne's version of IBM's Synchronous Data Link Control (SDLC) with control and recovery techniques to provide transmission between control units at standard rates of 4800 bps to 56K bps. High-speed satellite transmission has been used with PIX systems with no time delay problem. In fact, some users have reported response time improvements using PIX/PIXNET. Interfaces supported are RS-232 and V.35.

The PIXNET/XL system uses HDLC protocol, providing transmission between control units at speeds of 9600 bps to T1 rates. By using Paradyne's proprietary Multi-Link Protocol (MLP) software, 16 lines configure as one transmission group. The traffic load will be routed through available links to meet the application's bandwidth. If a link fails, the system loses no data and requires no operator intervention. When the line is restored, the links again share traffic.

PIXNET/FX uses fiber optic cables to extend the IBM byte or block multiplexer channel to 1.24 miles (2 km.) at a maximum data transfer rate of 1.4 million bytes per second.

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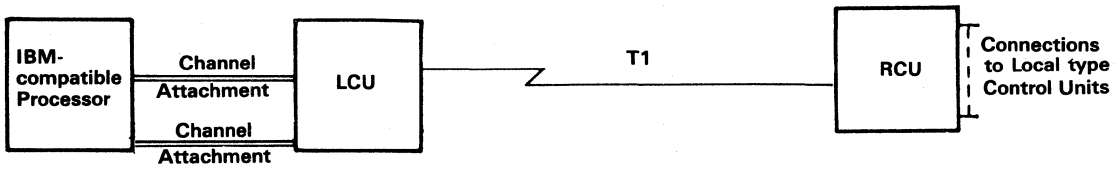
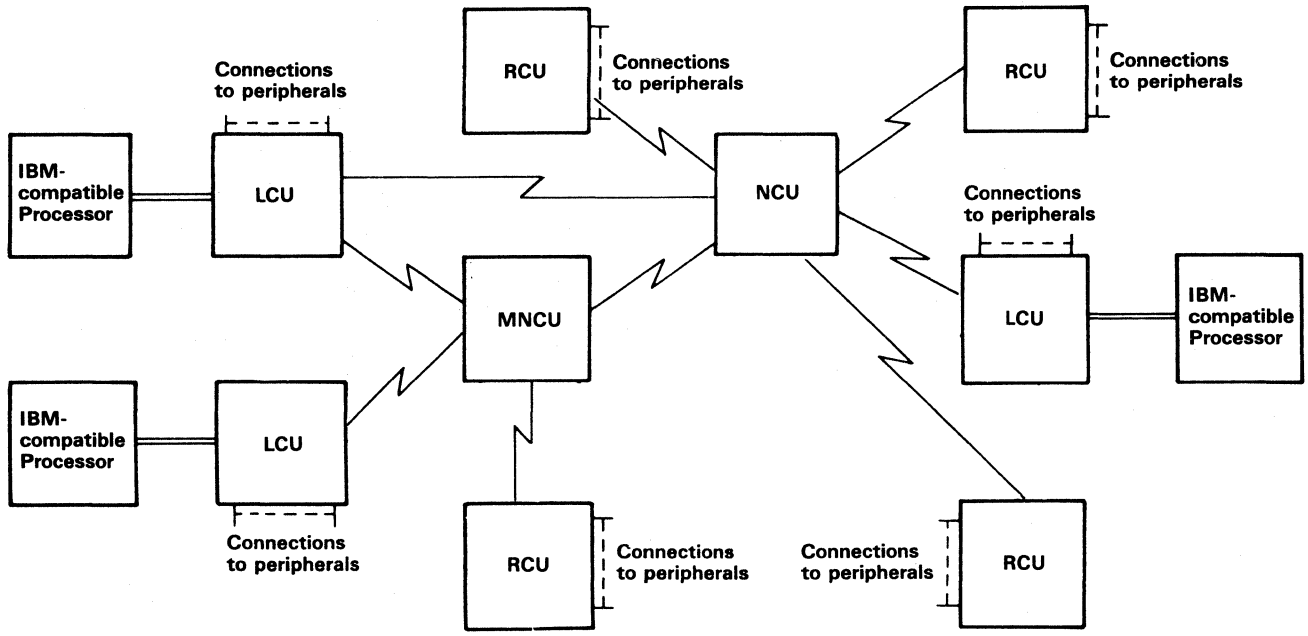
Configuration

Typical PIXNET/XL (Point-to-Point)



Typical PIXNET (Multihost Network)



Maximum number of addressable devices per PIXNET system is limited only by line speed and throughput considerations.
Maximum number of other control units directly attachable to NCU is 13.
Maximum number of devices (peripherals or other control units) directly attachable to LCU depends on types of devices and line speeds.

SOFTWARE

Paradyne provides control unit software for configuration requirements. Code is resident in memory and consists of modules for each connected device type. One module type supports multiple devices of the same type. Paradyne provides off-the-shelf software and firmware for various applications.

Because the host sees all devices as local devices, they can run with, but do not require, telecommunications access methods such as BTAM, QTAM, TCAM, or VTAM. The LCU simulation of the multiplexer channel/peripheral interface operates under any IBM operating system. Remote site telecommunications software is eliminated. Terminals running under existing IBM and compatible software systems are supported, including IMS, CICS, TSO, GBASwift, Environ/1, Westi, and Roscoe.

The PIXNET systems also offer Remote Console Support (RCS), which provides operators with functionally equivalent facilities currently available to Remote Job Entry (RJE) terminal operators, via Paradyne's RCS software. The system supports DOS/VSE/POWER, MVS/JES2, and OS/HASP. PIXNET systems operate under all IBM and compatible spooling systems including DOS/POWER, VS/POWER, POWER/VS, GRASP, GRASP/VS, SPRINT, ASAP, ESF, THE SPOOLER, HASP, JES, JES2, and JES3.

Paradyne's software product XL/XPRESS provides high-speed bidirectional data transfer for IBM (or compatible host-to-host communications). Combined with PIXNET/

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XL, XL/XPRESS transfers large volumes of data between hosts in multiple locations at T1 and greater rates.

XL/XPRESS is not a file transfer package, but rather a transport mechanism. Customers are responsible for providing VTAM file transfer applications. XL/XPRESS must be installed as a VTAM application. Since XL/XPRESS is completely transparent, no modifications to the operating system, VTAM, or VTAM application software are necessary.

XL/XPRESS supports the following applications: high-speed data transfer within an SNA network and between multiple SNA networks; transfer of data requiring speeds higher than those achievable through traditional approaches; simultaneous cross-domain terminal traffic and bulk data transfer between sites.

PERIPHERALS

The following IBM peripheral devices are supported:

Card Readers—IBM 2501, 2520, 2540 (via 2821), 3505.
Line Printer—IBM 1403 (via 2821), 3211 (via 3811), 3203/5, 4245, 4248.
Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).
Check Sorter—IBM 3890.
CRTs/Printers—IBM 3270: 3278, 3279, 3284, 3285, 3286, 3287, 3288, 3289, etc. (via 3274-1A/aB/1D, 3174-1L).
Laser Printer—IBM 3800 (Models 1, 2, 3, 6, and 8), 3827, 3835.
Magnetic Tape—IBM 3420 (800/1600/6250 bpi).

Other devices supported include Xerox, Siemens, Datagraphix, and STC laser printers, Kodak Komstar and Datagraphix output-microfilm devices, IBM CTCA, IBM Token Ring, asynchronous terminals, personal computers, and various digital plotters.

PRICING

The PIXNET and related peripherals can be purchased or are available on various lease plans. Pricing for a PIXNET communications system is between $50,000 and $120,000, depending upon the configuration. Paradyne directly services all products through a nationwide service organization. A national dispatch center operates 24 hours a day, seven days a week. □

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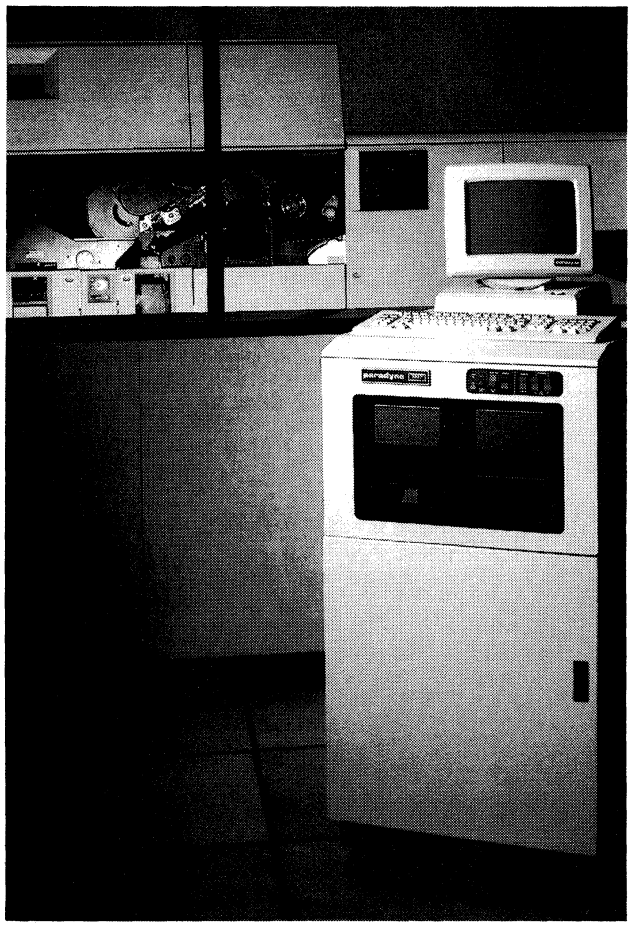
MANAGEMENT SUMMARY

UPDATE: *Since this report was last updated, Paradyne has increased the amount of global memory of the PIXNET Control Unit from 2 to 3.5 million bytes. The number of terminals supported by the PIXNET/XL systems has also been increased from 256 to 384 terminals. We also talked to several PIXNET users to get their reactions to the systems.*

Paradyne, based in Largo, Florida, is a leading supplier of communications network equipment. It has a reputation of being an innovator and leader in modem technology. Paradyne offers direct service operations throughout the United States, Canada, the United Kingdom, Japan, and Germany. The company provides a broad range of data communications and networking products that include modems, data encryption devices, multiplexers, network management systems, distributed data processing systems, communications networks, packet switches, intelligent terminal controllers, and peripherals. The peripherals include such items as terminals and printers. Over the last ➤



Paradyne's PIXNET/XL allows remote peripherals to function as if they were in the same room with the host. This system supports up to 384 terminals.

The PIXNET line of communications processors are virtual data link systems that permit remote peripherals to operate as if they were in the same room with the host computer. Control units are used to access the multiplexer channel of an IBM-compatible host for a wide variety of peripherals, including line printers, magnetic tape units, 3270-type CRT clusters, laser printers, and CAD/CAM devices. Multiple host switching and application switching within a host are supported. In addition, host-to-host communications is supported using IBM's CTC functionality. The systems are transparent, and do not require hardware or software modifications. Front-end hardware/software and host telecommunications access methods, such as TCAM or VTAM, are also not required.

FUNCTION: Supports high-speed applications such as remote printing, check processing, CAD/CAM processing, and CPU-to-CPU data transfer.
HOST COMPUTERS SUPPORTED: IBM and compatible mainframes.
ARCHITECTURE SUPPORTED: Multiple processor architecture using nodes.
OPERATING SOFTWARE: Depends upon the configuration.
COMPETITION: Amdahl 4705E and 4705T, and IBM 3705 and 3725.
PRICE: Prices range from $50,000 to $150,000, depending upon the configuration.

CHARACTERISTICS

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33541. Telephone (813) 530-2000. In Canada: Paradyne Canada Ltd., 200 Consumers Road, Fifth Floor, North York, Ontario M2J 4R4. Telephone (416) 494-0453.

DATE OF ANNOUNCEMENT: PIX—March 1976 (as PIX I); PIXNET—4th quarter 1979; PIXNET/XL—December 1984.

DATE OF FIRST DELIVERY: PIX—April 1976 (as PIX I); PIXNET—February 1980; PIXNET/XL—March 1985.

NUMBER DELIVERED TO DATE: Over 6,000.

SERVICED BY: Paradyne Corporation.

CONFIGURATION

The primary components of a PIXNET virtual data link system are the Local Control Unit (LCU), the Remote Control Unit (RCU), and, for PIXNET systems, the Master ➤

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few years, the company introduced a variety of new products including the PIXNET/XL, a high-speed communications processor; various VHS modems, which operate at speeds from 14,400 bps to 19,200 bps; the Analysis 550, a network management system; PDX Messenger, a multifunction communications workstation; HDX 12000, a 12,000 bps dial modem; and FDX 2400, a 2400 bps full-duplex modem.

PIXNET is a virtual data link communications system that allows local and remote peripherals to interact with one or more computers in a "local device" access method. This "channel extension" technique does not require front-end hardware or software, nor does it require remote host telecommunications software. In fact, there are no required host modifications, thus making its host operating system independent.

PIXNET refers to an entire family of Paradyne products designed to support a wide range of user requirements. A range from 4800 bps communication links to full T1 speeds is supported in point-to-point configurations. When multiple hosts and multiple remote users are involved, full networking functionality is provided.

PIXNET includes a variety of microprocessor-based control units which are configured for each user. A Local Control Unit (LCU) attaches to the multiplexer channel of an IBM or compatible mainframe to provide the host attachment. A Remote Control Unit (RCU) provides the peripheral device interfaces required to support a wide range of "local device" support. When networking is required, a Master Network Control Unit (MNCU) provides the user with the ability to have both applications and CPU switching functions. When extremely high communications speeds are required, a PIXNET/XL unit is capable of supporting a T1 communications link or up to eight 56KB links as a single communications facility. Each PIXNET control unit is microprocessor-based and has up to 3.5 million bytes of global memory.

Peripheral devices can attach directly to either the LCU or the RCU. The Master Network Control Unit supplies "ports" to communicate with either additional NCUs or PIX Control Units. The MNCU serves as the network monitor, connecting various devices to the correct host and application requested, and monitors the configuration file.

A PIXNET/XL system is capable of attaching simultaneously to two separate channels and can support up to 384 terminals. High-speed devices such as Xerox 9700 and IBM 3800 laser printers are also supported. In addition, high-speed host-to-host communications can be accomplished via XL and IBM's CTCA without concern for the normal distance limitation imposed by IBM.

Most devices capable of direct channel attachment can be supported through PIXNET. In addition, Paradyne offers a full line of peripherals which include CRTs, printers, and magnetic tape units which directly attach to PIXNET without the standalone controller requirement.

Network Control Unit (MNCU). Each control unit is microprocessor-based.

The LCU is co-located with the host computer and can connect to the multiplexer channel of an IBM 360, 370, 303X, 308X, 309X, 4300, or compatible computer. Applications switching is done using simple sign-on/sign-off procedures. Multiple LCUs can be connected to the same mainframe. Computer-to-computer communications can be facilitated by an LCU-to-LCU link utilizing IBM's CTCA.

The RCU is positioned remotely from the host and connects to the host via an LCU. RCU-to-RCU and RCU-to-MNCU links can also be established. The link between two control units is synchronous at rates of between 4800 and 1.544M bps. Multiple RCUs/MNCUs can be connected to an LCU, and multiple RCUs can be connected to an MNCU. The RCU can connect to only one other control unit, establishing a point-to-point connection. The MNCU has up to 13 ports available for connection of other control units, and provides capabilities for multiple-host switching and selection of applications within a host. Routing is done automatically by the MNCU, which also balances the network using dynamic line utilization statistics and associated line weighing factors, and provides backup for line failure.

The PIXNET system allows remote peripherals to communicate with the host as if they were directly connected. Each peripheral has its own system address and communications are interrupt driven. The system is a virtual data link and provides a transparent interface between the host and remotely located card readers/punches, line printers, magnetic tape units, and clustered CRTs/printers emulating 3270s. Paradyne has its own line of peripherals, or IBM peripherals can be used.

In addition to the microprocessor and memory, each control unit is equipped with a control panel, a cassette or floppy disk drive for program loading, and various adapters to interface the CPU, communications lines, and peripherals. The communications lines use external modems, which are manufactured by Paradyne and can be supplied as part of the system. Each peripheral port provides for direct memory access to its control unit. An LCU, in addition to its attachment to the host, can support a number of local card readers, CRTs, and line printers, which normally interface directly to the multiplexer channel, saving a control unit position on the multiplexer channel. The RCU is physically capable of connecting a variety of peripherals, and the MNCU provides 13 ports for connection of control units. The maximum number of connections that can actually be handled is established by throughput, which is difficult to calculate even when the high-speed line rate is known because the controllers use data compression techniques.

TRANSMISSION SPECIFICATIONS

Transmission between control units is synchronous at standard rates of 4800 bps to 1.544M bps. Transfer is usually full-duplex, but can be half-duplex. Paradyne's Synchronous Data Link Control protocol (SDLC) is used with Go-Back-N error control and recovery techniques. High-speed satellite transmission has been used with PIX systems, and time delay is not a problem. In fact, some users have reported response time improvements using PIXNET.

SOFTWARE

The software in the control units is provided by Paradyne for the required configuration. Code is resident in memory and consists of modules for each type of connected device. One module type supports multiple devices of the same type. Paradyne has "off-the-shelf" software and firmware for the various applications.

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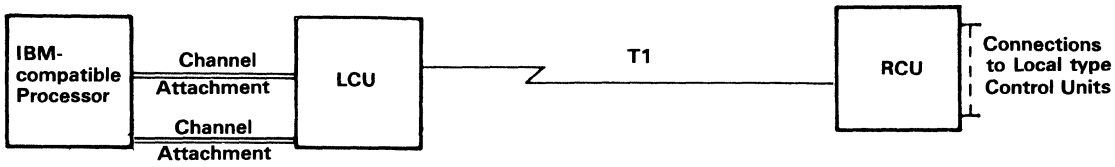
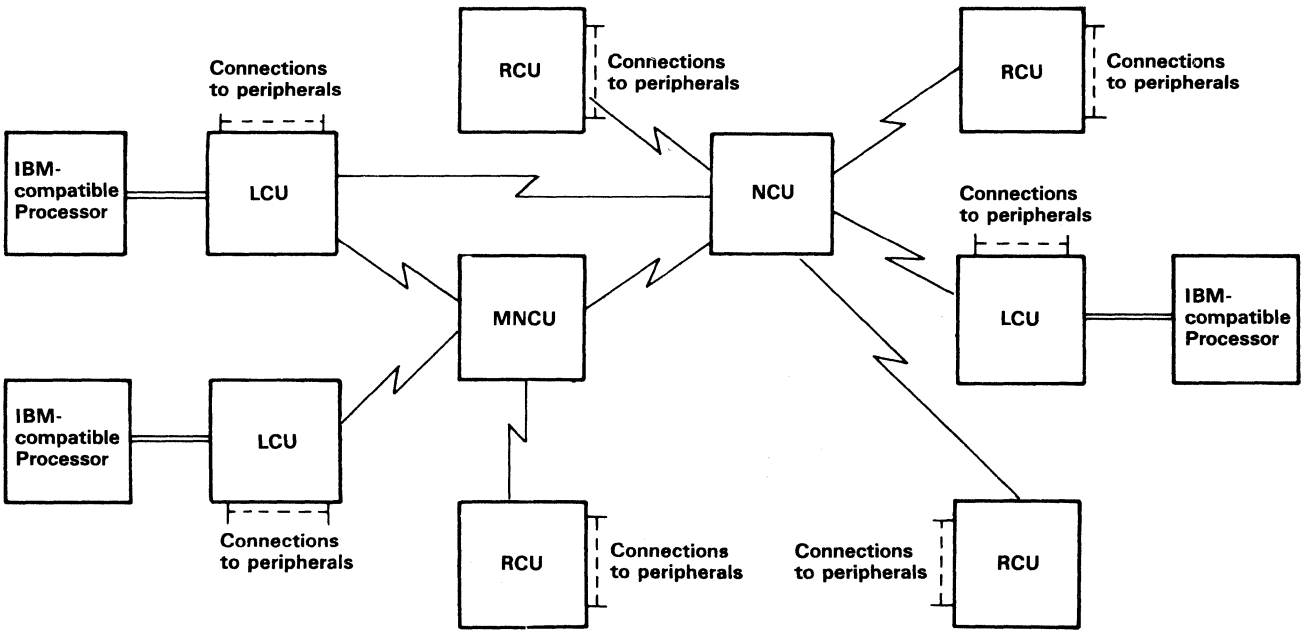
Configuration

Typical PIXNET/XL (Point-to-Point)



Typical PIXNET (Multihost Network)



Maximum number of addressable devices per PIXNET system is limited only by line speed and throughput considerations.
Maximum number of other control units directly attachable to NCU is 13.
Maximum number of devices (peripherals or other control units) directly attachable to LCU depends on types of devices and line speeds.

The communications link between the control units operates synchronously, half- or full-duplex, at speeds up to 1.544M bps.

COMPETITIVE POSITION

The Paradyne PIXNET systems have a unique ability to do VTAM-like functions without needing remote VTAM software in the host. Other communications processors that perform similar functions with appropriate software such as remote VTAM running in the host include the IBM 3705 and 3725, and the Amdahl 4705 and 4705E.

With a maximum memory capacity of 3.5 million bytes, each individual PIXNET/XL Control Unit has more memory than an IBM 3705-80 (which has 256K bytes), an IBM 3705-II (which has 512K bytes), or an IBM 3725 (which has

The host software is unaware of the communications lines or foreign peripherals and therefore requires no telecommunications access method, such as BTAM, QTAM, TCAM, or VTAM. The LCU simulation of the multiplexer channel/peripheral interface will operate under any IBM operating system.

Remote site telecommunications software is eliminated. Terminals running under most existing IBM and compatible software systems are supported, including IMS, CICS, TSO, GBASwift, Environ/1, Westi, Roscoe, and others.

The PIXNET systems also have a Remote Console Support (RCS) feature that allows remote operators to use the same type of facilities currently available to Remote Job Entry (RJE) terminal operators. The necessary RCS software is provided by Paradyne. RCS is designed to interface with unmodified IBM operating system software. It will operate with 3270-type CRT consoles. RCS provides facilities that are functionally equivalent to those available to the RJE

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2M bytes). As a front-end processor, a PIXNET/XL is channel-attachable to two hosts; the IBM 3705-II is channel-attachable to up to four hosts; Amdahl 4705E is channel-attachable to up to six hosts; and the IBM 3725 serves up to eight. As a remote line concentrator, a PIXNET/XL unit serves multiple hosts, as do the IBM 3725 and the Amdahl 4705E and 4705T.

ADVANTAGES AND RESTRICTIONS

A major advantage of a Paradyne PIXNET system is that its hardware capabilities provide VTAM-like switching functions, enabling users to switch to different applications without the expense and complexity of adding VTAM, TCAM, or BTAM software to the host computer. In addition, NCP is not required in the front end. The PIXNET system uses a Paradyne version of IBM's Synchronous Data Link Control (SDLC) protocol, and thus also provides the advantages of SNA. Data compression/compaction techniques are used to enhance high-speed line efficiency, and built-in error control and recovery procedures are standard.

Another PIXNET advantage is its transparency. The communications functions of PIXNET are transparent to the user and the host(s); all operations with the various peripherals proceed as if they are local devices. Each peripheral is addressed individually, and virtual simultaneous operation is achieved.

Other advantages include reduced line costs because the concentration capabilities of the system require only one line to the host, and remote job entry accommodated by specialized software/firmware.

The PIXNET RCU can be used to replace an IBM-compatible device controller (e.g., an IBM 3274 terminal controller) when Paradyne peripherals and CRTs are used. Users of the PIXNET system must configure all applicable device controllers, used in a traditional IBM environment, when non-Paradyne devices are required.

USER REACTION

Paradyne provided Datapro with a list of users to contact for a user reaction. We were able to talk with two users of the PIXNET/XL system. One user also had the PIXNET system installed. The length of time that the systems had been installed ranged from seven months to two-and-a-half years.

The users had the PIXNET/XL system because of its unique ability to allow remote and local peripherals to interact with one or more hosts in a "local access" method. Front-end hardware or software is not required, nor is remote host telecommunications software for this "channel extension" technique.

In asking these users to rate their systems for Overall Performance, the responses ranged from Fair to Excellent. The user who gave the Fair rating did so because of continuing problems that he was having with the system's tape drive support. Good was given for Ease of installation, Ease of Operation, and Ease of Expansion. Hardware Reliability ratings were rated Good and Very Good, with this user stating that he had never had one problem with the XL. Quality of Manufacturer's Software and Firmware got a Fair and a Good with the Fair coming from the man who had problems with the tape drive. Good was also given to the Quality of Manufacturer's Maintenance Service and Technical Support. Both men felt that when they had contacted Paradyne with problems, the company was responsive to them.

Both users were involved in the decision to go with Paradyne. They gave the following reasons for choosing PIX-

terminal operator. Support is provided for DOS/VS/POWER, MVS/JES2, and OS/HASP. PIX operates under all IBM and compatible spooling systems including DOS/POWER, VS/POWER, POWER/VS, GRASP, GRASP/VS, SPRINT, ASAP, ESF, THE SPOOLER, HASP, JES, and JES2.

In conjunction with the MNCU, PIXNET's Administrator Console software provides for network control, including session establishment, configuration control, configuration testing and reporting, and statistics gathering and status reporting.

PERIPHERALS

The following IBM peripheral devices are supported:

Card Readers—IBM 2501, 2520, 2540 (via 2821), 3505.
Line Printer—IBM 1403 (via 2821), 3211 (via 3811), 3203/5, 4245, 4248.
CAD/CAM—IBM 5080, 3250.
Page Printers—IBM 3800.
Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).
Check Sorter—IBM 3890.
CRTs/Printers—IBM 3270: 3278 (via 3274-1A/1B/1D), 3284, 3286, 3288, 3285, 3287, 3289, etc.

The following Paradyne peripheral devices are supported:

Line Printers—400 lpm, 900 lpm, 1200 lpm.
Page Printer—60 pages/minute.
Magnetic Tape—1600 to 6250 bpi.
CRT Operator Console—1,920-character screen (3270 type).
Paradyne Display System (PDX)—functional replacements for IBM 3270 displays, printers, and controllers.

Other devices supported are:

Xerox 8700, 9700 laser printer, Kodak Komstar computer output-microfilm device, Siemens laser printer, IBM CTCA, asynchronous terminals, personal computers, and various digital plotters.

PRICING

The PIXNET and related peripherals can be purchased or are available on various lease plans. Pricing for a PIXNET communications system is between $50,000 and $150,000, depending upon the configuration. Paradyne directly services all of their products through a nationwide service organization. A national dispatch center operates 24 hours/day, seven days a week. ■

Paradyne PIXNET Communications Systems

NET/XL: the system was flexible; applications met their needs; there are no software requirements on the mainframe; and the system was not distance dependent for degradation, i.e., distance did not effect the performance. Both users had looked at Network Systems' HYPERchannel, but felt that PIXNET/XL best suited their needs.

When asked for advantages or disadvantages of the system, one user stated that "it is a unique system and serves a specific purpose that you either need or you don't." The other user felt that PIXNET/XL lived up to its specs and speeds. In discussing disadvantages, the tape drive issue was brought up. This user said that the tape drive was not a Paradyne product, but one used by the company, and Paradyne was trying to get the vendor to fix the problem. The other user is planning on installing the tape drive system, but did not like the idea of being forced to use the unit provided by Paradyne. Users cannot go out and get one from another vendor. Another problem, although not specifically related to Paradyne, is that this system complicates the data processing environment by introducing additional vendors' hardware and software that makes problem resolution more difficult. He went on to say that it was something that had to be put up with if one wanted the capabilities offered by PIXNET/XL.

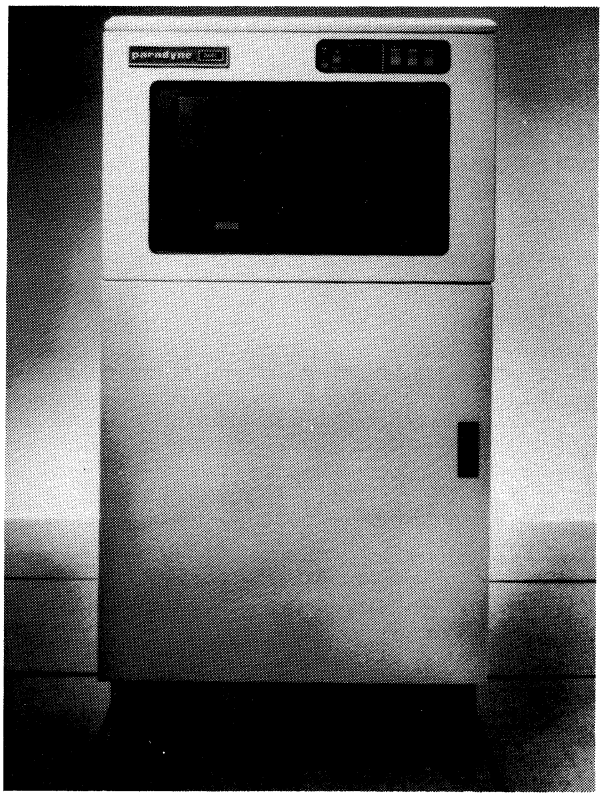
In asking if these users had any advice for potential buyers, one user commented that "it is important to know exactly what you will be running on the system before it is installed; if you change your plans, the specs will also have to be changed by Paradyne." Users should not assume that all devices are the same or that they will fit the specs (or parameters) set up by Paradyne. Paradyne has to make software changes, so users should be certain about their plans. When asked if they would recommend this system to others, one user gave an enthusiastic "Absolutely," while the other user said yes. □

Paradyne PIXNET Communications Systems

MANAGEMENT SUMMARY

UPDATE: *This report is being updated to reflect changes in Paradyne's PIXNET Communications Systems line of products. Paradyne has added the PIXNET/XL to its line of communications processors, deleted the Integrated Communications Processor as one of the PIXNET components, and changed the Network Control Unit to the Master Network Control Unit. These additions and changes are reflected in this updated report.*

Paradyne Corporation, based in Largo, Florida since 1969, is a worldwide supplier of communications networks. The company has direct service operations throughout the United States, Canada, the United Kingdom, Japan, and Germany. Paradyne offers a wide range of data communications and networking products that include the following: modems, data encryption devices, multiplexers, network management systems, distributed data processing systems, communications networks, packet switching, intelligent terminal controllers, and peripherals. The peripherals include such items as terminals, printers, card readers, and disk drives. Over the past year, Paradyne has introduced various new products such as the PIXNET/XL, a high-speed communications processor; various VHS modems, which operate at speeds from 14,400 bps to 19,200 bps; the Analysis 550, a network management system; PDX Mes- ➢



Paradyne's PIXNET-XL system extends the block or byte multiplexer channel of IBM mainframes to connect remote high-speed devices.

Paradyne's PIXNET is a virtual data link system that allows remote peripherals to operate as if they were in the same room with the host computer. Various control units provide access to the multiplexer channel of an IBM-compatible host for a wide variety of peripherals, including card readers, magnetic tape units, line printers, and 3270-type CRT clusters. Multiple host switching and application switching within a host are supported. The system is transparent, and no hardware or software modifications are required. Front-end hardware/software and host telecommunications access methods, such as TCAM or VTAM, are not required.

FUNCTION: May support high-speed applications such as remote printing, check processing, CAD/CAM processing, and CPU-to-CPU data transfer.
HOST COMPUTERS SUPPORTED: IBM and compatible mainframes.
ARCHITECTURE SUPPORTED: Multiple processor architecture using nodes.
OPERATING SOFTWARE: Depends upon the configuration.
COMPETITION: Amdahl 4705E and 4705T, and IBM 3705 and 3725.
PRICE: Prices range from $50,000 to $150,000, depending upon the configuration.

CHARACTERISTICS

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33540. Telephone (813) 530-2000. In Canada: Paradyne Canada Ltd., 200 Consumers Road, Fifth Floor, North York, Ontario M2J 4R4. Telephone (416) 494-0453.

DATE OF ANNOUNCEMENT: PIX—March 1976 (as PIX I); PIXNET—4th quarter 1979; PIXNET/XL—December 1984.

DATE OF FIRST DELIVERY: PIX—April 1976 (as PIX I); PIXNET—February 1980; PIXNET/XL—March 1985.

NUMBER DELIVERED TO DATE: Over 5,000.

SERVICED BY: Paradyne Corporation.

CONFIGURATION

The primary components of a PIXNET virtual data link system are the Local Control Unit (LCU), the Remote Control Unit (RCU), and, for PIXNET systems, the Master Network Control Unit (MNCU). Each control unit is microprocessor-based.

The LCU is co-located with the host computer and can connect to the multiplexer channel of an IBM 360, 370, ➢

Paradyne PIXNET Communications Systems

senger, a multifunction communications workstation; HDX 12000, a 12,000 bps dial modem; and FDX 2400, a 2400 bps full-duplex modem.

PIXNET is a virtual data link communications system that allows local and remote peripherals to interact with one or more computers in a "local device" access method. This "channel extension" technique does not require front-end hardware or software, nor does it require remote host telecommunications software. In fact, there are no required host modifications, thus making its host operating system independent.

PIXNET refers to an entire family of Paradyne products designed to support a wide range of user requirements. A range from 4800 bps communication links to full T1 speeds is supported in point-to-point configurations. When multiple hosts and multiple remote users are involved, full networking functionality is provided.

PIXNET includes a variety of microprocessor-based control units which are configured for each user. A Local Control Unit (LCU) attaches to the multiplexer channel of an IBM or compatible mainframe to provide the host attachment. A Remote Control Unit (RCU) provides the peripheral device interfaces required to support a wide range of "local device" support. When networking is required, a Master Network Control Unit (MNCU) provides the user with the ability to have both applications and CPU switching functions. When extremely high communications speeds are required, a PIXNET/XL unit is capable of supporting a T1 communications link or up to eight 56KB links as a single communications facility. Each PIXNET control unit is microprocessor-based and has up to two million bytes of global memory.

Peripheral devices can attach directly to either the LCU or the RCU. The Master Network Control Unit supplies "ports" to communicate with either additional MNCUs or PIX Control Units. The MNCU serves as the network monitor, connecting various devices to the correct host and application requested, and monitors the configuration file.

A PIXNET/XL system is capable of attaching simultaneously to two separate channels and can support up to 256 terminals. High-speed devices such as Xerox 9700 and IBM 3800 laser printers are also supported. In addition, high-speed host-to-host communications can be accomplished via XL and IBM's CTCA without concern for the normal distance limitation imposed by IBM.

Most devices capable of direct channel attachment can be supported through PIXNET. In addition, Paradyne offers a full line of peripherals which include CRTs, printers, and magnetic tape units which directly attach to PIXNET without the standalone controller requirement.

The communications link between the control units operates synchronously, half- or full-duplex, at speeds up to 1.544M bps.

303X, 308X, 4300, or compatible computer. Applications switching is done using simple sign-on/sign-off procedures. Multiple LCUs can be connected to the same mainframe. Computer-to-computer communications can be facilitated by an LCU-to-LCU link utilizing IBM's CTCA.

The RCU is positioned remotely from the host and connects to the host via an LCU. RCU-to-RCU and RCU-to-MNCU links can also be established. The link between two control units is synchronous at rates of between 4800 and 1.544M bps. Multiple RCUs/MNCUs can be connected to an LCU, and multiple RCUs can be connected to an MNCU. The RCU can connect to only one other control unit, establishing a point-to-point connection. The MNCU has up to 13 ports available for connection of other control units, and provides capabilities for multiple-host switching and selection of applications within a host. Routing is done automatically by the MNCU, which also balances the network using dynamic line utilization statistics and associated line weighing factors, and provides backup for line failure.

The PIXNET system allows remote peripherals to communicate with the host as if they were directly connected. Each peripheral has its own system address and communications are interrupt driven. The system is a virtual data link and provides a transparent interface between the host and remotely located card readers/punches, line printers, magnetic tape units, and clustered CRTs/printers emulating 3270s. Paradyne has its own line of peripherals, or IBM peripherals can be used.

In addition to the microprocessor and memory, each control unit is equipped with a control panel, a cassette or floppy disk drive for program loading, and various adapters to interface the CPU, communications lines, and peripherals. The communications lines use external modems, which are manufactured by Paradyne and can be supplied as part of the system. Each peripheral port provides for direct memory access to its control unit. An LCU, in addition to its attachment to the host, can support a number of local card readers, CRTs, and line printers, which normally interface directly to the multiplexer channel, saving a control unit position on the multiplexer channel. The RCU is physically capable of connecting a variety of peripherals, and the MNCU provides 13 ports for connection of control units. The maximum number of connections that can actually be handled is established by throughput, which is difficult to calculate even when the high-speed line rate is known because the controllers use data compression techniques.

TRANSMISSION SPECIFICATIONS

Transmission between control units is synchronous at standard rates of 4800 bps to 1.544M bps. Transfer is usually full-duplex, but can be half-duplex. Paradyne's Synchronous Data Link Control protocol (SDLC) is used with Go-Back-N error control and recovery techniques. High-speed satellite transmission has been used with PIX systems, and time delay is not a problem. In fact, some users have reported response time improvements using PIXNET.

SOFTWARE

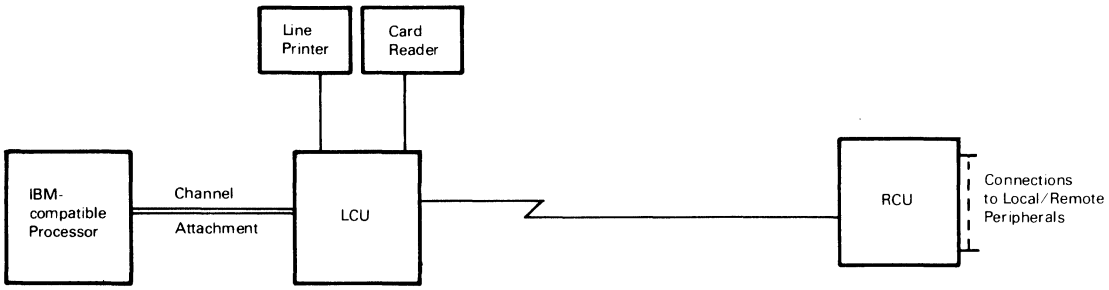
The software in the control units is provided by Paradyne for the required configuration. Code is resident in memory and consists of modules for each type of connected device. One module type supports multiple devices of the same type. Paradyne has "off-the-shelf" software and firmware for the various applications.

The host software is unaware of the communications lines or foreign peripherals and therefore requires no telecommunications access method, such as BTAM, QTAM, TCAM, or VTAM. The LCU simulation of the multiplexer channel/peripheral interface will operate under any IBM operating system.

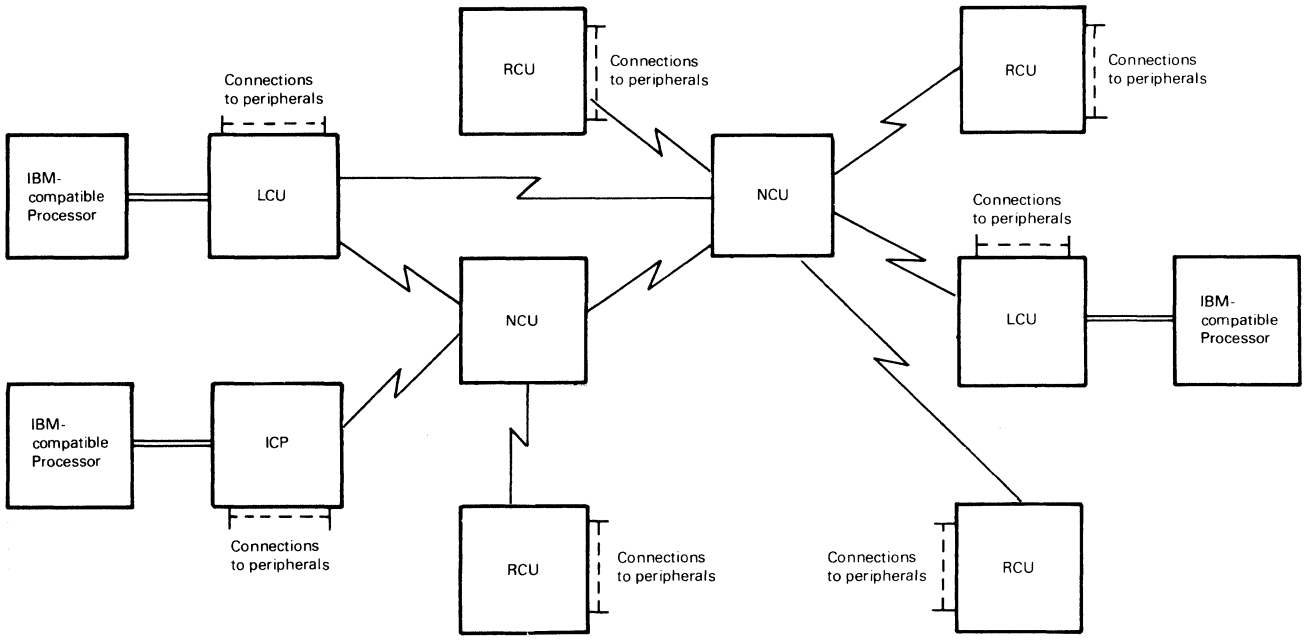
Paradyne PIXNET Communications Systems

Configuration

Typical PIX-II (Point-to-Point)



Typical PIXnet (Multi-host Network)



Maximum number of addressable devices per PIXNET system is limited only by line speed and throughput considerations.
Maximum number of other control units directly attachable to NCU is 13.
Maximum number of devices (peripherals or other control units) directly attachable to LCU depends on types of devices and line speeds.

COMPETITIVE POSITION

The Paradyne PIXNET systems are unique in their ability to perform VTAM-like functions without remote VTAM software in the host. Other communications processors that perform similar functions with appropriate software such as remote VTAM running in the host include the IBM 3705 and 3725, and the Amdahl 4705 and 4705E.

With a maximum memory capacity of two million bytes, each individual PIXNET Control Unit has more memory than an IBM 3705-80 (which has 256K bytes), an IBM 3705-II or Amdahl 4705 (each of which has 512K bytes), or an IBM 3725 or Amdahl 4705E (each of which has 1M bytes). As a front-end processor, a PIXNET is channel-attachable to two hosts; the IBM 3705 and Amdahl 4705 are each channel-attachable to up to four hosts; the Amdahl

Remote site telecommunications software is eliminated. Terminals running under most existing IBM and compatible software systems are supported, including IMS, CICS, TSO, GBASwift, Environ/1, Westi, Roscoe, and others.

The PIXNET systems also have a Remote Console Support (RCS) feature that allows remote operators to use the same type of facilities currently available to Remote Job Entry (RJE) terminal operators. The necessary RCS software is provided by Paradyne. RCS is designed to interface with unmodified IBM operating system software. It will operate with 3270-type CRT consoles. RCS provides facilities that are functionally equivalent to those available to the RJE terminal operator. Support is provided for DOS/VS/POWER, MVS/JES2, and OS/HASP. PIX operates under all IBM and compatible spooling systems including DOS/POWER, VS/POWER, POWER/VS, GRASP, GRASP/VS, SPRINT, ASAP, ESF, THE SPOOLER, HASP, JES, and JES2.

Paradyne PIXNET Communications Systems

4705E serves up to six, and the IBM 3725 serves up to eight. As a remote line concentrator, a PIXNET unit serves multiple hosts, as do the IBM 3705 and 3725, but the Amdahl 4705 serves only one host.

ADVANTAGES AND RESTRICTIONS

A major advantage of a Paradyne PIXNET system is that its hardware capabilities provide VTAM-like switching functions, enabling users to switch to different applications without the expense and complexity of adding VTAM, TCAM, or BTAM software to the host computer. In addition, NCP is not required in the front end. The PIXNET system uses a Paradyne version of IBM's Synchronous Data Link Control (SDLC) protocol, and thus also provides the advantages of SNA. Data compression/compaction techniques are used to enhance high-speed line efficiency, and built-in error control and recovery procedures are standard.

Another PIXNET advantage is its transparency. The communications functions of PIXNET are transparent to the user and the host(s); all operations with the various peripherals proceed as if they are local devices. Each peripheral is addressed individually, and virtual simultaneous operation is achieved.

Other advantages include reduced line costs because the concentration capabilities of the system require only one line to the host, and remote job entry accommodated by specialized software/firmware.

The PIXNET RCU can be used to replace an IBM-compatible device controller (e.g., an IBM 3274 terminal controller) when Paradyne peripherals and CRTs are used. Users of the PIXNET system must configure all applicable device controllers, used in a traditional IBM environment, when non-Paradyne devices are required.

USER REACTION

Paradyne provided Datapro with a list of users to contact for a user reaction. We were able to talk to three of these users who had either the PIXNET or PIXNET/XL systems. All of the users had the PIXNET system, and one user had also recently installed the PIXNET/XL. The users were a large insurance company, a retail drug company, and a large bank. The length of time that the systems had been installed ranged from eight months for the PIXNET/XL, to six years for one of the PIXNET systems.

In asking these users to rate their systems for overall satisfaction, the responses ranged from fair to very good. All three users gave a good for ease of installation, while two gave an excellent for hardware reliability and one gave a good. The quality of maintenance and quality of tech support ranged from fair to excellent. Ease of operation rated two excellents and one good.

All three users were involved in the decision to buy, and when asked why they chose Paradyne, a reason given by all three was that there wasn't that much else to choose from for their applications. All three are involved with the transfer of data at very high speeds, and Paradyne's PIXNET system met this need. Other reasons given were: the right price, fast channel response time, switching capabilities, ability to satisfy a need that IBM couldn't, and the fact that it allowed them to provide the type of service that their end users needed.

One user explained how he had LCUs in the data center with an RCU and CRT in the computer room. Connected to the LCUs were band printers and page printers. These printers offered very fast high-speed communications, printing capabilities, and very high print quality. The PIX links gave fast channel response time that the user felt he could not get from IBM devices. He found the Paradyne equipment to be very compatible with big mainframes and front-end processors.

Another user felt that the Paradyne architecture handles bandwidth effectively. He explained that if he had gone with another vendor, he would have had to install two T1

In conjunction with the MNCU, PIXNET's Administrator Console software provides for network control, including session establishment, configuration control, configuration testing and reporting, and statistics gathering and status reporting.

PERIPHERALS

The following IBM peripheral devices are supported:

Card Readers—IBM 2501, 2520, 2540 (via 2821), 3505.
Line Printer—IBM 1403 (via 2821), 3211 (via 3811), 3203/5, 4245.
CAD/CAM—IBM 5080, 3250.
Page Printers—IBM 3800.
Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).
Check Sorter—IBM 3890.
CRTs/Printers—IBM 3270: 3278 (via 3274-1A/1B/1D), 3284, 3286, 3288, 3285, 3287, 3289.

The following Paradyne peripheral devices are supported:

Line Printers—400 lpm, 600 lpm, 900 lpm, 1200 lpm.
Page Printer—60 pages/minute.
Magnetic Tape—1600 to 6250 bpi.
CRT Operator Console—1,920-character screen (3270 type).
Paradyne Display System (PDX)—functional replacements for IBM 3270 displays, printers, and controllers.

Other devices supported are:

Xerox 8200, 9700 laser printer, Kodak Komstar computer output-microfilm device, Siemens laser printer, IBM CTCA, asynchronous terminals, personal computers, and various digital plotters.

PRICING

The PIXNET and related peripherals can be purchased or are available on various lease plans. Pricing for a PIXNET communications system is between $50,000 and $150,000, depending upon the configuration. Paradyne directly services all of their products through a nationwide service organization. A national dispatch center operates 24 hours/day, seven days a week. ■

Paradyne PIXNET Communications Systems

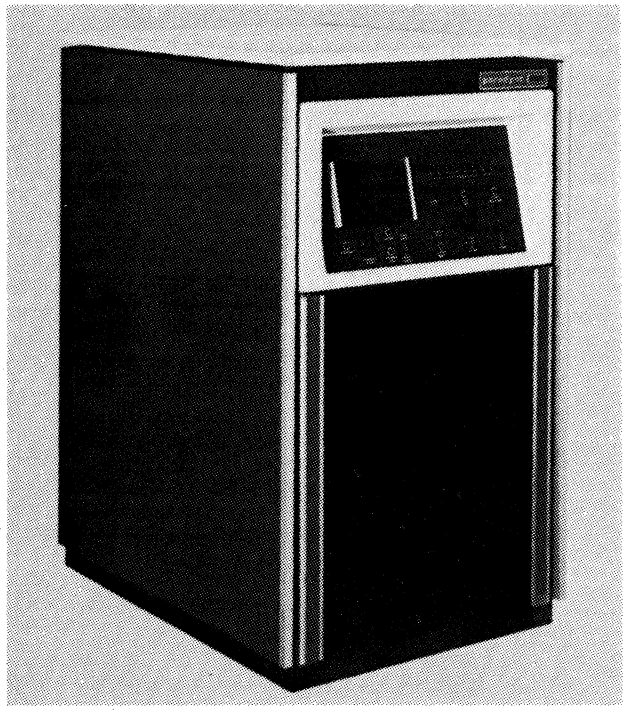
lines, and his operating expenses would have increased by about $80,000/month. This user gave examples of the amounts of data that is moved each month. He said that in checks alone, they move over 50 million/month. Over 390 million lines of data is transmitted each month. He quoted other figures and they were all in the millions. So for his needs, Paradyne fit the bill. He also liked the fact that the PIXNET system did not require software changes.

The third user felt that PIXNET's strongest point was in its switching capabilities. He saw the device as a local extension of byte channels. He did feel that a potential user should look carefully at the Paradyne equipment, in that they used a different way of addressing than was normally found. He felt that the basic technical setup was different from what a user might be familiar with, and that this point should be considered before making a decision to buy.

When asked about disadvantages, one user stated that his main problem was in selling others in his company on a non-IBM product. They were an IBM shop, and the others were wary about straying from the familiar. This user said that his only other complaint was in getting the equipment installed. Paradyne has a small service department, and they had to do some juggling to fit him in. When asked about after installation service, he said that they were very prompt and efficient. He would recommend the Paradyne equipment to a potential buyer.

The third user had no real disadvantages to list. He said it was just a case of adding one more competitor to the network. He felt that the PIXNET system met his needs. When asked if he would recommend the system to a potential buyer, he said yes. □

Paradyne PIX-II and PIXnet



The PIX Remote Control Unit (RCU) is located remotely to the host computer and communicates with the host via a PIX Local Control Unit (LCU). A variety of peripheral devices/ controllers can be physically connected to an RCU. The maximum number of terminal devices that can be connected to an RCU is 96.

A virtual data link system that allows remote peripherals to operate as if they were in the same room with the host computer.

Various control units provide access to the byte multiplexer channel of an IBM-compatible host for a wide variety of peripherals, including card readers, magnetic tape units, line printers, and 3270-type CRT clusters. Multiple host switching and application switching within a host are supported. The system is transparent, and no hardware or software modifications are required. Front-end hardware/software and host telecommunications access methods, such as TCAM or VTAM, are not required.

A typical configuration including the control units with 9600 bps modems, a remote 600 cpm card reader, remote 900 lpm line printer, and a remote magnetic tape drive can be purchased for $98,350 or leased for two years at $4,129 per month, including maintenance.

MANAGEMENT SUMMARY

PIX-II and PIXnet are virtual data link communications systems that allow local and remote peripherals to interact with one or more computers via local device access methods as if they were all locally connected. This "channel extension" technique does not require front-end hardware or software or host telecommunications software.

PIX-II refers to the second generation of Paradyne's Parallel Interface Extension products, which support only point-to-point connections in single-host environments. When Paradyne expanded its capabilities in 1979 to include multiple-host networking support, the name PIXnet was introduced. PIX-II is the name still generally used to refer to single-host environments in which a PIX system operates, and PIXnet generally refers to multi-host networks.

PIX systems can include any of four types of control units. The Local Control Unit (LCU) is located at the host site and connects to the byte multiplexer channel of an IBM 360, 370, 303X, 4300, or compatible host. The Remote Control Unit (RCU) is located at a remote site and connects to the host through the LCU, to which it is connected via standard data communication lines. The Integrated Communications Processor (ICP) can perform all the functions of the LCU, plus providing support for all RCU peripheral support functions and for application switching

CHARACTERISTICS

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33540; telephone (813) 536-4771. Paradyne Canada Ltd., 200 Consumers Road, Suite 504, Willowdale, Ontario M2J 4R4; telephone (416) 494-0453.

DATE OF ANNOUNCEMENT: PIX—March 1976 (as PIX I); PIXnet—4th quarter 1979.

DATE OF FIRST DELIVERY: PIX—April 1976 (as PIX I); PIXnet—February 1980.

NUMBER DELIVERED TO DATE: Over 2800 (PIX-II and PIXnet).

SERVICED BY: Paradyne Corporation.

CONFIGURATION

The primary components of a PIX-II or PIXnet virtual data link system are the Local Control Unit (LCU), the Remote Control Unit (RCU), the Integrated Communications Processor (ICP), and, for PIXnet systems only, the Network Control Unit (NCU). Each control unit is microprocessor-based and equipped with 64K bytes of memory expandable to 128K bytes.

The LCU and ICP are co-located with the host computer and can connect to a single port of the byte multiplexer channel of an IBM 360, 370, 303X 308X,4300, or compatible computer. The ICP provides all LCU functions, plus the RCU's peripheral support capability and a switching capa-

Paradyne PIX-II and PIXnet

in the attached host. The Network Control Unit, used in PIXnet configurations only, provides all the functions of the RCU, plus capabilities for multi-host selection and application selection within a host. Each of the four control units is microprocessor-based and provides up to 128K bytes of memory.

Any of the control units can accommodate a set of locally or remotely connected peripherals, each with its own system address, as well as communicating with other control unit(s) in the network. The NCU provides 13 ports for connection of peripherals and control units. The RCU can handle many peripheral devices but allows only one connection to another control unit. The number of devices and control units that an LCU or ICP can accommodate depends on device types and line speeds. Multiple LCUs and ICPs can be connected to a single host.

A PIX system in a point-to-point configuration can handle a maximum of 96 individually addressed peripherals. Many IBM peripherals can be accommodated as well as a comprehensive line of Paradyne peripherals, which includes card readers, line printers, CRTs with associated controllers, and magnetic tape units. A wide variety of integral or stand-alone modems is also offered.

The communications link between two control units operates synchronously, half-or full-duplex, at rates from 4800 bps to 57.6K bps.

Formed in the late 1960's, Paradyne quickly became a respected leader in the development of high-speed synchronous modems. Paradyne was the first firm to offer a 4800 bps modem for use on the dial network, a self-contained error-control modem, and a family of microprocessor-based programmable modems. In 1976, it introduced the PIX concept. The initial offering, the PIX-I, was a hard-wired machine with less capability than the PIX-II and PIXnet systems offered now. The PIX-I is still sold on an "as available" basis but is limited to refurbished units.

COMPETITIVE POSITION

The Paradyne PIX systems are unique in their ability to perform VTAM-like functions without VTAM software in the host. Other communications processors that perform similar functions with appropriate software such as VTAM running in the host include the IBM 3705 and new 3725 and the Amdahl 4705 and new 4705E.

With a maximum memory capacity of 128K bytes, each individual PIX-II or PIXnet control unit has less memory than an IBM 3705-80 (which has 256K bytes), an IBM 3705-II or Amdahl 4705 (each of which has 512K bytes), an IBM 3725 or Amdahl 4705E (each of which has 1M byte). However, since multiple control units can be configured, comparable memory capacity may be able to be attained in the aggregate. As a front-end processor, a PIX-II is channel-attachable to only one host; the IBM 3705 and Amdahl 4705 are each channel-attachable to up to four hosts, the Amdahl 4705E serves up to four, and the IBM 3725 serves

bility that permits application selection in the host. Applications switching is done using simple sign-on/sign-off procedures. Multiple LCUs and/or ICPs can be connected to the same mainframe. Computer-to-computer communications can be facilitated by an LCU-to-LCU or similar link.

The RCU and NCU are positioned remotely to the host, and are connected to the host via an LCU or ICP. RCU-to-RCU (terminal-to-terminal) and RCU-to-NCU links can also be established. The link between two control units is synchronous at rates of between 4800 and 57.6K bps. Multiple RCUs/NCUs can be connected to an LCU/ICP, and multiple RCUs can be connected to an NCU. The RCU can connect to only one other control unit, establishing a point-to-point connection. The NCU has up to 13 ports available for connection of other control units, and provides capabilities for multiple-host switching and selection of applications within a host. Routing is done automatically by the NCU, which also balances the network using dynamic line utilization statistics and associated line weighing factors, and provides back-up for line failure.

The PIX system allows remote peripherals to communicate with the host as if they were directly connected. Each peripheral has its own system address and communications are interrupt driven. The system is a virtual data link and provides a transparent interface between the host and remotely located card readers/punches, line printers, magnetic tape units, and clustered CRTs/printers emulating 3270s. Paradyne has its own line of peripherals, or some IBM peripherals can be used.

In addition to the microprocessor and memory, each control unit is equipped with a control panel, a cassette drive for program loading, and various adapters to interface the CPU, communications lines, and peripherals. The communications lines use external modems, which are manufactured by Paradyne and can be supplied as part of the system. Each peripheral port provides for direct memory access to its control unit. An LCU/ICP, in addition to its attachment to the host, can support a limited number of local card readers, CRTs, and line printers, which normally interface directly to the multiplexer channel, saving a control unit position on the multiplexer channel. The RCU is physically capable of connecting a variety of peripherals, and the NCU provides 13 ports for connection of peripherals and control units. The maximum number of connections that can actually be handled is established by throughput, which is difficult to calculate even when the high speed line rate is known because the controllers use data compression techniques.

TRANSMISSION SPECIFICATIONS

Transmission between control units is synchronous at standard rates of 4800, 9600, 19.2K, or 57.6K bps. Other rates are possible. Transfer is usually full-duplex, but can be half-duplex. Paradyne's Synchronous Data Link Control protocol (SDLC) is used with Go-Back-N error control and recovery techniques. High speed satellite transmission has been used with PIX systems, and time delay does not appear to be a problem. In fact, some users have reported response time improvements using PIX.

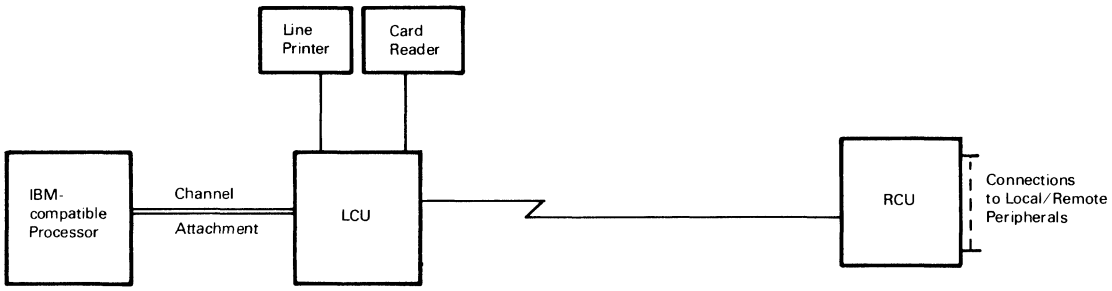
SOFTWARE

The software in the control units is provided by Paradyne for the required configuration. Code is resident in memory and consists of modules for each type of connected device. One module type supports multiple devices of the same type. Paradyne claims to have " off-the-shelf" software and firmware for most popular applications.

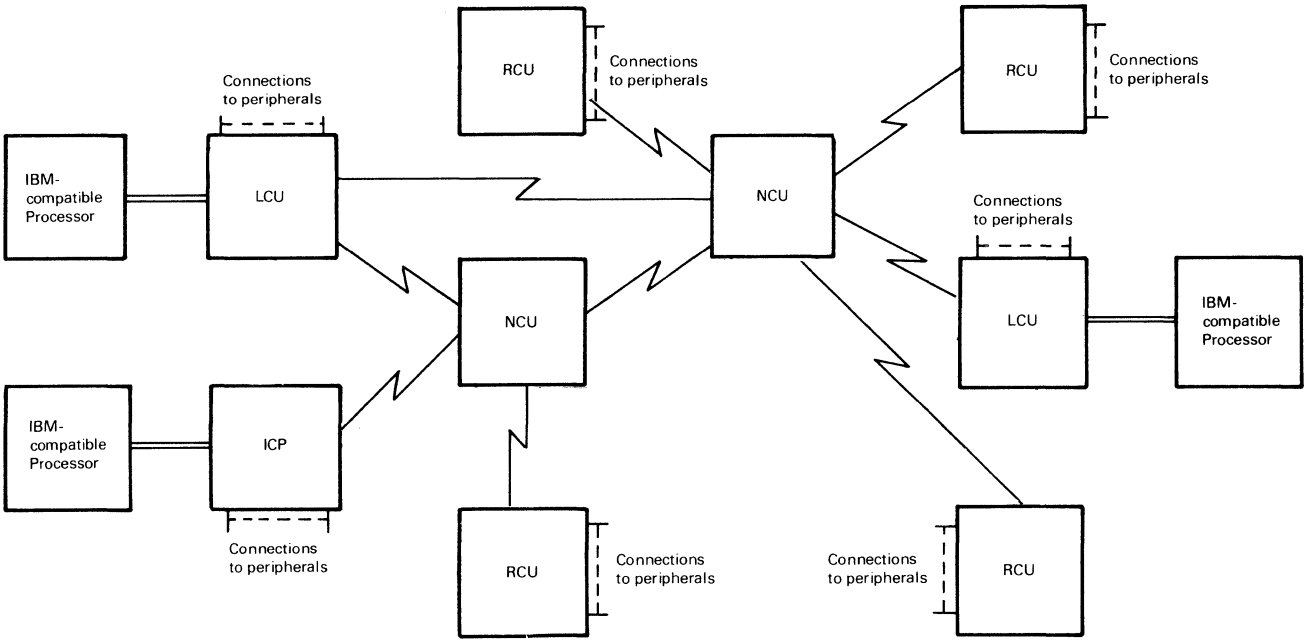
Paradyne PIX-II and PIXnet

Configuration

Typical PIX-II (Point-to-Point)



Typical PIXnet (Multi-host Network)



Maximum number of addressable devices per PIX-II or PIXnet system is limited only by line speed and throughput considerations.
Maximum number of other control units directly attachable to NCU is 13.
Maximum number of devices (peripherals or other control units) directly attachable to LCU or ICP depends on types of devices and line speeds.
Only a Paradyne card reader and a Paradyne line printer may be directly connected to the LCU as peripherals; all other control units may directly connect any of the full repertoire of peripherals supported.

up to eight. As a remote line concentrator, a PIXnet unit serves multiple hosts, as do the IBM 3705 and 3725, but the Amdahl 4705 serves only one host.

ADVANTAGES AND RESTRICTIONS

A major advantage of a Paradyne PIX system is that its hardware capabilities provide VTAM-like switching functions, enabling users to switch to different applications without the expense and complexity of adding VTAM, TCAM, or BTAM software to the host computer. In addition, NCP is not required in the front end. The PIX system uses a Paradyne version of IBM's Synchronous Data Link Control (SDLC) protocol, and thus also provides the ad-

The host software is unaware of the communications lines or foreign peripherals and therefore requires no telecommunications access method, such as BTAM, QTAM, TCAM, or VTAM. The LCU/ICP simulation of the byte multiplexer channel/peripheral interface will operate under DOS, DOS/VS, DOS/VSE, OS/MFT, OS/MVT, OS/VS1, OS/VS2 (SVS), and OS/VS2 (MVS).

Remote site telecommunications software is eliminated. Terminals running under most existing IBM and compatible software systems are supported, including IMS, CICS, TSO, GBASwift, Environ/1, Westi, Roscoe, and others.

The PIX-II and PIXnet systems also have a Remote Console Support (RCS) feature that allows remote operators to use the same type of facilities currently available to Remote Job

Paradyne PIX-II and PIXnet

vantages of SNA. Data compression techniques are used to enhance high speed line efficiency, and built-in error control and recovery procedures are standard.

Another PIX advantage is its transparency. The communications functions of PIX-II and PIXnet are transparent to the user and the host(s); all operations with the various peripherals proceed as if they are local devices. Each peripheral is addressed individually, and virtual simultaneous operation is achieved.

Other advantages include reduced line costs because the concentration capabilities of the system require only one line to the host, and remote job entry accommodated by specialized software/firmware.

A restriction is that the PIX RCU does not replace an IBM-compatible device controller (e.g., an IBM 3274 terminal controller). Users of the PIX system must configure all applicable device controllers used in a traditional IBM environment in addition to the PIX components.

USER REACTION

In Datapro's Network Users' Survey conducted in January and February of 1983, we received replies from four users of Paradyne PIX systems. These users' ratings are listed in the following table.

	Excellent	Good	Fair	Poor	WA*
Overall Performance	4	0	0	0	4.0
Ease of Installation	0	3	1	0	2.8
Ease of Operation	3	1	0	0	3.8
Ease of Expansion	3	1	0	0	3.8
Hardware Reliability	4	0	0	0	4.0
Quality of Manufacturer's Software/Firmware	2	2	0	0	3.5
Ease of Programming	2	0	0	0	**
Quality of Manufacturer's Maintenance Service	3	1	0	0	3.5
Quality of Manufacturer's Technical Support	3	1	0	0	3.8

*Weighted Average is based on a scale of 4.0 for Excellent.
**Weighted Average for less than three responses is considered invalid.

Two of these users were interviewed by telephone in June 1983. One of them is a west-coast company that provides an international component exchange; it helps companies trade their commodities, matching up a seller's excess inventory with a buyer. The company has offices at five sites. Every employee has a Paradyne terminal, which communicates with the central computer in such applications as sales inventory control, electronic mail, accounting functions, and customer tracking. The company has been using two Paradyne PIX Integrated Communications Processors for about a year; both units are located at the host computer, a Magnuson M80 which the company plans to replace with an IBM 4341.

The company spokesman said the PIX system works very well, and stated that its main advantage is that "you don't need VTAM running in the host system but you still get all the advantages of VTAM and SNA." He observed that VTAM (at the software level) gives you the ability to switch to different applications, and so does PIX (at the hardware level); SNA gives you the ability to use SDLC protocol, which works with satellite communications. The company is using Western Union's Westar satellite service. A PIX disadvantage is that a PIX unit cannot be attached directly to IBM-compatible devices, he noted. An IBM device controller is required to attach a PIX unit to IBM-compatible devices. He said Paradyne provides good support and is very flexible. "They really support their equipment, and they make it work for you before you pay."

The second user we interviewed represented a supermarket chain that has five Paradyne ICPs at two locations and an RCU at a third location. This PIXnet system interfaces with two IBM 4341 host systems. The user had originally installed an LCU, which was upgraded to an ICP, and added the other units in 1983. The user cited no problems with the Paradyne equipment except the peripherals, specifically card readers and a line printer manufactured by Control Data Corporation. These peripherals are leased from Paradyne, who has repaired them; the user claims that a human engineering problem remains with the line printer, on which the gate opens only about 75 degrees instead of 90 degrees.□

Entry (RJE) terminal operators. The necessary RCS software is provided by Paradyne. RCS is designed to interface with unmodified IBM operating system software. It will operate with Paradyne CRT consoles, Teletype-compatible terminals, or 1052- or 3270-type consoles. RCS provides facilities that are functionally equivalent to those available to the RJE terminal operator. Support is provided for DOS/VS/POWER, MVS/JES2, and OS/HASP. PIX operates under all IBM and compatible spooling systems including DOS/POWER, VS/POWER, POWER/VS, GRASP, GRASP/VS, SPRINT, ASAP, ESF, THE SPOOLER, HASP, JES, and JES2.

In conjunction with the NCU, PIXnet's Administrator Console software provides for network control, including session establishment, configuration control, configuration testing and reporting, and statistics gathering and status reporting.

PERIPHERALS

The following IBM peripheral devices are supported:

Card Readers—IBM 2501, 2520, 2540 (via 2821), 3505.
Line Printer—IBM 1403 (via 2821), 3211 (via 3811), 3203/5.
Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).
Check Sorter—3890.
CRTs/Printers—IBM 3270: 3278 (via 3274-1A/1B/1D), 3284, 3286, 3288, 3285, 3287, 3289.

The following Paradyne peripheral devices are supported:

Card Readers—300 cpm, 600 cpm.

Paradyne PIX-II and PIXnet

Line Printers—300 lpm, 600 lpm, 900 lpm, 1200 lpm, 2000 lpm.
Magnetic Tape—9-track, 800-bpi, NRZ; 9-track, 1600-bpi, Phase Encoded; 9-track, 800/1600 bpi, NRZ/PE.
CRT Operator Console—1920 character screen.
Paradyne Display System (PDS)—functional replacements for IBM 3270 displays, printers, and controllers.

Other devices supported are:

Xerox 9700 laser printer, Kodak Komstar computer output microfilm device, and various digital plotters.

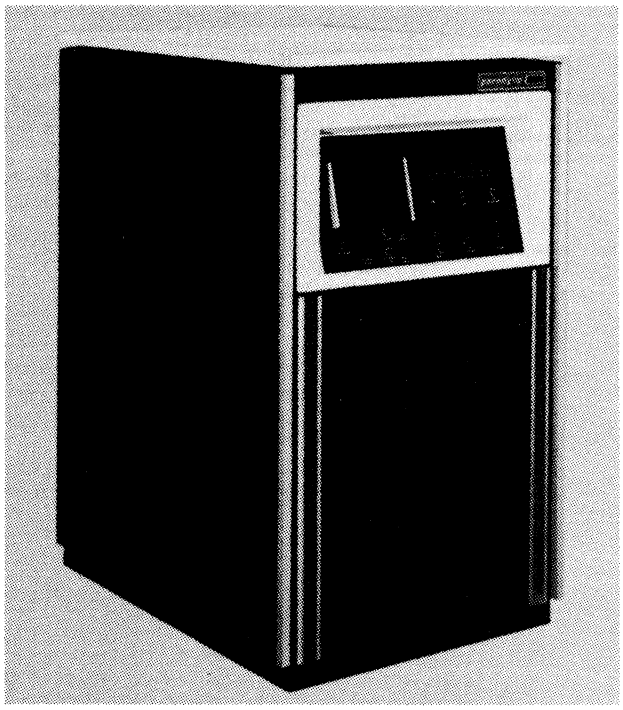
PRICING

The PIX-II and related peripherals can be purchased or are available on two- three- or five-year lease plans. Lease charges include maintenance. The maintenance rates in the accompanying table are for purchased equipment and are based on Zone 1 service, which is defined as being within a 50-mile radius of a Paradyne service center. Approximately 50 U.S. metropolitan areas are presently designated as service centers. Service outside Zone 1 is provided at a premium.

		Monthly Charges*				
		2-Yr.	3-Yr.	5-Yr.	Purchase Price	Monthly Maint.
7610-3	Local Control Unit (LCU); has 128K-byte memory	$ 912	$ 807	$ 747	$27,740	$157
7201	Device Address	24	21	19	680	6
7229	3270 Multiple Address	66	56	51	2,000	11
7210	V.35/Bell 303/RS-232 Port	86	76	70	3,000	16
7605	Integrated Communications Processor (ICP)	885	775	720	26,800	157
7510-20	Network Control Unit (NCU); has 128K-bytes memory	678	628	603	23,575	188
7511	Master Network Control Unit	857	787	747	30,000	167
7532	RS-232 Port	96	86	81	2,100	16
7535-16	V.35/Bell 303 Port	122	117	107	2,500	22
7803	Keyboard Console	124	119	114	3,900	24
7620-5	Remote Control Unit (RCU); has 128K-byte memory	791	701	651	23,370	151
7625	Remote Control Unit (RCU); includes tape drive (1600 bpi, DD, NRZ/PE, 9-track)	1,470	1,285	1,185	34,650	265
7626	Stand-alone Cabinet for 2nd and subsequent tapes	95	89	84	2,650	22
7208	IBM Multiplexer Channel Extension	168	157	151	2,800	28
7209	IBM Multiplexer Channel Device Controller; 1 per 2 drives	109	102	95	2,100	18
7212-1	Multiplexer Range Controller; 32 devices	168	157	151	4,480	28
7222	Print/Tape mode switch (optional with 7625, 7626)	11	10	10	350	2
	PIX Peripherals and Options					
8203	300 cpm Card Reader (w/ctlr)	209	187	175	5,300	70
8206	600 cpm Card Reader (w/ctlr)	257	227	215	6,000	70
8323-10	300 lpm Line Printer (w/ctlr)	532	482	460	14,000	175
8326-10	600 lpm Line Printer (w/ctlr)	852	752	710	18,000	200
8329-10	900 lpm Line Printer (w/ctlr)	1,102	982	920	26,000	260
8332-10	1200 lpm Line Printer; includes printer controller	1,471	1,372	1,270	46,000	400
8353-10/20	2000 lpm Line Printer; 1403 or 3211 compatible; includes printer	2,600	2,450	2,350	66,000	700
	Paradyne Display System (PDS):					
9401	PDS Local Controller	135	125	120	4,000	35
9402	PDS Remote Controller	95	90	85	2,500	20
9476-51	Display and Keyboard with Integrated Controller; up to 32 devices (Remote)**	166	160	155	5,850	50
9478-51	Display and Keyboard (Local)**	77	73	71	3,000	20
9487	150 cps Loop Printer and Controller	250	240	230	5,400	60

*Includes monthly maintenance.
**Wide selection of keyboards available.■

Paradyne PIX-II and PIXNET



The PIX Remote Control Unit (RCU) can be located locally or remotely to the host computer, and communicates with the host via a PIX Local Control Unit (LCU). Up to 25 peripheral devices/controllers can be physically connected to an RCU. The maximum number of device addresses that can be handled by an RCU is 64.

A virtual data link system that allows remote peripherals to operate as if they were in the same room with the host computer.

Various control units provide direct or indirect access to the byte multiplexer channel of an IBM-compatible host for a wide variety of peripherals, including card readers, magnetic tape units, line printers, and 3270-type CRT clusters. Multiple host switching and application switching within a host are supported. The system is transparent, and no hardware or software modifications are required. Front-end hardware/software and host telecommunications access methods, such as TCAM or VTAM, are not required.

A typical configuration including the control units with 9600 bps modems, a remote 600 cpm card reader, remote 900 lpm line printer, and a remote magnetic tape drive can be purchased for $87,150 or leased for two years at $3,203 per month, including maintenance.

MANAGEMENT SUMMARY

PIX-II and PIXNET are virtual data link communications systems that allow local and remote peripherals to interact with one or more computers via local device access methods as if they were all locally connected. This "channel extension" technique does not require front-end hardware or software, or host telecommunications software.

PIX-II refers to the second generation of Paradyne's Parallel Interface Extension products, which support only point-to-point connections in single-host environments. When Paradyne expanded its capabilities in 1979 to include multiple-host networking support, the name PIXNET was introduced. PIX-II is the name still generally used to refer to single-host environments in which a PIX system operates, and PIXNET generally refers to multi-host networks.

PIX systems can include any of four types of control units. The Local Control Unit (LCU) is located at the host site and connects to the byte multiplexer channel of an IBM 360, 370, 303X, 4300, or compatible host. The Remote Control Unit (RCU) may be located at the host site or at a remote site and connects to the host through the LCU, to which it is connected via standard data communication ➢

CHARACTERISTICS

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33540. Telephone (813) 536-4771.

DATE OF ANNOUNCEMENT: PIX—March 1976 (as PIX I); PIXNET—4th quarter 1979.

DATE OF FIRST DELIVERY: PIX—April 1976 (as PIX-I); PIXNET—February 1980.

NUMBER DELIVERED TO DATE: Over 1300 (PIX-II and PIXNET).

SERVICED BY: Paradyne Corporation.

CONFIGURATION

The primary components of a PIX-II or PIXNET virtual data link system are the Local Control Unit (LCU), the Remote Control Unit (RCU), the Integrated Communications Processor (ICP), and, for PIXNET systems only, the Network Control Unit (NCU). Each control unit is microprocessor-based and equipped with 32K bytes of memory expandable to 128K bytes.

The LCU and ICP are co-located with the host computer, and can connect to a single port of the byte multiplexer channel of an IBM 360, 370, 303X, 4300 or compatible computer. The ICP provides all LCU functions, plus the RCU's peripheral support capability and a switching capability that permits application selection in the host. Applications switching is done using simple sign-on/sign-off procedures. Multiple LCUs and/or ICPs can be connected to the same mainframe. Computer-to-computer communications can be facilitated by an LCU-to-LCU, LCU-to-ICP, or similar link. ➢

Paradyne PIX-II and PIXNET

lines. The Integrated Communications Processor (ICP) can perform all the functions of the LCU, plus providing support for all RCU peripheral support functions and for application switching in the attached host. The Network Control Unit, used in PIXNET configurations only, provides all the functions of the RCU, plus capabilities for multi-host selection and application selection within a host. Each of the four control units is microprocessor-based and provides up to 128K bytes of memory.

Any of the control units can accommodate a set of locally or remotely connected peripherals, each with its own system address, as well as communicating with other control unit(s) in the network. The NCU provides 14 ports for connection of peripherals and control units. The RCU can handle as many as 25 peripheral devices, but allows only one connection to another control unit. The number of devices and control units that an LCU or ICP can accommodate depends on device types and line speeds. Multiple LCUs and ICPs can be connected to a single host.

A PIX system can handle a maximum of 64 individually addressed peripherals. Many IBM peripherals can be accommodated as well as a comprehensive line of Paradyne peripherals, which includes card readers, line printers, CRTs with associated controllers, and magnetic tape units. A wide variety of integral or stand-alone modems is also offered.

The communications aspects of PIX-II or PIXNET are completely transparent to the user and the host(s); all operations with the various peripherals proceed as if they were local devices. Each peripheral is addressed individually as if it were local, and virtual simultaneous operation is achieved. Remote devices that would normally operate in half-duplex BSC mode can be serviced by a full-duplex link with essentially zero turn-around time.

The communications link between two control units operates synchronously, half- or full-duplex, at rates from 2400 bps to 56K bps. A Paradyne version of IBM's Synchronous Data Link Control (SDLC) protocol is used. Data compression techniques are used to enhance high speed line efficiency, and built-in error control and recovery procedures are standard.

Some of the salient features and benefits of PIX-II and PIXNET are:

- Transparency—Both the host and the peripherals operate as if the connection and operation were local.
- Reduced hardware cost—270X or 370X front ends are not required.
- Reduced software requirements—NCP is not required in the front end and VTAM, TCAM, or BTAM is not required in the host.
- Reduced line costs—The concentration technique of the system requires only one line.

The RCU and NCU can be positioned locally or remotely to the host, and are connected to the host via an LCU or ICP. RCU-to-RCU (terminal-to-terminal) and RCU-to-NCU links can also be established. The link between two control units is synchronous at rates of between 2400 and 56K bps. Multiple RCUs/NCUs can be connected to an LCU/ICP, and multiple RCUs can be connected to an NCU. The RCU can connect to only one other control unit, establishing a point-to-point connection. The NCU has up to 14 ports available for connection of other control units, and provides capabilities for multiple-host switching and selection of applications within a host. Routing is done automatically by the NCU, which also balances the network using dynamic line utilization statistics and associated line weighing factors, and provides back-up for line failure.

The PIX system allows remote peripherals to communicate with the host as if they were directly connected. Each peripheral has its own system address and communications are interrupt driven. The system is a virtual data link and provides a transparent interface between the host and remotely located card readers/punches, line printers, magnetic tape units, and clustered CRTs/printers emulating 3270s. Paradyne has its own line of peripherals, or some IBM peripherals can be used. A maximum of 64 peripherals can be individually addressed by the PIX system.

In addition to the microprocessor and memory, each control unit is equipped with a control panel, a cassette drive for program loading, and various adapters to interface the CPU, communications lines, and peripherals. The communications lines use external modems, which are manufactured by Paradyne and can be supplied as part of the system. Each peripheral port provides for direct memory access to its control unit. An LCU/ICP, in addition to its attachment to the host, can support a limited number of local card readers, CRTs, and line printers, which normally interface directly to the multiplexer channel, saving a control unit position on the multiplexer channel. The RCU is physically capable of connecting up to 25 peripherals, and the NCU provides 14 ports for connection of peripherals and control units. The maximum number of connections that can actually be handled is established by throughput, which is difficult to calculate even when the high speed line rate is known because the controllers use data compression techniques.

TRANSMISSION SPECIFICATIONS

Transmission between control units is synchronous at standard rates of 2400, 4800, 9600, 19.2K, or 56K bps. Other rates are possible. Transfer is usually full-duplex, but can be half-duplex. Paradyne's Synchronous Data Link Control protocol (SDLC) is used with Go-Back-N error control and recovery techniques. High speed satellite transmission has been used with PIX systems, and time delay does not appear to be a problem. In fact, some users have reported response time improvements using PIX.

SOFTWARE

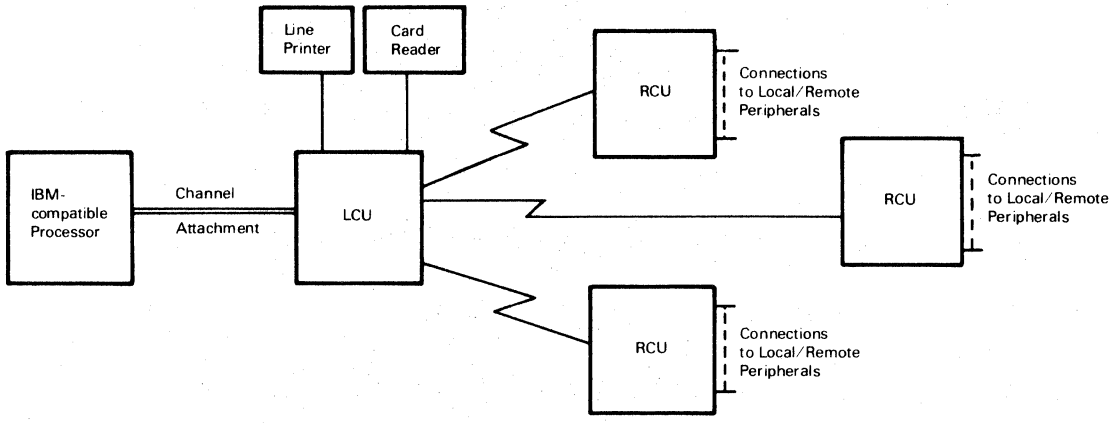
The software in the control units is tailored by Paradyne for the required configuration. Code is resident in memory and consists of modules for each type of connected device. One module type supports multiple devices of the same type. Paradyne claims to have "off-the-shelf" software and firmware for most popular applications.

The host software is unaware of the communications lines or foreign peripherals and therefore requires no telecommunications access method, such as BTAM, QTAM, TCAM, or VTAM. The LCU/ICP simulation of the byte multiplexer channel/peripheral interface will operate under DOS, DOS/VS, DOS/VSE, OS/MFT, OS/MVT, OS/VS1, OS/VS2 (SVS), and OS/VS2 (MVS).

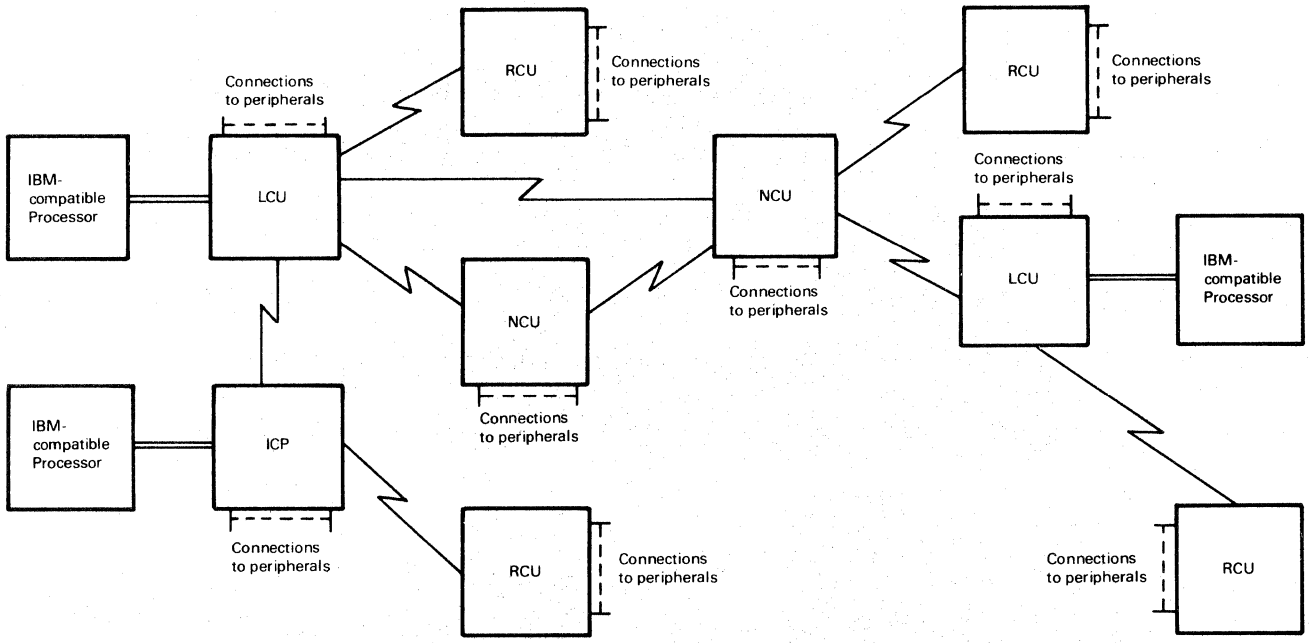
Paradyne PIX-II and PIXNET

Configuration

Typical PIX-II (Point-to-Point)



Typical PIXNET (Multi-host Network)



Maximum number of addressable devices per PIX-II or PIXNET system is 64.
Maximum number of peripherals directly attachable to RCU is 25.
Maximum number of devices (peripherals or other control units) directly attachable to NCU is 14.
Maximum number of devices (peripherals or other control units) directly attachable to LCU or ICP is dependent on types of devices and line speeds.
Only a Paradyne card reader and a Paradyne line printer may be directly-connected to the LCU as peripherals; all other control units may directly connect any of the full repertoire of peripherals supported.

- Reduced response time—Polling, ACK/NAK, and BSC turn-around time are eliminated because the host/peripheral interaction is interrupt-driven.
- High link efficiency—SDLC protocol for speeds to 56K bps in full-duplex mode with error recovery procedures.
- Remote Job Entry—Accommodated by specialized software/firmware.

Formed in the late 1960's, Paradyne quickly became a respected leader in the development of high-speed

Remote site telecommunications software is eliminated. Terminals running under most existing IBM and compatible software systems are supported, including IMS, CICS, TSO, GBASWIFT, ENVIRON/1, WESTI, ROSCOE, and others.

The PIX-II and PIXNET systems also have a Remote Console Support (RCS) feature that allows remote operators to use the same type of facilities currently available to Remote Job Entry (RJE) terminal operators. The necessary RCS software is provided by Paradyne. RCS is designed to interface with unmodified IBM operating system software. It will operate with Paradyne CRT consoles, Teletype-compatible terminals, or 1052- or 3270-type consoles. RCS provides facilities that are functionally equivalent to those

Paradyne PIX-II and PIXNET

synchronous modems. The firm was first with a 4800 bps modem for use on the dial network, first with a self-contained error-control modem, and first with a family of microprocessor-based programmable modems. In 1976, it was first with the PIX concept. The initial offering, the PIX-I, was a hard-wired machine with less capability than the PIX-II and PIXNET systems offered now. The PIX-I is still sold on an "as available" basis, but is limited to refurbished units.

USER REACTION

In January 1981, Datapro conducted telephone interviews with six Paradyne PIX-II users, whose names were supplied to us by Paradyne, and who reported their experience with a total of 14 local units (LCUs) and 18 remote control units (RCUs). The control units were supporting a wide range of peripherals devices, including CRTs, printers, card readers, reader/punches, and MICR reader/sorters; the typical RCU supported ten or twelve CRTs, one or two line printers, and a card reader. These PIX systems had been installed for an average of over two years. Four of the users attached their LCUs to IBM 303X mainframes, one user used an IBM 370/148, and one had an IBM 370/155. All PIX-related peripherals were used for remote job entry, remote printing, or time-sharing. All the PIX systems were acquired directly from Paradyne; four users were leasing their Paradyne equipment, and the other two had purchased it outright.

These users' ratings are summarized below:

	Excellent	Good	Fair	Poor	WA*
Overall performance	4	2	0	0	3.7
Ease of installation	5	1	0	0	3.8
Throughput	4	2	0	0	3.7
Hardware reliability	5	1	0	0	3.8
Promptness of maintenance	1	4	1	0	3.0
Quality of maintenance	2	4	0	0	3.3
Manufacturer's software	4	2	0	0	3.7
Manufacturer's technical support	4	1	1	0	3.5

*Weighted Average on a scale of 4.0 for Excellent.

These users reported that their PIX Systems were doing an excellent job for them. According to them, the PIX-II performs exactly as advertised, and provides a refreshingly unique, simple, and straightforward approach to remote data communications. One user stated that he is "always amazed that it is not more popular than it is." Another felt that "too many people get into a syndrome of thinking that if IBM doesn't support it, it won't work; well, this not only works, it works better than IBM's solution to the problem."

These users reported that the PIX system is much more cost effective than IBM's traditional approach, with savings realized on CPU overhead, host software, front-end hardware/software, and communications lines. In addition, the PIX allows types of devices normally used only at the local host site to be remotely located, without any special attachments or adapters, and with complete transparency to both the user and the host. No degradation in host system capabilities was experienced, and PIX system throughput was reported to be excellent.

According to these users, PIX control units are very reliable, durable, versatile, and simple to install and use. One user stated that "the control unit is the most reliable piece of telecommunications equipment we have." Another user pointed out that, unlike IBM's approach, no specially trained personnel are required to use it. Two users specifically mentioned the usefulness of Paradyne's diagnostics, although two others had specific suggestions for improvements in the LCU diagnostic package. The high quality of the Paradyne peripherals was also mentioned: "generally very durable"; "the card readers never fail"; "the line printer is better than IBM's 1403".

Very few negative comments were made by these users. Three of the six users had experienced some problems, generally of a minor nature, with Paradyne's software. One felt that new releases are not thoroughly tested, and have too many bugs. The second stated that it took 45 days for the Paradyne people to fix a software problem found during his system's installation. The third stated that a recent release of IBM host software has caused some minor incompatibility problems with his existing Paradyne software, and that it will take 3 to 4 weeks for Paradyne to resolve the incompatibility.

Two users felt that reponse to requests for field service is sometimes slow, although two other users stated that reponse time is excellent. One user found that dealing with multiple vendors (i.e. IBM and Paradyne) is somewhat inconvenient. Another stated that, under Paradyne's maintenance contract, if Paradyne is called in for a problem that turns out to be caused by another vendor's equipment, the user is billed for the call, whereas IBM is generally more lenient about charging, or doesn't change at all, for problems caused by non-IBM devices.

For the most part, these users enthusiastically recommended their PIX systems, and reported that the advantages greatly overshadowed the disadvantages.□

available to the RJE terminal operator. Support is provided for DOS/VS/POWER, MVS/JES2, and OS/HASP. PIX operates under all IBM and compatible spooling systems including DOS/POWER, VS/POWER, POWER/VS, GRASP, GRASP/VS, SPRINT, ASAP, ESF, THE SPOOLER, HASP, JES, and JES2.

In conjunction with the NCU, PIXNET's Administrator Console software provides for network control, including session establishment, configuration control, configuration testing and reporting, and statistics gathering and status reporting.

Paradyne PIX-II and PIXNET

PERIPHERALS

The following IBM peripheral devices are supported:
Card Readers—IBM 2501, 2520, 2540 (via 2821), 3505.
Line Printer—IBM 1403 (via 2821), 3211 (via 3811), 3203/5.
Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).
Check Sorter—3890.
CRTs/Printers—IBM 3270: 3278 (via 3274-1B/1D; via 3274-1A in future), 3284, 3286, 3288, 3285, 3287, 3289.

The following Paradyne peripheral devices are supported:
Card Readers—300 cpm, 600 cpm, 1000 cpm.
Line Printers—300 lpm, 600 lpm, 900 lpm, 1200 lpm, 2000 lpm.
Magnetic Tape—9-track, 800-bpi, NRZ; 9-track, 1600-bpi, Phase Encoded; 9-track, 800/1600 bpi, NRZ/PE.
VDU77 Display Control and Keyboard/Displays—1920 character screen.
CRT Operator Console—1920 character screen.
Paradyne Display System (PDS)—3270-compatible displays, printers, and controllers.

PRICING

The PIX-II and related peripherals can be purchased or are available on two-, three- or five-year lease plans. Lease charges include maintenance. The maintenance rates in the accompanying table are for purchased equipment and are based on Zone 1 service, which is defined as being within a 50-mile radius of a Paradyne service center. Approximately 50 U.S. metropolitan areas are presently designated as service centers. Service outside Zone 1 is provided at a premium.

		Monthly Charges* 2-Yr.	3-Yr.	5-Yr.	Purchase Price	Monthly Maint.
7610	Local Control Unit (LCU)	$360	$312	$284	$11,200	$60
7615	LCU Expansion Cabinet	105	92	83	3,400	15
7201	Device Address (except 3270)	23	20	18	680	5
7221	3270 Device Address	12	11	11	580	2
7229	3270 Multiple Address	60	50	45	2,000	5
7210-30	V.35 Digital; 56KB	86	76	70	2,550	16
7605	Integrated Communications Processor (ICP)	873	767	707	26,880	130
7510	Network Control Unit (NCU)	275	265	255	15,000	50
7532	RS-232 Port	95	85	80	2,100	15
7535	V.35/303 Port	120	115	105	2,500	20
7803	Keyboard Console	120	115	110	3,900	20
7620	Remote Control Unit (RCU)	235	208	191	6,600	60
7625	Remote Control Unit (RCU); includes space for tape drive	235	208	191	6,600	60
7626	Stand-alone Cabinet for 2nd and subsequent tapes	75	65	60	2,200	20
7205-1	VDU 77 Controller, 1 for 3 devices	32	27	25	1,000	5
7206	Punch Controller	37	32	29	1,200	5
7208	IBM MUX Channel Extension	105	97	93	2,000	5
7209	IBM MUX Channel Device Controller; 1 per 2 drives	70	65	60	1,500	5
7211	Diskette Controller	45	40	35	1,300	10
7212-1	MUX Range Controller; 32 devices	109	101	97	3,200	9
7222	Print/Tape mode switch (optional with 7625, 7626)	10	9	9	350	1
7801	CRT Console	134	119	111	3,000	27
7802	Model 77 Visual Display Unit	155	137	127	3,800	27
7809-10	Magnetic Tape Unit; 9 track, 800 bpi, NRZ	400	349	323	9,450	75
7809-20	Magnetic Tape Unit; 9 track; 1600 bpi, PE	545	478	441	11,900	90
7809-30	Magnetic Tape Unit; dual density, 9 track, 800/1600 bpi, NRZ/PE	670	575	525	14,280	105
7810	Diskette Unit	210	185	170	3,200	45
	LCU or RCU Features					
7101	Control Unit Microprocessor; includes 32K bytes of memory; mutually exclusive with 7102	195	152	138	5,400	30
7102	Control Unit Microprocessor; includes 128K bytes of memory; includes ECC circuitry; mutually exclusive with 7101	490	435	405	15,000	65
7110	4K Memory Modules	29	25	23	800	5
7111	Memory Expansion; for expansion of 7101 from 32K bytes to 64K bytes; max. 1	26	23	21	800	5
7202-20	Line Control Module (LCM)	40	36	34	1,030	10
7203	Printer Controller	32	27	25	1,000	5
7204	Card Reader Controller	32	27	25	1,000	5
7205	Async. Controller; 1 per 3 devices	32	27	25	1,000	5
7210-10	High Performance Line Controller; up to 56KB, RS-232-C	86	76	70	2,550	16
7210-20	High Performance Line Controller; up to 56KB, WE303 current interface	86	76	70	2,550	16
7210-30	High Performance Line Controller; up to 56KB; digital V.35 interface	86	76	70	2,550	16
7224	96-character set for 8331 printer	27	25	25	500	0

*Includes monthly maintenance.

Paradyne PIX-II and PIXNET

		Monthly Charges* 2-Yr.	3-Yr.	5-Yr.	Purchase Price	Monthly Maint.
	PIX Peripherals and Options					
8203	300 cpm Card Reader	167	155	145	4,300	60
8206	600 cpm Card Reader	220	195	185	5,000	60
8210	1000 cpm Card Reader	380	340	300	7,000	85
8313	300 lpm Line Printer	460	415	395	12,000	165
8316	600 lpm Line Printer	755	660	620	16,000	165
8319	900 lpm Line Printer	1,035	920	860	25,000	220
8332-10	1200 lpm Line Printer; includes printer controller	1,432	1,327	1,225	46,000	355
8353-10/ 20	2000 lpm Line Printer; 1403 or 3211 compatible; includes printer	2,500	2,350	2,250	66,000	600
2695	M-96 9600 bps Modem; leased line	195	180	155	6,500	30
2618	Short Haul Modem; 9600/19,200 bps	40	35	33	900	10
2650	4800 bps Modem; dial-up	131	121	101	3,000	21
2804-2	Voice Adapter Feature	17	17	17	450	5
2805-1	Line Switch Feature	7	7	7	150	1
	Paradyne Display System (PDS):					
9401	PDS Local Controller	379	360	345	10,000	60
9402	Communications Adapter	65	60	50	2,000	15
9476-1	Display and Keyboard with Integrated Controller; up to 32 devices	176	170	165	6,000	40
9478-11	Display and Keyboard	57	53	51	3,150	0
9487	150 cps Printer and Controller	250	240	230	6,600	60

*Includes monthly maintenance.■

Paradyne Parallel Interface Extension-II (PIX-II)

MANAGEMENT SUMMARY

The PIX-II connects to the byte multiplexer channel of an IBM System/360 or /370. It allows local and remote peripherals to interact with the computer via local device access methods as if they were all locally connected. This technique does not require front end hardware or software, or host telecommunications software.

Two hardware items are involved: a Local Control Unit (LCU) and a Remote Control Unit (RCU). The LCU is co-located with the host and is connected to the RCU via standard telecommunications links at speeds up to 56K bps. Many IBM peripherals can be accommodated as well as a comprehensive line of Paradyne peripherals, which include card readers, line printers, CRT's with associated controllers, and magnetic tape units. A wide variety of integral or stand-alone modems is also offered.

The communications aspect of PIX-II is completely transparent to the user and the host; all operations with the various peripherals proceed as if they were local devices. Each peripheral is addressed individually as if it were local, and virtual simultaneous operation is achieved. Remote devices that would normally operate in half-duplex BSC mode can be serviced by a full-duplex PIX-II link with essentially zero turn-around time.

The PIX-II communications link operates synchronously, half- or full-duplex, at rates from 4800 bps to 56K bps. Synchronous Data Link Control (SDLC) protocol is used.

The RCU can handle as many as 25 devices, each maintaining its own system address. Each LCU can accommodate multiple RCU's and multiple LCU's can be connected to the mainframe. The units are microproc- ➢

A virtual data link system that allows remote peripherals to operate as if they were in the same room with the host computer.

A Local Control Unit (LCU) connects to the byte multiplexer channel of an IBM System/360 or 370. The Remote Control Unit (RCU) can have up to 25 peripherals connected to it, including card readers, magnetic tape units, line printers, and 3270-type CRT clusters. The system is transparent; and no hardware or software modifications are required. Front-end hardware/software and host telecommunications access methods, such as TCAM or VTAM, are not required.

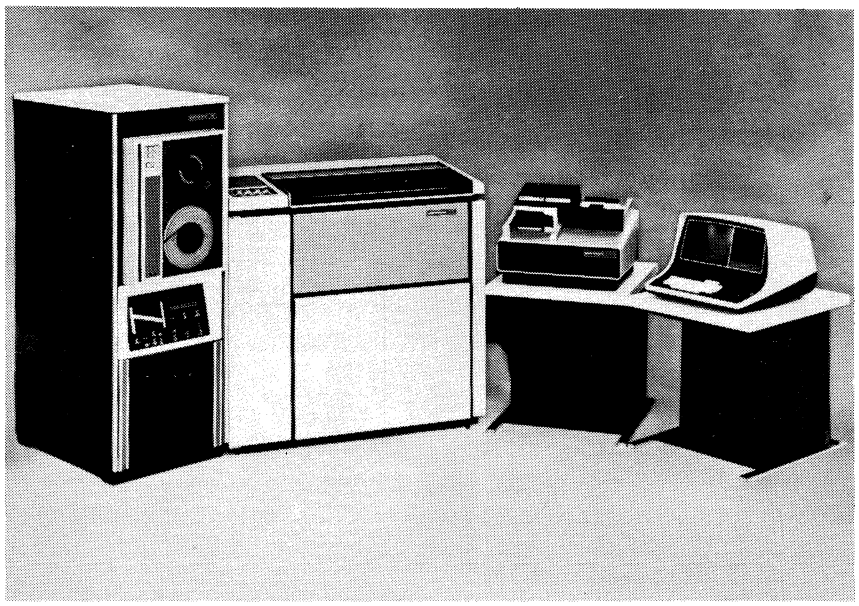
Both control units are vendor programmable and are microprocessor based. Communications between the control units is via SDLC protocol at speeds between 4800 bps and 56K bps.

A typical configuration including the control units with integral modems, a remote 600 cpm card reader, remote 900 lpm line printer, and a remote magnetic tape drive can be purchased for $79,640 or leased for two years at $2,663 per month, including maintenance.

CHARACTERISTICS

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33540. Telephone (813) 536-4771.

DATE OF ANNOUNCEMENT: March 1976 (as PIX I). ➤



The PIX-II Remote Control Unit (RCU) is shown to the left with companion peripherals. The tape drive, line printer, card reader, and CRT peripherals, as well as high-speed synchronous modems can be furnished by Paradyne as part of the PIX system. PIX provides a virtual data link that causes the peripherals to react as if they were directly connected to the host computer even though they may be located thousands of miles away.

Paradyne Parallel Interface Extension-II (PIX-II)

essor based with up to 64K bytes of memory. Data compression techniques are used to enhance high speed line efficiency, and built-in error control and recovery procedures are standard.

Some of the salient features and benefits of PIX-II are:

- Transparency — Both the host and the peripherals operate as if the connection and operation were local.
- Reduced hardware cost — 270X or 370X front ends are not required.
- Reduced software requirements — NCP is not required in the front end and VTAM, TCAM, or BTAM is not required in the host.
- Reduced line costs — The multiplexing technique of the system requires only one line.
- Reduced response time — Polling ACK/NAK and BSC turn-around time are eliminated because the host/peripheral interaction is interrupt driven.
- High link efficiency — SDLC protocol for speeds to 56K bps in full-duplex mode with error recovery procedures.
- Remote Job Entry — Accommodated by specialized software/firmware.

Formed in the late 1960's, Paradyne quickly became a respected leader in the development of high-speed synchronous modems. The firm was first with a 4800 bps modem for use on the dial network, first with a self-contained error-control modem, and first with a family of microprocessor-based programmable modems. In 1976, it was first with the PIX concept. The initial offering, the PIX-I, was a hard-wired machine with less capability than the PIX-II offered now. The PIX-I is still sold on an "as available" basis, but is limited to refurbished units.

DATE OF FIRST DELIVERY: April 1976 (as PIX I).

NUMBER DELIVERED TO DATE: Over 400 (PIX II).

SERVICED BY: Paradyne Corporation.

CONFIGURATION

The primary components of a PIX-II virtual data link system are the Local Control Unit (LCU) and the Remote Control Unit (RCU). Each is microprocessor based and equipped with 8K or 16K bytes of memory, expandable to 64K bytes. The LCU is co-located with the host computer, while the RCU's can be positioned locally or remotely. Communications between the LCU's and RCU's is synchronous at rates between 4800 bps and 56K bps. The LCU connects to one port of an IBM S/360 or /370 byte multiplexer channel. Multiple LCU's can be connected to the same mainframe. Multiple RCU's can be connected to an LCU; the maximum configuration is variable and depends on device types and line speeds. Computer-to-computer communications can be facilitated by an LCU-LCU communications link.

The PIX system allows remote peripherals to communicate with the host as if they were directly connected. Each peripheral has its own system address and communications are interrupt driven. The system is a virtual data link and provides a transparent interface between the host and remotely located card readers/punches, line printers, magnetic tape units, and clustered CRT's emulating 3270's. Many of IBM's peripherals can be used, or Paradyne has its own line of peripherals.

In addition to the microprocessor and memory, each LCU and RCU is equipped with a control panel, a cassette drive for program loading, and various adapters to interface the CPU, communications lines, and peripherals. The adapters are listed in the accompanying table. The communications lines use integral or external modems, both of which are manufactured by Paradyne and can be supplied as part of the system. Each peripheral port provides for direct memory access to its control unit. An LCU, in addition to its attachment to the host, can support a limited number of local card readers and line printers although this capability is seldom used. The RCU is physically capable of connecting up to 25 peripherals. The maximum number is established by throughput, which is difficult to calculate even when the high speed line rate is known because the controllers use data compression techniques.

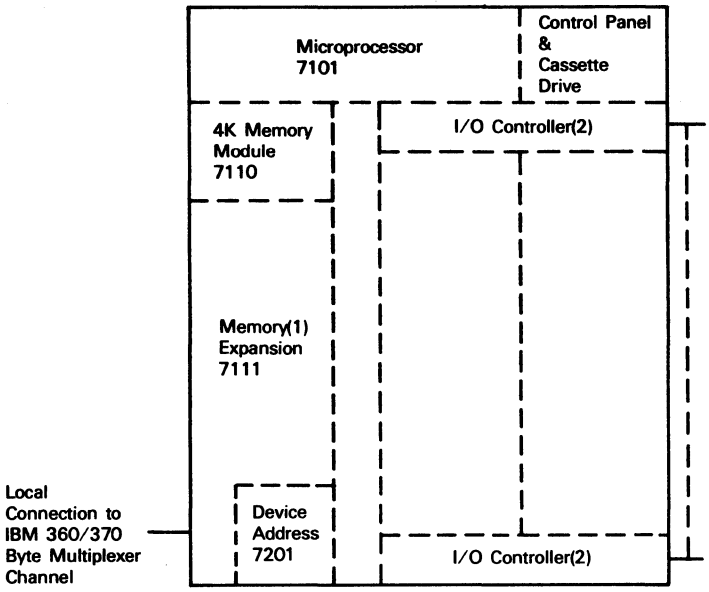
TABLE 1: I/O Controller Features Required

Control Units	Type of Line Peripheral	Adapter Type	Feature No.	Remarks
LCU	Asynchronous Line 4800-9600 bps local to 19.2K bps	Line Controller	7202	
	Synchronous to 56K bps	High Performance Line Controller	7201	
	Paradyne Card Reader	Card Reader Controller	7204	
	Paradyne Line Printer	Printer Controller	7203	
RCU	Asynchronous Line 4800-9600 bps	Line Controller	7202	
	Asynchronous Line and Paradyne	Async. Controller	7205	Supports up to three devices
	Synchronous to 56K bps	High Performance Line Controller	7210	
	Paradyne Card Reader	Card Reader Controller	7204	
	Paradyne Line Printer	Printer Controller	7203	
	Paradyne Magnetic Tape	Mag Tape Controller (NRZ)	7207-1	One tape drive per controller
		Mag Tape Controller (P.E.)	7207-2	One tape drive per controller
	IBM Peripherals	IBM Mux. Channel	7209	Up to two devices per controller

Paradyne Parallel Interface Extension-II (PIX-II)

Configuration

7610 Local Control Unit (LCU)



(1) one 16K Memory Expansion Unit required; maximum of two permitted.

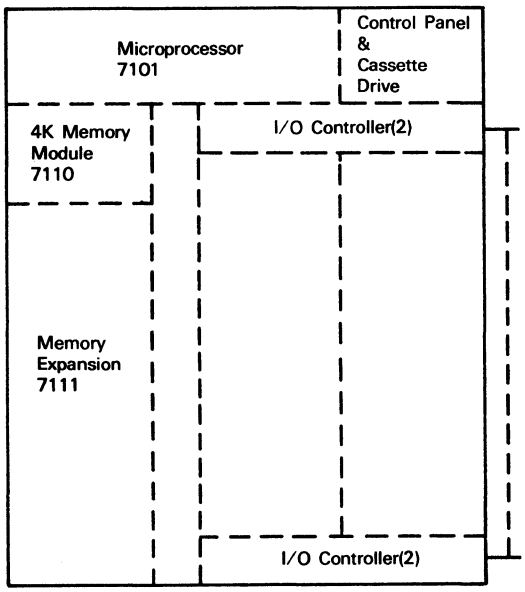
(2) LCU I/O Controllers include:
- Line to 19.2K bps
- High Performance Line to 56K bps
- Paradyne Printer
- Paradyne Card Reader

RCU I/O Controllers include:
- Line to 19.2K bps
- High Performance Line to 56K bps
- Paradyne Card Reader
- Paradyne Printer
- Paradyne Magnetic Tape (NRZ)
- Paradyne Magnetic Tape (P.E.)
- Paradyne Async Controller (1 controller per 3 async devices)
- IBM MUX Channel Device (1 controller per 2 devices)

Please see Management Summary for physical capacity limits.

Communications line I/O Controllers are attached to Paradyne LSI internal modems or external modems.

7620 Remote Control Unit (RCU)



USER REACTION

In September of 1978, Datapro conducted a telephone survey of five firms using the PIX-II. In several cases, we spoke to more than one person within the organization.

TRANSMISSION SPECIFICATIONS

Transmission between an RCU and an LCU is synchronous at standard rates of 4800, 9600, 19.2K, or 56K bps. Other rates are possible. Transfer is usually full-duplex, but can be half-duplex. Synchronous Data Link Control protocol

Paradyne Parallel Interface Extension-II (PIX-II)

Whenever possible, the people responsible for day-to-day operations were interviewed in addition to those responsible for the purchase or lease decision. With one exception, the ratings from individuals in the same organization were essentially identical. Consequently, one entry per firm is shown in the accompanying table. In the case of the exception, Datapro chose to tabulate the ratings of the person with "hands-on" experience, although comments from the other individual are provided in the text. The ratings are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	4	1	0	0	3.8
Ease of installation	1	3	0	1	2.8
Throughput	5	0	0	0	4.0
Reliability	4	0	0	1	3.4
Promptness of maintenance	3	0	2	0	3.2
Quality of maintenance	4	0	1	0	3.6
Software	2	2	0	0	3.5
Technical support	2	3	0	0	3.4

*Weighted Average based on 4.0 for Excellent.

The equipment covered by this survey includes 11 LCU's and 14 RCU's. Most installations were also using Paradyne peripherals and modems. Experience ranged from two months to one year and averaged six months. Four of the firms contacted were Fortune "500" companies that were involved in light or heavy manufacturing, oil, or a diversification of enterprises. The fifth was a bank. No problems specific to the peripherals were reported. The modems were highly praised, except in one case where some of the first 9600 bps units shipped from the factory for other than a PIX application had some initial difficulties.

The way in which the PIX was used varied widely. Some installations ran communications links of only several thousand feet between the LCU and RCU's, while others ran intercity lines. The lowest transmission speed reported was 4800 bps; the highest was 56K bps; and the predominant rate was 9600 bps. Installations that used telephone company leased lines, the dial network, and Dataphone Data Service were reported, as well as some directly connected metallic pairs. All host systems were IBM and, with the exception of one 3033, were System/370 Model 148's and above. Many of the mainframes had 370X or equivalent front ends in addition to the PIX. In at least one situation, the PIX replaced a front end. The most common operating system reported was OS MVS. IMS and TSO applications were mentioned frequently.

One user accounted for both Poor ratings in the table. His irritation began with the length of time required for installation. Apparently this was the first time that PIX interfaced with IMS and TSO. New ROM's and PROM's had to be created, which took several months. For whatever reason, this user had formed the impression that debugging could be accomplished in days. The IMS and TSO interface problem has obviously been conquered because several other users indicated at least satisfactory operation with similar installations.

(SDLC) is used with Go-Back-N error control and recovery techniques. High speed satellite transmission has been used with PIX systems, and time delay does not appear to be a problem. In fact, some users have reported response time improvements using PIX.

SOFTWARE

The software in the control units is tailored by Paradyne for the required configuration. Code is resident in memory and consists of modules for each type of connected device. One module type supports multiple devices of the same type. Paradyne claims to have "off-the-shelf" software and firmware for most popular applications.

The host software is unaware of the communications lines or foreign peripherals and therefore requires no telecommunications access method, such as BTAM, QTAM, TCAM, or VTAM. The LCU simulation of the byte multiplexer channel/peripheral interface will operate under DOS, DOS/VS, OS/MFT, OS/MVT, OS/VS1, OS/VS2 (SVS), and OS/VS2 (MVS).

Remote site telecommunications software is eliminated. Terminals running under most existing IBM and compatible software systems are supported, including IMS, CICS, TSO, GBASWIFT, ENVIRON/1, WESTI, ROSCOE, and others.

The PIX-II also has a Remote Console Support (RCS) feature that allows PIX-II remote operators to use the same type of facilities currently available to Remote Job Entry (RJE) terminal operators. The necessary RCS software is provided by Paradyne. RCS is designed to interface with unmodified IBM operating system software. It will operate with Paradyne CRT consoles, Teletype-compatible terminals, or 3270-type consoles. RCS provides facilities that are functionally equivalent to those available to the RJE terminal operator. Support is provided for DOS/VS/POWER, MVS/JES2, and OS/HASP. PIX operates under all IBM and compatible spooling systems including DOS/POWER, VS/POWER, POWER/VS, GRASP, GRASP/VS, SPRINT, ASAP, ESF, THE SPOOLER, HASP, JES, and JES2.

PERIPHERALS

The following IBM peripheral devices are supported:
- **Card Readers—IBM 2501, 2540 (via 2821), 3505.**
- **Line Printer—IBM 1403 (via 2821).**
- **Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).**

CRT—IBM 3270.

The following Paradyne peripheral devices are supported:
- **Card Readers—300 cpm, 600 cpm, 1000 cpm.**
- **Line Printers—300 lpm, 600 lpm, 900 lpm, 1200 lpm.**
- **Magnetic Tape—7 track, 200/556 bpi, 556/800 bpi, 200/800 bpi, NRZ; 9 track, 800 bpi, NRZ, 9-track, 1600 bpi, Phase Encoded.**
- **VDU77 Display Control and Keyboard/Displays—1920 character screen.**
- **CRT Operator Console—1920 character screen.**

PRICING

The PIX-II and related peripherals can be purchased or are available on two-, three- or five-year lease plans. Lease charges include maintenance. The maintenance rates in the accompanying table are for purchased equipment and are based on Zone 1 service, which is defined as being within a 50-mile radius of a Paradyne service center. Approximately 50 U.S. metropolitan areas are presently designated as service centers. Service outside Zone 1 is provided at a premium.

Paradyne Parallel Interface Extension-II (PIX-II)

The second problem described by the unsatisfied user was service. He described Paradyne as having "monumental internal communications problems." This user stated that a number of letters describing service problems had been sent, but no satisfaction had been forthcoming. Paradyne is aware of this situation and has already staffed up, made changes, and secured additional capital to solve the problem. One other user said that he would recommend PIX, but would advise the prospective customer to "check out the service capability in the area of installation."

Some notable quotes from those interviewed include: "Super box, haven't had an outage in the six months we've had it; Concept is great; Definitely a plus outfit." One person that described Ease of installation in less than glowing terms said, "They have expended a great deal of effort, manpower, and money to get us up."

The popularity of the PIX concept speaks for itself by sales volumes—over 400 units in two years. Most of the users surveyed consider Paradyne to be a solid firm and are looking forward to new product announcements. Paradyne also claims substantial improvement in service capability and ready availability of PIX firmware for all popular applications.□

Installation charges are $200 per unit, plus any applicable travel and expenses outside of Zone 1. Cables are separately priced. All Paradyne equipment carries a minimum 90-day warranty.

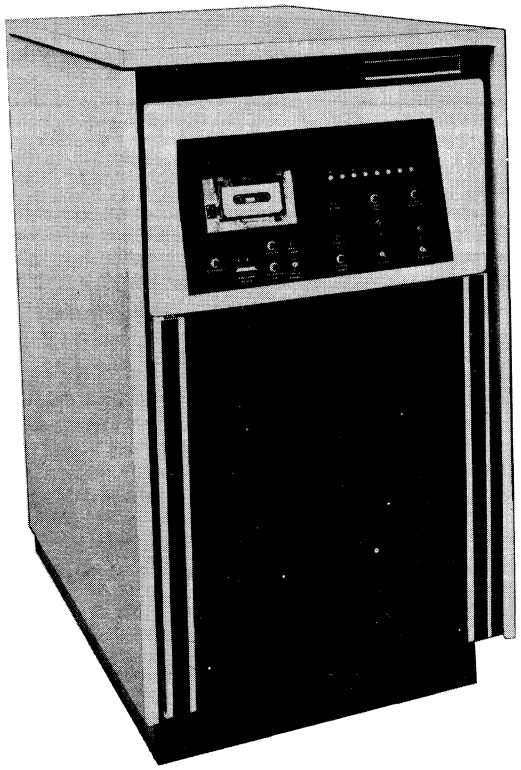
		Monthly Charges*			Purchase	Monthly
		2-Yr.	3-Yr.	5-Yr.	Price	Maint.
7610	Local Control Unit (LCU)	$353	$305	$277	$11,200	$53
7615	LCU Expansion Cabinet	101	88	79	3,400	11
7201	Device Address (except 3270)	21	18	16	680	3
7221	3270 Device Address	12	11	11	580	2
7229	3270 Multiple Address	60	50	45	2,000	5
7210-3	V.35 Digital; 56KB	80	70	64	2,400	16
7231	56KB Multiplexer	225	210	195	5,000	35
7620	Remote Control Unit (RCU)	224	197	180	6,600	49
7625	Remote Control Unit (RCU includes space for tape drive	224	197	180	6,600	49
7626	Stand-alone Cabinet for 2nd and subsequent tapes	71	61	56	2,200	16
7205-1	VDU 77 Controller, 1 for 3 devices	32	27	25	1,000	5
7206	Punch Controller	37	32	29	1,200	5
7207-1	Magnetic Tape Controller; 7 or 9 track, NRZ	130	110	100	3,050	20
7207-2	Magnetic Tape Controller; 9 track, 1600 bpi	185	160	145	4,960	25
7207-3	Magnetic Tape Controller; NRZ/PE, dual density	245	210	190	6,280	30
7208	IBM MUX Channel Extension	41	36	32	1,480	5
7209	IBM MUX Channel Device Controller; 1 per 2 devices	22	19	17	800	5
7211	Diskette Controller	45	40	35	1,300	10
7212	MUX Range Controller; 16 devices	45	40	35	1,700	5
7212-1	MUX Range Controller; 32 devices	84	69	64	3,200	9
7222	Print/Tape mode switch (optional with 7625, 7626)	10	9	9	350	1
7801	CRT Console	134	119	111	3,000	27
7802	Model 77 Visual Display Unit	155	137	127	3,800	27
7809-1	Magnetic Tape Unit; 9 track, 800 bpi, NRZ	265	234	218	6,400	50
7809-2	Magnetic Tape Unit; 9 track, 1600 bpi, PE	355	313	291	7,000	60
7809-3	Magnetic Tape Unit; dual density, 9 track, 800/1600 bpi, NRZ/PE	420	360	330	8,000	70
7807-1	Magnetic Tape Unit; 7 track, 200/556 bpi	275	244	228	6,400	60
7807-2	Magnetic Tape Unit; 7 track, 200/800 bpi	275	244	228	6,400	60
7807-3	Magnetic Tape Unit; 7 track 556/800 bpi	275	244	228	6,400	60
7810	Diskette Unit	205	180	165	3,200	40
	LCU or RCU Features					
7110	4K Memory Modules	27	23	21	800	3
7111	Memory Expansion; 1 required per 7101 above 16K	24	21	19	800	3

Paradyne Parallel Interface Extension-II (PIX-II)

			Monthly Charge*			Purchase	Monthly
			2-Yr.	3-Yr.	5-Yr.	Price	Maint.
➤	7202	Line Controller; 9.6KB	$ 31	$ 27	$ 25	$ 880	$7
	7202-2	Line Control Module LCM	31	27	25	880	7
	7203	Printer Controller	32	27	25	1,000	5
	7204	Card Reader Controller	32	27	25	1,000	5
	7205	Async. Controller; 1 per 3 devices	32	27	25	1,000	5
	7210-1	High Performance Line Controller; up to 56KB, RS232C	80	70	64	2,400	16
	7210-2	High Performance Line Controller; up to 56KB, WE303 current interface	80	70	64	2,400	16
	7223	Line Quality Indicator; mandatory on 7202/7210	6	6	6	150	0
	7224	96-character set for 8331 printer	27	25	25	500	0
		PIX Peripherals and Options					
	8203	300 cpm Card Reader	162	150	140	4,300	55
	8206	600 cpm Card Reader	215	190	180	5,000	55
	8210	1000 cpm Card Reader	375	335	295	7,000	80
	8313	300 lpm Line Printer	460	415	395	12,000	165
	8316	600 lpm Line Printer	755	660	620	16,000	165
	8319	900 lpm Line Printer	1,035	920	860	25,000	220
	8321	1100 lpm Line Printer	1,315	1,145	1,070	30,000	220
	8330	Power Paper Stacker	100	90	85	2,100	10
	8331	1220 lpm Charaband Printer	1,505	1,320	1,120	45,500	220
	8351	CDC 2000 Printer	2,250	2,100	2,000	65,000	450
	822	9600 bps Modem; point-to-point	135	122	115	4,650	10
	829	Short Haul Modem; 9600/19,200 bps	40	35	30	900	10
	832	4800 bps Modem; point-to-point	85	80	75	2,775	10
	804	Voice Adapter Feature	15	15	15	350	3
	805	Line Switch Feature	7	7	7	150	1

*Includes monthly maintenance.■

Paradyne Parallel Interface Extension-II (PIX-II)



Local and Remote Control Units for remote job entry to IBM System 360/370 computers.

Host computer software requires no modification with the PIX system. This is accomplished by having the Local Control Unit simulate a local peripheral interface to the host computer.

The Local Control Unit, in addition to handling communications lines, can serve as an interface between a 360/370 and Paradyne card readers and line printers. The Remote Control Unit can support IBM card readers/punches, line printers, and CRT's, and/or support Paradyne card readers, line printers, magnetic tape, and a CRT Operator Console.

Both control units are vendor-programmable and support communication line speeds between 4800 bps and 56,000 bps, using SDLC protocol, and can be either full- or half-duplex.

A typical configuration including one communications line, modems, a remote 600 cpm card reader, a remote 900 lpm line printer, and a remote magnetic tape drive can be purchased for $79,640 or leased for two years at $2,663 per month, including maintenance.

MANAGEMENT SUMMARY

For an IBM 360/370 installation with remote job entry requirements that does not want to get involved with communications access methods (BTAM, VTAM, TCAM, etc.), Paradyne offers the PIX system.

By simulating a peripheral interface, the PIX Local Control Unit allows the 360/370 to continue to give standard peripheral read and write commands, oblivious of the true nature of the attached device.

PIX-II is a significant up-grade in hardware and capability over the original system, now called PIX-I. The price differential for typical configurations is such as to preclude new installation of the hard-wired PIX-I over the software modifiable PIX-II. (Therefore, PIX I is not included in this report.) Included in the upgrade is remote support for Paradyne magnetic tape, IBM CRT's, and 56,000 bps transmission speed. The latter enhancement permits two remote CPU's to be linked via a PIX Local Control Unit at each end with both computers unaware of the direct hook-up.

The Local Control Units can also serve as stand-alone interface between a 360/370 and local Paradyne card readers and/or line printers.

CHARACTERISTICS

VENDOR: Paradyne Corporation, 8550 Ulmerton Road, Largo, Florida 33540. Telephone (813) 536-4771.

DATE OF ANNOUNCEMENT: March 1976.

DATE OF FIRST DELIVERY: April 1976.

NUMBER DELIVERED TO DATE: Information not available.

SERVICED BY: Paradyne Corporation.

CONFIGURATION

The PIX-II Data Communications System provides a transparent interface between an IBM system 360/370 and remotely located card readers/punches, line printers, magnetic tapes, and CRT's; between two remotely located IBM System 360/370's; or between an IBM System 360/370 and local Paradyne card readers and line printers. The hardware to accomplish this consists of a microprocessor that Paradyne has tailored into two special purpose controllers; the Local Control Unit (LCU) and the Remote Control Unit (RCU). Both processors have a control panel display, a cassette drive for program loading, a 4K memory module, a minimum of 16K Memory Expansion, and provision to attach I/O Controllers to Ports provided for direct memory access. The

Paradyne Parallel Interface Extension-II (PIX-II)

TABLE 1: I/O Controller Features Required

Control Units	Type of Line Peripheral	Controller Name	Feature No.	Remarks
LCU	Asynchronous Line 4800-9600 bps local to 19.2K bps	Line Controller	7202	
	Synchronous to 56K bps	High Performance Line Controller	7201	
	Paradyne Card Read	Card Reader Controller	7204	
	Paradyne Line Printer	Printer Controller	7203	
RCU	Asynchronous Line 4800-9600 bps	Line Controller	7202	
	Asynchronous Line and Paradyne	Async. Controller	7205	Supports up to three devices
	Synchronous to 56K bps	High Performance Line Controller	7210	
	Paradyne Card Reader	Card Reader Controller	7204	
	Paradyne Line Printer	Printer Controller	7203	
	Paradyne Magnetic Tape	Mag Tape Controller (NRZ)	7207-1	One tape drive per controller
		Mag Tape Controller (P.E.)	7207-2	One tape drive per controller
	IBM Peripherals	IBM Mux. Channel	7209	Up to two devices per controller

The throughput constraints, which can vary dramatically depending on the devices and volumes involved, will most likely be reached before the physical expansion limitations are reached. This is probably the reason why Paradyne is reluctant to define the physical I/O limitations. It is our educated guess that both control units are limited to ten ports with the Local Control Unit expandable by a like amount.

While each control unit is programmable, Paradyne handles all of the software requirements to the point that the software is as transparent to PIX users as the hardware is transparent to the 360/370.

PIX-II is truly a modular approach to attaching a long extension cord onto peripherals without host computer or programmer involvement. The cost, when volumes are moderate, is nominal: one port on the Byte Multiplexer Channel serves multiple-peripheral input and output traffic.

USER REACTION

In January 1977, Datapro telephoned three PIX-II users with an average installation life of six months. The 4.0 rating on Ease of Installation validated the transparency of the PIX-II system to the host computer software. All users, as the ratings below indicate were quite satisfied with the Paradyne equipment.

	Excellent	Good	Fair	Poor	WA*
Overall satisfaction	2	1	0	0	3.7
Ease of installation	3	0	0	0	4.0
Throughput	1	2	0	0	3.3
Hardware reliability	1	2	0	0	3.3
Promptness of mfr's. maint.	1	2	0	0	3.3
Quality of mfr's. maint.	1	1	1	0	3.0
Mfr's. software	2	1	0	0	3.7
Mfr's. technical support	1	2	0	0	3.3

*Weighted Average based on 4.0 for Excellent.

microprocessor is a 16-bit word device, with a 500-nanosecond memory cycle time. The average instruction execute time is 2.5 microseconds, and the instruction repertoire is 53. A maximum of two memory expansions can be added for a total of 32K words (64K bytes).

The Local Control Unit serves as an interface between the 360/370 and either communication lines and/or local Paradyne card readers and line printers. The LCU is attached to one port of the 360/370 Byte Multiplexer Channel and is designed to make the host computer believe a local peripheral is attached to the port. The obvious advantage is that no communications access method software is required within the host computer to support communications lines. Each communications line and peripheral that is to be attached requires its own I/O Controller attachment feature for attachment to a memory access port. Communications lines require either external modems or Paradyne LSI internal modems. The number of controllers an LCU can accommodate can be expanded with the LCU Expansion Cabinet feature. (Please see the Management Summary for controller capacity.) A Device Address feature is required in the LCU to support the relationship between the physical and logical location of devices.

An LCU can be attached, via communications lines, to one or multiple RCU's and/or LCU's.

The Remote Control Unit can be attached, via communications lines, to a LCU; requiring an I/O Line Controller and either an external modem or LSI internal modem. When the peripherals attached to the RCU are Paradyne peripherals, the appropriate peripheral I/O Controller attachment is required. When the peripherals are IBM peripherals, special controllers are required that will simulate, to the peripheral, an IBM Byte Multiplexer Channel. (Please see the Management Summary for controller capacity.)

TRANSMISSION SPECIFICATIONS

Communications lines can be either full- or half-duplex. Asynchronous speeds can be from 4800 to 9600 bps, and Synchronous speeds can be up to 56K bps. Table 1 lists the I/O Controller for each type of line or peripheral attached to either the LCU or the RCU.

Paradyne supplies two internal modems: a 9600 bps point-to-point and a 4800 bps point-to-point. A voice adapter and a line switch feature are available for each line.

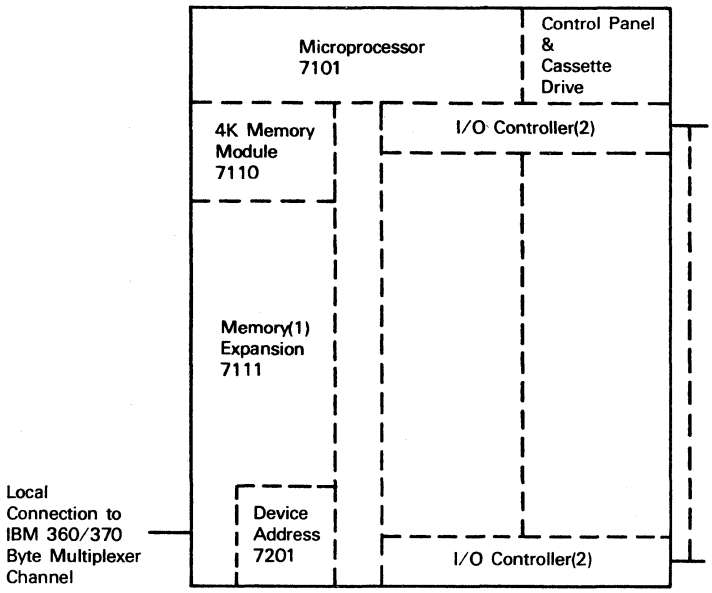
SOFTWARE

The software in the control units is tailored by Paradyne for the required configuration. The code which must be fully

Paradyne Parallel Interface Extension-II (PIX-II)

Configuration

7610 Local Control Unit (LCU)



(1) one 16K Memory Expansion Unit required; maximum of two permitted.

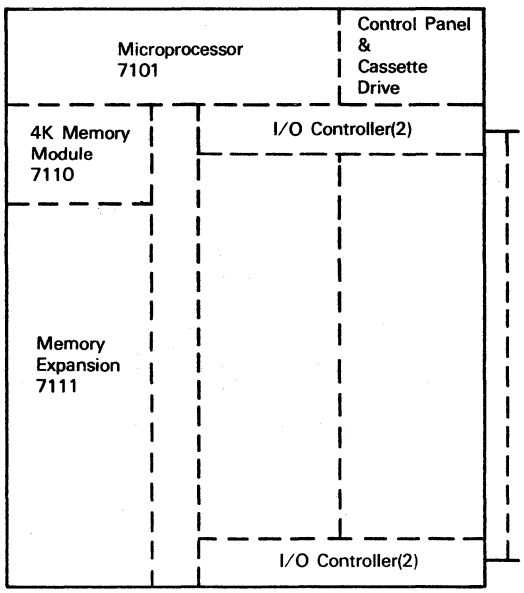
(2) LCU I/O Controllers include:
- Line to 19.2K bps
- High Performance Line to 56K bps
- Paradyne Printer
- Paradyne Card Reader

RCU I/O Controllers include:
- Line to 19.2K bps
- High Performance Line to 56K bps
- Paradyne Card Reader
- Paradyne Printer
- Paradyne Magnetic Tape (NRZ)
- Paradyne Magnetic Tape (P.E.)
- Paradyne Async Controller (1 controller per 3 async devices)
- IBM MUX Channel Device (1 controller per 2 devices)

Please see Management Summary for physical capacity limits.

Communications line I/O Controllers are attached to Paradyne LSI internal modems or external modems.

7620 Remote Control Unit (RCU)



Only one of the three users attached peripherals to the Local Control Unit. The maximum number of RCU's attached to one LCU, one of the users questioned, was three. One installation with a leased line between the LCU and the RCU installed a modem switch so that a dial-up line could be used as fall-back to the leased line.

resident in memory consists of modules that support each type of I/O controller. When more than one of the same type of controller is present, only one copy of the module is necessary to support all of the controllers of that type. Obviously, the amount of memory will be dependent on the number of different types of controllers.

Paradyne Parallel Interface Extension-II (PIX-II)

The only complaint was from the standpoint of the remote site (RCU) operations personnel. They wanted the ability to interrogate the status of PIX jobs in the host computer. Paradyne is responding to this user with a set of changes to HASP, a necessary prerequisite to satisfy that particular installation's request. This response, however, begs the general question, and is counter to the prime virtue of PIX-II, the virtue that gave it a 4.0 score for Ease of Installation.

A PIX-I user we talked to was able to give the remote site full remote job control, as well as remote job entry, by assigning a fully dedicated Virtual Machine to the remote job system. However, such an approach is costly in terms of CPU overhead.□

➤ **The host software is unaware of the communication lines or foreign peripherals and therefore requires no communications access method such as BTAM, QTAM, VTAM, etc. The LCU simulation of the Byte Multiplexer/Peripheral interface will operate under DOS or OS.**

PERIPHERALS

The following IBM peripheral devices are supported:
Card Readers—IBM 2501, 2540 (via 2821), 3505.
Line Printer—IBM 1403 (via 2821).
Card Punch—IBM 1442N2, 2540 (via 2821), 3525 (via 3505).
CRT—IBM 3270.

The following Paradyne peripheral devices are supported:
Card Readers—300 cpm, 600 cpm, 1000 cpm.
Line Printers—300 lpm, 600 lpm, 900 lpm, 1200 lpm.
Magnetic Tape—7 track, 200/556 bpi, 556/800 bpi, 200/800 bpi, NRZ; 9 track, 800 bpi, NRZ. 9-track, 1600 bpi, Phase Encoded.

CRT Operator Console—1920 character screen.

PRICING

The PIX system is available for purchase or on a 1-year, 2-year, 3-year, or 5-year lease. In addition to the purchase or rental charge, there is a one-time installation charge for some of the components. The monthly rental shown below includes the maintenance for Zone 1 maintenance. For Zone 2 or 3 add 30 percent or 60 percent, respectively, of the Zone 1 maintenance charge to arrive at the total monthly charge. Zone 1 is metropolitan areas.

		Monthly 2-yr.	Lease 5-yr.	Purchase Price	Zone 1 Maint.	Initial Installation Charge
7610	Local Control Unit (LCU)	$ 303	$ 247	$11,200	$ 23	$350
7620	Remote Control Unit (RCU)	183	150	6,600	19	350
7101	Microprocessor (8K) for LCU, RCU	131	108	4,600	17	120
7110	4K Memory Module (one per 7101)	24	20	880	2	—
7111	16K Memory Expansion (1 or 2 required per 7101)	24	18	800	2	—
7115	LCU Expansion Cabinet	95	78	3,400	10	—
7201	Device Address for LCU	19	15	680	2	—
	I/O Controllers—Communication Lines					
7201	Line to 19.2K bps	28	24	880	6	100
7210	High Performance Line to 56K bps	75	63	2,400	15	100
	I/O Controllers—for LCU and RCU Peripherals					
7203	Printer	29	24	1,000	4	—
7204	Card Reader	29	24	1,000	4	—
	I/O Controllers—for RCU only Peripherals					
7205	Async. (1 per 3 devices)	29	24	1,000	4	—
7207-1	Magnetic tape, NRZ (1 per device)	115	95	3,050	15	—
7207-2	Magnetic tape, P.E. (1 per device)	170	140	4,960	20	—
7208	IBM MUX Channel Extension	39	32	1,480	5	—
7209	IBM MUX Channel Device (1 per 2 devices)	21	17	800	5	—
	Paradyne Peripherals					
7801	CRT Console	125	109	3,000	25	50
7807-1	Magnetic Tape Unit; 7 track, 200/556, 556/800, 200/800 NRZ	245	213	6,400	45	75
7809-1	Magnetic Tape Unit; 9 track, 800 bpi, NRZ	245	213	6,400	45	75
7809-2	Magnetic Tape Unit; 9 track, 1600 bpi, P.E.	330	287	7,000	55	75
8203	300 cpm Card Reader	150	135	4,300	50	50
8206	600 cpm Card Reader	200	175	5,000	50	50
8210	1000 cpm Card Reader	350	290	7,000	75	70
8313	300 lpm Line Printer	425	380	12,000	150	50
8316	600 lpm Line Printer	700	605	16,000	150	50
8319	900 lpm Line Printer	960	840	25,000	200	75
8331	1220 lpm Charaband Printer	1,400	1,100	45,000	200	75
	Modems					
822	9600 bps Modem (point-to-point)	135	115	4,650	10	—
832	4800 bps Modem (point-to-point)	85	75	2,775	10	—
804	Voice Adapter Feature	15	15	350	3	—
805	Line Switch Feature	7	7	150	1	—

*Monthly lease charges include Zone 1 Maintenance.■