

# Protocol Conversion Systems: Overview

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**Note:** This report focuses on the protocol conversion systems market. It describes the industry's origins, identifies market leaders, presents market and technology trends, describes available types of products, explains the component processes of protocol conversion, and offers product selection guidelines.

## Market Analysis

### Market Highlights

The market for protocol conversion systems developed as a solution to the incompatibility problems between IBM and non-IBM devices and hosts. IBM made its part of the world synchronous. Most end-user devices, such as display terminals, printers, and personal computers, are asynchronous, as are a high percentage of the modems in the United States. Connecting peripheral equipment from other vendors to IBM hosts spawned a new industry dedicated to connecting incompatible devices. Since asynchronous displays are generally less expensive than IBM products, protocol conversion also allowed users to inexpensively connect large numbers of displays to IBM systems.

In 1971, KMW Systems of Austin, TX (acquired by Andrew Corp. in 1990) began developing asynchronous-to-synchronous protocol conversion products. Thereafter, other companies, such as Local Data (also now part of Andrew Corp.) and Netlink entered the market, each bringing its own expertise to the field. Protocol conversion manufacturers flourished until 1982, when IBM released its own protocol conversion products, thereby capturing much of the market.

Early protocol converters were stand-alone (floor or desktop) units that provided a single type of conversion (e.g., asynchronous ASCII to IBM 3270) for multiple

asynchronous display terminals and printers. The increasing need to link multiple IBM and non-IBM devices, however, has triggered the development of a variety of conversion systems, including board-level products for PCs and printers. Manufacturers have applied the same board-level technology to large, multiprotocol terminal controllers, producing multiprotocol communications processors capable of linking a variety of computer environments, including IBM midrange (5250), IBM 3270, token-ring and Ethernet LANs, and X.25 packet-switching networks.

Because display terminals have largely been replaced by personal computers, which can emulate displays through internal hardware, the traditional protocol converter (designed primarily for "dumb" terminals) is on the verge of extinction. Niche products, such as Macintosh- or IBM PC-emulation boards, continue to thrive; multiprotocol communications controllers, however, have absorbed most market profits.

### Market Leaders

#### Andrew Corp.

Andrew Corp. acquired Local Data, a leading protocol conversion manufacturer, in 1987. Local Data developed the DataLynx, InterLynx, and VersaLynx product lines, which provide access to IBM midrange, 3270 BSC, 2780/3780 BSC RJE, and SNA/SDLC environments for multiple or individual asynchronous displays, printers, and PCs emulating displays. Andrew still markets these products.

Having acquired KMW Systems in 1990, Andrew also markets a number of

—By *Martin Dintzis*  
Assistant Editor

Macintosh connectivity products. NetAccess is an adapter board that transforms a Macintosh II personal computer into a gateway capable of linking an entire AppleTalk network with an IBM midrange host. Macintosh workstations appear as IBM 52XX or 31XX displays, while Apple printers emulate IBM 52XX printers. Each Macintosh user has access to up to seven concurrent IBM midrange host applications and any number of Macintosh-resident applications. Andrew also supports Macintosh access to IBM midrange environments through its TwinAccess Series II (multiport) and TwinAccess Series III (single port) protocol converters.

## IBM

IBM provides bidirectional conversion between synchronous and asynchronous environments through the 3174 Establishment Controller, which also supports a token-ring gateway, X.25 network access, and an ISDN basic rate interface. IBM continues marketing its older protocol conversion solutions: the 3708 Network Conversion Unit and the 7171 Protocol Converter. A 10-port unit, the 3708 converts a 3270 datastream to and from ASCII code. Up to 18 asynchronous devices appear as Model 317X/327X displays and Model 3287 printers to an IBM SNA host. The

7171 connects from 16 to 64 asynchronous ASCII devices to the block multiplexer channel of an IBM host via an RS-232-C interface.

## Netlink

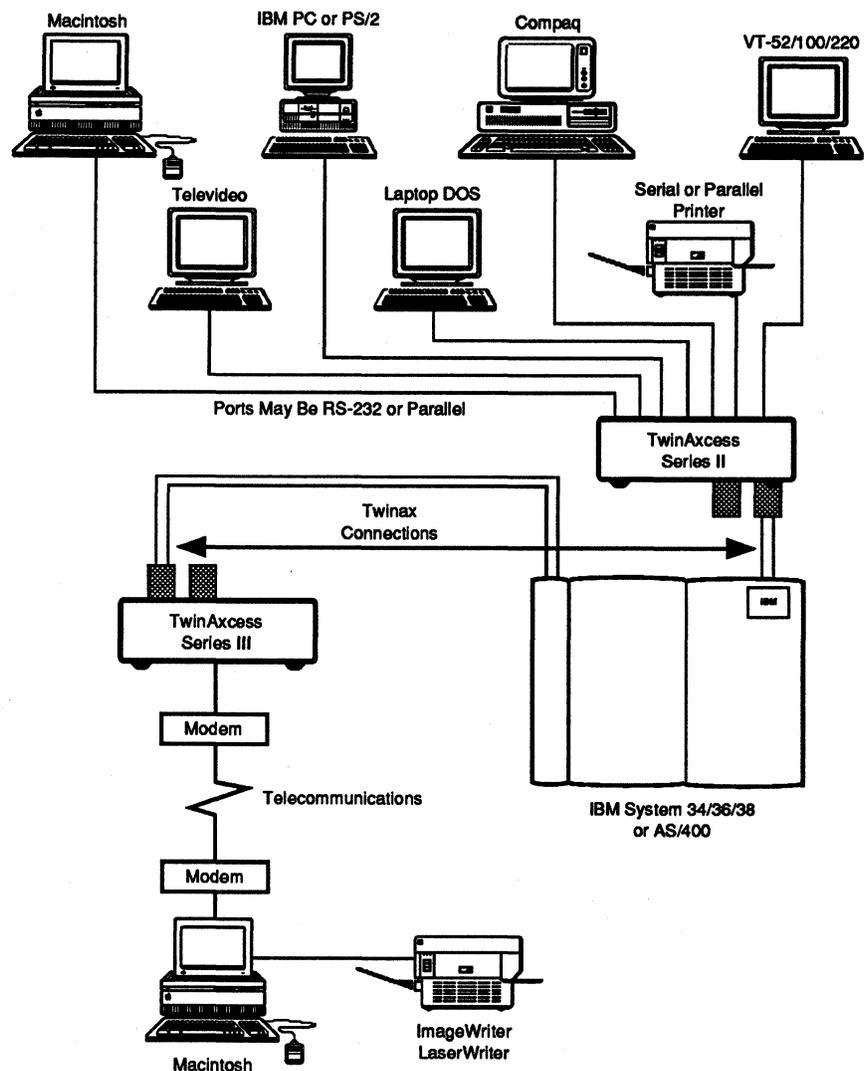
Netlink offers SNA\_Gate, a versatile product that functions as a protocol converter, a cluster controller, a line concentrator, and a remote job entry station. Connecting to an IBM 37XX communications controller, SNA\_Gate provides async-to-BSC, async-to-SNA/SDLC, or BSC-to-SNA/SDLC conversion, accommodating up to 250 devices over multidrop lines.

## Additional Vendors

Other major 3270-compatible communications controllers offering multiprotocol support include Apertus Technologies' Datastar 5000, IDEA Courier's Concert Controller, McDATA Corp.'s Linkmaster 7100 Network Controller, and Memorex Telex's 1174 Network Controller. All support up to four concurrent IBM mainframe host connections, multiple asynchronous host connections, a token-ring gateway, and various combinations of synchronous and asynchronous peripheral devices. Additionally, the Datastar 5000 and the Concert Controller support

Figure 1.  
Andrew Corp.'s TwinAccess  
Protocol Converters

*TwinAccess Series II accommodates up to seven local or remote asynchronous devices, including IBM-compatible and Macintosh personal computers, display terminals, and serial or parallel printers. TwinAccess Series III is a one-port version of the TwinAccess Series II unit.*



Ethernet LAN attachment. Except for the 1174 Network Controller, all support Digital LAT devices.

## Future Directions

Since the mid-1980s, user migration from host-controlled "dumb" terminals to intelligent LAN-attached PCs has driven traditional protocol conversion products (ones designed primarily for linking asynchronous display terminals to IBM hosts) to virtual extinction. Many of the remaining protocol conversion vendors have turned to niche markets, offering Macintosh-to-IBM AS/400, async-to-Unisys Poll/Select, HP LaserJet-to-IBM 3270, IBM 2780/3780 BSC RJE-to-IBM SDLC, or some other type of unique conversion capability.

Other vendors applied their knowledge of IBM protocols to X.25 communications and now manufacture multi-protocol packet assemblers/disassemblers (PADs) and packet switches. Already a commodity item, the X.25 PAD will eventually experience the same fate as the protocol converter; board-level PAD functionality is now available in packet switches, multiplexers, LAN bridges, communications controllers, and other equipment, making dedicated PADs unnecessary.

A third group of vendors, already discussed, has diversified, marketing multipurpose communications processors that address the multivendor networking requirements of a wide variety of users. The growing number of multiprotocol bridge/router products will reduce this market over time. At present, however, the communications controller is the most popular method of interconnecting multiple environments.

Protocol conversion is no longer a single function performed by a dedicated product. It has become a component process within increasingly intelligent processors that perform many different data processing and data conversion functions concurrently.

## Technology Analysis

### Technology Highlights

Data communications protocols specify the methods of data encoding, data transmission, device control, and error correction. Some common protocols are the ASCII (Teletype or TTY), IBM 3270 Bisynchronous Communications (Bisync or BSC), IBM Synchronous Data Link Control (SDLC), IBM 2780/3780 Bisynchronous Remote Job Entry (BSC RJE), Unisys Poll/Select, and the CCITT's High-Level Data Link Control (HDLC).

In protocol conversion, one protocol is reformatted or converted to another. The most common type of conversion addresses incompatibilities between the synchronous communications methods used by IBM mainframes and asynchronous communications. Once limited to stand-alone devices performing only a single type of conversion, protocol conversion is now available through software and board-level hardware for printers, PCs and LAN servers, communications controllers, and X.25 packet assemblers/disassemblers (PADs).

There are different levels of protocol conversion. Some devices perform a limited combination of physical interface, speed, and code conversion. Other products perform all of these, along with device emulation and error correction.

### Technology Basics

Protocols govern the format of a data exchange, remote connection recognition, transmitting and receiving location identification, transmission sequencing, interruption handling, error-checking methods, device and session control, data blocking, and security procedures. They range from simple character-by-character communications with no error checking to complex algorithms moving data among many devices.

In general, protocols specify the following three major areas.

- The method in which data is to be represented or encoded—the code set. Most data processing systems use either the American Standard Code for Information Interchange (ASCII) or IBM's Extended Binary Coded Decimal Interchange Code (EBCDIC).
- The method in which the codes are transmitted and received—asynchronous or synchronous. In asynchronous transmission, data is sent at random intervals with no specific timing, with start and stop bits between individual characters. In synchronous transmission, characters or bits are sent at a fixed rate; transmitting and receiving devices are synchronized, eliminating the need for start/stop bits.
- The exchanges of information by which the two devices establish control, detect failures or errors, and initiate corrective action.

Using hardware or software control, the sending device automatically formats the data and adds the required control bits before transmitting each character or block. The receiving device automatically checks each of the appended bits before acknowledging receipt of data. After detecting failures, the protocol initiates error-control procedures.

### Types of Protocols

*Byte-oriented protocols* require transmission of data in bytes or eight-bit blocks; each transmitted block requires an acknowledgment before the next block can be sent. *Bit-oriented protocols* allow data to be transmitted in blocks of any length up to a specified maximum; an acknowledgment can take place after one or several blocks have been received, depending on the protocol.

*ASCII or Teletype (TTY)*, a byte-oriented protocol, traditionally relates to teletypewriter equipment and services. An asynchronous protocol, ASCII provides very little error checking. ASCII transmission includes a start bit, a number of data bits (usually five to eight), and one or more stop bits. Data in ASCII protocol enters the communications line at any time. The receiving device is synchronized by the specification of a common line speed and detection of the start bits at the beginning of the transmission. ASCII requires an acknowledgment after each block is sent.

*IBM's Synchronous Data Link Control (SDLC)* is a bit-oriented protocol that uses a synchronized series of frames. Each frame contains a synchronization flag followed by an address field, a control field identifying the purpose of the transmission, the data itself, a frame-check

field, and a trailing flag. The flag character marks synchronization. SDLC permits up to 127 frames to be outstanding before requiring an acknowledgment. Private-line networks use SDLC.

*IBM Binary Synchronous Communications*, a character-oriented synchronous protocol also referred to as *Bi-sync* or *BSC*, forwards data and control characters in eight-bit bytes. A transmission in BSC incorporates a number of synchronizing (SYN) characters that ensure synchronization at both ends of the communications link. These characters are followed by a start-of-text (STX) character, a block of text, an end-of-text (ETX) character, and a block error-checking character (BCC). BSC does not support full-duplex transmission, nor is it supported by IBM's Systems Network Architecture (SNA). An acknowledgment must follow each block of data. The BSC protocol works in multipoint applications over private lines.

Other communications protocols include High-Level Data Link Control (HDLC), a CCITT-specified, bit-oriented protocol on which most other bit-oriented protocols are based; Digital's Digital Data Communications Message Protocol (DDCMP), a byte-oriented protocol that can accommodate 255 unacknowledged transmissions; and CCITT X-Series protocols, which govern transmission of data packets across an X.25 packet switched network.

### The OSI Model

The International Organization for Standardization (ISO) Open Systems Interconnection (OSI) reference model provides a framework for understanding the differences in conversion products. Each of the OSI model's layers defines a particular aspect of the entire data communications process. Figure 2 illustrates the seven-layer hierarchy.

*Layer 1—Physical Connection* provides mechanical and electrical specifications and procedures to establish, maintain, and end physical connections. This layer defines physical interface, code, speed, and synchronization functions. Layer 1 is associated, therefore, with physical interface, code, speed, and synchronization conversion.

*Layer 2—Data Link Control* ensures that the data passes without error from one computer to another. This process involves protocols that specify the format for data transmission. Parameters such as modem control and ring signaling are defined on this level.

*Layer 3—Network Layer* allows two systems to exchange data. This layer defines packet addressing and routing of data to the final destination. Units that handle conversion in this layer include gateway devices, such as packet assemblers/disassemblers (PADs). Front-end processors (FEPs) and terminal controllers with protocol conversion capabilities also fall into this category.

*Layer 4—Transport Layer* handles end-to-end error and flow control to ensure that the communications exchange is orderly and reliable. PAD devices are the major products associated with this layer.

*Layer 5—Session Layer* furnishes the structure for data exchange by managing connections between application processes, establishing and terminating connections, and sending end-to-end messages and controller dialogs.

*Layer 6—Presentation Layer* defines the way data is assembled and provides a systematic arrangement for the communications exchange to occur. This layer defines functions that convert coded data to display formats for terminal or microcomputer screens, printers, and other peripherals. In this layer, data is expanded or compressed and structured for file transfer or command translation. Emulators, which allow one type of terminal to appear as

Figure 2.  
The OSI Model

(7) Application—provides communications services
(6) Presentation—defines syntax of data
(5) Session—controls data exchange
(4) Transport—handles data flow, error control
(3) Network—handles data routing
(2) Data Link—ensures data transfer via protocols
(1) Physical—provides mechanical/electrical interface

*Layers One through Three define the interface between the host computer and the network. Layers Four through Seven provide compatibility to data format and exchange.*

another type, operate within the Presentation Layer. Products in this category include printer and display terminal adapters; personal computer 3270 emulation boards; and word processor interfaces that handle conversions between dissimilar word processors.

*Layer 7—Applications Layer* supports user and application tasks by providing the communications services for specific computer applications. Basically, this layer provides the meaning to the message.

Converters often provide translations on more than one level in the model. Conversion at one layer generally implies a need for compatibility in lower layers. For example, a protocol converter working on Level 2 functions also assumes responsibility for physical interface, code, speed, and synchronization.

### The Mechanics of Protocol Conversion

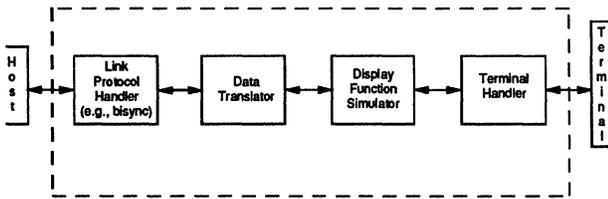
Protocol converters translate for dissimilar devices by simulating the appropriate protocol for each. As Figure 3 shows, this functionality gives protocol converters a distinctive, double-ended structure. For each end of the conversion process, a local protocol handler uses the protocol required by the attached device. Connecting these handlers is a gateway task that implements the movement of user data between the handlers.

If all communications protocols were structured in accordance with the OSI Reference Model, the converter would implement a set of seven-layer OSI protocols joined by the gateway task. Because the central task of the OSI protocol suite is to isolate users from the communications environment, a protocol converter dealing exclusively with the OSI model would be fairly simple to develop and could operate with few restrictions. With non-OSI protocols, such as those commonly used in today's networks, the following issues complicate the conversion process.

*The format of the user data.* If the data is easily separated from communications and device control protocols, it is more easily transferred to another environment. Special features, such as data compression, complicate protocol conversion if they do not exist in the other protocol.

*The degree of layering in the protocols.* Although full compliance with the OSI model is unlikely, any amount of OSI-like layering in the protocols will aid in the separation

Figure 3. The Protocol Conversion Process



of useful data from control information that must not be introduced into the other environment.

The availability of common functions in the protocols involved. Data exchange between the users requires a degree of synchronization between the two foreign protocols. For example, most older protocols operate in half-duplex mode—only one station at a time can send information. It is necessary for converters operating between half-duplex protocols to ensure that both stations are not given permission to send at the same moment, since neither could receive under those circumstances.

When protocol converters allow devices to simulate other devices, device control protocol translation may be needed. IBM's popular 3270 series of terminals is often emulated by lower cost asynchronous devices, but the 3270 has special features, such as the capability to return only modified fields to the host computer. This capability must be emulated within the protocol converter. Figure 4 shows the structure of a terminal emulator protocol converter.

**Products**

**Interface, Code, and Speed Converters**

An interface provides the physical connection between two devices. Interface conversion offers the lowest level of established compatibility. Data and control lines from devices terminate at a connector that handles assigned signal functions. For example, the RS-232-C interface connector has 25 pins—1 pin per function. The interface also prescribes voltage levels for electrical signals passing over the data and control lines.

Interface converters serve as adapters for different physical interfaces, translating signals, pin assignments, and voltage levels of one interface to those of another. Interface conversions commonly occur between RS-232-C and MIL-STD-188 or between RS-232-C and V.35.

Code converters translate one communications code to another. The most common codes are ASCII and EBCDIC. Conversion from one code to another may be simple, involving only the addition or deletion of control bits or the alteration of parity. A more complex code conversion might require changing the data character's bit pattern.

Basic code conversion hardware consists of two universal synchronous/asynchronous receiver/transmitters (USARTs), a translation table contained in read-only memory (ROM), and control circuitry. Characters received by the USART in one code are mapped in the ROM table into a corresponding character in the destination device's code. Converted data goes to the other USART, which transmits it to the destination device.

Asynchronous-to-synchronous converters perform physical interface and speed conversion for asynchronous devices, enabling those devices to communicate across synchronous facilities.

**Protocol Converters**

Protocol converters, one of the largest categories of conversion devices, perform changes at the Data Link Layer to ensure device compatibility. Protocol converters connect incompatible peripheral devices to hosts via microprocessors. A protocol converter actually changes one protocol to another by separating control characters from data and assembling the new datastream according to new specifications.

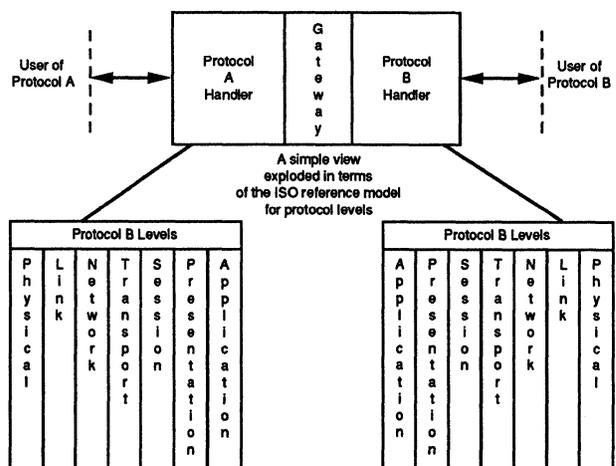
During the conversion sequence, the converter accepts blocks of data, adds or deletes the necessary control characters, reformats the block, and calculates the required check characters so the receiving device receives characters formatted according to its requirements. For example, in an ASCII-to-SDLC conversion, the converter accepts a character string, eliminates start and stop bits, assembles characters into a block, and adds headers and trailers to create complete frames. In a BSC-to-SDLC conversion, the converter changes the first four SYN bits of the bisync algorithm to the first flag bit of the SDLC algorithm.

Since protocol converters must stop, store, process, and retransmit data, they usually increase response time. The devices generally accept low-speed input to a buffer; work with the data; and then transmit it out in short, high-speed bursts.

**Gateways and PADs**

Gateways and PADs perform conversions on OSI Layers Three and Four (the Network and Transport Layers) and also perform lower layer functions. Gateway devices allow communications between incompatible networks, such as SNA and DECnet, SNA and Ethernet, or an IBM 3270 device and an X.25 packet switched network. Gateways also extend compatibility to the inherent protocols, codes, and interfaces of network architectures. By far the largest subset of gateway products is packet assembler/disassemblers (PADs).

Figure 4. Inside a Terminal Emulator



## Emulation Devices

An emulator resolves incompatibilities in protocol, code, physical interface, device characteristics, and link characteristics. The emulator alters control sequences from a display terminal, printer, plotter, or other device to simulate the emulated device's operations. The equivalent control sequences of various terminals and printers differ widely. For example, no asynchronous ASCII keyboard provides all of the special 3270 function keys.

Most IBM-compatible terminal controllers support emulation capability for attached asynchronous devices through some combination of adapter cards and software. As an alternative, an emulation product—such as a personal computer 3270 terminal adapter—can connect to a terminal controller. The PC terminal adapter accumulates an asynchronous datastream in its buffer until a 1,920-character screen image (the screen capacity for an IBM Model 3277 display terminal or compatible) is filled, or until the emulator receives an end-of-record, end-of-block control character. The emulator converts the ASCII terminal protocol and PC data format to those required by the terminal controller. The emulator then transfers the reformatted screen image to the controller, which recognizes the data as that of an IBM 3277 display. The terminal controller still performs all of its traditional functions: data concentration, device polling, flow control, buffering, error detection and correction, and interfacing of multiple attached terminals.

Although most protocol conversion systems perform ASCII-to-IBM conversions, other products provide the conversion required between IBM BSC protocols and IBM SDLC protocols. Users of older IBM BSC equipment who plan to migrate to an SNA/SDLC environment benefit from these products without replacing their old equipment. BSC-to-SDLC conversions occur between 2780/3780 BSC RJE or 3270 BSC protocols and SDLC protocols.

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## Selection Guidelines

### Terminal Controllers

When selecting a terminal controller with emulation capabilities, users should consider the capacity and versatility of the product. Some terminal controllers support only one device per port. Others support multidrop capability, allowing several devices to access a single controller port via a multidrop line. In either case, the maximum number of devices supported, as well as the maximum aggregate input rate (the maximum data handling capacity) of the controller, must be considered. Another key issue is the internal memory capacity, in bytes of RAM, of the unit.

Some communications controllers, including the IBM 3174 Establishment Controller, support only a predefined

set of asynchronous terminal and printer models. Other products allow user-defined conversion schemes for non-standard devices—including terminals with custom keyboard layouts. Products offering this capability include IBM's 3708 Network Conversion Unit and Andrew Corp.'s DataLynx/3174. Some protocol converters accommodate Apple Macintosh personal computers as well as IBM PCs.

Connections to ISDN networks, token-ring and Ethernet LANs, X.25 and X.25 packet switched networks, in addition to traditional IBM and asynchronous systems, will provide a future migration path to other communications solutions.

### Printer and Terminal Adapter Products

Unlike a communications controller, a terminal or printer adapter provides emulation for a single device, such as a personal computer, display terminal, or printer. For PCs and printers, adapter products are available as plug-in boards as well as desktop units. Emulation software, usually supplied by the vendor, works along with the adapter.

Board-level IBM 3270 and 5250 terminal emulators for personal computer products are designed to accommodate only one type of device (an IBM-compatible or Macintosh PC). Directly connected to the PC bus, however, they provide faster processing capability and multiple concurrent host sessions. Desktop units generally limit the user to one or two host sessions, but can accommodate a greater range of devices.

Some 3270/5250 terminal emulators and printer adapters provide asynchronous pass-through capability, in which both an IBM host and an asynchronous computer can share the device. For a display terminal, async pass-through allows the user to switch between an IBM host session and an asynchronous host session via a hot key. For an asynchronous printer, this feature allows control of the printer either by the IBM host or by a locally attached personal computer.

A key factor to consider when selecting an emulation device for a personal computer is its compatibility with off-the-shelf emulation software supporting distributed and cooperative processing, such as IBM's AS/400 PC Support. Functionally different from its predecessor, IBM's PC Support/3X software, AS/400 PC Support conforms to IBM Systems Application Architecture (SAA) and Advanced Peer-to-Peer Networking (APPN) standards for the implementation of distributed and cooperative processing applications. As users migrate from hierarchical (host-to-terminal) processing to distributed LAN-based systems, this level of functionality will become increasingly important. ■

# Protocol Conversion Systems: Market Overview

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## Synopsis

### Editor's Note

This report focuses on the protocol conversion systems market. It describes the industry's origins, the market leaders, and market trends. For information on the technology of protocol conversion, see "Protocol Conversion Systems: Technology Overview" (Report 3502). Comparison columns listing detailed characteristics of more than 120 conversion products from 33 different vendors can be found in "Protocol Conversion Systems: Comparison Columns" (Report 3503).

### Highlights

Protocol conversion technology provides a way to link incompatible host computers and devices. A major portion of this market addresses incompatibilities between IBM (synchronous) and non-IBM (asynchronous) hosts, displays, and printers. Conversion is also necessary for device and host access to packet-switching networks; communications between PCs or LANs and host computers; and connection of devices

using different physical interfaces, data codes, and communications speeds.

Until IBM entered the market in 1982, other vendors of protocol conversion products flourished. Another setback to the industry has been the shift away from host-controlled display terminals in favor of personal computers configured for terminal emulation.

The traditional protocol converter has largely given way to communications controllers capable of linking multiple environments and devices. Niche markets, such as Macintosh-to-IBM connectivity, also provide the most inventive vendors with fresh avenues for business.

—By *Martin Dintzis*  
Assistant Editor

# Analysis

## Market Overview

The market for protocol conversion systems developed as a solution to the incompatibility problems between IBM and non-IBM display terminals, printers, and hosts. IBM made its part of the world synchronous, while other vendors made theirs asynchronous. Connecting peripheral equipment from other vendors to IBM hosts spawned a new industry dedicated to smoothing out the differences between the two worlds. Since asynchronous displays were generally less expensive than IBM products, protocol conversion also became a popular means to inexpensively connect large numbers of displays to an IBM system.

After recognizing the need for asynchronous-to-synchronous transmission solutions, KMW Systems of Austin, TX (now known as Andrew/KMW) set out to fill the void, thereby establishing itself in 1971 as the pioneer of the protocol conversion market. Thereafter, other companies, such as Local Data (now known as Andrew Corp.), Micom Communications, and Netlink, entered the market, each bringing its own expertise to that field.

These protocol conversion manufacturers flourished until 1982, when they received a setback initiated by IBM. Presumably acting under the dictum, "If you can't beat them, join them," IBM released its own line of protocol converters.

The proliferation of private and public packet-switching networks in the latter half of the 1980s increased the need for conversion between the CCITT X.25 packet data mode and IBM BSC, IBM SNA/SDLC, and asynchronous transmission modes. As a result, some vendors of asynchronous-to-IBM protocol conversion products, including Memotec Data, Micom, and Plantronics Futurecomms, also offer X.25-to-IBM and X.25-to-async connectivity.

The increasing need to link multiple incompatible computers and devices has spawned the

development of other conversion products, including software for front-end processors, emulation cards, interface adapters, multifunction communications controllers, and gateways.

## Market Leaders

**Andrew Corp.** acquired Local Data, a leading protocol conversion manufacturer, in 1987. Local Data had developed the DataLynx, InterLynx, and VersaLynx product lines, which provide conversion between asynchronous and IBM BSC or SNA/SDLC environments for displays, printers, and PCs emulating displays. These devices are still marketed under Andrew's name.

Within the past two years, Andrew has released a steady stream of conversion products for both IBM mainframe and midrange environments, including the InterLynx/400 Protocol Converter and the Newport/Coax and Newport/Twinax synchronous adapters for Hewlett-Packard LaserJet printers. InterLynx/400 allows up to seven asynchronous display terminals, printers, or personal computers emulating displays to access an IBM AS/400 or System/3X host.

Andrew's protocol converters and display terminal adapters provide concurrent user access to both synchronous and asynchronous computers. The vendor's printer adapters allow a display- or PC-attached printer to be shared by both a host computer and the workstation user.

**Andrew/KMW** (formerly KMW Systems, which was acquired by Andrew Corp. in 1990) continues to blaze trails in the protocol conversion market by offering Macintosh connectivity products. Last year, the vendor introduced NetAccess, the first adapter board that transforms a Macintosh II personal computer into a gateway capable of linking an entire AppleTalk network with an IBM midrange host. Macintosh workstations appear as IBM 52XX or 31XX displays, while Apple printers emulate IBM 52XX printers. Each Macintosh user has access to up to seven concurrent IBM midrange host applications and any number of Macintosh-resident applications.

Andrew/KMW also supports Macintosh access to IBM midrange environments through its TwinAccess Series II (multiport) and TwinAccess Series III (single port) protocol converters. Series II (multiport) and Series III (single port) products for

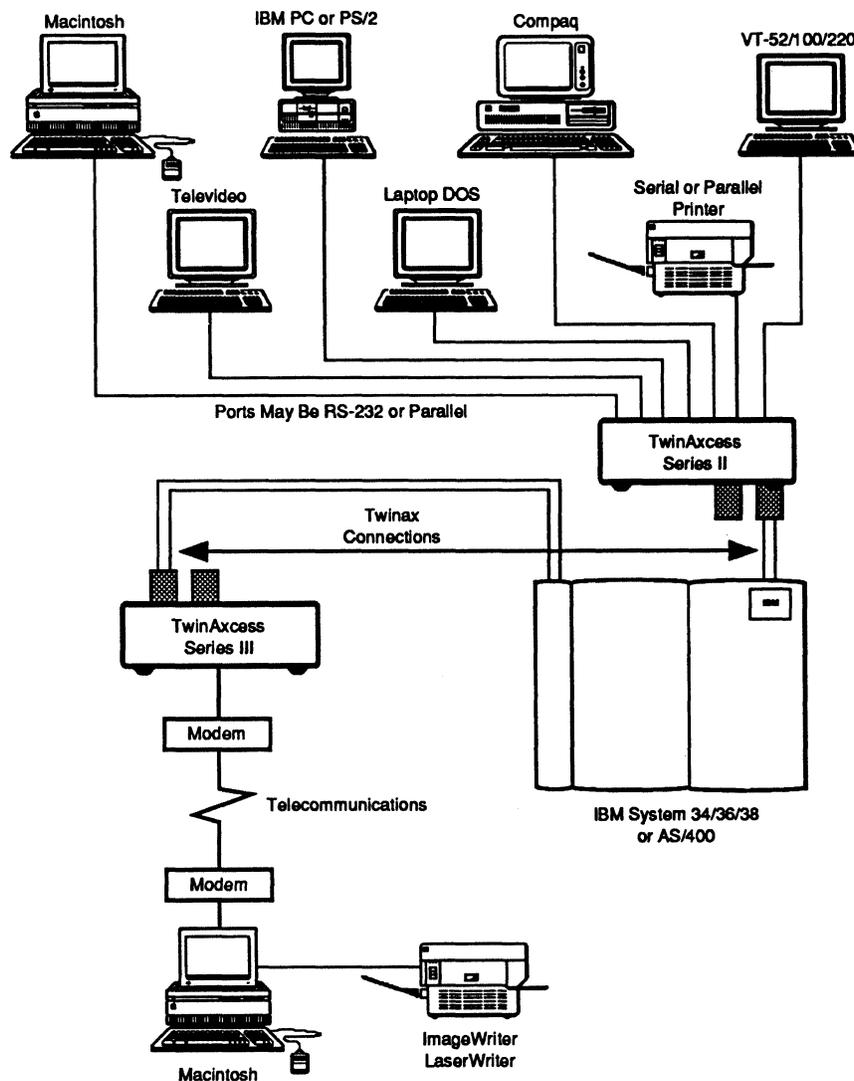


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*Andrew/KMW's TwinAccess  
Protocol Converters*

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3270 (IBM BSC, SNA/SDLC, and RJE) connectivity form another part of the vendor's product line.

IBM provides bidirectional conversion for both synchronous and asynchronous devices through the 3174 Establishment Controller, which also provides token-ring gateway functionality. IBM also continues to market the 3708 Network Conversion Unit and the 7171 Protocol Converter. The 3708 converts a 3270 datastream to and from ASCII code, allowing asynchronous devices to appear as 3270 displays and printers to an IBM SNA host. The 7171 can support from 16 to 64 asynchronous ASCII devices via an RS-232-C interface to the block multiplexer channel of an IBM host.

Micom Communications markets the Micom Box Type 3 unit, a network processor that can be configured, through a selection of software cartridges, for operation as an async-to-SNA/SDLC or

async-to-BSC protocol converter; an async, SNA/SDLC, BSC, or multiprotocol (async/SNA or async/BSC) packet assembler/disassembler (PAD); or an X.25 packet switch or switching PAD.

Netlink offers SNA\_Gate, a versatile product that can function as a protocol converter, a cluster controller, a line concentrator, and a remote job entry station facility. Connecting to an IBM 37XX communications controller, SNA\_Gate provides async-to-BSC, async-to-SNA/SDLC, or BSC-to-SNA/SDLC conversion, accommodating up to 250 devices over multidrop lines.

### Future Directions

Replacing older display terminals with microcomputers configured for terminal emulation has become a common practice. Users want access to

more than one computer system but do not want two terminals taking up space on their desks. By the early 1980s, organizations confirmed their preferences for micros over display terminals, installing them at a rapid rate and benefiting from their programmability. The shift from host-based systems to local area networks has heightened this trend, thereby weakening both the display terminal and protocol conversion industries.

The need for protocol conversion remains strong, however, because of the increasing need to link multiple dissimilar environments. Microcomputers have encouraged the development of new terminal emulation hardware and software products, including LAN gateway solutions. Products that link Macintoshes to IBM host environments, for example, are in demand, as evidenced by the product introductions of Apple Computer, Andrew/KMW, and other vendors.

While the sale of traditional protocol converters is on the decline, vendors throughout the IBM display system market, including AT&T, Apertus Technologies (formerly Lee Data), IBM, IDEA Courier, and Memorex Telex, have been successful in marketing large communications controllers capable of transparently linking multiple IBM hosts with large numbers of devices distributed across IBM 3270/5250, asynchronous, and token-ring environments. Some of these systems also provide enhanced functionality, such as multiple sessions with windowing for attached display terminals.

As businesses continue to expand and merge, the use of packet-switching networks to link multiple remote IBM and non-IBM environments remains a widespread practice. The sale of multiprotocol PADs, therefore, will continue to be a major source of revenue to many vendors of protocol conversion products. ■

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## Synopsis

### Editor's Note

This report concentrates on the technology of standalone hardware products that perform protocol conversions. For an examination of protocol conversion market trends, see "Protocol Conversion Systems: Market Overview" (Report 3501). Comparison columns displaying detailed characteristics of more than 120 protocol converters offered by 33 different vendors are located in "Protocol Conversion Systems: Comparison Columns" (Report 3503).

### Highlights

Protocol conversion reformat or converts one protocol to another. In most instances, a protocol converter takes asynchronous data and alters it for transmission on a synchronous data link. The device can also perform the opposite function (i.e., reformatting synchronous data for transmission on an asynchronous data link).

Some of the most common protocols are the American Standard Code for Information Interchange (ASCII), IBM's Extended Binary Coded Decimal Interchange Code (EBCDIC), IBM's Binary Synchronous Communications (BSC), and the CCITT's High-Level Data Link Control (HDLC).

Protocol conversion systems originated as "passports" into the IBM communications world, which IBM designed in a synchronous mode. Most terminals on the market, however, are asynchronous, as are a high percentage of the modems in the United States. Protocol converters maintain peaceful coexistence between terminals and IBM hosts, allowing information to flow freely.

As demand increased, other methods of protocol conversion evolved, such as software in front-end processors, adapter devices, X.25 converters, cluster controllers, data switches, packet assemblers/disassemblers (PADs), gateways, and network processors. Emulation devices also resolve incompatibility problems such as differences in protocols, codes, interfaces, and device and link characteristics.

—By *Martin Dintzis*  
Assistant Editor

## Analysis

Protocol conversion often involves far more than simply translating one protocol to another. The process can occur through multiple products, such as emulation devices, gateways, and packet assemblers/disassemblers (PADs), that foster compatibility among communications devices, local area networks, packet switched networks, or computer operating systems. Products can range from microprocessor-based circuit boards to front-end processors (FEPs) capable of performing conversion functions through software. Some devices perform only code or interface conversions, while others perform protocol conversion, device emulation, and/or code and interface translations in the same unit.

This report focuses on standalone hardware products that perform conversions allowing equipment from one manufacturer to communicate with equipment from another. The largest market segment addresses incompatibilities between the synchronous communications used by IBM mainframes and asynchronous ASCII terminals.

## Technology Basics

### Protocols

Protocols govern the format of a data exchange, recognition of a remote connection, identification of the transmitting and receiving locations, transmission sequence, handling of interruptions, error-checking methods and control, methods of blocking data, and security procedures. They range from single character-by-character communications with no error checking to complex algorithms moving data among many devices.

In general, protocols specify three major areas:

- The method in which data is to be represented or encoded—the code set. Most data processing systems use either the American Standard Code

for Information Interchange (ASCII) or IBM's Extended Binary Coded Decimal Interchange Code (EBCDIC).

- The method in which the codes are transmitted and received—asynchronous or synchronous. In asynchronous transmission, data is sent with start and stop bits between individual characters at random intervals with no specific timing. In synchronous transmission, characters or bits are sent at a fixed rate; transmitting and receiving devices are synchronized, eliminating the need for start/stop bits.
- The nondata exchanges of information by which the two devices establish control, detect failures or errors, and initiate corrective action.

Through hardware or software, the sending device automatically formats the data and adds the required bits before transmitting each character or block. The receiving device automatically checks each of the appended bits before acknowledging receipt of data. After detecting failures, the protocol initiates error-control procedures.

### Types of Protocols

*Byte-oriented protocols* require transmission of data in eight-bit blocks; each transmitted block requires an acknowledgment before the next block can be sent. *Bit-oriented protocols* allow data to be transmitted in blocks of any length up to a specified maximum; an acknowledgment may take place after one or several blocks have been sent, depending on the protocol. Some of the most common protocols are ASCII or Teletype (TTY), IBM's Synchronous Data Link Control (SDLC), and IBM's Binary Synchronous Communications (BSC).

*ASCII or TTY*—ASCII or TTY protocol traditionally relates to teletypewriter equipment and services. An asynchronous protocol, ASCII provides very little error checking. Transmission occurs in the form of a start bit, a number of data bits (usually five to eight), and one or more stop bits. Data in ASCII protocol enters the communications line at any time. The end of the link is synchronized through the specifications of a common line speed and detection of the start bits and the beginning of the character transmission. ASCII requires an acknowledgment after each block is sent.

*IBM's Synchronous Data Link Control (SDLC)*—a bit-oriented synchronous protocol that uses a synchronized series of frames. Each frame

has a synchronization flag, followed by an address field, a control field identifying the purpose of the transmission, the data itself, a frame-check field, and a trailing flag. The flag character marks synchronization. SDLC permits up to 127 frames to be outstanding before requiring an acknowledgment. Private-line networks use SDLC.

*IBM Binary Synchronous Communications (BSC)*—a character-oriented synchronous protocol, also referred to as *bisync*. Binary synchronous data and control characters consist of eight-bit bytes. A transmission in BSC incorporates a number of synchronizing (SYN) characters that ensure synchronization at both ends of the communications link. These characters are followed by a start-of-text (STX) character, a block of text, an end-of-text (ETX) character, and a block error-checking character (BCC). BSC does not support full-duplex transmission, nor is it supported by IBM's Systems Network Architecture (SNA). An acknowledgment must follow each block of data. The BSC protocol works in multipoint applications over private lines.

Other communications protocols include High-Level Data Link Control (HDLC), a CCITT-specified, bit-oriented protocol on which most other bit-oriented protocols are based, and Digital's Digital Data Communications Message Protocol (DDCMP), a byte-oriented protocol that can accommodate 255 unacknowledged transmissions.

### The OSI Model

The International Organization for Standardization (ISO) Open Systems Interconnection (OSI) reference model provides a framework for understanding the differences in conversion products. Each of the model's layers defines a particular aspect of the entire data communications process. Figure 1 illustrates the seven-layer hierarchy.

*Layer 1—Physical Connection* provides mechanical and electrical specifications and procedures to establish, maintain, and end physical connections. This layer defines interface, code, speed, and synchronization functions. Layer 1 covers interface, code, and asynchronous-to-synchronous converters.

*Layer 2—Data Link Control* ensures that the data passes without error from one computer to another. This process involves protocols that specify the format for data transmission. Protocol converters handle conversions in this layer.

Figure 1.

#### The OSI Model

(7) Application—provides communications services
(6) Presentation—defines syntax of data
(5) Session—controls data exchange
(4) Transport—handles data flow, error control
(3) Network—handles data routing
(2) Data Link—ensures data transfer via protocols
(1) Physical—provides mechanical/electrical interface

*Layers One through Three define the interface between the host computer and the network.*

*Layers Four through Seven provide compatibility to data format and exchange.*

Parameters such as modem control, ring signaling, and dedicated connections fall into this category.

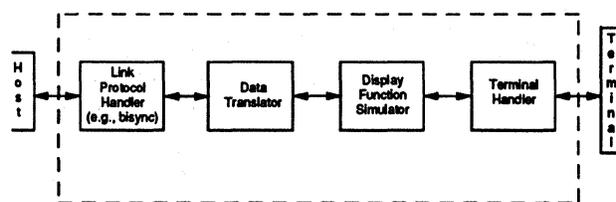
*Layer 3—Network Layer* allows two systems to exchange data. This layer defines packet addressing and data routing to final destination. Units that handle conversion in this layer include gateway devices, such as packet assemblers/disassemblers (PADs) that provide access to X.25 networks or between local area networks. Front-end processors (FEPs) with protocol conversion functions also fall into this classification.

*Layer 4—Transport Layer* handles end-to-end error and flow control to ensure that the communications exchange is orderly and reliable. PAD devices, a type of gateway product, are the major products in this layer.

*Layer 5—Session Layer* furnishes the structure for a data exchange by managing connections between application processes, establishing and terminating connections, and sending end-to-end messages and controller dialogs.

*Layer 6—Presentation Layer* defines the way data is assembled and provides a systematic arrangement for the communications exchange to occur. This layer defines functions that translate coded data and convert it into display formats for terminal or microcomputer screens, printers, and other peripherals. In this layer, data is expanded or compressed and structured for file transfer or command translation. Emulators, which allow one type of terminal to appear as another type, operate within the Presentation Layer. Products in this category include ASCII-to-3270 emulators, interfaces

Figure 2.

**The Protocol Conversion Process**

that allow personal computers to act as 3270-type devices or to access public networks, and word processor interfaces that handle conversions between dissimilar word processors.

*Layer 7—Applications Layer* supports user and application tasks by providing the communications services for specific computer applications. Basically, this layer provides the meaning to the message.

Converters often provide translations on more than one level in the model. Conversion at one layer generally implies a need for compatibility in lower layers. For example, a protocol converter working on Level 2 functions also assumes responsibility for compatibility in the interface, code, and synchronization functions.

**The Mechanics of Protocol Conversion**

Protocol converters translate for dissimilar devices by simulating the appropriate protocol for each. As Figure 2 shows, this functionality gives protocol converters a distinctive, double-ended structure. For each end of the conversion process, a local protocol handler uses the protocol required by the attached device. Connecting these handlers is a gateway task that implements the movement of user data between the handlers. If all communication protocols were structured in accordance with the OSI Reference Model, the converter would implement a set of seven-layer OSI protocols joined by the gateway task. Because the central task of a fully structured OSI protocol is to isolate users from the communication environment, a protocol converter dealing exclusively with full OSI model protocols would be fairly simple to develop and could operate with few restrictions. With non-OSI protocols, such as those commonly used in today's networks, the following issues complicate the conversion process:

*The format of the user data.* If the data is easily separated from communication and device control protocols, it is more easily transferred to another environment. Special features, such as data compression, complicate protocol conversion if they do not exist in the other protocol.

*The degree of layering in the protocols.* Although full compliance with the OSI model is unlikely, any amount of OSI-like layering in the protocols will aid in the separation of useful data from control information that must not be introduced into the other environment.

*The availability of common functions in the protocols involved.* Data exchange between the users requires a degree of synchronization between the two foreign protocols. For example, most older protocols operate in half-duplex mode—only one station at a time can send information. It is necessary for converters operating between half-duplex protocols to ensure that both stations are not given permission to send at the same moment, since neither could receive under those circumstances.

When protocol converters allow devices to simulate other devices, device control protocol translation may be needed. IBM's popular 3270 series of terminals is often emulated by lower cost asynchronous devices, but the 3270 has special features, such as the capability to return only modified fields to the host computer. This capability must be emulated within the protocol converter. Figure 3 shows the structure of a terminal emulator protocol converter.

**Products****Interface and Code Converters**

An interface provides the physical connection between two devices. Interface conversion offers the lowest level of established compatibility. Data and control lines from devices terminate at a connector that handles assigned signal functions. For example, the RS-232-C interface connector has 25 pins—1 pin per function. The interface also prescribes voltage levels for electrical signals passing over the data and control lines.

*Interface converters* serve as adapters for differing interfaces, accept the connectors of two different interfaces, and/or translate signals and voltage levels of one interface to another. Interface



An IBM 327X communications processor serves up to 32 IBM 3277-type terminals on a multipoint line. Data moving in this configuration is blocked out in 1,920-character screen images (blocks of data). If a user wants to replace IBM 3277 terminals with asynchronous ASCII devices, the ASCII units must appear as IBM 3277s to the IBM host. A terminal controller/emulator solves the problem by accumulating an asynchronous datastream in its buffer until a 1,920-character screen image is filled or until the emulator receives an end-of-record, end-of-block control character. The terminal controller converts the ASCII terminal protocol to the host protocol (i.e., BSC), rearranges the data format to appear as if it comes from an IBM 327X, and transfers the screen image to the host, which recognizes the data as that of an IBM 3277—not an asynchronous ASCII terminal. The terminal controller performs all functions of the device it replaces, including data concentration, poll/select, flow control, buffering, error detection and correction, and interfacing of multiple attached terminals.

Sometimes the emulating device connects to an IBM cluster controller rather than replacing it. In this situation, it then, in effect, performs the conversion between the terminal and the IBM controller instead of between the controller and the

host. These emulators allow the user to integrate incompatible equipment into an existing terminal cluster.

During an emulation/conversion/transfer sequence, the emulator interprets control sequences from a terminal to simulate the emulated terminal's operations. The equivalent control sequences of various terminals differ widely. For example, no asynchronous ASCII keyboard provides all of the special 3270 function keys.

Many users install terminal controllers to allow non-IBM devices in remote locations to access IBM mainframes. Many remote controllers have one synchronous line for 3270 access and two or more minicomputer interfaces. Local users can switch between hosts, depending on the application.

Although most protocol conversion systems perform ASCII-to-IBM conversions, other products provide the conversion required between IBM BSC protocols and IBM SDLC protocols. Users of older IBM BSC equipment who plan to migrate to an SNA/SDLC environment benefit from these products without replacing their old equipment. BSC-to-SDLC conversions generally occur between BSC 2780/3780 RJE or 3270 BSC protocols and SDLC protocols. ■

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# Protocol Conversion Systems: Vendors

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## Vendors

The following list includes the names, addresses, and phone numbers of 40 vendors that participate in the protocol conversion systems market.

**Agile**

825 Alfred Nobel Drive  
Hercules, CA 94547-1899  
(415) 724-1600

**Andrew Corp.**

2771 Plaza Del Amo  
Torrance, CA 90503  
(213) 320-7126

**Apertus Technologies**

7275 Flying Cloud Drive  
Eden Prairie, MN 95344  
(612) 828-0300

**Arkansas Systems, Inc.**

8901 Kanis Road  
Little Rock, AR 72205  
(501) 227-8471

**Astrocom Corp.**

120 W. Plato Boulevard  
St. Paul, MN 55107-2092  
(612) 227-8651

**Avatar Corp.**

65 South Street  
Hopkinton, MA 01748  
(508) 435-3000

**Black Box Corp.**

P.O. Box 12800  
Pittsburgh, PA 15241  
(412) 746-5500

**Commtext Inc.**

1655 Crofton Boulevard  
Crofton, MD 21114-1341  
(301) 721-3666

**Comstat Datacomm Corp.**

1720 Spectrum Drive, NW  
Lawrenceville, GA 30243  
(404) 822-1962

**Datagraf Inc.**

6101 W. Courtyard Drive, Bldg. 1  
Austin, TX 78730  
(512) 346-6866

**Develcon Electronics, Ltd.**

856 51st Street, E.  
Saskatoon, SK, Canada S7K 5C7  
(306) 933-3300

**Diversified Data Resources, Inc.**

7200 Redwood Boulevard, Suite 222  
Laredo, CA 94945  
(415) 898-8282

**Dowty Communications, Inc.**

55 Carnegie Plaza  
Cherry Hill, NJ 08003  
(609) 424-4451

**Emerald Technology, Inc.**

19021 120th Avenue, NE  
Bothell, WA 98011  
(206) 485-8200

**Forest Computer**

1749 Hamilton Road  
P.O. Box 409  
Okemos, MI 48864  
(517) 349-4700

**Gandalf Systems Corp.**

1020 Noel Avenue  
Wheeling, IL 60090  
(708) 541-6060

**General DataComm, Inc.**

1579 Straits Turnpike  
Middlebury, CT 06762-1299  
(203) 574-1118

**IBM**

Old Orchard Road  
Armonk, NY 10504  
Contact your local IBM representative.

**IDEA Courier, Inc.**

1515 W. 14th Street  
Tempe, AZ 85281  
(602) 894-7000

**IDEAssociates Inc.**

29 Dunham Road  
Billerica, MA 01821  
(508) 663-6878

**JBM Electronics**

4645 LaGuardia  
St. Louis, MO 63134  
(314) 426-7781

**Jupiter Technology, Inc.**  
78 Fourth Avenue  
Waltham, MA 02154  
(617) 890-4555

**Lee Data**  
Div. of IIS  
10230 W. 70th Street  
Eden Prairie, MN 55343  
(612) 828-0400

**McDATA Corp.**  
310 Interlocken Parkway  
Broomfield, CO 80021-3464  
(303) 460-9200

**Method Systems, Inc.**  
3511 Lost Nation Road, No. 202  
Willoughby, OH 44094-7741  
(216) 942-2100

**Micom Communications Corp.**  
4100 Los Angeles Avenue  
Simi Valley, CA 93063-3397  
(805) 583-8600

**Motorola Codex**  
20 Cabot Boulevard  
Mansfield, MA 02048  
(508) 261-4000

**MPI Technologies**  
4952 Warner Avenue  
Suite 301  
Huntington Beach, CA 92649  
(714) 840-8077

**NCR Corp.**  
Network Products Group  
2700 Snelling Avenue N.  
St. Paul, MN 55113  
(612) 638-7777

**Netlink Inc.**  
3214 Spring Forest Road  
Raleigh, NC 27604  
(919) 878-8612

**Nu Data, Inc.**  
32 Fairview Avenue  
Little Silver, NJ 07739  
(908) 842-5757

**Plantronics Futurecomms, Inc.**  
7450 New Technology Way  
Frederick, MD 21701  
(301) 662-5926

**Racal-Datacom**  
1601 N. Harrison Parkway  
P.O. Box 407044  
Ft. Lauderdale, FL 33340-7044  
(305) 846-1601

**RAD Data Communications**  
151 W. Passaic Street  
Rochelle Park, NJ 07662  
(201) 587-8822

**Renex Corp.**  
1513 Davis Ford Road  
Woodbridge, VA 22192  
(703) 494-2200

**Sync Research**  
7 Studebaker  
Irvine, CA 92718  
(714) 669-8020

**Telebyte Technology, Inc.**  
270 E. Pulaski Road  
Greenlawn, NY 11740  
(516) 423-3232

**Teleglobe Inc.**  
600 McCaffrey Street  
St. Laurent, PQ, Canada H4T 1N1  
(514) 738-4781

**Teleprocessing Products, Inc.**  
4565 E. Industrial Street, 7-K  
Simi Valley, CA 93063  
(805) 522-8147

**Wall Data Inc.**  
17769 NE 78th Place  
Redmond, WA 98052-4992  
(206) 883-4777 ■

# Protocol Conversion Systems: Comparison Columns

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## Synopsis

### Editor's Note

This report features comparison columns detailing products currently on the market. For information on market trends, see "Protocol Conversion Systems: Market Overview" (Report 3501). For information on protocol conversion technology, see "Protocol Conversion Systems: Technology Overview" (Report 3502).

### Highlights

In the Comparison Column Entry Descriptions, we have briefly defined the specification categories used in the columns. Separate sections explain the entries for Protocol Conversion Systems/Terminal Controllers and Code, Speed, Interface, and Async/Sync Converters.

Vendors of these products furnished the information. When a vendor did not provide information for a specific entry and we could not locate that information in our files, we listed "Vendor did not specify." Datapro wishes to thank the vendors for their cooperation.

In addition to the lines allocated for vendors to indicate specified information for their models, we have added space at the bottom of the columns for vendor notations about options or special features.

The absence of any company or product from these columns means that the company either failed to respond to our requests for information or declined to be part of the survey.

The accompanying text briefly describes the entries in the order in which they appear. We have organized the comparison columns into broad categories: Protocol Conversion Systems/Terminal Controllers and Code, Speed, Interface, and Async/Sync Converters.

# Vendors

---

## Protocol Conversion/Terminal Controller Vendors

**Andrew Corp.**

2771 Plaza Del Amo  
Torrance, CA 90503 (213) 320-7126, (800) 733-0331

**Andrew/KMW Systems**

100 Shepherd Mountain Plaza  
Austin, TX 78730-5014 (512) 338-3000, (800) 531-5167

**Arkansas Systems, Inc.**

8901 Kanis Road  
Little Rock, AK 72205 (501) 227-8471

**Avatar Corp.**

65 South Street  
Hopkinton, MA 01748 (508) 435-3000, (800) 289-2526

**Black Box Corp.**

P.O. Box 12800  
Pittsburgh, PA 15241 (412) 746-6552

**Carlisle Systems Group, Inc.**

Digital Controls Div.  
305 Pioneer Boulevard  
Springboro, OH 45066-1100 (513) 746-8118, (800) 421-0204

**Commtext Inc.**

1655 Crofton Boulevard  
Crofton, MD 21114 (301) 721-3666

**Comstat Datacomm Corp.**

1720 Spectrum Drive, NW  
Lawrenceville, GA 30243 (404) 822-1962, (404) 822-9496

**Diversified Data Resources, Inc.**

25 Mitchell Boulevard, Suite 7  
San Rafael, CA 94903 (415) 499-8870, (800) 233-3374

**Forest Computer**

1749 Hamilton Road, P.O. Box 509  
Okemos, MI 48864 (517) 349-4700

**Gandalf Data, Inc.**

130 Colonnadi Road, South  
Nepean, ON, Canada K2E 7M4 (613) 723-6500

**Innosys, Inc.**

2020 Challenger Drive, Suite 101  
Alameda, CA 94501 (415) 769-7717

**International Business Machines Corp. (IBM.)**

Old Orchard Road  
Armonk, NY 10504  
Contact your local IBM representative.

**JBM Electronics**

4645 La Guardia  
St. Louis, MO 63134 (314) 426-7781

**JDS Microprocessing**

22661 Lambert St., Suite 206  
El Toro, CA 92630 (714) 770-2263

**Memotec Data, Inc.**

600 McCaffrey Street  
Montreal, PQ, Canada H4T 1N1 (514) 738-4781

**Micom Communications Corp.**

4100 Los Angeles Avenue  
Simi Valley, CA 93063 (805) 583-8600, (800) 642-6687

**Netlink, Inc.**

3214 Spring Forest Road  
Raleigh, NC 27604 (919) 878-8612, (800) 638-5465

**Perle Systems, Inc.**

1980 Springer Drive  
Lombard, IL 60148 (708) 932-4171

**Plantronics Futurecomms, Inc.**

7450 New Technology Way  
Frederick, MD 21701 (301) 662-5926, (800) 537-9804

**Shaffstall Corp.**

7901 E. 88th Street  
Indianapolis, IN 46256 (317) 842-2077

**Telematics International, Inc.**

1201 Cypress Creek Road  
Ft. Lauderdale, FL 33309 (305) 772-3070, (800) 327-7944

**Thomas Engineering Company**

2440 Stanwell Drive  
Concord, CA 94520 (415) 680-8640, (800) 832-8649

**Trax Softworks, Inc.**

5840 Uplander Way  
Culver City, CA 90230-6620 (213) 649-5800

**Wall Data, Inc.**

17769 NE 78th Place  
Redmond, WA 98052 (206) 883-4777, (800) 433-3388

---

## Code, Speed, Interface, and Async/ Sync Converter Vendors

**Arkansas Systems, Inc.**

8901 Kanis Road  
Little Rock, AK 72205 (501) 227-8471

**Astrocom Corp.**

120 W. Plato Boulevard  
St. Paul, MN 55107-2092 (612) 227-8651

**Black Box Corp.**

P.O. Box 12800  
Pittsburgh, PA 15241 (412) 746-5500

**Carlisle Systems Group, Inc.**

Digital Controls Div.  
305 Pioneer Boulevard  
Springboro, OH 45066-1100 (513) 746-8118, (800) 421-0204

**Comdata Corp.**

7900 N. Nagle Avenue  
Morton Grove, IL 60053 (708) 470-9600

**Comstat Datacomm Corp.**

1720 Spectrum Drive, NW  
Lawrenceville, GA 30243 (404) 822-1962, (404) 822-9496

**DCC Corp.**

7300 N. Crescent Boulevard  
Pennsauken, NJ 08110 (609) 662-7272

**General DataComm, Inc.**

1579 Straits Turnpike  
Middlebury, CT 06762-1299 (203) 574-1118

**JBM Electronics**

4645 La Guardia  
St. Louis, MO 63134 (314) 426-7781

**Memotec Data, Inc.**

600 McCaffrey Street  
Montreal, PQ, Canada H4T 1N1 (514) 738-4781

**Nu Data, Inc.**

32 Fairview Avenue  
Little Silver, NJ 07739 (201) 842-5757

**Perle Systems, Inc.**

1980 Springer Drive  
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**Plantronics Futurecomms, Inc.**

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**Shaffstall Corp.**

7901 E. 88th Street  
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**Telebyte Technology, Inc.**

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Greenlawn, NY 11740 (516) 423-3232

**TeleProcessing Products, Inc.**

4565 E. Industrial Street, 7-K  
Simi Valley, CA 93063 (805) 522-8147

**Trax Softworks, Inc.**

5840 Uplander Way  
Culver City, CA 90230-6620 (213) 649-5800

**VIR, Inc.**

105 James Way  
Southampton, PA 18966 (215) 364-8866, (800) 344-3934

**Wall Data, Inc.**

17769 NE 78th Place  
Redmond, WA 98052 (206) 883-4777, (800) 433-3388

# Conversion Systems/ Terminal Controllers Comparison Column Entry Descriptions

For the reader's convenience, we have organized the comparison columns into two broad categories:

**Conversion Systems/ Terminal Controllers** can include protocol converters, terminal emulators, remote cluster controllers, and terminal controllers. Basically, devices in this section provide conversion from one protocol to another and/or allow one device (such as an asynchronous display terminal) to act as another type of device (such as an IBM 3270 display terminal) in a network.

The following text briefly describes the column entries in the order in which they appear in the columns.

## Conversion Systems/ Terminal Controllers

**Model.** Listed here is the exact model number or name of each device.

**Device Type.** This entry specifies if the device is a protocol converter, terminal emulator, code converter, or interface converter.

**Conversion Performed.** All converters perform some type of translation

from one code, speed, or protocol to another. The most common conversion is asynchronous ASCII to IBM SNA/SDLC or BSC, but a number of other translations occur on the units represented in the columns.

**Specific Device Emulated.** In many cases, conversion devices provide the means to convert the text format of one type of device into the characteristics and format of another. This translation, called emulation, is indicated, if available. Most protocol converters also support device emulation.

**Specific Functionality Provided.** Most converters allow one device to be used as another type of device in the network. For example, a number of units allow asynchronous displays to be used as IBM 3278 Model 2 displays.

**Virtual Screen Sizes Supported (char.).** For a device to provide emulation, it must support the screen size, in characters, of the emulated device. For example, a device emulating an IBM 3270 terminal

must support a 1,920-character screen.

**Command Port Supported.** Some converters support a port through which users can select operating parameters and monitor, diagnose, and control the network. A "yes" answer indicates that the device has a command port.

## Host-Side Specifications

**Specific Hosts Supported.** Conversion devices generally support IBM or compatible hosts, asynchronous hosts such as Digital's VAX, or both. In this entry, vendors list the name of the computer(s) with which the converter operates.

**Host Operating Systems Supported.** In this entry, vendors indicate the operating system from a choice of DOS/VS, OS/VS, RSTS/E or VAX VMS, or Other.

**Number of Host Selections Supported Concurrently.** If a converter supports more than one host line, the device can support both connected hosts concurrently, or separately through a switch selection.

**Connections Supported.** Conversion devices support direct connections and multipoint and/or point-to-point connections. Most converters support more than one type of connection, and many support all three.

**Connection to Host via Controller.** Some conversion devices emulate a controller, but others must connect to a controller in the network. If applicable, vendors specified the type of controller to which the converter interfaces.

## Transmission Specifications/Host Line

**Maximum Transmission Speed (bps).** This entry, stated in bits per second, indicates the maximum speed of operation or data rate supported by the device.

**Synchronization.** This entry refers to the time relationship among the bits comprising the characters that make up the messages. Conversion devices handle data in spurts (asynchronous) or continuous streams (synchronous).

**Transmission Mode.** Most converters operate in either half- or full-duplex mode or both. Half-duplex mode supports data transmission in either direction, but not simultaneously. In full-duplex operation, the data is simultaneously transmitted and received over a common communications facility. Simplex mode permits unidirectional data transmission, whereby data is either transmitted or received.

**Protocols Supported.** There are two basic types

of protocols: byte oriented (IBM's BSC or Digital's DDCMP) or bit oriented (IBM SNA/SDLC or ISO HDLC). Converters usually translate one protocol to another and thus support different protocols on the terminal and host sides.

**Codes Supported.** The most common codes are ASCII, used in the asynchronous protocol, and EBCDIC, the usual code generated by synchronous devices.

**Interface.** Interface is the electrical connection between components. Most communications devices provide an electrical interface (RS-232-C) in accordance with the standards established by the Electronics Industries Association (EIA). Several other interface standards exist, notably CCITT Recommendations V.24 and V.28.

**Clocking.** The repetitive, regularly timed signals controlling synchronous transmissions, clocking can be set internally by the device itself or externally by another device or be derived from the datastream.

### **Terminal-Side Specifications/ Terminal Line**

**Number and Type of Ports Provided.** In general, a conversion device

supports asynchronous ports that accommodate a large variety of asynchronous printers, terminals, and personal computers. Many converters also support a dynamic printer port. Devices represented in the columns support from one to many input devices.

**Specific Devices Supported.** Most conversion devices designed for asynchronous-to-IBM SDLC or BSC conversion support virtually any asynchronous device. Some converters, however, are designed for operation only with a specific terminal. An answer of "virtually any device" means that the vendor's list of supported terminals was too long to fit into the assigned space, but the converter did support all major asynchronous display terminals and/or personal computers available in today's market.

**Connections Supported.** The options offered to vendors in this entry are Direct, Dial-Up, Remote, Leased, and Other.

### **Transmission Specifications/ Terminal Line**

**Maximum Transmission Speed (bps).** This entry refers to the highest possible rate of speed at which data can be sent.

**Maximum Aggregate Input Rate (bps).** Conversion devices generally support many input ports, each operating at several different speeds, e.g., from 50 to 9600 bps.

Aggregate input refers to the maximum data rate accepted from all channels simultaneously. For example, if there are four channels operating at a maximum 9600 bps rate per channel, the aggregate input rate could be four times 9600, or 38.4K bps.

**Synchronization.** Vendors indicate asynchronous or synchronous here.

**Transmission Mode.** Vendors note if the mode is half or full duplex.

**Protocols Supported.** The choices offered to vendors are TTY II, BSC, and Other.

**Codes Supported.** Vendors indicate if their products support ASCII or EBCDIC.

**Interfaces Supported.** The choices offered to vendors are RS-232-C, RS-449, and Other.

### **Diagnostics**

Many conversion devices perform tests that check the device and the line connections. Most converters conduct a self-test of internal circuitry upon power-up and provide front-panel LEDs to monitor system status.

### **Pricing and Availability**

**Purchase (\$).** Vendors provide the base price of the unit, excluding options, here.

**Serviced by.** Usually, the vendor offers service on an on-site or factory repair/return basis. In some cases, a third party provides service.

**Availability (Days ARO).** Here we list the current lead time on orders, given in days after receipt of order (ARO).

**Date of First Commercial Delivery.** This entry indicates the actual date on which the vendor delivered the product to the marketplace.

**Comments**  
In this section, vendors list options and unique capabilities of their products.

Vendor	Andrew Corp.	Andrew Corp.	Andrew Corp.	Andrew Corp.
<b>Model</b>	DataLynx/3174	DataLynx/3780	DataLynx/5294	InterLynx/3278
<b>Device Type</b>	Protocol converter, Sys/370 to ASCII cluster controller	Protocol converter, terminal emulator	Protocol converter, terminal emulator	Terminal emulator
<b>Conversion Performed</b>	ASCII to EBCDIC, Async to SNA/SDLC, or async to BSC	Async to IBM 2770/2780/3780/3741	Async to IBM 5250	Async to IBM 3270
<b>Specific Device Emulated</b>	IBM 3274 Model 51C, IBM 3174-51R	IBM RJE Station	IBM 5294/5394 controller	IBM 3278 Model 2 display
<b>Specific Functionality Provided</b>	Async display or printer to IBM 3278 display or IBM 3287 printer	Links 2 async devices (1 display, PC, or mini-computer; and 1 printer)	Links 32 async devices to one or two S/3X or AS/400 hosts	Async display to IBM 3278 Model 2 display
<b>Virtual Screen Sizes Suppt. (char.)</b>	1920, 3564	Vendor did not specify	Vendor did not specify	Vendor did not specify
<b>Command Port Supported</b>	Yes	No	Yes	No
<b>Host Side Specifications</b>				
<b>Specific Hosts Supported</b>	IBM 43XX, 3080/3090	DEC PDP-11, VAX; IBM 3080/3090, 43XX, 8100	IBM AS/400, IBM System/3X	DEC PDP-11, VAX; IBM AS/400, 3080/3090, 43XX, and 9370
<b>Host Operating Systems Supported</b>	DOS/VS, OS/VS	DOS/VS, OS/VS, RSTS/E or VAX VMS	SSP, CPF, OS/400	DOS/VS, OS/VS, RSTS/E, or VAX VMS
<b>No. Host Selections Suppt. Concurrently</b>	2 SNA or 2 BSC, and 4 async ports	1 BSC	1 or 2 SDLC	1 SDLC and 1 async
<b>Connections Supported</b>	Direct connection, point-to-point on dial-up line, multi-point on leased line	Direct connection, point-to-point on dial-up line	Direct connection, point-to-point on dial-up line	Direct connection
<b>Connection to Host Via Controller</b>	IBM 37XX	No controller is needed	Not applicable	IBM 3174/3274
<b>Transmission Spec.-Host Line</b>				
<b>Maximum Transmission Speed (bps)</b>	19.2K bps; 56K bps optional	19.2K	19.2K, each host channel	19.2K, each host channel
<b>Synchronization</b>	Synchronous	Synchronous	Synchronous	Synchronous
<b>Transmission Mode</b>	Half/full duplex	Half duplex	Full duplex	Full duplex
<b>Protocols Supported</b>	BSC, SNA/SDLC	IBM BSC 2770/2780/3780/3741	SNA/SDLC	SNA/SDLC
<b>Codes Supported</b>	ASCII, EBCDIC	ASCII, EBCDIC	EBCDIC	EBCDIC
<b>Interface</b>	2 RS-232-C	1 RS-232-C	2 RS-232-C	Type A Coax
<b>Clocking</b>	Internal, external	Internal	Vendor did not specify	Vendor did not specify
<b>Terminal Side Spec.-Terminal Line</b>				
<b>Number and Type of Ports Provided</b>	4 to 23 RS-232-C ports	1 async display terminal port	Up to 32 async ports	1 async port
<b>Specific Devices Supported</b>	All popular brands of term.; all IBM-compat. PCs; also, up to 6 user-definable terminal drivers	Vendor did not specify	Vendor did not specify	Terminals: IBM 3101 & 3161, VT 52/100, ADDS Viewpoint, ADM-3A/21, TV 910/925, Wyse 100
<b>Connections Supported</b>	Remots, leased, connect. to X.25 PAD with echoplex suppression	Direct connection, dial-up	Direct connection, dial-up	Direct connection
<b>Transmission Spec.-Terminal Line</b>				
<b>Maximum Transmission Speed (bps)</b>	19.2K	19.2K	19.2K	19.2K
<b>Maximum Aggregate Input Rate (bps)</b>	614.4K	19.2K	19.2K	19.2K
<b>Synchronization</b>	Asynchronous	Synchronous	Asynchronous	Asynchronous
<b>Transmission Mode</b>	Full duplex	Half duplex	Full duplex	Full duplex
<b>Protocols Supported</b>	TTY II	BSC, ASCII, ANSI	ASCII, ANSI	TTY II, ASCII, ANSI
<b>Codes Supported</b>	ASCII	ASCII	ASCII	ASCII
<b>Interfaces Supported</b>	RS-232-C	RS-232-C	RS-232-C	RS-232-C
<b>Diagnostics</b>	Extensive network diagnostics	Self-test, status LEDs	Self-test, status LEDs	Vendor did not specify
<b>Pricing and Availability</b>				
<b>Purchase (\$)</b>	3,000 to 10,500	1,445	2,000 with 4 device ports	995
<b>Serviced By</b>	Andrew Corp.	Andrew Corp.	Andrew Corp.	Andrew Corp.
<b>Availability (days ARO)</b>	7 days	7	7	7
<b>Date of First Commercial Delivery</b>	December 1986	October 1990	September 1990	July 1990
<b>Comments</b>	—	—	—	—

Vendor	Andrew Corp.	Andrew Corp.	Andrew Corp.	Andrew Corp.
Model	InterLynx/400	Newport III/Coax	Newport Twinax	VersaLynx/3278
Device Type	Protocol converter	Printer adapter	Printer adapter	Terminal emulator
Conversion Performed	Async to IBM 5250	ASCII to EBCDIC & async to IBM 3270	ASCII to EBCDIC & async to IBM 5250	IBM 3270 to async
Specific Device Emulated	IBM 5294/5394 controller	IBM 3287 Model 2 printer	IBM 4214, 5219, 5224, 5225, and 5256 Model printers	Digital Equipment VT100, IBM 3101, TV 925, TTY
Specific Functionality Provided	Links 7 async devices to an IBM midrange host	Async HP LaserJet printer to IBM 3287 printer	Async HP LaserJet printer to IBM printer	IBM printer to async printer
Virtual Screen Sizes Suppt. (char.)	Vendor did not specify	Not applicable	Not applicable	Vendor did not specify
Command Port Supported	No	Not applicable	Not applicable	No
Host Side Specifications Specific Hosts Supported	IBM AS/400, IBM System/3X	IBM 3080/3090, 43XX, 8100, 9370; IBM PC, PS/2	IBM System/3X, AS/400; IBM PC, PS/2	DEC PDP-11, VAX; IBM 43XX, 30XX, 9370, S/370
Host Operating Systems Supported	SSP, CPF, OS/400	All mainframe operating systems	All IBM midrange host operating systems	DOS/VS, OS/VS, RSTS/E or VAX VMS
No. Host Selections Suppt. Concurrently	1 SDLC	1 async and 1 SNA/SDLC	1 async session and 1 IBM midrange host session	1 SDLC and 1 async
Connections Supported	Direct connection	Direct connection	Direct connection	Direct connection, point-to-point on dial-up line
Connection to Host Via Controller	Vendor did not specify	IBM 3174/3274	IBM 5294/5394	IBM 3174/3274
<b>Transmission Spec.-Host Line</b> Maximum Transmission Speed (bps) Synchronization Transmission Mode Protocols Supported	19.2K Synchronous Full duplex SNA/SDLC	38.4K bps Synchronous Half duplex BSC, SNA/SDLC	38.4K bps Synchronous Half duplex SNA/SDLC	19.2K Asynchronous, synchronous Full duplex SNA/SDLC, ASCII, ANSI
Codes Supported	EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC
Interface	Vendor did not specify	Type A coax	Twinax	1 RS-232-C, Type A coax
Clocking	Vendor did not specify	Data derived	Data derived	Vendor did not specify
<b>Terminal Side Spec.-Terminal Line</b> Number and Type of Ports Provided	Vendor did not specify	Not applicable (the unit is an adapter card)	Not applicable (the unit is an adapter card).	1 sync display terminal port plus 1 optional printer port
Specific Devices Supported	Terminals: IBM 3101/316X, DEC VT 100/220, and products from ADDS, C-Itch, Televideo, Wyse, DG, and others	HP LaserJet Series II, IID, III, and IIID	HP LaserJet Series II and IID	IBM 3178/3278 Model 2
Connections Supported	Direct connection, dial-up	Direct connection	Direct connection	Direct connection, dial-up
<b>Transmission Spec.-Terminal Line</b> Maximum Transmission Speed (bps) Maximum Aggregate Input Rate (bps) Synchronization Transmission Mode Protocols Supported	19.2K Vendor did not specify Asynchronous Full duplex ASCII, ANSI	38.4K bps 38.4K bps Asynchronous Half duplex BSC, SCSI	38.4K bps 38.4K bps Asynchronous Half duplex SCSI	19.2K 19.2K Vendor did not specify Full duplex TTY II, ASCII, ANSI
Codes Supported	ASCII	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC
Interfaces Supported	RS-232-C, Centronics parallel	RS-232-C	RS-232-C	RS-232-C
<b>Diagnostics</b>	Self-test, status LEDs	Self-test, status LEDs	Self test, status LEDs	ASCII line tests, self-test, status LEDs
<b>Pricing and Availability</b> Purchase (\$) Serviced By Availability (days ARO) Date of First Commercial Delivery	2,900 with 4 device ports Andrew Corp. 7 February 1990	895 Andrew Corp. Immediate delivery September 1990	895 Andrew Corp. Immediate delivery May 1989	595 to 645 Andrew Corp. 7 September 1990
<b>Comments</b>	—	DB9F-DB25F serial cable opt.; host & PC can share printer; no external power sourcing	Host and PC can share printer; no external power sourcing	—

Vendor	Andrew/KMW Systems	Andrew/KMW Systems	Andrew/KMW Systems	Andrew/KMW Systems
<b>Model</b>	<b>NetAccess</b>	<b>Series II 2780/3780</b>	<b>Series II 3270</b>	<b>Series II 3770</b>
<b>Device Type</b>	AppleTalk-to-IBM AS/400 or S/3X Gateway	Protocol converter	Protocol converter	Protocol converter
<b>Conversion Performed</b>	Async to IBM SNA/SDLC	Asynchronous to 3270 BSC RJE	SNA or BSC to async	Async to SNA/SDLC
<b>Specific Device Emulated</b>	IBM Model 5251, 529X, 3179, 3196, & 3197	IBM 2780/3780 remote job entry station	IBM 3274 Model 51C, IBM 3271	IBM 3776/3777 RJE workstation
<b>Specific Functionality Provided</b>	Apple Macintosh PCs-IBM midrange displays and printers	I/O async device-2780/3780 RJE	Async display-IBM 3270 display	Acommodates I/O devices such as magnetic tape units, printers, and plotters
<b>Virtual Screen Sizes Suppt. (char.)</b>	Vendor did not specify	Vendor did not specify	3,564	Vendor did not specify
<b>Command Port Supported</b>	No	Yes	Yes	Yes
<b>Host Side Specifications</b>				
Specific Hosts Supported	IBM AS/400, IBM System/3X	Any IBM 2780- or 3780-compatible device	IBM S/370-compatible	IBM S/370-compatible mainframes
Host Operating Systems Supported	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
No. Host Selections Suppt. Concurrently	1 SDLC	1 BSC	8	Vendor did not specify
Connections Supported	Direct connection	Switched/dedicated pt.-to-pt./multipoint	Switched/dedicated pt.-to-pt./multipoint	Switched, dedicated pt.-to-pt.
Connection to Host Via Controller	Direct twinaxial connection	IBM 37XX, direct to 2780/3780 device	IBM 37XX	IBM 37XX
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	19.2K	19.2K	19.2K; 56K optional	19.2K; 56K optional
Synchronization	Synchronous	Synchronous	Synchronous	Synchronous
Transmission Mode	Vendor did not specify	Full duplex, half duplex	Half duplex	Full duplex, half duplex
Protocols Supported	SNA/SDLC	BSC	BSC, SNA/SDLC	BSC
Codes Supported	Vendor did not specify	EBCDIC	EBCDIC	EBCDIC
<b>Interface</b>	1 Twinax interface	1 RS-232-C, V.35, X.21	1 RS-232-C	1 RS-232-C, V.35, or X.21 port
<b>Clocking</b>	Vendor did not specify	External, internal	External, internal	External, internal
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	7 Macintosh ports/card; 5 cards max.	Up to 8	Up to 8 asynchronous	Up to 8 async
Specific Devices Supported	Macintosh IIs	Virtually any ASCII or EBCDIC peripheral device	Virtually any async display, printer, or PC	Virtually any ASCII or EBCDIC peripheral device in serial or parallel
Connections Supported	Direct connection	Direct connection, dial-up	Direct connection, dial-up	Direct connection
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	Vendor did not specify	19.2K	To 19.2K	To 19.2K
Maximum Aggregate Input Rate (bps)	19.2K	Vendor did not specify	Vendor did not specify	Vendor did not specify
Synchronization	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission Mode	Vendor did not specify	Full duplex, half duplex	Full duplex	Full duplex, half duplex
Protocols Supported	ASCII	Xon/Xoff, CTS, prompt	Xon/Xoff, CTS	Xon/Xoff, CTS, ASCII
Codes Supported	ASCII	ASCII, EBCDIC	ASCII	ASCII
Interfaces Supported	Uses AppleTalk cabling and connectors	RS-232-C, Centronics parallel	RS-232-C, parallel	RS-232-C, parallel, Centronics
<b>Diagnostics</b>	Vendor did not specify	ASCII line tests, self-test, status LEDs	ASCII line tests, self-test, status LEDs	ASCII line tests, self-test
<b>Pricing and Availability</b>				
Purchase (\$)	3,995 per card	1,995 to 4,395	1,295 to \$3,695	2,995 to 5,395
Serviced By	Andrew/KMW Systems	Andrew/KMW Systems	Andrew/KMW Systems	Andrew/KMW Systems
Availability (days ARO)	30	30	30	30
Date of First Commercial Delivery	February 1990	October 1981	Oct. 1981	October 1981
<b>Comments</b>	—	Modem eliminator configuration for local attachment available	—	Optional modem eliminator configuration for local attachment

Vendor	Andrew/KMW Systems	Andrew/KMW Systems	Andrew/KMW Systems	Arkansas Systems, Inc.
Model	Series III 3287/Coax	TwinAccess Series II	TwinAccess Series III	PATH I
Device Type	Protocol converter	Protocol converter	Protocol converter	Protocol converter
Conversion Performed	Async to IBM 3270	Async to IBM 5250	Async to IBM 5250	IBM BSC 3780 to IBM 3270
Specific Device Emulated	IBM 3287 Model 1 or 2 printer	IBM 5294/5394 controller	IBM 5294/5394 controller	IBM S/34/36/38 or AS/400 to 3270 devices
Specific Functionality Provided	Async printer-IBM 3287 Model 1 or 2 printer	Async displays, PCs, IBM 5251 displays	Async device-IBM 5251 display or 52XX printer	3780 point to point-3270 multipoint BSC
Virtual Screen Sizes Suppt. (char.)	3,584	1,920	1,920	Vendor did not specify
Command Port Supported	No	Yes	Yes	No
Host Side Specifications				
Specific Hosts Supported	IBM 43XX	Digital Equipment PDP-11, Digital Equipment VAX, IBM AS/400, IBM System/3X	Digital Equipment PDP-11, Digital Equipment VAX, IBM AS/400, IBM System/3X	IBM S/3X and AS/400
Host Operating Systems Supported	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
No. Host Selections Suppt. Concurrently	1 BSC and 1 SDLC	1 SDLC and 1 async	1 SDLC and 1 async	2 BSC
Connections Supported	Direct connection	Direct connection	Direct connection	Direct connection, point-to-point on dial-up line
Connection to Host Via Controller	IBM 3174/3274	Direct twinaxial connection to IBM host	Direct twinaxial connection to IBM host	Vendor did not specify
Transmission Spec.-Host Line				
Maximum Transmission Speed (bps)	19.2K; 56K optional	Vendor did not specify	Vendor did not specify	9,600
Synchronization	Synchronous	Synchronous	Synchronous	Synchronous
Transmission Mode	Half duplex	Vendor did not specify	Vendor did not specify	Full duplex
Protocols Supported	IBM Type A coax	SNA/SDLC	SNA/SDLC	3780
Codes Supported	EBCDIC	EBCDIC	EBCDIC	EBCDIC
Interface	1 coax	Twinax	Twinax	1 RS-232-C
Clocking	Data derived	Vendor did not specify	Vendor did not specify	External, internal
Terminal Side Spec.-Terminal Line				
Number and Type of Ports Provided	1 async or Dataproducts/Centronics port	7 RS-232-C or Centronics parallel ports	1 RS-232-C or Centronics parallel port	1 port supports 20 addresses
Specific Devices Supported	Any ASCII output device	Async display terminals, PCs, and printers, including Macintosh printers and PCs	An async display terminal, PC, or printer, including 9 Macintosh printers and PCs	IBM 3274, 3276; other 3270 devices such as teller terminals, and ATMs
Connections Supported	Direct connection, dial-up, remote	Direct connection, dial-up	Vendor did not specify	Leased
Transmission Spec.-Terminal Line				
Maximum Transmission Speed (bps)	19.2K	19.2K	19.2K	9,600
Maximum Aggregate Input Rate (bps)	Vendor did not specify	Vendor did not specify	Vendor did not specify	9,600
Synchronization	Asynchronous	Asynchronous	Asynchronous	Synchronous
Transmission Mode	Half duplex	Full duplex, half duplex	Full duplex, half duplex	Full duplex
Protocols Supported	Xon/Xoff, CTS, ASCII	Xon/Xoff, CTS, ASCII	Xon/Xoff, CTS, ASCII	BSC
Codes Supported	ASCII	ASCII	Vendor did not specify	EBCDIC
Interfaces Supported	RS-232-C, Centronics/Dataproducts, parallel	RS-232-C, Centronics parallel	RS-232-C, Centronics parallel	RS-232-C
Diagnostics	ASCII line tests, self-test, status LEDs	ASCII line tests, self-test, status LEDs	ASCII line tests, self-test, status LEDs	Self-test, problem annunciation
Pricing and Availability				
Purchase (\$)	1,295	3,595 for 7 device ports	1,295	4,950
Serviced By	Andrew/KMW Systems	Andrew/KMW Systems	Andrew/KMW Systems	Arkansas Systems, Inc.
Availability (days ARO)	7 days	30	30	Off the shelf
Date of First Commercial Delivery	March 1987	June 1981	June 1981	1985
Comments	Transparency, graphics support from SAS and ISCO	Full 5251 attribute support, including color; 25th status line	Full 5251 attribute support, including color; 25th status line	Connects 3270 bisync devices to an IBM midrange host via a 3780 bisync comm. line

Vendor	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.
<b>Model</b>	PATH II	PATH III	PATH IV	PATH IV-PBM
<b>Device Type</b>	Protocol converter	Protocol converter	Protocol converter	Protocol converter
<b>Conversion Performed</b>	BSC to SDLC, 5250 remote SNA/SDLC to 3270 multipoint BSC	3780 bisync to 3780 bisync	5250 remote SDLC TO 3624 bisync	IBM 3624 ATM to IBM 4732 PBM
<b>Specific Device Emulated</b>	IBM 5251 Model 12	3780	IBM 5251 Model 12	IBM 4732 PBMS
<b>Specific Functionality Provided</b>	IBM 3270-IBM 5250 SNA	3780 bisync-3780 bisync	5250 remote SNA/SDLC-IBM 3624 ATM bisync	Bisync-3, ATM-SNA LU0 PBM
<b>Virtual Screen Sizes Suppt. (char.)</b>	1,920	Vendor did not specify	1,920	Vendor did not specify
<b>Command Port Supported</b>	No	No	No	No
<b>Host Side Specifications</b>				
Specific Hosts Supported	IBM S/34/36/38 or AS/400	IBM System/3X	IBM S/34/36/38 or AS/400	IBM AS/400
Host Operating Systems Supported	Vendor did not specify	Vendor did not specify	Vendor did not specify	OS/400
No. Host Selections Suppt. Concurrently	1 BSC and 1 SDLC	2 BSC 3780s	1 BSC and 1 SDLC	1 SDLC
Connections Supported	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection	Direct connection, point-to-point on dial-up line	Direct connection, multipoint on leased line
Connection to Host Via Controller	Vendor did not specify	Vendor did not specify	Vendor did not specify	None
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	19.2K	9,600	19.2K	9,600
Synchronization	Synchronous	Synchronous	Synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Half duplex
Protocols Supported	SNA/SDLC	BSC	SNA/SDLC	SNA/SDLC
Codes Supported	EBCDIC	EBCDIC	EBCDIC	EBCDIC
<b>Interface</b>	1 RS-232-C	1 RS-232-C	1 RS-232-C	1 RS-232-C
<b>Clocking</b>	External, internal	External, internal	External, internal	Internal
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	1 multidrop 3270 line	3780	Up to 64 devices over multidrop leased lines	1 SDLC port
Specific Devices Supported	3270 compatible, including ATMs, teller terminals	Any 3780 device	IBM 3624 ATM	IBM 3624 ATM version 8, with bisync feature
Connections Supported	Direct connection, dial-up, leased, remote	Direct connection	Leased, remote	Direct connection, leased
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	9,600	9,600	9,600	4,800
Maximum Aggregate Input Rate (bps)	9,600	9,600	9,600	4,800
Synchronization	Synchronous	Synchronous	Synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Half duplex
Protocols Supported	BSC	BSC	BSC	IBM transparent bisync-3
Codes Supported	EBCDIC	EBCDIC	EBCDIC	EBCDIC
Interfaces Supported	RS-232-C	RS-232-C	RS-232-C	RS-232-C
<b>Diagnostics</b>	Self-test, problem annunciation	Self-test	Self-test	Keybd. & monitor opt., w/ functions; printer opt.
<b>Pricing and Availability</b>				
Purchase (\$)	7,950	4,950	5,950	10,000
Serviced By	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.
Availability (days ARO)	Contact vendor	Contact vendor	Contact vendor	Off the shelf
Date of First Commercial Delivery	1985	1986	1986	June 1990
<b>Comments</b>	Supports a maximum of 8 IBM 3274s on one comm. line	Overcomes IBM S/3X-BSC 3780 protocol contention limitations	Allows an IBM S/34/36/38 or AS/400 to drive a network of 3624 ATMs directly	Lets 3624 ATMs act like 4730 ATMs to the host

Vendor	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.
Model	PATH IX	PATH V	PATH VI	PATH XV (ECCAA)
Device Type	Protocol converter	Protocol converter	Protocol converter	Protocol converter
Conversion Performed	ASCII to EBCDIC	NCR 150 async	IBM 5250 to Burroughs sync	Local IBM 5250 to IBM 3780 bisync
Specific Device Emulated	IBM 5251 Model 11 display	IBM 5251 Model 12	IBM 5251 Model 12	SDLC/SNA protocol workstation
Specific Functionality Provided	Async poll select-IBM 5250	5250 local/remote-Burroughs poll/select	5250 remote SNA/SDLC-Burroughs poll/select sync	5250 local/remote-3780 pt-to-pt bisync
Virtual Screen Sizes Suppt. (char.)	1,920	1,920	1,920	Vendor did not specify
Command Port Supported	No	No	No	Vendor did not specify
Host Side Specifications				
Specific Hosts Supported	IBM S/3X	IBM S/34/36/38 or AS/400	IBM S/34/36/38 or AS/400	IBM S/3X and AS/400
Host Operating Systems Supported	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
No. Host Selections Suppt. Concurrently	Twinax	SDLC 5250	SDLC 5250	Vendor did not specify
Connections Supported	Direct connection	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line	Vendor did not specify
Connection to Host Via Controller	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Transmission Spec.-Host Line				
Maximum Transmission Speed (bps)	Vendor did not specify	9,600	9,600	19.2K
Synchronization	Synchronous	Asynchronous	Synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Vendor did not specify
Protocols Supported	SNA/SDLC	SNA/SDLC	SNA/SDLC	Vendor did not specify
Codes Supported	EBCDIC	EBCDIC	EBCDIC	Vendor did not specify
Interface	Twinax	Twinax	1 RS-232-C	Vendor did not specify
Clocking	Vendor did not specify	Data derived	Vendor did not specify	Vendor did not specify
Terminal Side Spec.-Terminal Line				
Number and Type of Ports Provided	Multiple terminals	Multidrop poll select network	Multidrop Burroughs sync	Attaches bisync comm. lines to IBM S/3X
Specific Devices Supported	Not applicable	Burroughs terminals: TT102, MT355, TU1800, RT650, RT750; NCR 150 async devices: 279, 2261, 2262, 5000 Series	All sync poll/select devices	3892 MICR Reader Sorter, 5294 controller
Connections Supported	Multidrop	Leased	Leased, remote	Direct connection, remote
Transmission Spec.-Terminal Line				
Maximum Transmission Speed (bps)	9,600	9,600	9,600	19.2K
Maximum Aggregate Input Rate (bps)	9,600	9,600	9,600	19.2K
Synchronization	Asynchronous	Asynchronous	Synchronous	Synchronous
Transmission Mode	Half duplex	Half duplex	Full duplex	Full duplex
Protocols Supported	Poll/select	Poll/select	Poll/select	BSC
Codes Supported	ASCII	ASCII	ASCII	Vendor did not specify
Interfaces Supported	RS-232-C	RS-232-C	RS-232-C	Vendor did not specify
Diagnostics	Self-test	Problem annunciation	Problem annunciation	Problem annunciation optional
Pricing and Availability				
Purchase (\$)	5,950	5,950	5,950	6,950
Serviced By	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.	Arkansas Systems, Inc.
Availability (days ARO)	Vendor did not specify	Contact vendor	Off the shelf	Off the shelf
Date of First Commercial Delivery	1987	1986	1986	1987
Comments	Connects IBM terminal cluster to a Burroughs host	Connects async poll select terminals to an IBM S/3X or AS/400 w/o host comm line	—	PATH XV allows the attachment of multiple bisync lines

Vendor	Arkansas Systems, Inc.	Avatar Corp.	Avatar Corp.	Avatar Corp.
Model	PATH XVIII	EP-Connect	PA1500G	Passport
Device Type	Protocol converter, code converter	Protocol converter	Protocol converter	Protocol converter
Conversion Performed	Burroughs poll/select to 3270 bisync	EBCDIC to ASCII	EBCDIC to ASCII	EBCDIC to ASCII
Specific Device Emulated	IBM 3274 Model 51C	ASCII printer	ASCII printer	ASCII printer
Specific Functionality Provided	3277 Model 2-Burroughs MT-11	IBM 3287 printer-ASCII printer	IBM 3287 printer-ASCII printer	IBM 3287 printer-ASCII printer
Virtual Screen Sizes Suppt. (char.)	1,920	1,920	1,920	1,920
Command Port Supported	No	No	No	No
Host Side Specifications				
Specific Hosts Supported	IBM 43XX, or any host supporting IBM VTAM BSC	IBM 43XX, IBM 30XX	IBM 43XX, IBM 30XX	IBM 43XX, IBM 30XX
Host Operating Systems Supported	OS/VS	DOS/VS, MCS, TSO, CICS	DOS/VS, MCS, TSO, CICS	DOS/VS, MCS, TSO, CICS
No. Host Selections Suppt. Concurrently	1 BSC and 1 Burroughs poll/select	1 SDLC or 1 SNA	1 SDLC or 1 SNA	1 SDLC or 1 SNA
Connections Supported	DCE/DTE w/constant or switched CTS, RTS	Direct connection	Direct connection	Direct connection
Connection to Host Via Controller	IBM 37XX	IBM 3174/3274, IBM 3276	IBM 3174/3274, IBM 3276	IBM 3174/3274, IBM 3276, printer adapter
Transmission Spec.-Host Line				
Maximum Transmission Speed (bps)	9,600	Vendor did not specify	Vendor did not specify	Vendor did not specify
Synchronization	Synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Half duplex	Full duplex	Full duplex	Full duplex
Protocols Supported	BSC	SNA/SDLC	SNA/SDLC	SNA/SDLC
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC
Interface	1 RS-232-C	1 RS-232-C, Centronics parallel, Type A coax	1 RS-232-C, Centronics parallel, Type A coax	1 RS-232-C, Centronics parallel, Type A coax
Clocking	DCE or DTE	Internal	Internal	Internal
Terminal Side Spec.-Terminal Line				
Number and Type of Ports Provided	1 port multiplexed to 32 devices	Not applicable	Not applicable	Not applicable
Specific Devices Supported	Burroughs EF7000, Datamaxx 983, 1200, 4300	Vendor did not specify	Vendor did not specify	Vendor did not specify
Connections Supported	Direct connection, leased, remote	Direct connection, dial-up, remote	Direct connection, dial-up, remote	Direct connection, dial-up, remote
Transmission Spec.-Terminal Line				
Maximum Transmission Speed (bps)	9,600	Vendor did not specify	Vendor did not specify	Vendor did not specify
Maximum Aggregate Input Rate (bps)	9,600	Vendor did not specify	Vendor did not specify	Vendor did not specify
Synchronization	Synchronous	Vendor did not specify	Vendor did not specify	Vendor did not specify
Transmission Mode	Half duplex	Vendor did not specify	Vendor did not specify	Vendor did not specify
Protocols Supported	Burroughs poll/select	Vendor did not specify	Vendor did not specify	Vendor did not specify
Codes Supported	ASCII	Vendor did not specify	Vendor did not specify	Vendor did not specify
Interfaces Supported	RS-232-C	Vendor did not specify	Vendor did not specify	Vendor did not specify
Diagnostics	CRT display printer diagnostic trace and dump	On-board self test	On-board self test	On-board self test
Pricing and Availability				
Purchase (\$)	5,950	795	795	595
Serviced By	Arkansas Systems, Inc.	Avatar	Avatar	Avatar
Availability (days ARO)	Contact vendor	2	2	2
Date of First Commercial Delivery	1989	1984	1984	1984
Comments	Can be configured to support up to 32 devices	—	—	—

Vendor	Avatar Corp.	Black Box Corp.	Carlisle Systems Group	Commtext Inc.
<b>Model</b>	<b>Pro-Series</b>	<b>A/S-2G Protocol Converter</b>	<b>PACE II</b>	<b>CX-81</b>
<b>Device Type</b>	Protocol converter	Protocol converter	Protocol converter	Protocol converter
<b>Conversion Performed</b>	EBCDIC to ASCII	ASCII to bisync 2780/3780	NCR ISO async to TTY ASCII	ASCII to EBCDIC
<b>Specific Device Emulated</b>	ASCII printer	IBM RJE Station	NCR 796-301/7900 Model 3	IBM 3271 Model 2, 3174 Model 51R, 3274
<b>Specific Functionality Provided</b>	IBM 3287 printer-ASCII printer	Any ASCII device-3780 bisync device	Async ASCII/ANSI CRT-NCR polled async line	Async display-IBM 3278 Model 2 display
<b>Virtual Screen Sizes Suppt. (char.)</b>	1,920	Vendor did not specify	6016-byte input buffer per port	1,920
<b>Command Port Supported</b>	No	No	Yes	Yes
<b>Host Side Specifications</b>				
Specific Hosts Supported	IBM 43XX, IBM 30XX	DEC PDP-11, VAX; IBM S/3X, AS/400; IBM 3080/3090, 43XX;	NCR V Systems 8000 and 9800	IBM 43XX
Host Operating Systems Supported	DOS/VS, MCS, TSO, CICS	Vendor did not specify	NCR VRX, VRX/E	DOS/VS, OS/VS, RSTS/E, VAX VMS
No. Host Selections Suppt. Concurrently	1 SDLC or 1 SNA	1 BSC and 1 async	4	2 IBM hosts (BSC and/or SDLC)
Connections Supported	Direct connection	Direct connection, point-to-point on dial-up line	Vendor did not specify	Direct connection, point-to-point on dial-up line, multipoint on leased line
Connection to Host Via Controller	IBM 3174/3274, IBM 3276	Direct connection to both async and bisync systems	CSG Polaris, NCR 621/721, ICS, LLCS	Vendor did not specify
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	Vendor did not specify	9.6K for async & bisync ports	38.4K	64K
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous	Synchronous
Transmission Mode	Full duplex	Half duplex	Vendor did not specify	Full duplex
Protocols Supported	SNA/SDLC	BSC-2780/3780	NCR ISO async	BSC, SNA/SDLC
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC	Vendor did not specify	ASCII, EBCDIC
Interface	1 RS-232-C, Centronics parallel, Type A coax	2 RS-232-C (1 async, 1 bisync)	Two EIA-232-D	Vendor did not specify
Clocking	Internal	External, internal, (either/or)	External, internal	External, internal
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	Not applicable	1 async port connects to any ASCII term.	4 multimode ports for CRTs or printers	5 async w/support for 5 aux. printers
Specific Devices Supported	Vendor did not specify	Any ASCII device	ADDS, Wyse, NCR, ANSI X3.64, any serial printer	Vendor did not specify
Connections Supported	Direct connection, dial-up, remote	Direct connection, dial-up, leased, remote	Vendor did not specify	Direct connection, dial-up
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	Vendor did not specify	9.6K	38.4K	38.4K
Maximum Aggregate Input Rate (bps)	Vendor did not specify	9.6K	76.8K	Vendor did not specify
Synchronization	Vendor did not specify	Asynchronous, synchronous	Vendor did not specify	Asynchronous
Transmission Mode	Vendor did not specify	Half duplex	Vendor did not specify	Full duplex
Protocols Supported	Vendor did not specify	BSC, or async	TTY	Vendor did not specify
Codes Supported	Vendor did not specify	ASCII, EBCDIC	Vendor did not specify	ASCII
Interfaces Supported	Vendor did not specify	RS-232-C	EIA-232-D	RS-232-C, V.24
<b>Diagnostics</b>	On-board self test	ASCII line tests, self-test, status LEDs	Vendor did not specify	Self-test
<b>Pricing and Availability</b>				
Purchase (\$)	795	1,295	1,350	3,295
Serviced By	Avatar	Black Box Corp.	NCR	Centel Business Systems
Availability (days ARO)	2	Vendor did not specify	1 to 30	Contact vendor
Date of First Commercial Delivery	1984	Several years ago	1985	August 1989
<b>Comments</b>	—	Has built-in modem eliminators-DCE/DTE selectable-block size	Data compress.; users can switch between polled and TTY applicat. on one CRT	Emulates dual control units for each host (1 or 2); 64 LUs per control unit

Vendor	Commtext Inc.	Commtext Inc.	Comstat Datacomm Corp.	Diversified Data Resources, Inc.
<b>Model</b>	CX-83	CX-86	C-2200 LTDS	HYDRA II
<b>Device Type</b>	Protocol converter, data PBX	Protocol converter, data PBX	Protocol converter	Protocol converter, dial-back security (2 modes) w/audit trail
<b>Conversion Performed</b>	ASCII to EBCDIC	ASCII to EBCDIC	Poll/select	ASCII to EBCDIC, async to IBM 3270, async to IBM 3211; async to IBM 3286
<b>Specific Device Emulated</b>	IBM 3274 Model 51C	IBM 3274 Model 51C	Vendor did not specify	IBM 3174/3274 controller
<b>Specific Functionality Provided</b>	Async display-IBM 3278 Model 2	Async display-IBM 3278 Model 2	Poll/select-serial or parallel TTY	Async terminal or PC-IBM 3215 or 3277
<b>Virtual Screen Sizes Suppt. (char.)</b>	1,920	1,920	1,920	1,920
<b>Command Port Supported</b>	Yes	Yes	No	No
<b>Host Side Specifications</b>				
Specific Hosts Supported	IBM 43XX, IBM 8100	IBM 43XX, IBM 8100	Unisys small, medium, or large systems	IBM 3080/3090, IBM 43XX
Host Operating Systems Supported	DOS/VS, OS/VS, RSTS/E, or VAX VMS	DOS/VS, OS/VS, RSTS/E or VAX VMS	Any Unisys mainframe	DOS/VS, OS/VS
No. Host Selections Suppt. Concurrently	4 IBM-BSC or SNA/SDLC hosts	10 IBM BSC or SNA/SDLC hosts	1 sync or async	Vendor did not specify
Connections Supported	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line, TDI on input from host CP 2000 or CP 3680	Direct connection, point-to-point on dial-up line, multipoint on leased line, any async LAN gateway Channel-attached, byte channel only
Connection to Host Via Controller	IBM 37XX	IBM 37XX		
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	64K	64K	Up to 38.4K	Channel attached
Synchronization	Synchronous	Synchronous	Asynchronous, synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Vendor did not specify
Protocols Supported	BSC, SNA/SDLC, X.25 through NPSI	BSC, SNA/SDLC, X.25 through NPSI	Poll/Select	Vendor did not specify
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC	ASCII	Vendor did not specify
Interface	Vendor did not specify	Vendor did not specify	1 RS-232-C, TDI (two-wire direct interface)	Vendor did not specify
Clocking	External, internal	External, internal	Data derived, extern./intern.	Vendor did not specify
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	Up to 20 async or 10 Type A coax ports	50 async or 25 Type A coax	Up to two serial TTY & one parallel	4, 8, 16, 32, or 64 RS-232-C ports
Specific Devices Supported	Vendor did not specify	Vendor did not specify	Centronix, Dataproducts, or ODEC parallel	Too numerous to list—any async terminal, printer, PC w/ emulation software, many light pens, bar code readers & printers, etc.
Connections Supported	Direct connection, dial-up	Direct connection, dial-up	Direct connection, dial-up, leased	Direct connection, dial-up, leased, indirect LAN (via async gateway)
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	38.4K	38.4K	Up to 38.4K	38.4K
Maximum Aggregate Input Rate (bps)	Configuration dependent	Configuration dependent	Up to 38.4K	2.46M
Synchronization	Asynchronous	Asynchronous	Asynchronous, synchronous	Asynchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Protocols Supported	Vendor did not specify	Vendor did not specify	TTY II	Vendor did not specify
Codes Supported	ASCII	ASCII	ASCII	ASCII; custom. transl. tables
Interfaces Supported	RS-232-C, V.11, Type A coax, async coax, RS-422, V.24	V.24, V.11, Type A coax, async coax, current loop	RS-232-C, parallel	RS-232-C
<b>Diagnostics</b>	Self-test, status LEDs	Self-test, status LEDs	ASCII line tests, self-test, status LEDs	Self-test; diagnostic display via any async port
<b>Pricing and Availability</b>				
Purchase (\$)	4,950 to 6,800	6,550-13,950	Vendor did not specify	4,900+ (4 ports)
Serviced By	Centel Business Systems	Centel Business Systems	Comstat Datacom Corp.	JDS MicroProcessing, Inc.
Availability (days ARO)	Contact vendor	Contact vendor	10	14
Date of First Commercial Delivery	1983	1980	1985	1983
<b>Comments</b>	Has functions of ASCII-3270 prot. conv., 3270-ASCII decnvtr., & PBX/PAD	Enables up to 5 concurrent multiple sessions per user across multiple hosts	—	Upgradeable to as many as 64 ports

Vendor	Forest Computer, Inc.	Gandalf Data, Inc.	Innosys, Inc.	International Business Machines Corp. (IBM)
<b>Model</b>	<b>Connection System</b>	<b>ITM 3270</b>	<b>IC100</b>	<b>3708 Network Conversion Unit</b>
<b>Device Type</b>	Gateway	Protocol converter, terminal emulator, 3274/3276 controller emulator	Protocol converter, terminal emulator, code converter	Protocol converter
<b>Conversion Performed</b>	ASCII to EBCDIC	ASCII to EBCDIC	ASCII to EBCDIC, BSC to SDLC, ALC, SLC, SNA, X.25, Burroughs poll/select	ASCII to SNA/SDLC
<b>Specific Device Emulated</b>	DEC VT100, VT220 displays; IBM 5251 Model 11 display; IBM 5294/5394 controller	IBM 3274 Model 51C, IBM 3276 Model 12	IBM 3274 Model 51C, ALC terminal	IBM 3274 Model 51C
<b>Specific Functionality Provided</b>	IBM 5250-DEC VT220	Async ASCII terminals to IBM host	'All in ASCII	Async-SNA/SDLC
<b>Virtual Screen Sizes Suppt. (char.)</b>	1,920	1,920, 3,564, 480	1,920	Vendor did not specify
<b>Command Port Supported</b>	Yes	No	Yes	Yes
<b>Host Side Specifications</b>				
Specific Hosts Supported	Digital Equipment PDP-11, Digital Equipment VAX, IBM AS/400, IBM System/3X	IBM 43XX, any host that supports the IBM 3274	Digital Equipment PDP-11, VAX; IBM 43XX; numerous other hosts	IBM System/3X, IBM 43XX, IBM 8100, S/370, 30XX, 9370
Host Operating Systems Supported	RSTS/E or VAX VMS, OS/400	Independent of host operating system	DOS/VS, OS/VS	MVS, VM, VSE
No. Host Selections Suppt. Concurrently	1 token ring, 1 SDLC, and 1 Ethernet	1 SDLC	1 BSC and 1 SDLC, or 1 SDLC and 1 async	1 or 2 IBM hosts, and 1 async host
Connections Supported	Point-to-point on dial-up line, multipoint on leased line, LAN	Direct connection, point-to-point on dial-up line, multipoint on leased line	Point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line
Connection to Host Via Controller	Vendor did not specify	Emulates a cluster controller	IBM 3274	IBM 37XX
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	64K	19.2K	56K	19.2K
Synchronization	Synchronous	Synchronous	Asynchronous, synchronous	Asynchronous
Transmission Mode	Full duplex	Full duplex, half duplex	Full duplex, half duplex	Full duplex, half duplex
Protocols Supported	SNA/SDLC, DECnet	SNA/SDLC	Vendor did not specify	SNA/SDLC
Codes Supported	ASCII, EBCDIC	EBCDIC	ASCII, EBCDIC, ALC Baudot	ASCII, EBCDIC
Interface	1 RS-232-C, token ring, Ethernet	1 RS-232-C	1 RS-232-C, 1 RS-422	1 RS-232-C, 1 RS-422
Clocking	External	External, internal	External, internal	Vendor did not specify
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	500	8; each channel connects to terminal	Not applicable	10 asynchronous device ports
Specific Devices Supported	IBM 5250, DEC VT200	IBM 3278 Models 1-5, IBM 3279-4 color model, IBM 3287 printer	Not applicable	ADD5, Data General, DEC, HP, and WYSE display terminals
Connections Supported	Token ring	Direct connection, dial-up, leased	Direct connection, dial-up, leased, remote	Direct connection, dial-up, leased
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	64K	19.2K	56K	19.2K
Maximum Aggregate Input Rate (bps)	Vendor did not specify	Vendor did not specify	56K	Vendor did not specify
Synchronization	Synchronous	Asynchronous	Asynchronous, synchronous	Asynchronous
Transmission Mode	Full duplex	Full duplex	Full duplex, half duplex	Full duplex, half duplex
Protocols Supported	SNA/SDLC, DECnet	Vendor did not specify	BSC, TTY II	Vendor did not specify
Codes Supported	ASCII, EBCDIC	ASCII	ASCII, EBCDIC	ASCII, EBCDIC
Interfaces Supported	Token ring, Ethernet	RS-232-C	RS-232-C	RS-232-C, RS-422
<b>Diagnostics</b>	Remote diagnostics	ASCII line tests, self-test, async loopback	Self-test	Control terminal
<b>Pricing and Availability</b>				
Purchase (\$)	Vendor did not specify	2,400 hardware; 2K software	12,500	4,375
Serviced By	Vendor did not specify	Gandalf Data, Inc.	Innosys, Inc.	IBM
Availability (days ARO)	Vendor did not specify	Vendor did not specify	15	Contact vendor
Date of First Commercial Delivery	Vendor did not specify	July 1988	1982	1985
<b>Comments</b>	—	Passthru printing (for printer attached to terminal)	'ALC, SLC, SNA, X.25, bisync	3708 supports SNA network management features through NetView, NPDA, or NDLM

Vendor	International Business Machines Corp. (IBM)	International Business Machines Corp. (IBM.)	JBM Electronics	JDS MicroProcessing
Model	7171	Asynchronous Emulation Adapter (for the 3174 Establishment Controller)	MAPC-3270	HYDRA II
Device Type	Protocol converter	Protocol converter	Protocol converter	Protocol converter
Conversion Performed	ASCII to EBCDIC	Bidirectional async to IBM 3270	Async to IBM 3270	ASCII to EBCDIC
Specific Device Emulated	3274 Model 10	IBM 3178/3279 displays & IBM printers	IBM 3174/3274 controller, IBM 3278 Model 2 display	IBM 3274
Specific Functionality Provided	Async-IBM 3270	Async-IBM displays and printers	Async ASCII-IBM 3278 display	Async ASCII-IBM S/370 channel
Virtual Screen Sizes Suppt. (char.)	Vendor did not specify	1,920	1,920, 2,560, 3,564	1,920
Command Port Supported	Yes	Yes	Yes	Yes
Host Side Specifications				
Specific Hosts Supported	IBM 3081, 3083, 3084	DEC PDP-11, VAX; IBM 3080/3090, 43XX, 8100, 9370, System/390	IBM 3080/3090, IBM 43XX, IBM 9370	IBM 43XX, 30XX
Host Operating Systems Supported	VM/SP, MVS	OS/VS, RSTS/E or VAX VMS	DOS/VS, OS/VS	DOS/VS, OS/VS, VM/CMS, MCA/XA
No. Host Selections Suppt. Concurrently	1 IBM host	8 async host/devices per adapter	1 SDLC and 1 async	1 non-SNA and 1 ASCII
Connections Supported	Direct connection	Direct connection, point-to-point on dial-up line	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line
Connection to Host Via Controller	IBM 3274	Resides in the IBM 3174	IBM 37XX	Byte multiplexer channel
Transmission Spec.-Host Line				
Maximum Transmission Speed (bps)	19.2K	19.2K	38.4K	Channel speed
Synchronization	Asynchronous	Asynchronous, synchronous	Asynchronous, synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex, half duplex	Full duplex, half duplex	Full duplex
Protocols Supported	Vendor did not specify	BSC, SNA/SDLC, ASCII, ANSI	BSC, SNA/SDLC	3270/channel
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC	EBCDIC
Interface	1 RS-232-C	1 current loop	1 current loop, 1 RS-232-C, 1 RS-422	Bus and tag cables
Clocking	Vendor did not specify	Vendor did not specify	External, internal	Internal
Terminal Side Spec.-Terminal Line				
Number and Type of Ports Provided	Up to 64 async ports	8 EIA-232-D host/device ports	Up to 16 async ports	Up to 64 ports
Specific Devices Supported	IBM 3101, IBM PCs, and terminals from Digital, LSI, TeleVideo, and others	Async terminals from ADDS, Digital, Esprit, HP, Lear Siegler, and Televideo; PCs & PS/2s emulating display terminals; async hosts	90 different terminals on menu	ASCII CRTs, printers, PCs
Connections Supported	Direct connection	Vendor did not specify	Direct connection, dial-up, leased	Direct connection, dial-up, leased
Transmission Spec.-Terminal Line				
Maximum Transmission Speed (bps)	19.2K	19.2K	Vendor did not specify	38.4K
Maximum Aggregate Input Rate (bps)	Vendor did not specify	Vendor did not specify	38.4K	Vendor did not specify
Synchronization	Asynchronous	Asynchronous, synchronous	Asynchronous	Asynchronous
Transmission Mode	Full duplex	SNA/SDLC, BSC, async	Full duplex, half duplex	Full duplex
Protocols Supported	Vendor did not specify		TTY II	3270
Codes Supported	ASCII, EBCDIC	ASCII, ANSI	ASCII	ASCII
Interfaces Supported	RS-232-C	EIA-232-D	RS-232-C	RS-232-C
Diagnostics	Special maintenance facility	Diagnostics provided by the 3174	ASCII line tests, self-test, status LEDs	Self-test, memory dump
Pricing and Availability				
Purchase (\$)	14,100 for 10 device ports	2,645	995 base unit	4,900 and up
Serviced By	IBM	IBM	JBM Electronics	JDS MicroProcessing
Availability (days ARO)	Contact vendor	Contact vendor	14 days	30
Date of First Commercial Delivery	1984	May 1989	1985	1983
Comments	—	—	—	Call-back/password sec., positive logoff security, audit trail

Vendor	JDS MicroProcessing	Memotec Data, Inc.	Memotec Data, Inc.	Memotec Data, Inc.
Model	HYDRA SNA	DM 1200 B	DM 2000 B Plus	DM 2400 B PLUS
Device Type	Protocol converter	Protocol converter, cluster controller	Protocol converter, cluster controller	Protocol converter, data PBX for Unisys systems
Conversion Performed	ASCII to EBCDIC	Burroughs poll select	Burroughs poll select	Burroughs poll select
Specific Device Emulated	IBM 3274 controller	All Burroughs-compatible terminals	Digital Equipment VT100, all Burroughs compatible terminals	Digital Equipment VT100, all Burroughs-compatible terminals
Specific Functionality Provided	Async ASCII-IBM S/370 channel	Group poll to poll select	Group poll-poll select	Group poll-poll select
Virtual Screen Sizes Suppt. (char.)	1,920	3,564	3,564	3,564
Command Port Supported	Yes	No	No	Yes
Host Side Specifications				
Specific Hosts Supported	IBM 43XX, 30XX, and 9370	Burroughs computers, from B-20 to A-17	Burroughs computers, from B-20 to A-17	All Burroughs hosts, from B-20 to A-17
Host Operating Systems Supported	VTAM, VM/CMS, MVS/XA	Vendor did not specify	Vendor did not specify	Vendor did not specify
No. Host Selections Suppt. Concurrently	1 SNA and 1 ASCII	1 or 2 host ports (sync, async, or TDI)	1 or 2 host ports (sync, async, or TDI)	1 to 7 host ports (sync, async, TDI)
Connections Supported	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line, TDI	Direct connection, point-to-point on dial-up line, multipoint on leased line, TDI	Direct connection, point-to-point on dial-up line, multipoint on leased line, TDI
Connection to Host Via Controller	Direct to block or byte multiplexer channel	Any Burroughs FEP	Any Burroughs FEP	Any Burroughs FEP
Transmission Spec.-Host Line				
Maximum Transmission Speed (bps)	Channel speed	19.2K	19.2K	19.2K
Synchronization	Synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Full duplex	Half duplex	Half duplex	Half duplex
Protocols Supported	SNA/channel	Burroughs poll select	Burroughs poll select	Burroughs poll select
Codes Supported	EBCDIC	ASCII	ASCII	Vendor did not specify
Interface	Bus and tag cables	1 RS-232-C, TDI	1 RS-232-C, TDI	1 RS-232-C, TDI
Clocking	Internal	Data derived, extern./intern.	Data derived, extern./intern.	Data derived, extern, intern
Terminal Side Spec.-Terminal Line				
Number and Type of Ports Provided	Up to 64 ports	64 terminal addresses supported	254 terminal addresses supported	254 terminal addresses supported
Specific Devices Supported	ASCII CRTs, printers, PCs	All Burroughs-compatible and async devices	Any Burroughs-compatible or async device	All Burroughs-compatible and async devices
Connections Supported	Direct connection, dial-up, leased, remote	Direct connection, dial-up, leased, remote, TDI	Direct connection, dial-up, leased, remote, TDI	Direct connection, dial-up, leased, remote, TDI
Transmission Spec.-Terminal Line				
Maximum Transmission Speed (bps)	38.4K	19.2K	19.K	19.2K
Maximum Aggregate Input Rate (bps)	Vendor did not specify	Vendor did not specify	All ports at 19.2K	Vendor did not specify
Synchronization	Asynchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Full duplex	Full duplex, half duplex	Full duplex, half duplex	Full duplex, half duplex
Protocols Supported	SNA/3270	TTY II, Burroughs poll select, NCR poll	TTY II, Burroughs poll select, NCR poll	TTY II, Burroughs poll select, NCR poll
Codes Supported	ASCII	ASCII	ASCII	ASCII
Interfaces Supported	RS-232-C	RS-232-C, TDI	RS-232-C, TDI	RS-232-C, TDI
Diagnostics	Self-test, channel trace	Self-test, status LEDs, optional loop back	Status LEDs, optional loopback	Self-test, status LEDs, optional loop back
Pricing and Availability				
Purchase (\$)	12,900 and up	4,000 up	9,000	16,000 up
Serviced By	JDS MicroProcessing	Memotec Data, Inc.	Memotec Data, Inc.	Memotec Data, Inc.
Availability (days ARO)	60	30	30	30
Date of First Commercial Delivery	December 1988	1985	1985	1985
Comments	Call-back, multilevel security, dynamic baud rate set	Also acts as remote front-end processor; host-based net management	Also acts as a remote front-end processor; host-based net management	Also acts as remote front-end processor; host-based net management

**Protocol Conversion  
Systems:  
Comparison Columns  
Conversion  
Systems/Terminal  
Controllers**

Vendor	Micom Communications Corp.	Netlink, Inc.	Netlink, Inc.	Netlink, Inc.
Model	Micom Box Type 3 (MB3)	SNA-Gate 3703-1	SNA-Gate 3703-1A	SNA-Gate 3703-1B
Device Type	Protocol converter	Protocol converter	Protocol converter	Protocol converter
Conversion Performed	ASCII to EBCDIC	ASCII to EBCDIC, BSC to SDLC	ASCII to EBCDIC, LU0/1/2/3	BSC to SDLC, BSC 3275 to LU1/2; BSC 1 RJE to LU0/1
Specific Device Emulated	IBM 3274 Model 51C, IBM 3276 Model 12	Full func. PU Type 2, with multiple LU types (8100)	Full func. PU Type 2, with multiple LU types (8100)	IBM 3174/3274 controller, IBM 3770
Specific Functionality Provided	IBM PU Type 2	LU type dynamic-based on bind	LU type dyn., based on bind	BSC 2780/3780 or 3271/5377-3274
Virtual Screen Sizes Suppt. (char.)	1,920	3278 (types 2/3/4/5)	3278 (types 2, 3, 4, 5)	1,920, 3,584
Command Port Supported	Yes	Yes	Yes	Yes
Host Side Specifications				
Specific Hosts Supported	Digital Equipment PDP-11, VAX; IBM 43XX, 8100, 3090,	IBM 43XX, IBM 8100, VTAM, 8100 Tandem, IBM S/370	IBM 43XX, IBM 8100, IBM S/370, VTAM, 8100 Tandem	IBM 43XX, IBM 8100, 370/Tandem
Host Operating Systems Supported	DOS/VS, OS/VS, RSTS/E or VAX VMS	MVS	MVS	MVS
No. Host Selections Suppt. Concurrently	1 SDLC and 1 async, or 1 BSC and 1 async	40	40	40
Connections Supported	Direct connection, point-to-point on dial-up line, multipoint on leased line, using IBM 3174 or 37XX	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line, IBM 37XX, or equiv. IBM 3705, 3725 or equivalent	Direct connection, point-to-point on dial-up line, multipoint on leased line
Connection to Host Via Controller	IBM 37XX	IBM 37XX or equivalent	IBM 37XX or equivalent	IBM 37XX, Amdahl, Comten
Transmission Spec.-Host Line				
Maximum Transmission Speed (bps)	19.2K	64K	64K	64K
Synchronization	Asynchronous, synchronous	Synchronous	Synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex, half duplex	Full duplex, half duplex	Full duplex, half duplex
Protocols Supported	BSC, SNA/SDLC	SNA/SDLC	SNA/SDLC	SNA/SDLC
Codes Supported	ASCII, EBCDIC	EBCDIC	EBCDIC	EBCDIC
Interface	1 RS-232-C, 1 RS-422	1 RS-232-C, V.35, X.21	1 RS-232-C, V.35, X.21	1 RS-232-C, V.35, X.21
Clocking	External, internal	External, internal	External, internal	External, internal
Terminal Side Spec.-Terminal Line				
Number and Type of Ports Provided	Up to 16 ports	2 to 8 BSC ports/2 to 16 async, multidrop ports	2 to 16 async, multidrop ports	2 to 8 BSC, multidrop ports
Specific Devices Supported	IBM displays, PCs, and all major printers for display terminals	Any terminal supporting cursor addressing; software-controlled via host	Any terminal supporting cursor addressing; software controlled via host	Contact vendor
Connections Supported	Direct connection, dial-up, leased, remote	Direct connection, dial-up, point-to-point	Point-to-point	Direct connection, dial-up, leased, remote, point-to-point
Transmission Spec.-Terminal Line				
Maximum Transmission Speed (bps)	19.2K	300 to 9,600 bps	300 to 9,600 bps	300 to 9,600 bps
Maximum Aggregate Input Rate (bps)	76.8K	64K	64K	64K
Synchronization	Asynchronous	Asynchronous, synchronous	Asynchronous	Synchronous
Transmission Mode	Full duplex	Full duplex, half duplex	Full duplex, half duplex	Half duplex
Protocols Supported	TTY II	BSC, TTY II, 327X, 2780, 3780, 2700, Burroughs poll/seq., 2740-1	Xon/Xoff	BSC
Codes Supported	ASCII	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC
Interfaces Supported	RS-232-C	RS-232-C	RS-232-C	RS-232-C
Diagnostics	ASCII line tests, self-test, status LEDs	Self-test, status LEDs	Self-test, status LEDs	Self-test, status LEDs
Pricing and Availability				
Purchase (\$)	3,055 for 4 ports	7,000 to 9,500	4,000 to 6,000	5,250 to 6,000
Serviced By	Micom auth. svce. reps.	Contact vendor	Contact vendor	Contact vendor
Availability (days ARO)	30	10 to 14	10 to 14	10 to 14
Date of First Commercial Delivery	January 1983	July 1982	February 1986	December 1986
Comments	—	3-year warranty; expandable by 2 port increments; PC file transfer	3 year warranty; expandable by 2 port increments; PC file transfer	3 year warranty; expandable by 2 port increments; PC file transfer

Vendor	Perle Systems, Inc.	Perle Systems, Inc.	Plantronics Futurecomms, Inc.	Plantronics Futurecomms, Inc.
<b>Model</b>	PERLE Model 31	XGATE HIU	MicroTURBO	NanoTURBO
<b>Device Type</b>	Protocol converter	Protocol converter	Protocol converter, terminal emulator, code converter	Protocol converter, terminal emulator, code converter
<b>Conversion Performed</b>	ASCII to EBCDIC	Async to IBM SNA/SDLC	ASCII to EBCDIC, async to IBM SNA/SDLC, async to IBM 3270	ASCII to EBCDIC, async to IBM SNA/SDLC, async to IBM 3270
<b>Specific Device Emulated</b>	IBM 5251 Model 11 display, IBM 5291 or 3180 Display Station	IBM 3180 Display Station	IBM 3174/3274 controller, IBM PU Type 2	IBM 3174/3274 controller, IBM PU Type 2
<b>Specific Functionality Provided</b>	ASCII display-IBM 3180, 5291, 5251	ASCII PCs & printers-IBM 3180	ASCII display-IBM 3174/3274	ASCII display-IBM 3174/3274
<b>Virtual Screen Sizes Suppt. (char.)</b>	3,564	3,564	1,920	1,920
<b>Command Port Supported</b>	Vendor did not specify	Yes	Yes	Yes
<b>Host Side Specifications</b>				
Specific Hosts Supported	IBM AS/400, IBM System/3X	IBM AS/400, IBM System/3X	DEC PDP-11, VAX; IBM AS/400, System/3X, IBM PU Type 4	DEC PDP-11, VAX; IBM AS/400, System/3X, PU Type 4
Host Operating Systems Supported	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
No. Host Selections Suppt. Concurrently	1 SNA/SDLC	1 SDLC	32 BSC, 32 SDLC, 8 async	32 BSC, 32 SDLC, 2 async
Connections Supported	Direct connection, point-to-point on dial-up line	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line, multipoint on leased line
Connection to Host Via Controller	IBM 5294/5394	IBM 5294/5394	IBM 3174/3274, IBM 37XX	IBM 3174/3274
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	1M	56K	Up to 19.2K	Up to 19.2K
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Vendor did not specify	Full duplex	Full duplex	Full duplex
Protocols Supported	Vendor did not specify	SNA/SDLC	BSC, SNA/SDLC, HDLC, QLLC, Transparent frame relay	BSC, SNA/SDLC, HDLC, QLLC, Transparent frame relay
Codes Supported	ASCII	ASCII, EBCDIC	ASCII, EBCDIC	ASCII, EBCDIC
<b>Interface</b>	1 RS-232-C, Twinax	1 RS-232-C, V.35, X.21	1 RS-232-C	1 RS-232-C
<b>Clocking</b>	External	External, internal	External, internal	External
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	7 ports for printers or terminals	20 PC ports and 20 printer ports	Up to 10 async/SNA/BSC ports	Up to 6 sync (SNA/BSC) and async ports
Specific Devices Supported	Vendor did not specify	IBM PC & compatibles w/our software	Any asynchronous device	Any asynchronous device
Connections Supported	Direct connection, dial-up, leased	Dial-up, leased, remote	Direct connection, dial-up, leased, remote	Direct connection, dial-up, leased, remote
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	38.4K	19.2K	Up to 19.2K	Up to 19.2K
Maximum Aggregate Input Rate (bps)	38.4K	19.2K	61.4K	Vendor did not specify
Synchronization	Asynchronous, synchronous	Synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Vendor did not specify	Full duplex	Full duplex	Full duplex
Protocols Supported	Vendor did not specify	TTY II	BSC, SDLC	Vendor did not specify
Codes Supported	ASCII, EBCDIC	ASCII	ASCII, EBCDIC	ASCII, EBCDIC
Interfaces Supported	RS-232-C	RS-232-C, V.35, X.21	RS-232-C	RS-232-C
<b>Diagnostics</b>	Vendor did not specify	Status LEDs	ASCII line tests, self-test, status LEDs	ASCII line tests, self-test, status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	From 1,995	10,850 (incl. PC software)	2,995	1,995.00 Standard NanoTURBO
Serviced By	Perle Systems, Inc.	Perle Systems, Inc.	PFI	PFI
Availability (days ARO)	10	10	21 to 28	21 to 28
Date of First Commercial Delivery	October 1990	October 1990	December 1988	Vendor did not specify
<b>Comments</b>	Supports multiple sessions for terminals	—	SNA to X.25 & Telex to X.25 conversion opt.; supports PFI's net management	Optional SNA to X.25 & Telex to X.25 conversion; compatible with PFI's net management

**Protocol Conversion  
Systems:  
Comparison Columns  
Conversion  
Systems/Terminal  
Controllers**

Vendor	Plantronics Futurecomms, Inc.	Shaffstall Corp.	Telematics International, Inc.	Thomas Engineering Company
<b>Model</b>	<b>PAC.25 TURBO</b>	<b>Shaffstall 6000</b>	<b>SmartNet 5250/T</b>	<b>Unitec</b>
<b>Device Type</b>	Protocol converter, terminal emulator, code converter	Code converter	Protocol converter	Protocol converter, terminal emulator, code converter
<b>Conversion Performed</b>	ASCII to EBCDIC, async to IBM SNA/SDLC, async to IBM 3270	ASCII to EBCDIC, BSC to SDLC, proprietary	Vendor did not specify	ASCII to EBCDIC, async to IBM SNA/SDLC, BSC to SDLC
<b>Specific Device Emulated</b>	IBM 3174/3274 controller, IBM PU Type 2	IBM 3274 Model 51C	IBM 5291, 5292, 5256, 5219, 3812	IBM 3174/3274 controller, 3278 display, 3287 printer, Bull VIP 7700, 7760, 7800
<b>Specific Functionality Provided</b>	ASCII display-IBM 3174/3274	Async-sync	ASCII devices-IBM Twinax ports	Bidirectional conversion between IBM 3178/3279 displays & 3287 printers and async displays and printers
<b>Virtual Screen Sizes Suppt. (char.)</b>	1,920	1,920	Vendor did not specify	1,920
<b>Command Port Supported</b>	Yes	No	Yes	Yes
<b>Host Side Specifications</b>				
Specific Hosts Supported	DEC PDP-11, VAX; IBM AS/400, System/3X, PU Type 4	Digital Equipment PDP-11, Digital Equipment VAX	System 34/36/38	IBM 3080/3090, IBM 43XX; all Bull 6000, 7000, & 8000 hosts
Host Operating Systems Supported	Vendor did not specify	DOS/VS	Vendor did not specify	Vendor did not specify
No. Host Selections Suppt. Concurrently	128 BSC; 128 SDLC; 38 async	Vendor did not specify	Vendor did not specify	Up to 44 host ports
Connections Supported	Direct connection, point-to-point on dial-up line, multipoint on leased line	Direct connection, point-to-point on dial-up line	Twinax interface	Direct connection, point-to-point on dial-up line, multipoint on leased line
Connection to Host Via Controller	IBM 3174/3274, IBM 37XX	IBM 37XX	Connects to IBM 5294	Vendor did not specify
<b>Transmission Spec.-Host Line</b>				
Maximum Transmission Speed (bps)	Up to 64K	19.2K	19.2K	56K
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Vendor did not specify	Asynchronous, synchronous
Transmission Mode	Full duplex	Full duplex	Vendor did not specify	Full duplex, half duplex
Protocols Supported	BSC, SNA/SDLC, HDLC, QLLC, SDLC, Transp. frame relay	BSC, SNA/SDLC	Vendor did not specify	BSC, SNA/SDLC, VIP, Uniscope, IPARS, X.25
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC, DX, DCA, DEF	Vendor did not specify	ASCII, EBCDIC, PARS
Interface	1 RS-232-C, RS-449	1 RS-232-C	Vendor did not specify	1 RS-232-C, 1 RS-422
Clocking	External, internal	External	Vendor did not specify	External, internal
<b>Terminal Side Spec.-Terminal Line</b>				
Number and Type of Ports Provided	Up to 72 async/SNA/BSC ports	Four ports and printer port	Up to 7 asynchronous	Up to 44 async or sync ports
Specific Devices Supported	Any synchronous device	Vendor did not specify	IBM, DEC, Lear Siegler, ADDS, Televideo, Wyse	ANSI 3.64-compatible; IBM 327X; Bull VIP 7700, 7760, 7800, HDS 5.7; Unisys UTS 20/40/400
Connections Supported	Direct connection, dial-up, leased, remote	Direct connection, dial-up	Vendor did not specify	Direct connection, dial-up
<b>Transmission Spec.-Terminal Line</b>				
Maximum Transmission Speed (bps)	Up to 64K	19.2K	Vendor did not specify	19.2K
Maximum Aggregate Input Rate (bps)	307.2K	9,600	Vendor did not specify	1.2M
Synchronization	Asynchronous, synchronous	Synchronous	Vendor did not specify	Asynchronous, synchronous
Transmission Mode	Full duplex	Half duplex	Vendor did not specify	Full duplex, half duplex
Protocols Supported	BSC, SDLC	TTY II, BSC 2770/2780/3780	Vendor did not specify	BSC
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC, DX, DCA, DEF	Vendor did not specify	ASCII
Interfaces Supported	RS-232-C	RS-232-C	RS-422	RS-232-C
<b>Diagnostics</b>	ASCII line tests, self-test, status LEDs	Self-test	Vendor did not specify	Self-test, status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	5,225 to 15,505	5,500 to 20,000	2,925 (8 ports)	1,500-30,000
Serviced By	Vendor did not specify	TRW Inc.	Telematics	Thomas Eng. Co., ITT ServeCom
Availability (days ARO)	21 to 28	30	Contact vendor	14
Date of First Commercial Delivery	2nd quarter 1988	August 1987	1987	August 1985
<b>Comments</b>	Optional SNA to X.25 & Telex to X.25 conversion; compatible with PFI's net management	The 6000 is a data conversion system for data transmission	—	Multi-processor, multi-function network computer

<b>Vendor</b>	Trax Softworks, Inc.	Wall Data Inc.
<b>Model</b>	VM DialOut	DCF II 3270
<b>Device Type</b>	Terminal emulator	Protocol converter
<b>Conversion Performed</b>	IBM 3270 (bisync or SNA) to async	ASCII to EBCDIC
<b>Specific Device Emulated</b>	Digital Equipment VT100, TTY	IBM 3274 Model 51C
<b>Specific Functionality Provided</b>	IBM 3270-async	Async-3270 SDLC-
<b>Virtual Screen Sizes Suppt. (cher.)</b>	All 3270 sizes, including 1,920, 2560, & 3,564	1,920
<b>Command Port Supported</b>	Yes	Yes
<b>Host Side Specifications</b>		
Specific Hosts Supported	DEC PDP-11, VAX; IBM AS/400 , 3080/3090, 43XX, or 9370; any async host	IBM 43XX, 3270 types
Host Operating Systems Supported	DOS/VS, OS/VS	VM/CMS, TSO
No. Host Selections Suppt. Concurrently	1 BSC and 1 SDLC	Any combination of SDLC, BSC, and async
Connections Supported	Direct connection, point-to-point on dial-up line, multipoint on leased line	Point-to-point on dial-up line; direct connection through RS-232-C cabling
Connection to Host Via Controller	IBM 3174/3274, IBM 37XX	Emulates 3174, 3274 controller
<b>Transmission Spec.-Host Line</b>		
Maximum Transmission Speed (bps)	38.4K	Vendor did not specify
Synchronization	Synchronous	Synchronous
Transmission Mode	Full duplex	Half duplex
Protocols Supported	BSC, SNA/SDLC	BSC, SNA/SDLC, async
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC
<b>Interface</b>	1 RS-232-C	1 RS-232-C
<b>Clocking</b>	Internal	Internal
<b>Terminal Side Spec.-Terminal Line</b>		
Number and Type of Ports Provided	Limited only by host; up to 15,000	Up to 17 RS-232-C ports
Specific Devices Supported	All 3270 terminals (IBM 3278, 3180, etc.)	async terminals, PCs, PS/2s, and printers
Connections Supported	Direct connection, dial-up, leased, remote, channel-attached	Direct connection, dial-up, leased, remote
<b>Transmission Spec.-Terminal Line</b>		
Maximum Transmission Speed (bps)	1.44M	19.2K
Maximum Aggregate Input Rate (bps)	40M	Vendor did not specify
Synchronization	Synchronous	Asynchronous
Transmission Mode	Full duplex	Half duplex
Protocols Supported	BSC, SNA/SDLC; channel attached	BSC, TTY II
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC
Interfaces Supported	RS-232-C	RS-232-C
<b>Diagnostics</b>	ASCII line tests, self-test, status LEDs	Self-test
<b>Pricing and Availability</b>		
Purchase (\$)	Vendor did not specify	4,995
Serviced By	Trax Softworks, Inc.	Wall Data, Inc.
Availability (days ARO)	Vendor did not specify	2 weeks
Date of First Commercial Delivery	1982	Vendor did not specify
<b>Comments</b>	VM dialout lets 3270 users dialout to async systems	Can simultaneously support SNA, BSC, and async in one unit

## Code, Speed, Interface, and Async/Sync Converters

### Comparison Column Entry Descriptions

**Code, Speed, Interface, and Async/Sync Converters** include a number of devices that handle conversions from one code, interface, speed, or synchronization to another. These units are generally less sophisticated devices than those represented in the other category.

The following text briefly describes the column entries in the order in which they appear in the columns.

#### **Code, Speed, Interface, and Async/Sync Converters**

**Model.** This entry lists the exact name and model number of the product.

**Device Type.** In this entry, vendors indicate if the device is an interface converter, async/sync converter, code and speed converter, or another type.

**Conversion Performed.** Responses in this category include RS-232-C to

V.35, RS-232-C to RS-422, and AT&T 301/303 to V.35.

#### **Transmission Specifications**

**Maximum Transmission Speed (bps).** Vendors list the maximum transmission speed in bits per second.

**Synchronization.** The possible responses are synchronous and asynchronous.

**Transmission Mode.** The devices operate in either half-duplex or full-duplex mode.

**Codes Supported.** Vendors indicate ASCII, Baudot, EBCDIC, or Other.

**Interface.** Vendors select from a choice of RS-232-C, V.24, V.28, V.35, Current Loop, or Other.

**Specific Devices Supported.** Typical responses include any async DTE,

any async or sync DCE, ASCII printers, and IBM 3X78 display terminals.

#### **Connections Supported.**

The possibilities here are Direct, Dial-Up, Leased Lines, and Other.

**Diagnostics.** The types of diagnostics offered in the questionnaire to vendors are Status LEDs, Remote Tests, Loopbacks, and Other.

#### **Pricing and Availability**

The explanations for the entries **Purchase, Serviced by, Availability (days ARO), Date of First Commercial Delivery,** and **Comments** are the same as those for Conversion Systems/Terminal Controllers.

Vendor	Arkansas Systems, Inc.	Astrocom Corp.	Black Box Corp.	Carlisle Systems Group
Model	PATH IV-PBM	ATS-1	Communications Adapter Plus (CAP)	93729 A/S Converter
Device Type	Protocol and data converter	Async/sync converter	Code and speed converter	Async/sync converter, speed converter, switched carrier emulator
Conversion Performed	See comments section	Asynchronous to synchronous	Speed conversion of code structure, transmission mode, word structure, and flow control	Async DTE to sync modem
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	9,600 bps	19.2K	45.5 to 19.2K	38.4K
Synchronization	Synchronous	Synchronous	Asynchronous	Synchronous
Transmission Mode	Half duplex	Full duplex	Half duplex, full duplex	Half duplex, full duplex
Codes Supported	EBCDIC	ASCII	ASCII, EBCDIC, Baudot, ticker tape, transcode	ASCII, Baudot
Interface	RS-232-C	RS-232-C	RS-232-C	EIA-232-D
<b>Specific Devices Supported</b>	Version 8 IBM 3624 ATM's w/Bisync feature	Vendor did not specify	Any async device	Async DTE, or async/sync DCE DCE
<b>Connections Supported</b>	Direct, leased lines	Vendor did not specify	Any type	Direct, leased lines, dial-up
<b>Diagnostics</b>	CRT + keyboard option; printer option	Status LEDs	Status LEDs	Status LEDs, self-test
<b>Pricing and Availability</b>				
Purchase (\$)	10,000	395	395	425
Serviced by	Arkansas Systems, Inc.	Astrocom	Black Box Corp.	Contact vendor
Availability (days ARO)	Off the shelf	Immediately	Available from stock	30
Date of First Commercial Delivery	June 1990	Vendor did not specify	Vendor did not specify	1985
<b>Comments</b>	Converts protocol & application data from IBM 3624 ATMs to IBM 4732 PBM protocol & data formats	—	Customized conversions available to fit customer requirements; provides connectivity between 2 incompatible async devices; cards for rack mount also available	6K buffer for speed change; daisy chainable

**Protocol Conversion  
Systems:  
Comparison Columns  
Code, Speed, Interface, and  
Async/Sync Converters**

Vendor	Comdata Corp.	Comstat Datacomm Corp.	Comstat Datacomm Corp.	Comstat Datacomm Corp.
<b>Model</b>	ASC-100 Async/Sync Converter	C-2200 LTDS	C-88000 Turbo Concentrator	C-8800 LT
<b>Device Type</b>	Async/sync converter	Interface converter, async/sync converter	Interface converter, async/sync converter, multiported FEPs	Interface converter, async/sync converter, remote front-end processor
<b>Conversion Performed</b>	Vendor did not specify	RS-232-C to TTY	RS-232-C to TDI	RS-232-C to TDI
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	600 to 19.2K (automatically selected)	Up to 38.4K	Up to 38.4K w/optional 56K	Up to 38.4K
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC, Wang	ASCII, Burroughs Poll/Select	Burroughs poll/select	ASCII, Burroughs poll/select
Interface	RS-232-C	RS-232-C	RS-232-C; V.35 is optional	RS-232-C
<b>Specific Devices Supported</b>	Vendor did not specify	Burroughs-compatible terminals	Burroughs-compatible terminals	Burroughs-compatible terminals
<b>Connections Supported</b>	Direct	Direct, leased lines, dial-up	Direct, leased lines, dial-up, TDI	Direct, leased lines, dial-up, TDI
<b>Diagnostics</b>	Vendor did not specify	Status LEDs	Status LEDs, internal generated screens	Status LEDs, internally-converted screens
<b>Pricing and Availability</b>				
Purchase (\$)	247	995 to 1,495	3,495 for 4 ports; 7,175 for 8 ports	1,295 to 1,795
Serviced by	Comdata Corp.	Comstat Datacomm Corp.	Comstat Datacomm Corp.	Comstat Datacomm Corp.
Availability (days ARO)	3-4	5	5 days	5 days
Date of First Commercial Delivery	Vendor did not specify	May 1985	January 1987	May 1985
<b>Comments</b>	Power derived from RS-232-C interface (some applications may require auxiliary power); codes are switch selectable; all RS-232-C leads are supported	—	—	—

Vendor	DCC Corp.	General DataComm, Inc.	General DataComm, Inc.	JBM Electronics
Model	ECS-21	ASC-3	GDC Interface Converter	ASC-RJE
Device Type	Interface converter	Async/sync converter	Interface converter	Async/sync converter
Conversion Performed	RS-232-C to 20mA current loop	Asynchronous to synchronous	RS-422 to RS-232-C/V.35; RS-232-C to V.35	Async to bisync or SNA/SDLC
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	20K	19.2K	Vendor did not specify	38.4K
Synchronization	Asynchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Half duplex, full duplex	Half duplex, full duplex	Half duplex, full duplex	Half duplex, full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII	ASCII	ASCII, EBCDIC
Interface	RS-232-C, current loop, 20 mA	RS-232-C, V.28	RS-232-C, V.35, RS-422	RS-232-C
Specific Devices Supported	Vendor did not specify	Asynchronous terminal	DTE/DCE	IBM 2770, 2780, 3741, 3780, 3270
Connections Supported	Leased lines	Direct, dial-up	Direct, dial-up	Direct, leased lines, dial-up
Diagnostics	Status LEDs, manual loopback	None	Power LED	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	125	245	Contact vendor	995
Serviced by	DCC Corp.	General DataComm	General DataComm	JBM Electronics
Availability (days ARO)	Stock to 30	Immediately	30	14 days
Date of First Commercial Delivery	1986	1990	1985	1988
Comments	Optically isolated; data line and low speed control path; LEDs indicate data transmission, loop current, and control status	In-line, miniature converter; operates without AC power	—	—

Vendor	JBM Electronics	JBM Electronics	Memotec Data, Inc.	Memotec Data, Inc.
Model	BBC	BPC	DM 50 B	DM 51 B
Device Type	Speed and data format conversion	Code and speed converter	Interface converter	Interface converter, TDI extender
Conversion Performed	Bisync to bisync	Bisync to SNA	RS-232-C to TDI (Burroughs)	RS-232-C to TDI (Burroughs)
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	38.4K	38.4K	19.2K	19.2K
Synchronization	Asynchronous, synchronous	Synchronous	Asynchronous	Asynchronous
Transmission Mode	Half duplex, full duplex	Half duplex, full duplex	Half duplex	Half duplex
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC	Code transparent	Code transparent
Interface	RS-232-C	RS-232-C	RS-232-C, TDI	RS-232-C, TDI
Specific Devices Supported	Vendor did not specify	IBM 3270, 3770	Burroughs terminals and hosts	Burroughs terminals and hosts
Connections Supported	Direct, leased lines, dial-up	Direct, leased lines, dial-up	Direct, leased lines, TDI	Direct, leased lines, TDI
Diagnostics	Status LEDs	Status LEDs, remote tests	Status LEDs	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	1995	1995	175	275
Serviced by	JBM Electronics	JBM Electronics	Memotec Data, Inc.	Memotec Data, Inc.
Availability (days ARO)	14 days	7 days	30	30
Date of First Commercial Delivery	1989	1984	1985	1985
Comments	—	—	—	Will regenerate TDI signals for another 1,000 feet

Vendor	Memotec Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
Model	DM 55 B	5144	7210/7212	7211
Device Type	Interface converter, async/sync converter	Code and speed converter	Interface converter	Interface converter
Conversion Performed	RS-232-C or TDI (Burroughs) to sync	RS-232-C to Bell 43401	RS-232-C to Centronics, Centronics to RS-232-C	RS-232-C to Centronics
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	19.2K	Up to 19.2K	Up to 19.2K	Vendor did not specify
Synchronization	Asynchronous, synchronous	Synchronous	Asynchronous	Asynchronous
Transmission Mode	Half duplex, full duplex	Full duplex	Half duplex	Full duplex
Codes Supported	Code transparent	ASCII, bi-phase encoding	ASCII	ASCII
Interface	RS-232-C, TDI	RS-232-C, V.28, V.24, Bell 43401	RS-232-C, V.28, V.24, Centronics	RS-232-C, V.28, V.24, Centronics
Specific Devices Supported	Burroughs terminals and hosts	Vendor did not specify	Vendor did not specify	Vendor did not specify
Connections Supported	Direct, leased lines	Leased lines	Direct	Direct
Diagnostics	Status LEDs	Status LEDs, loopbacks	Status LEDs	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	895/pair	225	88	109
Serviced by	Memotec Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
Availability (days ARO)	30	Stock	Stock	Stock
Date of First Commercial Delivery	1985	1986	1988	1989
Comments	Must be used in pairs	Synch short haul	Selectable DTE/DCE, parity, stop and data bits	2K buffer

Vendor	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
<b>Model</b>	7213	7220	7221	7222
<b>Device Type</b>	Interface converter	Code and speed converter	Interface converter, code and speed converter	Interface converter, code and speed converter
<b>Conversion Performed</b>	RS-232-C to Centronics	Vendor did not specify	RS-232-C to IBM Parallel (Centronics)	RS-232-C to IBM parallel (Centronics)
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	Vendor did not specify	Up to 19.2K	Up to 19.2K	Vendor did not specify
Synchronization	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII
Interface	RS-232-C, V.28, V.24, Centronics	RS-232-C, V.28, V.24	RS-232-C, V.28, V.24, IBM parallel (Centronics)	RS-232-C, V.28, V.24, IBM parallel (Centronics)
<b>Specific Devices Supported</b>	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
<b>Connections Supported</b>	Direct	Direct	Direct	Direct
<b>Diagnostics</b>	Status LEDs	Status LEDs	Status LEDs	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	225	398	398	450
Serviced by	Nu Data, Inc.	Nu Data, Inc.	Du Data, Inc.	Nu Data, Inc.
Availability (days ARO)	Stock	Stock	Stock	Stock
Date of First Commercial Delivery	1989	1985	1985	1985
<b>Comments</b>	64K buffer	Scientific software for async/sync converter available at customer request; supports Xon/Xoff or CTS/DTR control	Scientific software for async/sync inputs avail. at customer request; supports Xon/Xoff or CTS/DTR control	Software for async/sync conversion avail. at customer request; supports Xon/Xoff or CTS/DTR control

Vendor	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
Model	7230/7231	7235	7240	7243/7244
Device Type	Interface converter	Interface converter	Interface converter	Interface converter
Conversion Performed	RS-232-C to RS-449; RS-449 to RS-232-C	RS-449/422/423 to EIA-530	RS-232-C to EIA-485	RS-232-C to EIA 422, EIA-422 to RS-232-C
Transmission Specifications				
Maximum Transmission Speed (bps)	Vendor did not specify	Up to 64K	Up to 64K	Vendor did not specify
Synchronization	Vendor did not specify	Asynchronous, synchronous	Asynchronous	Asynchronous
Transmission Mode	Vendor did not specify	Full duplex	Full duplex	Vendor did not specify
Codes Supported	Transparent	Transparent	Transparent	Transparent
Interface	RS-232-C, V.28, V.24, 449	Vendor did not specify	RS-232-C, V.28, V.24, EIA-485 multipoint	Vendor did not specify
Specific Devices Supported	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Connections Supported	Direct	Direct	Direct	Direct
Diagnostics	Vendor did not specify	Vendor did not specify	Status LEDs	Status LEDs
Pricing and Availability				
Purchase (\$)	89	74	148	98
Serviced by	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
Availability (days ARO)	Stock	Stock	Stock	Stock
Date of First Commercial Delivery	1988	1988	1988	1988
Comments	Powered from interface	Powered from the interface	Collision detection & streaming control	Extends RS-232 links

**Protocol Conversion  
Systems:  
Comparison Columns  
Code, Speed, Interface, and  
Async/Sync Converters**

Vendor	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
<b>Model</b>	<b>7257</b>	<b>7270</b>	<b>7272</b>	<b>7274</b>
<b>Device Type</b>	Interface converter	Interface converter	Interface converter	Interface converter
<b>Conversion Performed</b>	RS-232 to EIA-530/422	RS-232-C to V.35	RS-232-C to EIA-422	V.35 to EIA-422 (X.21)
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	Vendor did not specify	Up to 64K	Up to 64K	Up to 2.048M
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	Transparent	ASCII, Transparent	Transparent	Transparent
Interface	RS-232-C, V.28, V.24, EIA-530/422	RS-232-C, V.35, V.28, V.24	RS-232-C, V.28, V.24, EIA-422	V.35, EIA-422 (X.21)
<b>Specific Devices Supported</b>	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
<b>Connections Supported</b>	Direct	Direct	Direct	Direct
<b>Diagnostics</b>	Status LEDs	Status LEDs	Status LEDs	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	283	289	268	298
Serviced by	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
Availability (days ARO)	Stock	Stock	Stock	Stock
Date of First Commercial Delivery	1988	1988	1988	1988
<b>Comments</b>	Rackmount card (model 7258): \$253; max. 16 per rack	Rackmount card (Model 7271): \$259; max. 16 per rack	Rackmount card (Model 7273): \$238; max.; 16 per rack	Rackmount card (Model 7275) \$268; max. 16 cards per rack

Vendor	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
<b>Model</b>	7276	7278	7290	7292
<b>Device Type</b>	Interface converter	Interface converter	Interface converter	Interface converter
<b>Conversion Performed</b>	RS-232-C to EIA-449/422	V.35 to EIA-449/422	RS-232-C to MIL 188	MIL 188 unbalanced to MIL 188-114A balanced
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	Up to 64K	Up to 2.048M	Vendor did not specify	Vendor did not specify
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	Transparent	Transparent	Transparent	Transparent
Interface	RS-232-C, V.28, V.24, EIA-449/422	V.35, EIA 449/422	RS-232-C, V.28, V.24, MIL 188	MIL-188 unbalanced
<b>Specific Devices Supported</b>	Vendor did not specify	Vendor did not specify	Vendor did not specify	MIL-188-114A balanced
<b>Connections Supported</b>	Direct	Direct	Direct	Direct
<b>Diagnostics</b>	Status LEDs	Status LEDs	Status LEDs	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	209	289	298	328
Serviced by	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.	Nu Data, Inc.
Availability (days ARO)	Stock	Stock	Stock	Stock
Date of First Commercial Delivery	1988	1988	1988	1988
<b>Comments</b>	Rackmount card (Model 7277): \$179; max. 16 per 19" rack	Rackmount card (Model 7279): \$259; max. 16 per rack	Rackmount card (Model 7291): \$268; max. 16 per rack	Rackmount card (Model 7293): \$298; max. 16 per rack

**Protocol Conversion  
Systems:  
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Code, Speed, Interface, and  
Async/Sync Converters**

Vendor	Nu Data, Inc.	Nu Data, Inc.	Perle Systems, Inc.	Plantronics Futurecomms, Inc.
<b>Model</b>	7314	7360	PERLE Model 3I	MicroTURBO
<b>Device Type</b>	Interface converter	Interface converter	Async/sync converter	Interface converter, code and speed converter, async/sync converter
<b>Conversion Performed</b>	RS-232-C to current loop	RS-232-C to 20/60 mA current loop	RS-232-C to Twinax	RS-232-C to V.35, RS-232-C to RS-422
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	Vendor did not specify	Up to 19.2K	38.4K	Up to 19.2K
Synchronization	Asynchronous	Asynchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Full duplex	Full duplex	Vendor did not specify	Full duplex
Codes Supported	Transparent	Transparent	ASCII, EBCDIC	ASCII, EBCDIC, Baudot
Interface	RS-232-C, V.28, current loop, V.24	RS-232-C, V.28, current loop, V.24	RS-232-C	RS-232-C, V.24, X.21 bis, RS-449, V.35
<b>Specific Devices Supported</b>	Vendor did not specify	Vendor did not specify	IBM 5251, 5291, 3180, 5224 Model 25, 5256, 5219	IBM SNA/SDLC, BSC 3270, BSC 2780/3780; Telex
<b>Connections Supported</b>	Direct	Direct	Direct, leased lines, dial-up	Direct, leased lines, dial-up
<b>Diagnostics</b>	Status LEDs	Status LEDs	Status LEDs	Status LEDs
<b>Pricing and Availability</b>				
Purchase (\$)	169	96	From 1,995	2,995
Serviced by	Nu Data, Inc.	Nu Data, Inc.	Perle Systems, Inc.	PFI
Availability (days ARO)	Stock	Stock	10	21 to 28
Date of First Commercial Delivery	1988	1986	October 1990	December 1988
<b>Comments</b>	Internal/external loop, 20/60 mA current loop, neutral or polar	Internal or external loop supply	Replaces Perle Model 3 in product line	Optional SNA to X.25 and Telex to X.25 conversion; compatible with PFI's PAC.NET network manager

**Protocol Conversion  
Systems:  
Comparison Columns  
Code, Speed, Interface, and  
Async/Sync Converters**

Vendor	Plantronics Futurecomms, Inc.	Plantronics Futurecomms, Inc.	Shaffstall Corp.	Telebyte Technology, Inc.
<b>Model</b>	NanoTURBO	PAC.25 TURBO	Shaffstall 6000	62-1/2
<b>Device Type</b>	Interface converter, code and speed converter, async/sync converter	Interface converter, code and speed converter, async/sync converter	Interface converter, code and speed converter	Interface converter
<b>Conversion Performed</b>	RS-232-C to V.35, RS-232-C to RS-422	RS-232-C to V.35, RS-232-C to RS-422	Vendor did not specify	RS-232-C to EIA-530 (MIL STD 188-114 Type 2)
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	Up to 19.2K	Up to 64K	19.2K	1M
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC	ASCII, EBCDIC, Baudot
Interface	RS-232-C, V.24, X.21 bis, RS-449, V.35	RS-232-C, V.24, X.21 bis, RS-449, V.35	RS-232-C	RS-232-C, EIA-530
<b>Specific Devices Supported</b>	IBM SNA/SDLC, BSC 3270, BSC 2780/3780; Telex	IBM (SNA/SDLC BSC 3270, BSC 2780/3780; Telex	Vendor did not specify	Computers, printers, terminals, serial devices
<b>Connections Supported</b>	Direct, dial-up	Direct, leased lines, dial-up	Direct, dial-up	Direct
<b>Diagnostics</b>	Status LEDs	Status LEDs	CRT error messages	Vendor did not specify
<b>Pricing and Availability</b>				
Purchase (\$)	1,995 Standard NanoTURBO	5,225 to 15,505, depending on configuration	Contact vendor	138
Serviced by	PFI	PFI	TRW, Inc.	Telebyte Technology, Inc.
Availability (days ARO)	21 to 28	21 to 28	30	Vendor did not specify
Date of First Commercial Delivery	February 1991	February 1991	August 1987	Vendor did not specify
<b>Comments</b>	Optional SNA to X.25 and Telex to X.25 conversion; compatible with PFI's PAC.NET network manager	Optional Features: SNA to X.25 conversion, Telex to X.25 conversion (TLX.25 TURBO)	The 6000 is a data conversion system for data transmission	Supports 10 Category I, and 3 Category II circuits

Vendor	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
<b>Model</b>	62-7/8	63-2	63-3/4	65
<b>Device Type</b>	Interface converter	Interface converter	Interface converter	Interface converter
<b>Conversion Performed</b>	EIA-530 to RS-232-C (MIL STD 188-114 Type 1)	RS-232-C to RS-422	RS-232-C to RS-422	RS-232-C to current loop
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	100K	38.4K	100K at 4000 feet; 1M at 350 feet	9.6K
Synchronization	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Half duplex, full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot
Interface	RS-232-C, EIA-530	RS-232-C, RS-422	RS-232-C, RS-422	RS-232-C, current loop
<b>Specific Devices Supported</b>	Computers, printers, terminals, serial devices			
<b>Connections Supported</b>	Direct	Direct	Direct	Direct
<b>Diagnostics</b>	Vendor did not specify			
<b>Pricing and Availability</b>				
Purchase (\$)	160	110	126	105
Serviced by	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
Availability (days ARO)	Vendor did not specify			
Date of First Commercial Delivery	Vendor did not specify			
<b>Comments</b>	—	—	Self-powered	Self-powered

Vendor	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
<b>Model</b>	66	67	69-1	69-2
<b>Device Type</b>	Interface converter	Interface converter	Interface converter	Interface converter
<b>Conversion Performed</b>	RS-232-C to RS-485	RS-232-C to V.35	RS-232-C to MIL STD 188C	RS-232-C to MIL STD 188C
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	38.4K	56K, 64K, and above	19.2K	19.2K
Synchronization	Asynchronous	Asynchronous, synchronous	Vendor did not specify	Asynchronous
Transmission Mode	Half duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot
Interface	RS-232-C, RS-485	RS-232-C, V.35	RS-232-C, MIL-STD 188C	RS-232-C, MIL STD 188C
<b>Specific Devices Supported</b>	Computers, printers, terminals, serial devices			
<b>Connections Supported</b>	Direct	Direct	Direct	Direct
<b>Diagnostics</b>	Status LEDs	Status LEDs	Vendor did not specify	Vendor did not specify
<b>Pricing and Availability</b>				
Purchase (\$)	120	195	100	160
Serviced by	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
Availability (days ARO)	Vendor did not specify			
Date of First Commercial Delivery	Vendor did not specify			
<b>Comments</b>	—	—	—	—

Vendor	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
Model	69-3	69-4	69-5	69-6
Device Type	Interface converter	Interface converter	Interface converter	Interface converter
Conversion Performed	RS-232-C to MIL STD 188C	RS-232-C to MIL STD 188-114	RS-232-C to MIL-STD-188-114	RS-232-C to MIL STD 188-114
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	19.2K	38.4K	38.4K	38.4K
Synchronization	Synchronous	Vendor did not specify	Asynchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot
Interface	RS-232-C, MIL STD 188C	RS-232-C, MIL STD 188-114	RS-232-C, MIL-STD-188-114	Vendor did not specify
<b>Specific Devices Supported</b>				
	Computers, printers, terminals, serial devices			
<b>Connections Supported</b>				
	Direct	Direct	Direct	Direct
<b>Diagnostics</b>				
	Vendor did not specify			
<b>Pricing and Availability</b>				
Purchase (\$)	195	140	250	325
Serviced by	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
Availability (days ARO)	Vendor did not specify			
Date of First Commercial Delivery	Vendor did not specify			
Comments	—	—	—	—

Vendor	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
<b>Model</b>	78	121	261	262
<b>Device Type</b>	Interface converter	Interface converter	Interface converter	Interface converter
<b>Conversion Performed</b>	RS-232-C to current loop	RS-232-C to RS-422	RS-232-C to RS-422	RS-232-C to RS-422
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	9.6K	38.4K	38.4K	38.4K
Synchronization	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Transmission Mode	Half duplex, full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot
Interface	RS-232-C, current loop	RS-422	RS-232-C, RS-422	RS-232-C, RS-422
<b>Specific Devices Supported</b>	Computers, printers, terminals, serial devices			
<b>Connections Supported</b>	Direct	Vendor did not specify	Direct	Direct
<b>Diagnostics</b>	Status LEDs	Vendor did not specify	Vendor did not specify	Vendor did not specify
<b>Pricing and Availability</b>				
Purchase (\$)	195	150	82	138
Serviced by	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.	Telebyte Technology, Inc.
Availability (days ARO)	Vendor did not specify			
Date of First Commercial Delivery	Vendor did not specify			
<b>Comments</b>	—	—	—	Optically isolated

**Protocol Conversion  
Systems:  
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Code, Speed, Interface, and  
Async/Sync Converters**

Vendor	TeleProcessing Products, Inc.	TeleProcessing Products, Inc.	TeleProcessing Products, Inc.	TeleProcessing Products, Inc.
<b>Model</b>	TP-200	TP-200M	TP-201	TP-350
<b>Device Type</b>	Async/sync converter	Async/sync converter	Async/sync converter	Interface converter
<b>Conversion Performed</b>	Async to sync with speed matching	Async to sync with speed matching; flow control	Async to sync	RS-232-C to V.35, or V.35 to RS-232-C
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	19.2K	9.6K	9.6K; optional 19.2K	To 100K
Synchronization	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous	Asynchronous, synchronous
Transmission Mode	Half duplex, full duplex	Full duplex	Half duplex, full duplex	Half duplex, full duplex
Codes Supported	ASCII	ASCII (7, 8, or 9 bits)	ASCII, 7 or 8 bits; 9 bit optional	ASCII, EBCDIC, Baudot
Interface	RS-232-C	RS-232-C	RS-232-C	RS-232-C, V.35
<b>Specific Devices Supported</b>	Async DTE, sync DCE	Async DTE; async or sync DCE	Async DTE, sync DCE	Async DTE, sync DCE
<b>Connections Supported</b>	Direct, async DTE, and sync DCE/RS-232-C	Dial-up, async to sync DCE/RS-232-C	Direct, async DTE, sync DCE/RS-232-C	Vendor did not specify
<b>Diagnostics</b>	Loopbacks	Status LEDs, loopbacks, remote tests	Vendor did not specify	Status LEDs, loopbacks
<b>Pricing and Availability</b>				
Purchase (\$)	395 for quantity of 1-9	735 for quantity of 1-9	295 for quantity of 1-9	450 for quantity of 1-9
Serviced by	TeleProcessing Products, Inc.	TeleProcessing Products, Inc.	TeleProcessing Products, Inc.	TeleProcessing Products, Inc.
Availability (days ARO)	30	30	30	30
Date of First Commercial Delivery	1978	1981	1984	1979
<b>Comments</b>	Auxiliary AC power cord available; speed matching standard; 3K character buffer	Control signal option for controlled carrier applications; direct dial emulation option	Auxiliary AC power adapter optional; 9-bit option available	May be used with our TP-2002 Line Driver to extend RS-232-C interface to up to 2000 feet, at up to 9600 bps; available in both standalone and rackmounted versions

Vendor	Trax Softworks, Inc.	VIR, Inc.	VIR, Inc.	VIR, Inc.
<b>Model</b>	VM Dial Out	MIU-303	MIU-530	MIU-530/V.35
<b>Device Type</b>	Code and speed converter	Interface converter	Interface converter	Interface converter
<b>Conversion Performed</b>	3270 to async	AT&T 303	RS-449 or EIA-530 to RS-232-C	RS-449 or EIA-530 to V.35
<b>Transmission Specifications</b>				
Maximum Transmission Speed (bps)	1M	Vendor did not specify	Vendor did not specify	Vendor did not specify
Synchronization	Asynchronous	Synchronous	Synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot
Interface	RS-232-C	RS-232-C, V.35, 303	RS-449, EIA-530 or RS-422	V.35, RS-449, RS-422
<b>Specific Devices Supported</b>	Any 3270-compatible device	Vendor did not specify	Vendor did not specify	Vendor did not specify
<b>Connections Supported</b>	Direct, leased lines, dial-up	Direct, dial-up	Direct, dial-up	Direct, dial-up
<b>Diagnostics</b>	Status LEDs; data scope built in; self-test	Status LEDs, optional monitor port	Status LEDs	Status LEDs, optional monitor port
<b>Pricing and Availability</b>				
Purchase (\$)	9,000-20,000	610 for standalone version; 600 for rackmount version	450 standalone version; 435 rackmount version	450 standalone version; 435 rackmount version
Serviced by	Trax Softworks, Inc.	VIR	VIR	VIR
Availability (days ARO)	Vendor did not specify	Vendor did not specify	Vendor did not specify	Vendor did not specify
Date of First Commercial Delivery	December, 1982	Vendor did not specify	Vendor did not specify	2nd quarter of 1990
<b>Comments</b>	—	10 speed selector; uses internal or external clock	10 speed selector; uses internal or external clock	10 speed selections; uses internal or external clock

<b>Vendor</b>	VIR, Inc.	VIR, Inc.	Wall Data, Inc.
<b>Model</b>	MIU-V.35	MIU-X.21	DATA GATE/Concentrator
<b>Device Type</b>	Interface converter	Interface converter	Code and speed converter
<b>Conversion Performed</b>	RS-232-C to V.35	RS-232-C to X.21, V-35 to X.21, RS-422 to X.21	Single RS-232-C port to multiple RS-232-C
<b>Transmission Specifications</b>			
Maximum Transmission Speed (bps)	Vendor did not specify	Vendor did not specify	9.6K
Synchronization	Synchronous	Synchronous	Synchronous
Transmission Mode	Full duplex	Full duplex	Full duplex
Codes Supported	ASCII, EBCDIC, Baudot	ASCII, EBCDIC, Baudot	EBCDIC
Interface	RS-232-C, V.35	RS-232-C, RS-422	RS-232-C
<b>Specific Devices Supported</b>	Vendor did not specify	Vendor did not specify	IBM 3274, 3276, 5294, 5251-12
<b>Connections Supported</b>	Direct, dial-up	Direct, dial-up	Direct, leased lines, dial-up
<b>Diagnostics</b>	Status LEDs, optional monitor port	Status LEDs, optional monitor port	Remote tests
<b>Pricing and Availability</b>			
Purchase (\$)	450 standalone version; 435 rackmount version VIR	450 for standalone version; 435 for rackmount version VIR	7,495
Serviced by			Wall Data, Inc.
Availability (days ARO)	Vendor did not specify	Vendor did not specify	30
Date of First Commercial Delivery	1982	Vendor did not specify	Vendor did not specify
<b>Comments</b>	10 speed selector; uses internal or external clock	10 speed selector; uses internal or external clock	Maximum of 8 SDLC dial-up or multi-drop lines; port expander for 37X5 FEPs and 3274-type controllers