

Icot 35X/36X Virtual Terminal Systems

MANAGEMENT SUMMARY

Icot Corporation, originally founded as Microform Data Systems, Inc. in 1968, was reorganized as Icot Corporation in 1980. The company specializes in manufacturing data communications equipment for the airline, retail/financial, and telecommunications industries, as well as IBM-compatible controllers and terminals. The company employs approximately 200 people. In 1984, Icot garnered \$19 million in sales, 16 percent of which were channeled into research and development efforts. In addition to the protocol converters covered in this report, Icot also manufactures the CrystaLink Series of communications processors and a series of terminals and workstations designed for reservation systems.

Icot's 35X/36X Virtual Terminal Systems (VTS) combine line concentration, cluster control, and terminal emulation features through which users can expand an IBM 3270 network with inexpensive, conversation mode ASCII terminals. VTS can also provide personal computer-to-mainframe communications. As a cluster controller, VTS units provide terminal control, local-copy printing, management of terminal polling and selection, and error detection and correction.

At present, VTS consists of four models: the 351, 352, 361, and 362. Icot's 351/352 emulates an IBM 3271 cluster controller; the 361/362 systems emulate an IBM 3274 Model 21C or 51C controller. The 351 unit supports 6 asynchronous ports, while the 352 unit supports 12 such ports. The 361 and 362 support 8 and 16 asynchronous ports, respectively. Each VTS converter also accommodates one synchronous host port, as well as an optional second host port. On the 351/352 units, the host connection may be two BSC lines or one BSC and one SDLC line. On the 361/362 units, both host lines support SNA/SDLC. ➤



Icot's 362 protocol converter emulates an IBM 3274 21C or 51C cluster controller. The unit will allow up to 16 asynchronous ASCII devices to emulate IBM 3270 displays and printers. The synchronous link to the host supports the SNA/SDLC protocol. The 362 will support two host lines; the second line is available as an option.

Icot's 35X/36X Virtual Terminal Systems (VTS) are protocol converters that allow asynchronous terminals, printers, and personal computers to emulate IBM 3270 devices. The 351/352 emulates an IBM 3271 unit and allows ASCII devices to emulate IBM 3277 Models 2 through 5. The 361/362 emulates an IBM 3274 Model 21C or 51C cluster controller and allows ASCII devices to emulate IBM 3278/3287 Models 2 through 5.

MODELS: VTS 351—supports 6 asynchronous ports; VTS 352—supports 12 asynchronous ports; VTS 361—supports 8 asynchronous ports; VTS 362—supports 16 asynchronous ports. All models include one synchronous host line; a second host line is optional.

CONVERSION: VTS 351/352—ASCII to BSC/SDLC; VTS 361/362—ASCII to SNA/SDLC.

TRANSMISSION RATES: Aggregate transmission speed for terminal inputs is 19.2K bps; BSC host line speed (on VTS 351/352 only)—9600 bps; SDLC host line speed—19.2K bps.

COMPETITION: Datastream, Protocol Computers Inc., Local Data, Renex Corporation.

PRICE: Prices for the VTS converters range from \$5,800 to \$9,800 for the basic models. Various options are available for an additional charge.

CHARACTERISTICS

VENDOR: Icot Corporation, 3801 Zanker Road, San Jose, CA 95150. Telephone (408) 433-3300. In Canada: Signatel Ltd., 558 Gordon Baker Road, Willowdale, Ontario M2H 3B4. Telephone (416) 449-7744.

DATE OF FIRST ANNOUNCEMENT: Icot 351—March 1982; Icot 352—October 1981; Icot 361/362—information not available.

DATE OF FIRST DELIVERY: Icot 351/352—June 1982; Icot 361/362—November 1983.

SERVICED BY: Icot Corporation.

MODELS

Icot's Virtual Terminal System (VTS) product line includes the 35X and 36X series protocol converters. The 35X series units emulate an IBM 3271 cluster controller; the 36X units emulate an IBM 3274 Model 21C or 51C cluster controller. Both units will operate with IBM 43XX, 30XX, 360, and 370 host computers. There are two models in each series. The 35X series includes the 351, which supports 6 asynchronous terminal line connections, and the 352, which supports 12 ➤

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VTS architecture provides synchronous line interfaces for connection to one or two hosts, and asynchronous transmission line interfaces for terminal connection. All models incorporate multiple line processors and serial interfaces. Each line processor is controlled by a microprocessor with its own RAM and PROM. One processor, an Intel 8088, supports the asynchronous terminal lines with an aggregate throughput of 19.2K bps. A second processor supports the synchronous host line, and a third processor may be added for a second host synchronous line.

In addition to their own RAMs, the line processors share from 32K to 128K bytes of system RAM (depending on the model), used for data buffering and interprocessor communications. Also provided are 2K to 4K bytes of nonvolatile RAM for storing control tables containing configuration parameters and other system information. Through supervisory commands, users can easily access and modify this data via an ASCII terminal connected to any VTS port.

ASCII display terminals attached to the VTS can emulate the following devices: IBM 3277 Models 2 through 5; IBM 3278 Models 1 through 5; and IBM 3279 Model 2A/3A (base color mode only). The 35X also provides emulation of IBM 3284 Model 1 and 2 printers for ASCII receive-only or send/receive printer terminals, whether buffered or unbuffered. The ASCII printers can operate as system printers that support print applications from the host, local-copy printers for the ASCII terminals, or shared printers for both system and local-copy functions. The 36X units support 328X printer emulation on ASCII send/receive or receive-only devices. These models also provide co-located printer support and passthrough graphics.

VTS converters support a wide variety of ASCII terminals, printers, and personal computers. Icot provides predefined keyboard support for Lear Siegler ADM 3A, Adds Regent 40, DEC VT100, Hazeltine 1500, Televideo 925, Hewlett-Packard 2622A, IBM 3101, Telex 310, and the Icot 70X. Personal computers accommodated by the VTS include those from Apple, Commodore, DEC, IBM, and Radio Shack. Any port on the VTS supports any terminal type, whether CRT or printer. The terminals attach to the 35X/36X either locally via direct connection or remotely via a dial-up or leased line, and automatic speed and character format detection can be configured independently for each port.

In addition to the VTS converters, Icot manufactures the 700 and 701 ASCII terminals, which feature fully compatible IBM 3278 keyboards with keys for added functions not ►

► asynchronous line connections. The 36X series includes the 361, supporting 8 asynchronous lines, and the 362, supporting 16 asynchronous lines. Each Virtual Terminal System also supports up to two host lines. On the 35X units, the host lines may be configured as two BSC lines or one BSC line and one SNA/SDLC line. The 36X host lines are configurable only for SNA/SDLC connections.

With the 35X units, ASCII terminals and printers can emulate IBM 3277 Models 2 through 5; the 36X units allow ASCII terminals and printers to emulate IBM 3278 units and the base color mode of the IBM 3279.

CONFIGURATION

System control on Icot's VTS protocol converters is distributed among multiple processors. On each unit there are three basic processing areas. The main circuit board holds the emulation processor, input/output processor, system memory, and power supply; an upline processor board is piggybacked onto the main section.

The emulation processor, an Intel 8088, emulates 3270 functions and interfaces with the upline processor through system memory. The input/output processor controls the asynchronous lines. This processor interfaces with the emulation processor via dual-port shared RAM and program-controlled interrupts. Both the input/output and emulation processors have local RAM for stack and vectors, but share the dual-port RAM for buffering. Each processor is under the control of its own set of PROMs.

The upline processor, also an Intel 8088, appears to the IBM host as a Physical Unit Type 2 controller supporting Logical Unit Types 2 and 3. This processor, like the others, uses local RAM for stack and vectors and is under the control of its own PROM.

All of the processors access system memory, which resides on the main board. Total RAM memory capacity is 128K bytes. In addition, there is a maximum of 4K bytes of nonvolatile RAM for storing system configuration parameters.

TRANSMISSION SPECIFICATIONS

The VTS architecture provides 1, or optionally 2, synchronous line interfaces for host connection and from 6 to 16 asynchronous line interfaces for terminal connection, depending upon the specific model. Aggregate throughput on the asynchronous terminal lines is 19.2K bps. On the 351/352 units the host line is a 9600 bps BSC link; an optional line to the host may be a 9600 bps BSC link or a 19.2K bps SDLC link. On the 361/362 units, both the primary and secondary host lines support SNA/SDLC protocol, and transmission on both the asynchronous terminal and host links is 19.2K bps.

ASCII terminals can connect to the 35X or 36X via standard EIA cabling and a null modem, or through modems (or line drivers) over private circuits or dial-up connections. All terminals and modems in the configuration must be set to full-duplex mode operation. Each terminal line may be configured for auto log-on, for a specific speed and character format, or for auto speed and character format detection.

VTS units support the RS-232-C interface; RS-422 and current loop interfaces are available as an option. Since RS-232-C and RS-422 are mutually exclusive on a unit, users must specify the type of interface desired at the time of order. The RS-422 interface is used for local multidropping of VTS units from an RS-422 modem or local multidropping of VTS units from another Icot processor. ►

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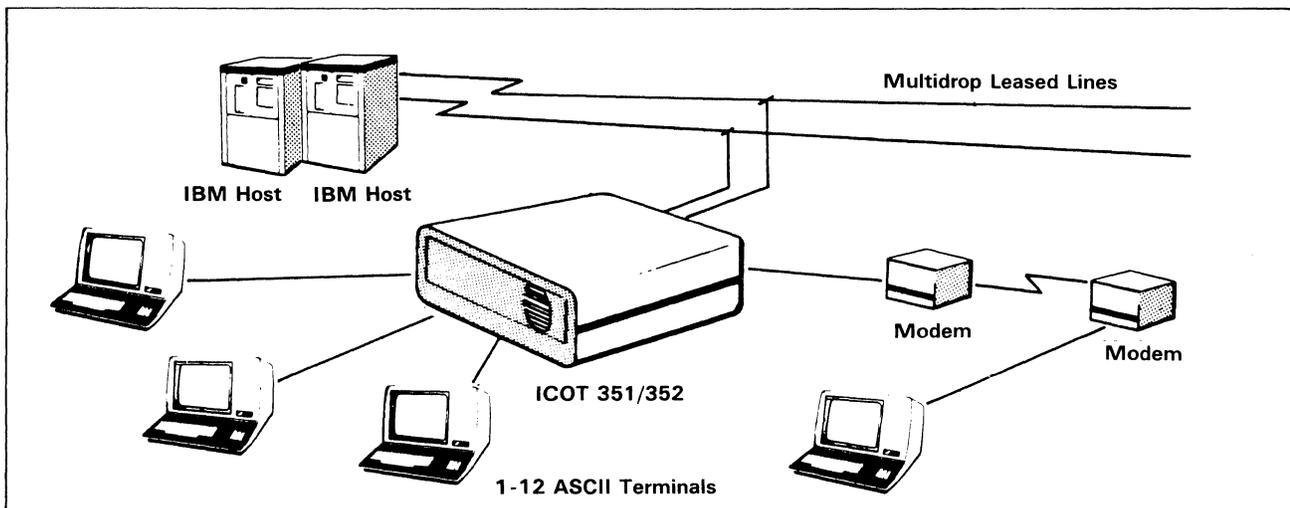
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Icot's 351/352 Virtual Terminal System supports any mix of ASCII display and printer terminals and personal computers simultaneously. The terminals can be attached either locally via direct connection or remotely via dial-up or leased lines.

➤ available on the IBM 3270 terminals, such as Calculator Mode, Add Session, Exchange Session, Local Re-Draw, and Local-Copy Print. The Icot terminals also provide a variety of screen sizes to support emulation of 3278 Models 1 through 5. Also included in the product line is the CrystaLink Series of communications processors, which provide multiple line polling and network control, line concentration, protocol conversion, and message switching and reformatting. CrystaLink products, marketed specifically to retail and financial organizations, are designed to enhance network efficiency in a variety of applications, including point of sale, electronic funds transfer, and inventory control systems.

COMPETITIVE POSITION

According to Icot's 1984 annual report, the company doubled sales of its data communications products between 1983 and 1984. Fiscal 1984 was the first full year that Icot's revenues came entirely from sales of data communications products and services. Although Icot reported a net loss for fiscal 1984, the loss was significantly smaller than that incurred in the previous year. Quarterly financial performance improved during each quarter of 1984, and the company reported a slight profit in the fourth quarter. During 1984, Icot invested approximately 16 percent of its \$19 million sales revenues into research and development, and these efforts culminated in several technical enhancements, e.g., passthrough graphics and co-located printer support, to the VTS product line.

Icot's financial position appears sound, and the company is committed to increasing sales by at least 50 percent in 1985. Since Icot has developed its protocol conversion products during the past three years, it is still plowing back a significant amount of revenues into research and development, and this should lead to greater improvements in the overall product line. However, the entire computer industry is now in a slowdown, and Icot will face some very stiff competition in the protocol converter market. ➤

➤ DEVICE CONTROL

Operation of Icot's 35X/36X converters depends upon information contained in 14 internal reference tables. Tables numbered 6 through 14 contain specific information about terminal types. (The VTS products support 39 different types of ASCII devices that support cursor positioning and screen erase functions. This includes personal computers, such as an IBM PC or Apple II/III, that support these capabilities.) Tables 1 through 5 contain information about the user environment, i.e., port, line, controller, device, and authorized user definitions. In most cases, a system manager will have to initialize only the first five tables before the VTS becomes operational. Information in terminal-type tables includes reference parameters for a number of ASCII devices, including products from Adds Regent, DEC, Hazeltine, Hewlett-Packard, Icot, Lear Seigler, Televideo, Telex, and Colorgraphics. The system manager can change the terminal reference tables, however, to accommodate operational characteristics of an ASCII device not specifically listed in the tables.

A system manager controls the VTS emulation functions through a series of supervisory commands, entered via an ASCII terminal keyboard. To access the command menu, the manager must first log on to the system by entering a user identification and current password. An "Enter Command" will then appear on the screen. At this point, the system operator may enter commands to send broadcast messages to all terminals connected to the VTS, logon and off, change user passwords, change operating parameters, display operating tables, and so forth. An Install command lets the system manager restore table entries to their original state (initial default value). Since the entire table will be restored to initial default values once the Install command is initiated, any changes needed in the table must be reentered.

A recently added command, ADD LP, allows the addition of co-located printers to the 362 system. These printers are added through a Display session and assume the bps rate and word format of that session. Although one display session may have only one co-located printer, a co-located printer may be associated with more than one display session and assigned multiple control units and uplines. Graphics support is also available on the 362. The host computer is responsible for sending graphics data to and from the attached printer or display, and the 362 treats this data strictly on a passthrough basis by storing it in a special 512- ➤

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▶ As protocol conversion and terminal emulation techniques have become more widely accepted in the data communications environments, larger vendors have taken far more interest in this lucrative market. IBM, for example, has introduced two protocol converters that will allow customers to use asynchronous ASCII devices in an SNA network. The company also plans to add protocol conversion capabilities to its remote concentrators. Micom, another prominent vendor, has also been very successful in marketing its Micro7400, which like Icot's 36X units, emulates an IBM 3274 cluster controller.

Icot's other competitors include Datastream, Renex Corporation, and Protocol Computers Inc. Datastream's Model 774, 776, and 874 cluster controllers provide IBM 3270 emulation for ASCII terminals, printers, and personal computers and support direct-connect or dial-in access from any terminal in the cluster. Renex manufactures a Translator Series of protocol-converter controllers that link asynchronous terminals and printers to an IBM host. The RT9S is an 8-port unit; the RT13S is its 12-port counterpart. Protocol Computers Inc., a company that has been in the protocol conversion business since 1980, manufactures a wide range of 3270-compatible units, including Models 1051, 1067, 1071, and 1076.

ADVANTAGES AND RESTRICTIONS

There is one major advantage to using protocol converters like Icot's 35X/36X VTS: they provide the capability to use inexpensive ASCII terminals instead of more expensive IBM 3270 units. As equipment prices and line costs rise along with the need for network expansion, protocol converters can help users save money.

The trade-off is that both the terminal operators already using the ASCII terminals and the terminal operators already trained on IBM's 3270 terminals must now learn the keyboard sequences and combinations that effect 3270 emulation. For example, on the Icot products, three alphanumeric characters on the IBM terminal are different on the emulating ASCII terminal: a "not" sign is a circumflex sign; the solid vertical bar becomes a broken vertical bar; and the cent sign is absent altogether. Learning new keyboard routines can be awkward at first, and until operators become proficient at handling the keystrokes, organizations can expect some productivity losses. Whether using protocol converters is worth this inconvenience depends on how much money can be saved, based on how many ASCII terminals are already in-house, how many more terminals will be needed as the network expands, and what effect the additional keystrokes have on productivity in the long run.

Icot has chosen not to emulate Insert Mode operation on an unformatted screen. According to the company, the decision was made because this operation is very time-consuming at normal BSC and SDLC line transmission speeds, and is not the result of any inherent limitation in the 35X/36X itself.

▶ byte graphics buffer. Although this buffer holds 512 bytes of data, the host must request information from the buffer in 256-byte blocks. Initiating graphics capability on any ASCII device requires a configuration change in the device's table; otherwise graphics data will be treated as a normal 3270 datastream.

For an ASCII terminal to emulate an IBM 3270-type terminal, the VTS converter must perform a variety of translations on keystrokes and function relationships, certain aspects of displayed images, and operator information. IBM display terminal keyboards provide specific keys for special functions, such as Erase Input or Insert Mode, but many ASCII terminal keyboards have no equivalent keys. To solve this problem, the 35X/36X defines a unique keystroke combination or sequence as equivalent to the desired IBM key function, whenever an equivalent key does not already exist. Which keystrokes are required depends on the type of ASCII keyboard being used. Some functions are generated by depressing a combination of the Control key and a selected alphabetic key, others by depressing the Escape key followed by an alphabetic or numeric key. For example, on an Adds Regent 40 keyboard, Control/I provides a new line function; on a DEC VT100 keyboard, a Line Feed key provides the same function; and on a Hewlett-Packard 2622A, a Control/J sequence provides a new line function.

The VTS provides several additional capabilities not available on the IBM terminal. Through an Add Session feature, available through keystroke combinations, the user can establish a second concurrent session with the same or another host computer. The Exchange Session function allows the user to alternate between the two sessions without logging off of either session. The Quit Session feature provides the means to terminate one or both concurrent sessions. Through a Local Re-Draw feature, users can redisplay the entire contents of the last screen. A Local-Copy Print feature permits a local printer to provide a hard copy of the terminal display. A Calculator Mode allows a specific set of adjacent keys to be used as a calculator keypad.

Through the VTS, an ASCII display terminal can support both formatted and unformatted display images, protected and unprotected fields, and other IBM display modes. For example, the 351/352 supports the IBM Numeric Lock feature, whereby the operator is restricted to keying into a specified input field only data containing numeric attributes, i.e., 0 to 9, a hyphen, a period, and DUP. For some ASCII terminal models, if the terminal operator fails to release the shift key (downshift) before entering data into the numeric field, the 351/352 automatically emulates downshifting by translating the entered uppercase character, e.g., a "#," to the corresponding lowercase numeric character, e.g., a "3." On others, the VTS simply invalidates any uppercase entry, and users must reset and shift into lowercase to continue a session.

Some IBM application programs highlight certain fields by displaying them in bold (high-intensity) characters. The VTS provides the means for an ASCII terminal to emulate character intensification in one of two ways: with corresponding intensification or with reversed foreground and background colors. Intensification may not be able to be emulated at all, however, if a terminal does not have such video attributes.

Unlike conversation mode ASCII terminals, IBM display terminals do not have a built-in scrolling function. On ASCII terminals, scrolling normally occurs when an operator enters a character into the last screen position or attempts to move the cursor down or to the right from the last screen position. Because the VTS controls the screen image, there is no restriction on where one may place the cursor. A terminal operator can, therefore, place the cursor in the last screen position and either enter a character or move the

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▶ At the end of Icot's 351/352 VTS Terminal User's Guide, there is a section that contains diagrams of several popular ASCII terminal keyboards. Listed below each keyboard are IBM 3270-terminal functions and the keystrokes to obtain those functions on the ASCII terminal. Users will find this section very helpful when dealing with a variety of ASCII terminals.

USER REACTION

In Datapro's 1985 Terminal Users Survey, four users rated Icot's 352 and 362 protocol converters. A total of four units were represented. The respondents gave the units a good rating for overall performance, although maintenance and service received only fair to poor marks. It is significant to note that Icot signed a worldwide service and maintenance agreement with NCR Corporation in the fourth quarter of 1984. NCR maintains a broad system of service organizations, and we expect this agreement will positively influence any problems that Icot may have experienced in the support area.

	Excellent	Good	Fair	Poor	WA*
Overall performance	0	4	0	0	3.0
Ease of installation	0	2	2	0	2.5
Ease of operation	0	2	2	0	2.5
Hardware reliability	0	2	2	0	2.5
Manufacturer's maintenance & technical support	0	1	1	2	1.8

*Weighted Average based on a scale of 4.0 for Excellent. □

▶ cursor down or to the right to effect scrolling. Users can also configure the VTS to write into the last character position and to show that character in the status display field.

IBM 3277 LEDs indicate three conditions: Input Inhibited, Insert Mode, and System Available. The IBM 3278 uses a status line at the bottom of the display screen to indicate the same. The 35X/36X provides a status display field to give information on keystroke errors that inhibit input. Error codes indicate error conditions, e.g., an attempt to enter a character into a position occupied by an attribute character, to enter an invalid character, to enter a character into a protected field, and so forth. When errors result in an input inhibited condition, the terminal operator must press the Reset key to continue.

When users invoke a print function to obtain a copy of the contents of the terminal screen, a printer status message appears in the status display field. An identification code for the first available printer appears; if there are no available printers or a user is not authorized to use a printer, a "None" message appears. Another code shows the printer's status: whether the printer is active, busy, or shared by the host system and whether the print request has been accepted or cancelled. Depressing a Reset key clears the printer status message.

The terminal log-on procedure in a 35X/36X-controlled system depends upon line configuration, i.e., whether the line is configured for auto log-on, for a specific speed and

character format, or for auto speed and character format. The log-on procedure consists of a series of steps through which users can begin a session. For example, starting a session on a system configured for auto speed requires the following steps: slowly entering an uppercase U until the terminal displays the character or a maximum of six Us; entering an uppercase UI; inputting a five-character user ID followed by a return or enter key; and pressing any key to clear the screen. Once a session has been established, the 35X/36X is ready to communicate with the host.

Communicating with multiple host lines and/or multiple control addresses requires additional steps that address the control unit or line selection for the desired host. Once the control unit or line selection is made, pressing any key clears the screen, and the session continues.

If the terminal operator makes any mistakes during the log-on procedure, error messages appear on the screen. Users have three attempts on invalid inputs before the 35X/36X automatically logs off. Some of the available error messages include: Invalid Format, ID Unknown, Resources Not Available, Invalid Device Definition.

With the 35X/36X, users can establish and conduct two independent IBM display terminal emulation sessions on the same ASCII terminal, alternate from one session to the other, and terminate either session without disrupting the other. The 351/352 also allows an ASCII receive-only or send/receive printer to be used instead of an IBM 3284 Model 1 or 2. Receive-only printers are logged on automatically whenever data is about to be transmitted to them, but terminal operators log on send/receive printers in a routine that is similar to signing on a display terminal. Keystroke combinations are used on the keyboard of the send/receive printer terminal to invoke all session functions. Auto disconnect on no activity and message broadcasts can also be supported on the printer terminals.

System controls and indicators on the VTS units include a reset switch, system nonvolatile RAM (NVR) read/write switches, system NVR address switches, and front-panel LEDs for diagnostics and monitoring nonvolatile RAM. All VTS units include local and system diagnostic tests. Local tests check the integrity of on-board resources dedicated to a line processor, e.g., local RAM and Line Wrap. System diagnostics check resources that are shared by all of the VTS processors. All diagnostic tests are executed automatically when power is applied to the VTS unit.

PHYSICAL SPECIFICATIONS

The standalone 351 and 352 units are 6 inches high, 17.3 inches wide, 14.4 inches deep, and weigh 10 pounds. The 361/362 units are 8.12 inches high, 17.45 inches wide, and 14.4 inches deep, and weigh 31 pounds. The 36X units may be mounted in a standard 19-inch equipment rack; a maximum of six units may be mounted in a 60-inch high rack.

PRICING

The VTS 351 unit with six terminal ports, and one interface and port for an upline BSC host, is priced at \$5,800. The same unit with an SDLC host interface is \$6,550. The 12-port 352 with one host port and a BSC host interface is \$7,600; the same unit with an SDLC host interface is \$8,350. A 361 with eight ports and one SDLC line is \$6,500; the 16-port 362 with one SDLC line is \$9,800; the second SDLC upline is an additional \$2,225. Remote printer support, passthrough graphics, and dual-session options are an additional \$500 each. ■

Icot 35X/36X Virtual Terminal Systems

MANAGEMENT SUMMARY

Icot Corporation, originally founded as Microform Data Systems, Inc. in 1968, was reorganized as Icot Corporation in 1980. The company specializes in manufacturing data communications equipment for the airline, retail/financial, and telecommunications industries, as well as IBM-compatible controllers and terminals. The company employs approximately 200 people. In 1984, Icot garnered \$19 million in sales, 16 percent of which were channeled into research and development efforts. In addition to the protocol converters covered in this report, Icot also manufactures the CrystaLink Series of communications processors and a series of terminals and workstations designed for reservation systems.

Icot's 35X/36X Virtual Terminal Systems (VTS) combine line concentration, cluster control, and terminal emulation features through which users can expand an IBM 3270 network with inexpensive, conversation mode ASCII terminals. VTS can also provide personal computer-to-mainframe communications. As a cluster controller, VTS units provide terminal control, local-copy printing, management of terminal polling and selection, and error detection and correction.

At present, VTS consists of four models: the 351, 352, 361, and 362. Icot's 351/352 emulates an IBM 3271 cluster controller; the 361/362 systems emulate an IBM 3274 Model 21C or 51C controller. The 351 unit supports 6 asynchronous ports, while the 352 unit supports 12 such ports. The 361 and 362 support 8 and 16 asynchronous ports, respectively. Each VTS converter also accommodates one synchronous host port, as well as an optional second host port. On the 351/352 units, the host connection may be two BSC lines or one BSC and one SDLC line. On the 361/362 units, both host lines support SNA/SDLC. ➤



Icot's 362 protocol converter emulates an IBM 3274 21C or 51C cluster controller. The unit will allow up to 16 asynchronous ASCII devices to emulate IBM 3270 displays and printers. The synchronous link to the host supports the SNA/SDLC protocol. The 362 will support two host lines; the second line is available as an option.

Icot's 35X/36X Virtual Terminal Systems (VTS) are protocol converters that allow asynchronous terminals, printers, and personal computers to emulate IBM 3270 devices. The 351/352 emulates an IBM 3271 unit and allows ASCII devices to emulate IBM 3277 Models 2 through 5. The 361/362 emulates an IBM 3274 Model 21C or 51C cluster controller and allows ASCII devices to emulate IBM 3278/3287 Models 2 through 5.

MODELS: VTS 351—supports 6 asynchronous ports; VTS 352—supports 12 asynchronous ports; VTS 361—supports 8 asynchronous ports; VTS 362—supports 16 asynchronous ports. All models include one synchronous host line; a second host line is optional.

CONVERSION: VTS 351/352—ASCII to BSC/SDLC; VTS 361/362—ASCII to SNA/SDLC.

TRANSMISSION RATES: Aggregate transmission speed for terminal inputs is 19.2K bps; BSC host line speed (on VTS 351/352 only)—9600 bps; SDLC host line speed—19.2K bps.

COMPETITION: Datastream, Protocol Computers Inc., Local Data, Renex Corporation.
PRICE: Prices for the VTS converters range from \$5,800 to \$9,800 for the basic models. Various options are available for an additional charge.

CHARACTERISTICS

VENDOR: Icot Corporation, P.O. Box 7248, 830 Maude Avenue, Mountain View, CA 94043. In Canada: Signatel Ltd., 558 Gordon Baker Road, Willowdale, Ontario M2H 3B4.

DATE OF FIRST ANNOUNCEMENT: Icot 351—March 1982; Icot 352—October 1981; Icot 361/362—information not available.

DATE OF FIRST DELIVERY: Icot 351/352—June 1982; Icot 361/362—November 1983.

SERVICED BY: Icot Corporation.

MODELS

Icot's Virtual Terminal System (VTS) product line includes the 35X and 36X series protocol converters. The 35X series units emulate an IBM 3271 cluster controller; the 36X units emulate an IBM 3274 Model 21C or 51C cluster controller. Both units will operate with IBM 43XX, 30XX, 360, and 370 host computers. There are two models in each series. The 35X series includes the 351, which supports 6 asynchronous terminal line connections, and the 352, which supports 12 ➤

Icot 35X/36X Virtual Terminal Systems

► The 35X VTS can communicate with the host in both IBM BSC or SDLC protocol, while the 36X units communicate only in SNA/SDLC. Their physical controllers can emulate multiple logical control unit addresses, providing a single VTS system with the capability to support multiple applications operating on one or two hosts. The ASCII terminal users can select any of these applications for which they have authorization, and can switch back and forth between two active sessions without logging off one application to use the other.

VTS architecture provides synchronous line interfaces for connection to one or two hosts, and asynchronous transmission line interfaces for terminal connection. All models incorporate multiple line processors and serial interfaces. Each line processor is controlled by a microprocessor with its own RAM and PROM. One processor, an Intel 8088, supports the asynchronous terminal lines with an aggregate throughput of 19.2K bps. A second processor supports the synchronous host line, and a third processor may be added for a second host synchronous line.

In addition to their own RAMs, the line processors share from 32K to 128K bytes of system RAM (depending on the model), used for data buffering and interprocessor communications. Also provided are 2K to 4K bytes of nonvolatile RAM for storing control tables containing configuration parameters and other system information. Through supervisory commands, users can easily access and modify this data via an ASCII terminal connected to any VTS port.

ASCII display terminals attached to the VTS can emulate the following devices: IBM 3277 Models 2 through 5; IBM 3278 Models 1 through 5; and IBM 3279 Model 2A/3A (base color mode only). The 35X also provides emulation of IBM 3284 Model 1 and 2 printers for ASCII receive-only or send/receive printer terminals, whether buffered or unbuffered. The ASCII printers can operate as system printers that support print applications from the host, local-copy printers for the ASCII terminals, or shared printers for both system and local-copy functions. The 36X units support 328X printer emulation on ASCII send/receive or receive-only devices. These models also provide co-located printer support and passthrough graphics.

VTS converters support a wide variety of ASCII terminals, printers, and personal computers. Icot provides predefined keyboard support for Lear Siegler ADM 3A, Adds Regent 40, DEC VT100, Hazeltine 1500, Televideo 925, Hewlett-Packard 2622A, IBM 3101, Telex 310, and the Icot 70X. Personal computers accommodated by the VTS include those from Apple, Commodore, DEC, IBM, and Radio Shack. Any port on the VTS supports any terminal type, whether CRT or printer. The terminals attach to the 35X/36X either locally via direct connection or remotely via a dial-up or leased line, and automatic speed and character format detection can be configured independently for each port.

In addition to the VTS converters, Icot manufactures the 700 and 701 ASCII terminals, which feature fully compatible IBM 3278 keyboards with keys for added functions not

► asynchronous line connections. The 36X series includes the 361, supporting 8 asynchronous lines, and the 362, supporting 16 asynchronous lines. Each Virtual Terminal System also supports up to two host lines. On the 35X units, the host lines may be configured as two BSC lines or one BSC line and one SNA/SDLC line. The 36X host lines are configurable only for SNA/SDLC connections.

With the 35X units, ASCII terminals and printers can emulate IBM 3277 Models 2 through 5; the 36X units allow ASCII terminals and printers to emulate IBM 3278 units and the base color mode of the IBM 3279.

CONFIGURATION

System control on Icot's VTS protocol converters is distributed among multiple processors. On each unit there are three basic processing areas. The main circuit board holds the emulation processor, input/output processor, system memory, and power supply; an upline processor board is piggybacked onto the main section.

The emulation processor, an Intel 8088, emulates 3270 functions and interfaces with the upline processor through system memory. The input/output processor controls the asynchronous lines. This processor interfaces with the emulation processor via dual-port shared RAM and program-controlled interrupts. Both the input/output and emulation processors have local RAM for stack and vectors, but share the dual-port RAM for buffering. Each processor is under the control of its own set of PROMs.

The upline processor, also an Intel 8088, appears to the IBM host as a Physical Unit Type 2 controller supporting Logical Unit Types 2 and 3. This processor, like the others, uses local RAM for stack and vectors and is under the control of its own PROM.

All of the processors access system memory, which resides on the main board. Total RAM memory capacity is 128K bytes. In addition, there is a maximum of 4K bytes of nonvolatile RAM for storing system configuration parameters.

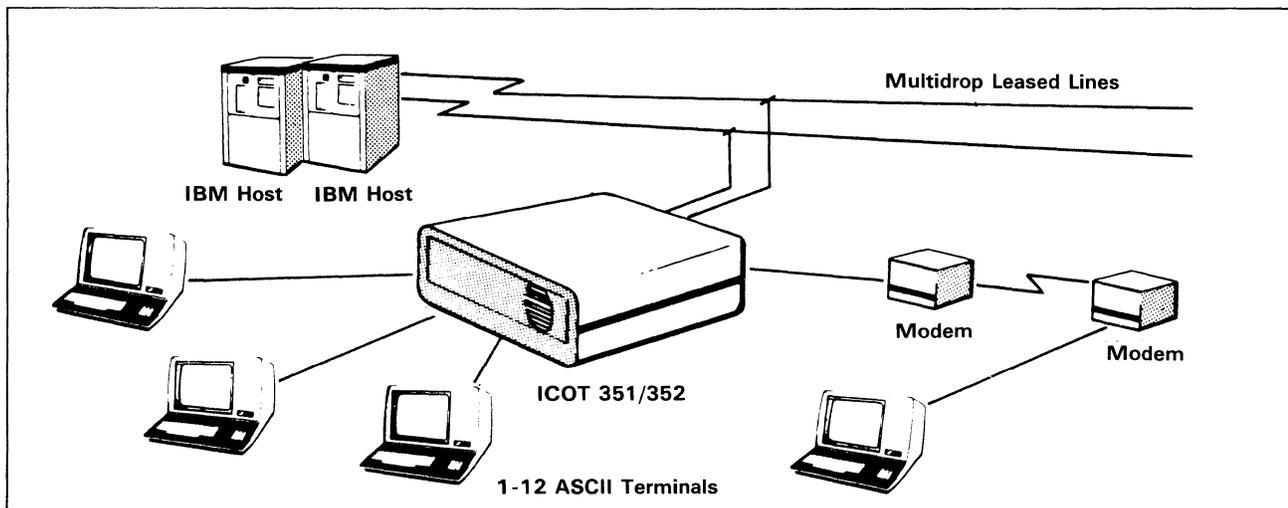
TRANSMISSION SPECIFICATIONS

The VTS architecture provides 1, or optionally 2, synchronous line interfaces for host connection and from 6 to 16 asynchronous line interfaces for terminal connection, depending upon the specific model. Aggregate throughput on the asynchronous terminal lines is 19.2K bps. On the 351/352 units the host line is a 9600 bps BSC link; an optional line to the host may be a 9600 bps BSC link or a 19.2K bps SDLC link. On the 361/362 units, both the primary and secondary host lines support SNA/SDLC protocol, and transmission on both the asynchronous terminal and host links is 19.2K bps.

ASCII terminals can connect to the 35X or 36X via standard EIA cabling and a null modem, or through modems (or line drivers) over private circuits or dial-up connections. All terminals and modems in the configuration must be set to full-duplex mode operation. Each terminal line may be configured for auto log-on, for a specific speed and character format, or for auto speed and character format detection.

VTS units support the RS-232-C interface; RS-422 and current loop interfaces are available as an option. Since RS-232-C and RS-422 are mutually exclusive on a unit, users must specify the type of interface desired at the time of order. The RS-422 interface is used for local multidropping of VTS units from an RS-422 modem or local multidropping of VTS units from another Icot processor.

Icot 35X/36X Virtual Terminal Systems



Icot's 351/352 Virtual Terminal System supports any mix of ASCII display and printer terminals and personal computers simultaneously. The terminals can be attached either locally via direct connection or remotely via dial-up or leased lines.

▷ available on the IBM 3270 terminals, such as Calculator Mode, Add Session, Exchange Session, Local Re-Draw, and Local-Copy Print. The Icot terminals also provide a variety of screen sizes to support emulation of 3278 Models 1 through 5. Also included in the product line is the CrystaLink Series of communications processors, which provide multiple line polling and network control, line concentration, protocol conversion, and message switching and reformatting. CrystaLink products, marketed specifically to retail and financial organizations, are designed to enhance network efficiency in a variety of applications, including point of sale, electronic funds transfer, and inventory control systems.

COMPETITIVE POSITION

According to Icot's 1984 annual report, the company doubled sales of its data communications products between 1983 and 1984. Fiscal 1984 was the first full year that Icot's revenues came entirely from sales of data communications products and services. Although Icot reported a net loss for fiscal 1984, the loss was significantly smaller than that incurred in the previous year. Quarterly financial performance improved during each quarter of 1984, and the company reported a slight profit in the fourth quarter. During 1984, Icot invested approximately 16 percent of its \$19 million sales revenues into research and development, and these efforts culminated in several technical enhancements, e.g., passthrough graphics and co-located printer support, to the VTS product line.

Icot's financial position appears sound, and the company is committed to increasing sales by at least 50 percent in 1985. Since Icot has developed its protocol conversion products during the past three years, it is still plowing back a significant amount of revenues into research and development, and this should lead to greater improvements in the overall product line. However, the entire computer industry is now in a slowdown, and Icot will face some very stiff competition in the protocol converter market. ▷

▷ DEVICE CONTROL

Operation of Icot's 35X/36X converters depends upon information contained in 14 internal reference tables. Tables numbered 6 through 14 contain specific information about terminal types. (The VTS products support 39 different types of ASCII devices that support cursor positioning and screen erase functions. This includes personal computers, such as an IBM PC or Apple II/III, that support these capabilities.) Tables 1 through 5 contain information about the user environment, i.e., port, line, controller, device, and authorized user definitions. In most cases, a system manager will have to initialize only the first five tables before the VTS becomes operational. Information in terminal-type tables includes reference parameters for a number of ASCII devices, including products from Adds Regent, DEC, Hazeltine, Hewlett-Packard, Icot, Lear Seigler, Televideo, Telex, and Colorgraphics. The system manager can change the terminal reference tables, however, to accommodate operational characteristics of an ASCII device not specifically listed in the tables.

A system manager controls the VTS emulation functions through a series of supervisory commands, entered via an ASCII terminal keyboard. To access the command menu, the manager must first log on to the system by entering a user identification and current password. An "Enter Command" will then appear on the screen. At this point, the system operator may enter commands to send broadcast messages to all terminals connected to the VTS, logon and off, change user passwords, change operating parameters, display operating tables, and so forth. An Install command lets the system manager restore table entries to their original state (initial default value). Since the entire table will be restored to initial default values once the Install command is initiated, any changes needed in the table must be reentered.

A recently added command, ADD LP, allows the addition of co-located printers to the 362 system. These printers are added through a Display session and assume the bps rate and word format of that session. Although one display session may have only one co-located printer, a co-located printer may be associated with more than one display session and assigned multiple control units and uplines. Graphics support is also available on the 362. The host computer is responsible for sending graphics data to and from the attached printer or display, and the 362 treats this data strictly on a passthrough basis by storing it in a special 512- ▷

Icot 35X/36X Virtual Terminal Systems

▷ As protocol conversion and terminal emulation techniques have become more widely accepted in the data communications environments, larger vendors have taken far more interest in this lucrative market. IBM, for example, has introduced two protocol converters that will allow customers to use asynchronous ASCII devices in an SNA network. The company also plans to add protocol conversion capabilities to its remote concentrators. Micom, another prominent vendor, has also been very successful in marketing its Micro7400, which like Icot's 36X units, emulates an IBM 3274 cluster controller.

Icot's other competitors include Datastream, Renex Corporation, and Protocol Computers Inc. Datastream's Model 774, 776, and 874 cluster controllers provide IBM 3270 emulation for ASCII terminals, printers, and personal computers and support direct-connect or dial-in access from any terminal in the cluster. Renex manufactures a Translator Series of protocol-converter controllers that link asynchronous terminals and printers to an IBM host. The RT9S is an 8-port unit; the RT13S is its 12-port counterpart. Protocol Computers Inc., a company that has been in the protocol conversion business since 1980, manufactures a wide range of 3270-compatible units, including Models 1051, 1067, 1071, and 1076.

ADVANTAGES AND RESTRICTIONS

There is one major advantage to using protocol converters like Icot's 35X/36X VTS: they provide the capability to use inexpensive ASCII terminals instead of more expensive IBM 3270 units. As equipment prices and line costs rise along with the need for network expansion, protocol converters can help users save money.

The trade-off is that both the terminal operators already using the ASCII terminals and the terminal operators already trained on IBM's 3270 terminals must now learn the keyboard sequences and combinations that effect 3270 emulation. For example, on the Icot products, three alphanumeric characters on the IBM terminal are different on the emulating ASCII terminal: a "not" sign is a circumflex sign; the solid vertical bar becomes a broken vertical bar; and the cent sign is absent altogether. Learning new keyboard routines can be awkward at first, and until operators become proficient at handling the keystrokes, organizations can expect some productivity losses. Whether using protocol converters is worth this inconvenience depends on how much money can be saved, based on how many ASCII terminals are already in-house, how many more terminals will be needed as the network expands, and what effect the additional keystrokes have on productivity in the long run.

Icot has chosen not to emulate Insert Mode operation on an unformatted screen. According to the company, the decision was made because this operation is very time-consuming at normal BSC and SDLC line transmission speeds, and is not the result of any inherent limitation in the 35X/36X itself.

▶ byte graphics buffer. Although this buffer holds 512 bytes of data, the host must request information from the buffer in 256-byte blocks. Initiating graphics capability on any ASCII device requires a configuration change in the device's table; otherwise graphics data will be treated as a normal 3270 datastream.

For an ASCII terminal to emulate an IBM 3270-type terminal, the VTS converter must perform a variety of translations on keystrokes and function relationships, certain aspects of displayed images, and operator information. IBM display terminal keyboards provide specific keys for special functions, such as Erase Input or Insert Mode, but many ASCII terminal keyboards have no equivalent keys. To solve this problem, the 35X/36X defines a unique keystroke combination or sequence as equivalent to the desired IBM key function, whenever an equivalent key does not already exist. Which keystrokes are required depends on the type of ASCII keyboard being used. Some functions are generated by depressing a combination of the Control key and a selected alphabetic key, others by depressing the Escape key followed by an alphabetic or numeric key. For example, on an Adds Regent 40 keyboard, Control/I provides a new line function; on a DEC VT100 keyboard, a Line Feed key provides the same function; and on a Hewlett-Packard 2622A, a Control/J sequence provides a new line function.

The VTS provides several additional capabilities not available on the IBM terminal. Through an Add Session feature, available through keystroke combinations, the user can establish a second concurrent session with the same or another host computer. The Exchange Session function allows the user to alternate between the two sessions without logging off of either session. The Quit Session feature provides the means to terminate one or both concurrent sessions. Through a Local Re-Draw feature, users can redisplay the entire contents of the last screen. A Local-Copy Print feature permits a local printer to provide a hard copy of the terminal display. A Calculator Mode allows a specific set of adjacent keys to be used as a calculator keypad.

Through the VTS, an ASCII display terminal can support both formatted and unformatted display images, protected and unprotected fields, and other IBM display modes. For example, the 351/352 supports the IBM Numeric Lock feature, whereby the operator is restricted to keying into a specified input field only data containing numeric attributes, i.e., 0 to 9, a hyphen, a period, and DUP. For some ASCII terminal models, if the terminal operator fails to release the shift key (downshift) before entering data into the numeric field, the 351/352 automatically emulates downshifting by translating the entered uppercase character, e.g., a "#," to the corresponding lowercase numeric character, e.g., a "3." On others, the VTS simply invalidates any uppercase entry, and users must reset and shift into lowercase to continue a session.

Some IBM application programs highlight certain fields by displaying them in bold (high-intensity) characters. The VTS provides the means for an ASCII terminal to emulate character intensification in one of two ways: with corresponding intensification or with reversed foreground and background colors. Intensification may not be able to be emulated at all, however, if a terminal does not have such video attributes.

Unlike conversation mode ASCII terminals, IBM display terminals do not have a built-in scrolling function. On ASCII terminals, scrolling normally occurs when an operator enters a character into the last screen position or attempts to move the cursor down or to the right from the last screen position. Because the VTS controls the screen image, there is no restriction on where one may place the cursor. A terminal operator can, therefore, place the cursor in the last screen position and either enter a character or move the

Icot 35X/36X Virtual Terminal Systems

➤ At the end of Icot's 351/352 VTS Terminal User's Guide, there is a section that contains diagrams of several popular ASCII terminal keyboards. Listed below each keyboard are IBM 3270-terminal functions and the keystrokes to obtain those functions on the ASCII terminal. Users will find this section very helpful when dealing with a variety of ASCII terminals.

USER REACTION

In Datapro's 1985 Terminal Users Survey, four users rated Icot's 352 and 362 protocol converters. A total of four units were represented. The respondents gave the units a good rating for overall performance, although maintenance and service received only fair to poor marks. It is significant to note that Icot signed a worldwide service and maintenance agreement with NCR Corporation in the fourth quarter of 1984. NCR maintains a broad system of service organizations, and we expect this agreement will positively influence any problems that Icot may have experienced in the support area.

	Excellent	Good	Fair	Poor	WA*
Overall performance	0	4	0	0	3.0
Ease of installation	0	2	2	0	2.5
Ease of operation	0	2	2	0	2.5
Hardware reliability	0	2	2	0	2.5
Manufacturer's maintenance & technical support	0	1	1	2	1.8

*Weighted Average based on a scale of 4.0 for Excellent. □

➤ cursor down or to the right to effect scrolling. Users can also configure the VTS to write into the last character position and to show that character in the status display field.

IBM 3277 LEDs indicate three conditions: Input Inhibited, Insert Mode, and System Available. The IBM 3278 uses a status line at the bottom of the display screen to indicate the same. The 35X/36X provides a status display field to give information on keystroke errors that inhibit input. Error codes indicate error conditions, e.g., an attempt to enter a character into a position occupied by an attribute character, to enter an invalid character, to enter a character into a protected field, and so forth. When errors result in an input inhibited condition, the terminal operator must press the Reset key to continue.

When users invoke a print function to obtain a copy of the contents of the terminal screen, a printer status message appears in the status display field. An identification code for the first available printer appears; if there are no available printers or a user is not authorized to use a printer, a "None" message appears. Another code shows the printer's status: whether the printer is active, busy, or shared by the host system and whether the print request has been accepted or cancelled. Depressing a Reset key clears the printer status message.

The terminal log-on procedure in a 35X/36X-controlled system depends upon line configuration, i.e., whether the line is configured for auto log-on, for a specific speed and

character format, or for auto speed and character format. The log-on procedure consists of a series of steps through which users can begin a session. For example, starting a session on a system configured for auto speed requires the following steps: slowly entering an uppercase U until the terminal displays the character or a maximum of six Us; entering an uppercase UI; inputting a five-character user ID followed by a return or enter key; and pressing any key to clear the screen. Once a session has been established, the 35X/36X is ready to communicate with the host.

Communicating with multiple host lines and/or multiple control addresses requires additional steps that address the control unit or line selection for the desired host. Once the control unit or line selection is made, pressing any key clears the screen, and the session continues.

If the terminal operator makes any mistakes during the log-on procedure, error messages appear on the screen. Users have three attempts on invalid inputs before the 35X/36X automatically logs off. Some of the available error messages include: Invalid Format, ID Unknown, Resources Not Available, Invalid Device Definition.

With the 35X/36X, users can establish and conduct two independent IBM display terminal emulation sessions on the same ASCII terminal, alternate from one session to the other, and terminate either session without disrupting the other. The 351/352 also allows an ASCII receive-only or send/receive printer to be used instead of an IBM 3284 Model 1 or 2. Receive-only printers are logged on automatically whenever data is about to be transmitted to them, but terminal operators log on send/receive printers in a routine that is similar to signing on a display terminal. Keystroke combinations are used on the keyboard of the send/receive printer terminal to invoke all session functions. Auto disconnect on no activity and message broadcasts can also be supported on the printer terminals.

System controls and indicators on the VTS units include a reset switch, system nonvolatile RAM (NVR) read/write switches, system NVR address switches, and front-panel LEDs for diagnostics and monitoring nonvolatile RAM. All VTS units include local and system diagnostic tests. Local tests check the integrity of on-board resources dedicated to a line processor, e.g., local RAM and Line Wrap. System diagnostics check resources that are shared by all of the VTS processors. All diagnostic tests are executed automatically when power is applied to the VTS unit.

PHYSICAL SPECIFICATIONS

The standalone 351 and 352 units are 6 inches high, 17.3 inches wide, 14.4 inches deep, and weigh 10 pounds. The 361/362 units are 8.12 inches high, 17.45 inches wide, and 14.4 inches deep, and weigh 31 pounds. The 36X units may be mounted in a standard 19-inch equipment rack; a maximum of six units may be mounted in a 60-inch high rack.

PRICING

The VTS 351 unit with six terminal ports, and one interface and port for an upline BSC host, is priced at \$5,800. The same unit with an SDLC host interface is \$6,550. The 12-port 352 with one host port and a BSC host interface is \$7,600; the same unit with an SDLC host interface is \$8,350. A 361 with eight ports and one SDLC line is \$6,500; the 16-port 362 with one SDLC line is \$9,800; the second SDLC upline is an additional \$2,225. Remote printer support, passthrough graphics, and dual-session options are an additional \$500 each. ■

Icot 351/352 Virtual Terminal System



Icot's VTS consists of two models. The Model 351 supports 6 asynchronous terminal line connections; Model 352 supports 12 such connections. As terminal controllers, both units emulate an IBM 3271 or 3274 controller.

MANAGEMENT SUMMARY

Icot's 351/352 Virtual Terminal System (VTS) combines line concentration, cluster control, and terminal emulation features through which users can expand an IBM 3270 network with inexpensive, conversation mode ASCII terminals. VTS can also provide personal computer-to-mainframe communications.

At present, VTS consists of two models; the Model 351 supports 6 asynchronous terminal line connections, and the Model 352 supports 12 such connections. As a terminal cluster controller, Icot's VTS emulates an IBM 3271 or 3274 to communicate with an IBM or IBM-compatible host and provide terminal control (e.g., CRT cursor control) local-copy printing, management of terminal polling and selection, and error detection and correction.

The 351/352 VTS can communicate with the host in IBM BSC or SDLC protocol. Its physical controllers can emulate multiple logical control unit addresses, providing a single VTS system with the capability to support multiple applications operating on one or two hosts. The ASCII terminal users can select any of these applications for which they have authorization, and can switch back and forth between two active sessions without logging off one application to use the other.

VTS architecture provides synchronous line interfaces for connection to one or two hosts, and asynchronous transmission line interfaces for terminal connection. Both models have a single circuit board with multiple line processors and serial interfaces. Each line processor is controlled by a microprocessor with its own RAM and PROM. One pro- ➤

Icot's 351/352 Virtual Terminal System (VTS) is a protocol converter that allows asynchronous terminals, printers, and personal computers to emulate IBM 3270 devices. The VTS is compatible with both BSC and SNA/SDLC networks.

MODELS: VTS 351—supports 6 asynchronous ports; VTS 352—supports 12 asynchronous ports. Both models include one synchronous host line; a second host line is optional.

CONVERSION: ASCII to BSC/SDLC.

TRANSMISSION RATES: Aggregate transmission speed for terminal inputs—up to 19.2K bps; BSC host line speed—9600 bps; SDLC host line speed—19.2K bps.

COMPETITION: Datastream, Protocol Computers Inc, Renex Corporation.

PRICE: VTS 351 with BSC line—\$5,800; with SDLC line—\$6,550. VTS 352 with BSC line—\$7,600; with SDLC line—\$8,350.

CHARACTERISTICS

VENDOR: Icot Corporation, P.O. Box 7248, 830 Maude Avenue, Mountain View, CA 94043. In Canada: Signatel Ltd., 558 Gordon Baker Road, Willowdale, Ontario M2H 3B4.

DATE OF FIRST ANNOUNCEMENT: Icot 351—March 1982; Icot 352—October 1981.

DATE OF FIRST DELIVERY: Icot 351—June 1982; Icot 352—December 1981.

SERVICED BY: Icot Corporation

MODELS

Icot's Virtual Terminal System (VTS) 351/352 allows conversational-mode ASCII terminals to emulate IBM 3270 terminals. Both models also perform cluster controller functions, including terminal control, local-copy print, management of polling and selection, and error detection and correction.

- Icot 351—supports 6 asynchronous terminal line connections and 6 or 12 1920-character sessions.
- Icot 352—supports 12 asynchronous terminal line connections and 12 1920-character sessions.

TRANSMISSION SPECIFICATIONS

The VTS architecture provides 1, or optionally 2, synchronous line interfaces for host connection and either 6 or 12 asynchronous line interfaces for terminal connection. Both units come in three configurations: with one BSC host line, with two BSC host lines, and with one BSC and one SDLC host line. ➤

Icot 351/352 Virtual Terminal System

➤ processor, an Intel 8088, supports 6 or 12 ASCII terminal lines with an aggregate throughput of 19.2K bps. A second processor, an Intel 8085, supports a 9600 bps BSC line running to the host. With a third processor, users can add a second BSC line (requires an 8085 processor) or an optional 19.2K bps SDLC line (requires an 8088 processor) to communicate with a second host port on the same or a different host.

In addition to their own RAMs, the line processors share 32K bytes of system RAM that is used for data buffering and interprocessor communications. Also provided are 2K bytes of nonvolatile RAM for storing control tables containing configuration parameters and other system information. Using supervisory commands, users can easily access and modify this data via an ASCII terminal connected to any VTS port.

ASCII display terminals attached to the VTS can emulate the following devices: IBM 3277 Models 1 and 2; IBM 3278 Models 1, 2, 3, 4, and 5; and IBM 3279 Model 2A/3A (base color mode only). The VTS also provides emulation of IBM 3284 Model 1 and 2 printers for ASCII receive-only or send/receive printer terminals, whether buffered or unbuffered. The ASCII printers can operate as system printers that support print applications from the host, local-copy printers for the ASCII terminals, or shared printers for both system and local-copy functions.

The VTS offers support for a wide variety of ASCII terminals, printers, and personal computers. Icot provides predefined keyboard support for Lear Siegler ADM 3A, Adds Regent 40, DEC VT100, Hazeltine 1500, Televideo 925, Hewlett-Packard 2622A, IBM 3101/Telex 310, and the Icot 70X. Any port on the VTS supports any terminal type, whether CRT or printer. The terminals attach to the 351/352 either locally via direct connection or remotely via a dial-up or leased line, and automatic speed and character format detection can be configured independently for each port.

In addition to the 351/352 VTS, Icot manufactures the 700 and 701 ASCII terminals, which feature fully compatible IBM 3278 keyboards with keys for added functions not available on the IBM 3270 terminals, such as Calculator Mode, Add Session, Exchange Session, Local Re-Draw, and Local-Copy Print. The Icot terminals also provide a variety of screen sizes to support emulation of 3278 Models 1 through 5.

COMPETITIVE POSITION

Icot's major competitors include Datastream, Renex Corporation, and Protocol Computers Inc. Datastream's Model 774, 776, and 874 cluster controllers provide IBM 3270 emulation for ASCII terminals, printers, and personal computers and support direct-connect or dial-in access from any terminal in the cluster. Renex manufactures a Translator Series of protocol-converter controllers that link asynchronous terminals and printers to an IBM host. The RT9S is an 8-port unit; the RT13S is its 12-port counterpart. Protocol Computers Inc., a company that has been in the protocol conversion business since 1980, manufactures a wide range of 3270-compatible units, including Models ➤

➤ Both VTS units have a single circuit board containing all the line processors, each with their own RAM and PROM and serial line interfaces. One of the processors, an Intel 8088, supports 6 or 12 ASCII terminal lines having an aggregate throughput of 19.2K bps. A second processor, an Intel 8085, supports a 9600 bps BSC host line. A third processor can add an optional second line to the same or a different host; this line may be a 9600 bps BSC line or 19.2K bps SDLC line.

ASCII terminals can connect to the 351/352 via standard EIA cabling and a null modem, or through modems (or line drivers) over private circuits or dial-up connections. All terminals and modems in the configuration must be set to full-duplex mode operation. Each terminal line may be configured in any of three ways: for auto log-on, for a specific speed and character format, or for auto speed and character format detection.

Models 351 and 352 support RS-232-C interfaces; RS-422 and current loop interfaces are available as an option.

DEVICE CONTROL

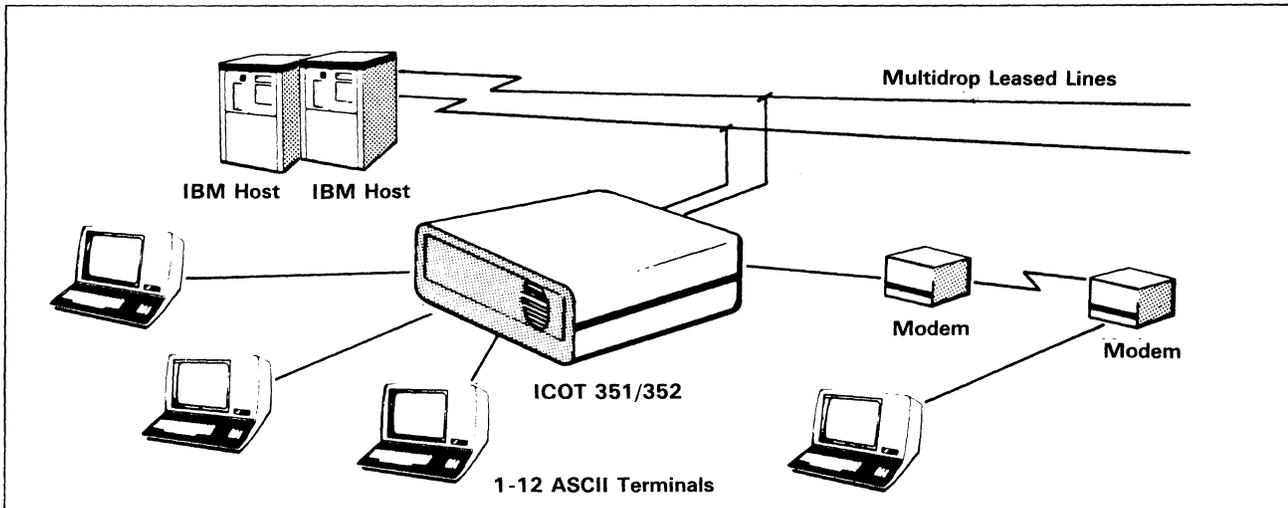
For an ASCII terminal to emulate an IBM 3270 terminal, the 351/352 must perform a variety of translations on keystrokes and function relationships, certain aspects of displayed images, and operator information. IBM display terminal keyboards provide specific keys for special functions, such as Erase Input or Insert Mode, but many ASCII terminal keyboards have no equivalent keys. To solve this problem, the 351/352 defines a unique keystroke combination or sequence as equivalent to the desired IBM key function, whenever an equivalent key does not already exist. Which keystrokes are required depends on the type of ASCII keyboard being used. Some functions are generated by depressing a combination of the Control key and a selected alphabetic key, others by depressing the Escape key followed by an alphabetic or numeric key. For example, on an Adds Regent 40 keyboard, Control/I provides a new line function; on a DEC VT100 keyboard, a Line Feed key provides the same function; and on a Hewlett-Packard 2622A, a Control/J sequence provides a new line function.

The 351/352 provides several additional capabilities not available on the IBM terminal. Through an Add Session feature, available through keystroke combinations, the user can establish a second concurrent session with the same or another host computer. The Exchange Session function allows the user to alternate between the two sessions without logging off of either session. The Quit Session feature provides the means to terminate one or both concurrent sessions. Through a Local Re-Draw feature, users can redisplay the entire contents of the last screen. A Local-Copy Print feature permits a local printer to provide a hard copy of the terminal display. A Calculator Mode allows a specific set of adjacent keys to be used as a calculator keypad.

Emulating the IBM terminal image is an important function of the 351/352. Most applications programs that support the IBM 3270 system divide the terminal screen into fields and provide a formatted display. An attribute character defines the characteristics of each field and its display mode (protected or unprotected, normal or bold intensity, alphanumeric or numeric only, etc.). This character occupies the position immediately to the left of the field on the screen, but the user cannot see the character. Attribute character positions are protected, meaning that nothing may be entered in the corresponding screen position.

Fields on a formatted display have two functions: they convey information via headings and prompt messages, or they accept data entry or text input. Headers and prompt messages are usually written in protected text; input fields may be either unprotected or partially protected. Partial ➤

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Icot's 351/352 Virtual Terminal System supports any mix of ASCII display and printer terminals and personal computers simultaneously. The terminals can be attached either locally via direct connection or remotely via dial-up or leased lines.

➤ 1051, 1067, 1071, and 1076. For example, the PCI 1071 is a BSC-to-ASCII converter for IBM 3271 emulation.

As protocol conversion and terminal emulation techniques become more widely accepted in the data communications marketplace, larger data communications vendors are expected to take far more interest in this potentially lucrative market. By far the most emulated terminals are in the IBM 3270 family, and any vendor that supplies ASCII-to-3270 emulation will be locked in a fierce battle to capture business in a 3270 and plug-compatible market that rakes in approximately \$2 billion a year.

ADVANTAGES AND RESTRICTIONS

There is one major advantage to using protocol converters like Icot's 351/352 VTS: they provide the capability to use inexpensive ASCII terminals instead of more expensive IBM 3270 units. As equipment prices and line costs rise along with the need for network expansion, protocol converters can help users save money.

The trade-off is that both the terminal operators already using the ASCII terminals and the terminal operators already trained on IBM's 3270 terminals must now learn the keyboard sequences and combinations that effect 3270 emulation. For example, on the Icot products, three alphanumeric characters on the IBM terminal are different on the emulating ASCII terminal: a "not" sign is a circumflex sign; the solid vertical bar becomes a broken vertical bar; and the cent sign is absent altogether. Learning new keyboard routines can be awkward at first, and until operators become proficient at handling the keystrokes, organizations can expect some productivity losses. Whether using protocol converters is worth this inconvenience depends on how much money can be saved, based on how many ASCII terminals are already in-house, how many more terminals will be needed as the network expands, and what effect the additional keystrokes have on productivity in the long run.

➤ protection restricts entry of certain types of characters, for example, alphabetic characters in a field designated as numeric only by the field attribute code. The fields initially contain default data, spaces, or nulls, which are subsequently written over as data is entered into them.

Through the 351/352, an ASCII display terminal can support both formatted and unformatted display images, protected and unprotected fields, and other IBM display modes. For example, the 351/352 supports the IBM Numeric Lock feature, whereby the operator is restricted to keying into a specified input field only data containing numeric attributes, i.e., 0 to 9, a hyphen, a period, and DUP. For some ASCII terminal models, if the terminal operator fails to release the shift key (downshift) before entering data into the numeric field, the 351/352 automatically emulates downshifting by translating the entered upper-case character, e.g. a "#," to the corresponding lower-case numeric character, e.g., a "3." On others, the VTS simply invalidates any upper-case entry, and users must reset and shift into lower case to continue a session.

Some IBM application programs highlight certain fields by displaying them in bold (high intensity) characters. The 351/352 provides the means for an ASCII terminal to emulate character intensification in one of two ways: with corresponding intensification or with reversed foreground and background colors. Intensification may not be able to be emulated at all, however, if a terminal does not have such video attributes.

Unlike conversation mode ASCII terminals, IBM display terminals do not have a built-in scrolling function. On ASCII terminals, scrolling normally occurs when an operator enters a character into the last screen position or attempts to move the cursor down or to the right from the last screen position. Because the 351/352 controls the screen image, there is no restriction on where one may place the cursor. A terminal operator can, therefore, place the cursor in the last screen position and either enter a character or move the cursor down or to the right to effect scrolling. Users can also configure the 351/352 to write into the last character position and to show that character in the status display field.

➤ IBM 3277 LEDs indicate three conditions: Input Inhibited, Insert Mode, and System Available. The IBM 3278 uses a status line at the bottom of the display screen to indicate the

Icot 351/352 Virtual Terminal System

➤ Icot has chosen not to emulate Insert Mode operation on an unformatted screen. According to the company, the decision was made because this operation is very time-consuming at normal BSC and SDLC line transmission speeds, and is not the result of any inherent limitation in the 351/352 itself.

At the end of Icot's 351/352 VTS Terminal User's Guide, there is a section that contains diagrams of several popular ASCII terminal keyboards. Listed below each keyboard are IBM 3270-terminal functions and the keystrokes to obtain those functions on the ASCII terminal. Users will find this section very helpful when dealing with a variety of ASCII terminals.

USER REACTION

We contacted three Icot VTS users, whose names were supplied by the company. Two of these users' organizations were businesses; one worked at a university. All of the respondents had Model 352 units, which they had purchased from Icot. One user had seven 352s, one had six, and the third had four. Icot provided maintenance and technical support for the 352s in all of the organizations. Each user rated the 352s in five categories. These ratings are as follows:

	Excellent	Good	Fair	Poor	WA*
Overall performance	2	1	0	0	3.7
Ease of installation	3	0	0	0	4.0
Ease of expansion	2	1	0	0	3.7
Hardware reliability	1	2	0	0	3.3
Manufacturer's maintenance & technical support	1	2	0	0	3.3

*Weighted Average based on a scale of 4.0 for Excellent.

As the ratings clearly show, all of the users were pleased with their VTS 352s. The units provided more flexible terminal-to-mainframe communications in all cases. The users unanimously agreed that the Icot 352s had one clear advantage: they helped their organizations save money. □

➤ same. The 351/352 provides a status display field similar to the 3278s to emulate the three IBM 3277 indicators and to give information on keystroke errors that inhibit input. Error codes indicate error conditions, e.g., an attempt to enter a character into a position occupied by an attribute character, to enter an invalid character, to enter a character into a protected field, and so forth. When errors result in an input inhibited condition, the terminal operator must press the Reset key to continue.

When users invoke a print function to obtain a copy of the contents of the terminal screen, a printer status message appears in the status display field. An identification code for the first available printer appears; if there are no available

printers or a user is not authorized to use a printer, a "None" message appears. Another code shows the printer's status: whether the printer is active, busy, or shared by the host system and whether the print request has been accepted or cancelled. Depressing a Reset key clears the printer status message.

The terminal log-on procedure in a 351/352-controlled system depends upon line configuration, i.e., whether the line is configured for auto log-on, for a specific speed and character format, or for auto speed and character format. The log-on procedure consists of a series of steps through which users can begin a session. For example, starting a session on a system configured for auto speed requires the following steps: slowly entering an upper-case U until the terminal displays the character or a maximum of six Us; entering an upper case U; inputting a five-character user ID followed by a return or enter key; and pressing any key to clear the screen. Once a session has been established, the 351/352 is ready to communicate with the host.

Communicating with multiple host lines and/or multiple control addresses requires additional steps that address the control unit or line selection for the desired host. Once the control unit or line selection is made, pressing any key clears the screen, and the session continues.

If the terminal operator makes any mistakes during the log-on procedure, error messages appear on the screen. Users have three attempts on invalid inputs before the 351/352 automatically logs off. Some of the available error messages include: Invalid Format, ID Unknown, Resources Not Available, Invalid Device Definition.

With the 351/352, users can establish and conduct two independent IBM display terminal emulation sessions on the same ASCII terminal, alternate from one session to the other, and terminate either session without disrupting the other. The 351/352 also allows an ASCII receive-only or send/receive printer to be used instead of an IBM 3284 Model 1 or 2. Receive-only printers are logged on automatically whenever data is about to be transmitted to them, but terminal operators log on send/receive printers in a routine that is similar to signing on a display terminal. Like the display terminal emulation, keystroke combinations are used on the keyboard of the send/receive printer terminal to invoke all session functions. Auto disconnect on no activity and message broadcasts can also be supported on the printer terminals.

System controls and indicators on the 351/352 include a reset switch, system nonvolatile RAM (NVR) read/write switches, system NVR address switches, and front-panel LEDs for diagnostics and monitoring nonvolatile RAM.

PHYSICAL SPECIFICATIONS

Both the standalone models 351 and 352 are 6 inches high, 17.3 inches wide, 14.4 inches deep, and weigh 10 pounds.

PRICING

The VTS 351 unit with six terminal ports, and one interface and port for an upline BSC host, is priced at \$5,800. The same unit with an SDLC host interface is \$6,550. The 12-port 352 with one host port and a BSC host interface is \$7,600; the same unit with an SDLC host interface is \$8,350. ■

KMW Protocol Converters

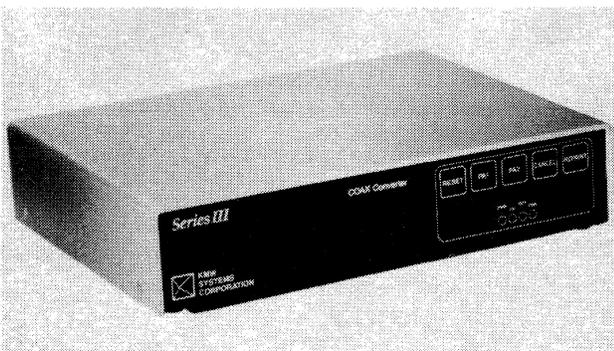
datapro ANALYSIS

UPDATE: *KMW has introduced the Series III Coax model protocol converter, providing a single-port connection of non-IBM output devices to 3270-class cluster controllers. In addition, a cooperative development effort with Apple Computer has produced a Macintosh-to-IBM System/3X link and file transfer product.*

After its founding in 1971, KMW recognized the need for an IBM-compatible synchronous transmission scheme; developments in this technology led to the introduction of the company's first protocol converter in 1977. KMW is generally recognized as the first vendor to offer protocol converters.

Today, KMW Systems offers a full line of microprocessor-based converters that allow local or remote attachment of asynchronous ASCII devices to synchronous mainframes. KMW's Series II family of converters offers protocol translations for both batch and interactive environments; the Series III units are one-port versions of the Series II Twinax and 3287/Coax converters. Although Series III converters are designed to operate with microcomputers, they work with other types of asynchronous equipment as well. For an overview of KMW protocol conversion capabilities, see Figure 1.

Apple Macintosh computers are gradually entering the business world; naturally, users demand connectivity. KMW recently completed a joint development project with Apple Computer, bringing to market terminal emulation and file transfer for Macintosh to IBM System/3X minicomputers.



KMW's Series III Coax protocol converter allows non-IBM devices to connect to IBM systems.

VENDOR: KMW Systems Corporation, 6034 West Courtyard Drive, Austin, Texas 78730. Telephone (512) 288-1453; (800) 531-5167.

CANADIAN DISTRIBUTION: Atelco Incorporated, 55 Renfrew Drive, Markham, Ontario L3R 8H3. Telephone (416) 479-8590.

MODELS: Series II—3270 (SNA or BSC), 2780/3780, 3770, HASP, Twinax, and 3287/Coax; Series III Twinax; Series III 3287/Coax; Series III Coax.

COMPETITION: IBM, Local Data, and Wall Data.

PRICE: 2780/3780—\$2,294; 3287/Coax—\$1,695; HASP—\$5,284; 3770—\$5,284; Twinax 5251—\$1,495; Series III Coax—\$1,295.

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PRODUCT EVALUATION

File transfers between IBM System/3X and Apple Macintosh microcomputers can now be accomplished with KMW Twinax protocol converters. KMW supports a file transfer package called Emulator Transfer Utility (ETU). With ETU running on the System/3X and the KMW converter, an IBM or compatible PC or Apple Macintosh can emulate a 5250 terminal and transfer files in both directions. Standard features include error correction, printer pass-through, blink and column separator, 5250 status indicators, full EBCDIC character set, and support of 5250 special function keys with pull-down window. For an overview of KMW's Macintosh features, see Figure 2.

Each of the six models within the Series II family supports the attachment of up to seven or eight asynchronous ASCII devices and provides the necessary protocol translations that allow this equipment to emulate various types of IBM synchronous units. KMW converters support devices including CRTs, printers, plotters, card readers, paper tape readers, digitizers, and magnetic tape units. Converters handling batch protocols include the 2780/3780, HASP, and 3770 models. The 2780/3780 allows asynchronous equipment to emulate IBM 2780/3780 Remote Job Entry (RJE) workstations; the HASP unit allows attached asynchronous devices to emulate IBM 360/370 HASP RJE workstations; and the 3770 unit allows attached asynchronous devices to emulate IBM 3776 Models 3 and 4 or 3777 Model 3 RJE workstations. Series II

KMW Protocol Converters

units handling interactive protocols include the 3270 SNA or BSC unit, the Twinax, and the 3287/Coax. The 3270 unit emulates either an IBM SDLC 3274 or BSC 3271 control unit with attached 3278 CRTs and/or 3287 printers.

The Twinax product allows asynchronous ASCII equipment to emulate IBM 5225 printers or 5251 Models 1 or 11 terminals, and the 3287/Coax model allows asynchronous ASCII output devices to attach to an IBM 3270 cluster controller and emulate 3287 printers. The Series III Twinax and 3287/Coax units offer the same functionality as their Series II counterparts, but they support the attachment of one or two asynchronous devices, rather than seven. In addition to the six models in the Series II family, KMW Systems custom-designs products for OEMs and end users with special needs.

KMW's converters are easily installed and configured via a standard asynchronous terminal displaying menu-driven commands. Configuration data are saved in non-volatile EEPROM and retained in the event of power loss. The units support three levels of diagnostic testing—from Level 1 PROM and RAM checks to Level 3 loopback testing. While all of the units operate at selectable transmission rates ranging from 110 to 19.2K bps, some units support an optional 56K bps speed. Where applicable, Series II converters support parallel devices, such as Dataproducts and Centronics printers. The 3270 model also supports SAS, PVI, ISSCO, and other graphics packages, as well as operation in automatic transparent mode for full-color graphics support.

KMW Systems also sells the 8000 Series of IBM channel gateways through its Auscom division. The major applications for these devices is to allow IBM mainframes to

interface with "non-IBM" LANs, such as Ethernet. Auscom's various models of channel interfaces connect to IBM byte or block multiplexer, selector, or FIPS-60 channels. They emulate IBM control units, can recognize any subset of 256 subchannel addresses, and appear as one or more control units to the host. The Auscom interfaces are fully programmable and incorporate extensive diagnostics.

In addition to protocol converters and IBM channel interfaces, KMW Systems offers a comprehensive line of raster (pixel) graphics products. These products convert line segments, text, and other graphics information into pixel format—a process that is normally handled by a mainframe computer. By off-loading this conversion function to a KMW graphics processor, users can free up host CPU time for more critical tasks. The KMW processor also supports the connection of input sources and hard copy output devices from many vendors.

MARKET POSITION

KMW Systems, the original protocol converter manufacturer, also has a strong presence in the specialized market for graphic element processors used in engineering graphics applications. Protocol converters actually emerged from this primary business, but these products have become an important part of KMW's overall product line as the company has moved toward a marketing strategy that encompasses "total communications network" solutions. As part of this strategy, KMW has purchased Auscom, a prominent manufacturer of IBM mainframe channel interface units, which play an important role in the computer graphics market by allowing IBM mainframes to drive high-resolution graphics systems used in various industrial applications. Auscom channel interfaces are also used to connect IBM computers to local area networks that are not compatible with IBM equipment.

KMW Systems faces some strong competition in the protocol converter market from Local Data, Micom, and IBM. All of these vendors have strong market shares in the converter market segment. KMW appears to have made substantial gains in offering its products through OEMs and distributors, however, and the company has an especially strong reputation in engineering and industrial environments.

APPLICATIONS PROFILE

According to current users of KMW Systems' converters, the key advantage of KMW's products is their reliability. In addition, the company offers a broad range of conversions for the IBM environment, including asynchronous ASCII to SNA/SDLC and BSC. KMW Systems has a strong engineering orientation and provides high-quality

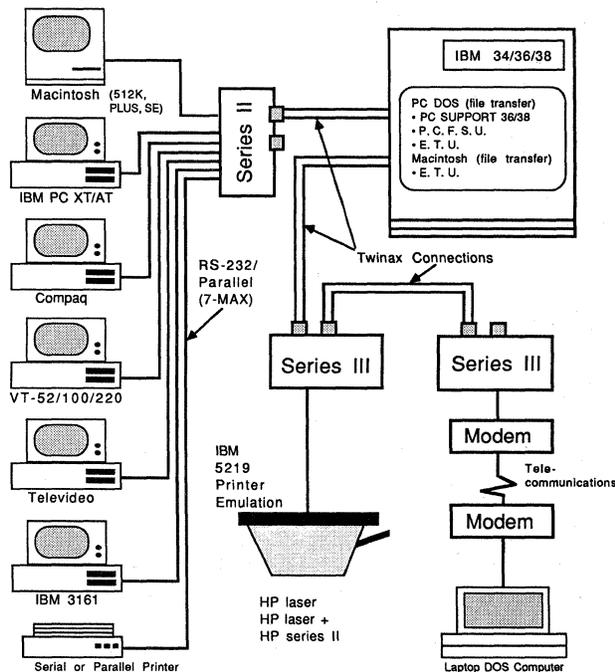


Figure 1. This illustrates the connectivity options using KMW Twinax protocol converters.

KMW Protocol Converters

service and maintenance to its customers. In addition, the company is equipped to offer customized equipment upon request.

The Series III units were designed to compete with "micro-to-mainframe links" in the personal computer market. The products offer two main advantages over traditional board-level emulation products for PCs. Series III converters do not occupy valuable PC card slot space, and they allow full remote dial-in capability—an option that is not feasible on board-level communications products. In addition to operating with personal computers, Series III converters will also accommodate standard CRTs and minicomputers.

KMW is known to be responsive to its customers' service requirements. With the vast majority of sales made by a direct sales force, customers can expect prompt responses to service requests.

USER REACTION

We contacted two users of KMW protocol converters to gather their impressions and experiences. Highlights of the two interviews follow.

SITE ONE: The MIS Director of a scientific instrument manufacturing company uses KMW protocol converters to tie shop-floor microcomputer systems (IBM and compatible personal computers) to an IBM System/36 running manufacturing applications.

Protocol converters with support for IBM twinaxial connections were most appropriate for this application, since this eliminated the need to install a communications

adapter on the System/36. KMW products were chosen because of the support provided by KMW. When asked to characterize KMW, the manager said, "Their secret weapon was their ability and willingness to work with the customer."

The user plans to install additional shop floor systems, including specialized automated testing and inspection machines, and plans to communicate with the System/36 using more KMW devices. Although they have had some problems with memory-resident software packages on the PCs, the manager states that the KMW products have been in service continuously for over two years with no hardware failures.

SITE TWO: On the West Coast, a medium-sized city is creating a new financial management system on the IBM System/38. The project team connects Compaq and Apple Macintosh microcomputers to a remotely located System/38. One application involves capturing System/38 screen images on the Macintosh and incorporating them into user documentation.

KMW protocol converters were chosen specifically for their ability to connect the System/3X to the Macintosh and IBM (and compatible) PCs. We interviewed two members of the project team. Both gave KMW's protocol converters and technical support staff high marks. One noted, "Without KMW's technical support staff, we would have had extreme difficulty getting the system up. Their technical support staff is superb."

Both expressed disappointment with the documentation, commenting that it lacks coordination and should provide more detailed information. When we contacted KMW, a company spokesperson indicated that the documentation is already being revised.

SPECIFICATIONS

MODELS: Series II—3270 (SNA or BSC), 2780/3780, 3770, HASP, Twinax, and 3287/Coax; Series III Twinax; Series III 3287/Coax; Series III Coax.

DATE ANNOUNCED: 3270 SNA, 2780/3780, 3770, HASP—October 1981; 3270 BSC—November 1982; Twinax—1985; 3287/Coax—1984; Series III Twinax and 3287/Coax—March 1986; Series III Coax—September 1987.

DATE FIRST INSTALLED: Series III Twinax—June 1986; information not available for other models.

NUMBER INSTALLED TO DATE: Information not available.

MODELS

KMW Systems' product line includes the Series II and Series III protocol converters, which allow the attachment

of serial asynchronous and byte-parallel devices to an IBM synchronous network. Specific models within the Series II line are:

- 3270 (SNA or BSC)—emulates an IBM SDLC 3274 or BSC 3271 control unit with attached 3278 CRTs and/or 3287 printers; supports virtually any type of CRT that has addressable cursor positioning, cursor-home, and clear-screen capabilities; emulates all standard 3278 functions, as well as a scroll mode that allows keyboard printer devices to perform full-screen editing; is compatible with SAS, PVI, ISSCO, and other graphics packages, allowing full-screen emulation for data processing and automatic transparent mode for full-color graphics; supports custom terminals upon request.
- 2780/3780—allows attached asynchronous devices to emulate IBM 2780/3780 remote job entry workstations;

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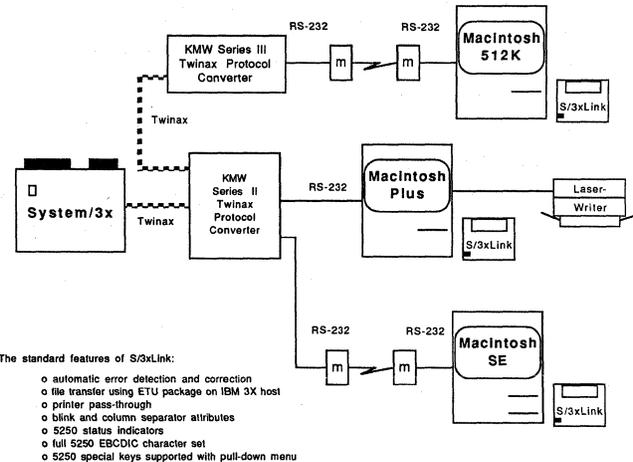


Figure 2. An illustration of KMW's Macintosh to System/3X capabilities.

input devices (e.g., card readers, paper tape readers) appear to the host as tape units; output devices (e.g., line printers, pen plotters) appear as line printers or card punches.

- 3770—allows attached asynchronous devices to emulate IBM 3776 Models 3 and 4 or IBM 3777 Model 3 RJE workstations; input devices appear to the host as card readers; output devices appear as line printers or card punches; input/output devices (e.g., graphics CRTs, minicomputers) appear to the host as line printers or card punches for output and may be dynamically switched to appear as card readers for input.
- HASP—allows attached asynchronous devices to emulate IBM 360/370 HASP RJE workstations; input and output device emulation is the same as that of the 3770 unit.
- Twinax—allows attachment of parallel or asynchronous serial devices to IBM System/34, /36, or /38 hosts; asynchronous equipment appears to the host as IBM 5225 printers or 5251 Model 1 or 11 terminals; unit supports a security feature that makes each port appear to be turned off, but then turned back on when DSR is toggled inactive; transparent output mode allows transfer of data without translation so that host software can support graphics terminals and other devices.
- 3287/Coax—allows attachment of non-IBM output devices to a Type A port on an IBM 3274 or 3276 cluster controller through an RG62A/U coaxial cable connection with a maximum 1,500-meter length; attached devices emulate IBM 3287 printers. Transmission speed between the 3287/Coax and an IBM 3274 controller is 2.5M bps.

The Series III product line contains miniaturized versions of the Twinax and the 3287/Coax converters. The products incorporate the full power of Series II firmware

encoding in a scaled-down hardware format. Both units include three levels of diagnostics, menu-driven programmability, and pass-through mode operation for supporting graphics applications. With the exception of the Twinax and 3287/Coax units, KMW Systems' converters attach to the host via a modem connection. The Twinax converter attaches to an IBM/34, /36, or /38 via a twinaxial cable. The 3287/Coax unit communicates with the IBM host through local attachment to a 3270 cluster controller. Specific transmission specifications for each model are outlined below.

Model 3270 (BSC or SNA)—

- Number of asynchronous ports: eight.
- Synchronization: synchronous.
- Maximum transmission speed: 110 to 19.2K bps (selectable).
- Transmission mode: half duplex.
- Error checking: IBM 16-bit cyclic redundancy check (CRC).
- Interface: RS-232-C, V.35 with 56K bps operation.
- Configurations supported: switched or dedicated, point to point or multipoint.
- Additional features: modem eliminator configuration available.

Model 2780/3780—

- Number of asynchronous ports: eight.
- Synchronization: synchronous.
- Maximum transmission speed: 110 to 19.2K bps (selectable).
- Transmission mode: half/full duplex.
- Error checking: IBM 16-bit CRC.
- Interface: RS-232-C, parallel interface for printers (e.g., Centronics, Dataproducts).
- Configurations supported: switched or dedicated, point to point or multipoint.
- Additional features: each port configurable for type of parity, number of stop bits, protocol (e.g., X-on/X-off or CTS), and ASCII or EBCDIC data.

Model 3770—

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- Number of asynchronous ports: eight.
- Synchronization: synchronous.
- Maximum transmission speed: 110 to 19.2K bps (selectable); 56K bps optional.
- Transmission mode: Half duplex.
- Error checking: IBM 16-bit CRC.
- Interface: RS-232-C, V.35 with 56K bps operation; parallel interface for printers.
- Configurations supported: switched or dedicated, point to point or multipoint.
- Additional features: each port configurable for type of parity, number of stop bits, protocol (e.g., X-on/X-off or CTS), and ASCII or EBCDIC data; unit supports 256- or 512-byte transmission blocks, NRZ/NRZI line format, auto logon, and optional modem eliminator configuration for local attachment.

Model HASP—

- Number of asynchronous ports: eight.
- Synchronization: synchronous.
- Maximum transmission speed: 110 to 19.2K bps (selectable); 56K bps optional.
- Transmission mode: half/full duplex.
- Error checking: IBM 16-bit CRC.
- Interface: RS-232-C, V.35 with 56K bps operation; parallel interface for printers.
- Configurations supported: switched or dedicated.
- Additional features: each port configurable for type of parity, number of stop bits, protocol (e.g., X-on/X-off or CTS), and ASCII or EBCDIC data; unit supports 400- or 512-byte transmission blocks and optional modem eliminator configuration for local attachment.

Model Twinax—

- Number of asynchronous ports: seven (one on Series III Twinax).
- Synchronization: not applicable.
- Maximum transmission speed: 110 to 19.2K bps (selectable).
- Transmission mode: not applicable.

- Error checking: per twinax protocol.
- Interface: RS-232-C, parallel interface for printers.
- Configurations supported: direct connection.
- Additional features: cable-through feature allows attachment of several devices to the same twinax cable; format control is through line feed, carriage return, and form feed control characters; unit supports automatic baud rate detection and DRT/DSR modem control.

Model 3287/Coax—

- Number of asynchronous ports: seven (one on Series III 3287/Coax).
- Synchronization: synchronous.
- Maximum transmission speed: 150 to 19.2K bps (selectable).
- Transmission mode: Not applicable.
- Error checking: Not applicable.
- Interface: RS-232-C, parallel interface for printers.
- Configurations supported: direct connection.
- Additional features: format control is through line feed, carriage return, and form feed control characters; transparency mode output of untranslated data allows use of special features on attached devices.

PRICING

KMW Systems' protocol converters are available for purchase; quantity discounts are available for five or more units. Purchase prices for one to four and five to nine units are shown in the following table.

EQUIPMENT PRICES

	Purch. 1-4 (\$)	Purch. 5-9 (\$)
Series II Models		
2780/3780	2,294	2,064
HASP Protocol Converter	5,284	5,114
3770 Protocol Converter	5,284	5,114
3270 Protocol Converter	1,495	1,420
Twinax 5251	1,495	1,420
3287/Coax	1,695	1,610
Series III Models		
Series III Coax	1,295	1,205
Series III Twinax	1,195	995

KMW offers discounts for educational institutions and quantity purchases. □

