Mini-Micro Systems

A CAHNERS PUBLICATION

FEBRUARY 15, 1985/$15.00

Communications Digest

The product guide for system integrators

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Simple.

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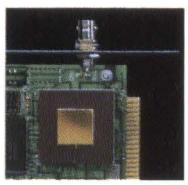

a window for running a PC DOS application. Which can be programmed to talk with any host session—or all five at once. Not to mention two electronic notepads.

The coaxial connection attaches to a 3274 cluster controller. While the modem connection lets you work remotely without the need for a controller.

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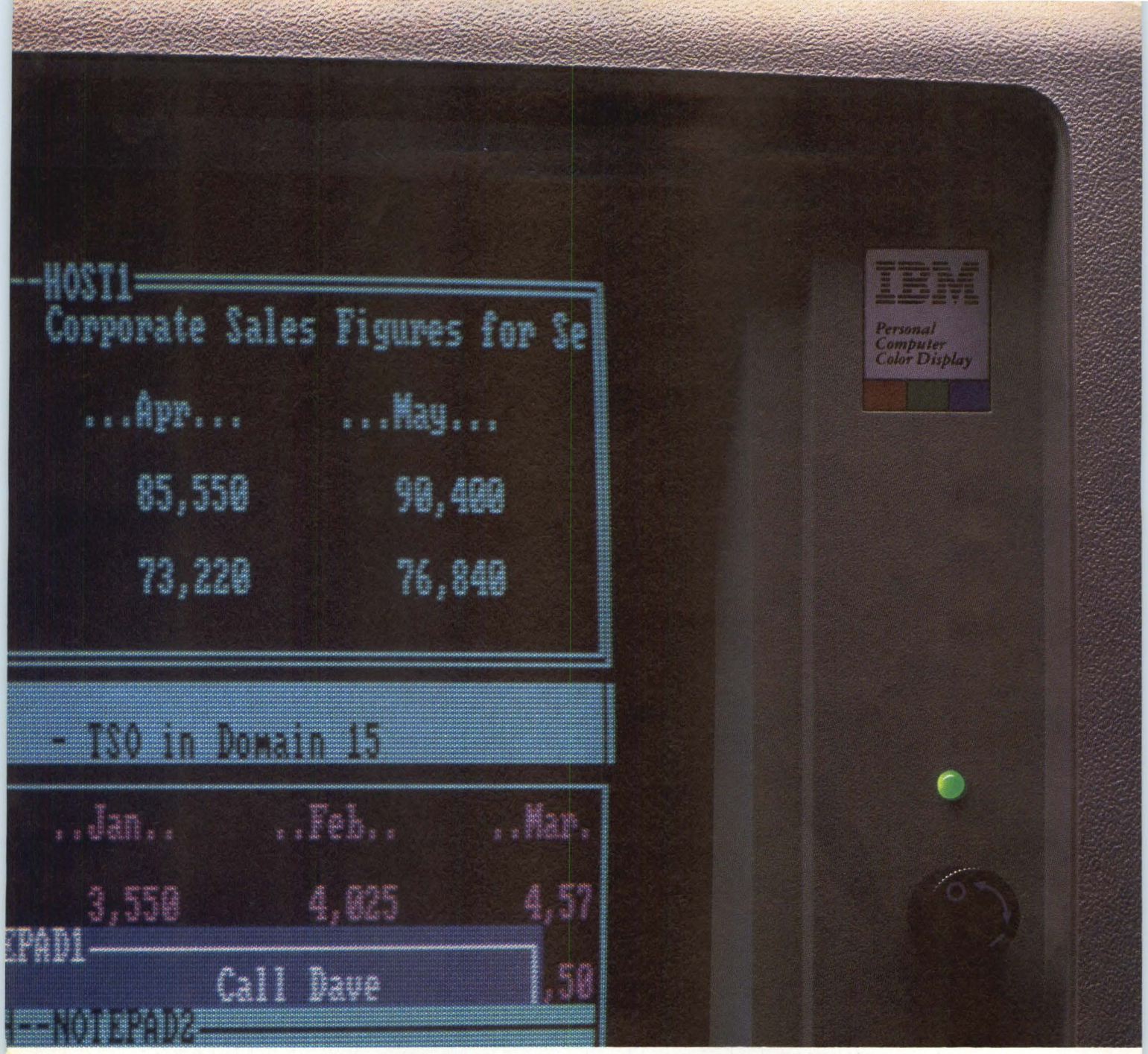

into the 3270 PCs you need.

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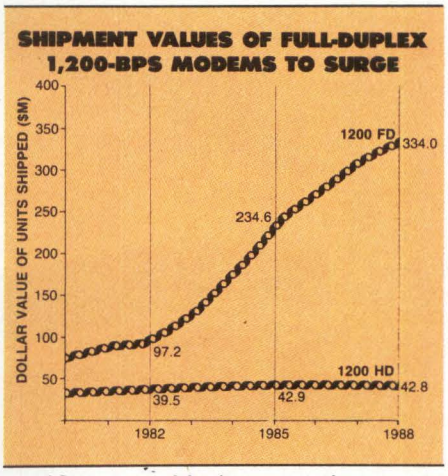
Communications Digest

A CAHNERS PUBLICATION VOL. XVIII NO. 3 FEBRUARY 15, 1985



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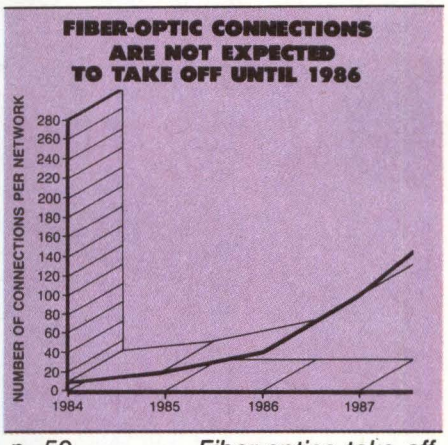

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DEPARTMENTS

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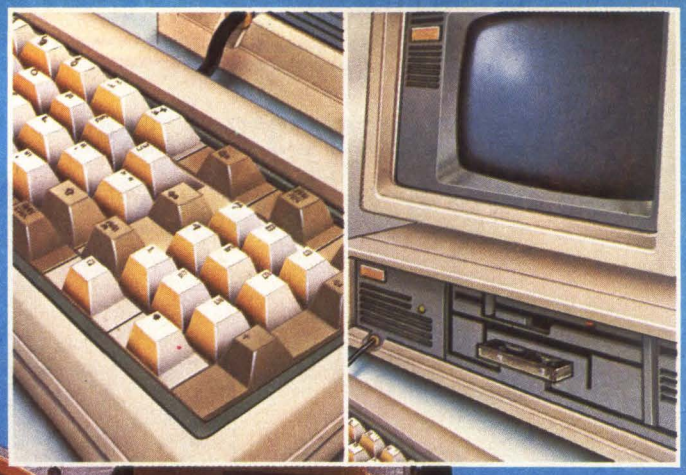

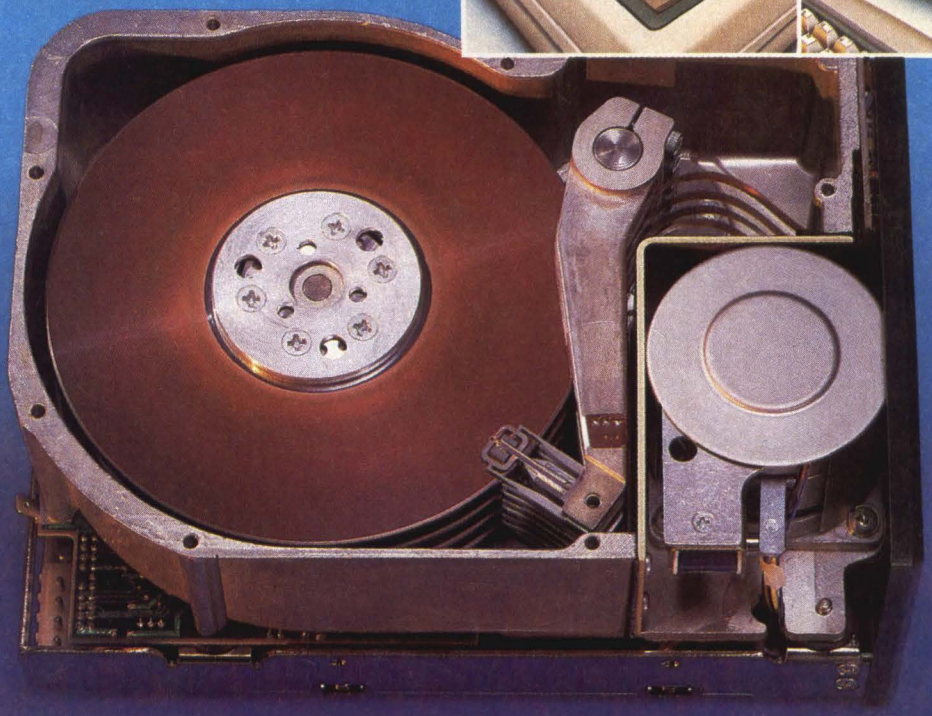

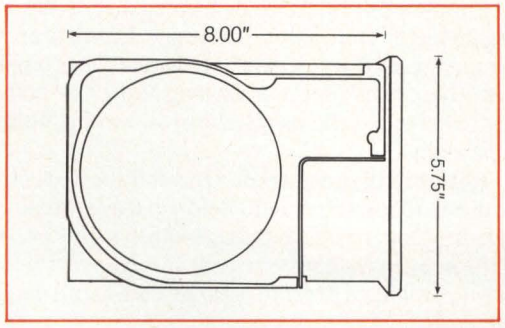

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EDITORIAL

DIGESTS EXPAND TO DATA COMMUNICATIONS

This, our first *Communications Digest,* is one of four special *Mini-Micro Systems* issues to be published this year. Like our *Computer Digest*, issued each June, the *Communications Digest* will be published annually in February. These two, along with our *Peripherals Digests*, published in April and November, make up our 1985 digest schedule.

We have chosen 1985 to introduce our first *Communications Digest* because it's a year in which most system integrators are expected to incorporate data communications features into their value-added products. Interconnectability of computer systems has clearly risen from a desirable feature to a necessity. As we approach the 1990s, interconnectability will increasingly reshape the architectures of almost all computer systems. No longer can system integrators view their products as only standalone solutions.

This year, all computer system designers will have to be aware of the data communications standards now in place and the many that have yet to be specified. To learn about the standards, or lack of standards, in each of five product categories, turn to the staff-written articles that begin each *Digest* section. Then, to see which products are already on the market, turn to the product guide following each article.

Since the new *Communications Digest* is published in February, *Mini-Micro Systems'* regular data communications issue (traditionally scheduled for March) now moves to September. Continuing unchanged in our 1985 editorial calendar are two other special-emphasis issues—June's State of the Market Report and December's State of the Technology Report.

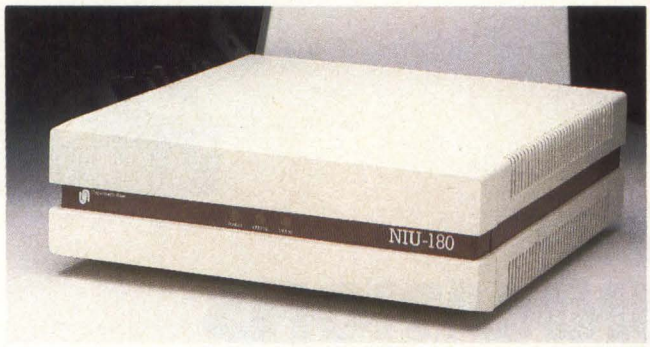
As noted in 1984's *Fall Peripherals Digest,* we have modified the product categories in our peripherals digests so that each category is covered once a year. The *Spring Peripherals Digest* will cover flexible, optical and rigid disk drives and subsystems with platter sizes of 8 to 14 inches; line printers and page printers; ½-inch cartridge tape drives; monitors; and graphics terminals. The *Fall Peripherals Digest* coverage will include flexible and rigid disk drives and subsystems with platter sizes up to 5¼ inches; matrix and solid-font character printers; ¼-inch and smaller cassette/cartridge tape drives; and alphanumeric display terminals.

Our job is to provide timely and complete coverage of product developments in the value-added market. If you have suggestions for improving our product coverage, please send them to the Editor-in-Chief, *Mini-Micro Systems*, 221 Columbus Ave., Boston, Mass. 02116.

Rick Dalrymple

Rick Dalrymple
Senior Editor

THE NIU-180 LOWERS COST-PER-CONNECTION.



Announcing the NIU-180: the first of an extraordinary new family of Network Interface Units that represents a direction everyone's been waiting for in local area networking. *Much higher performance. Much lower cost.*

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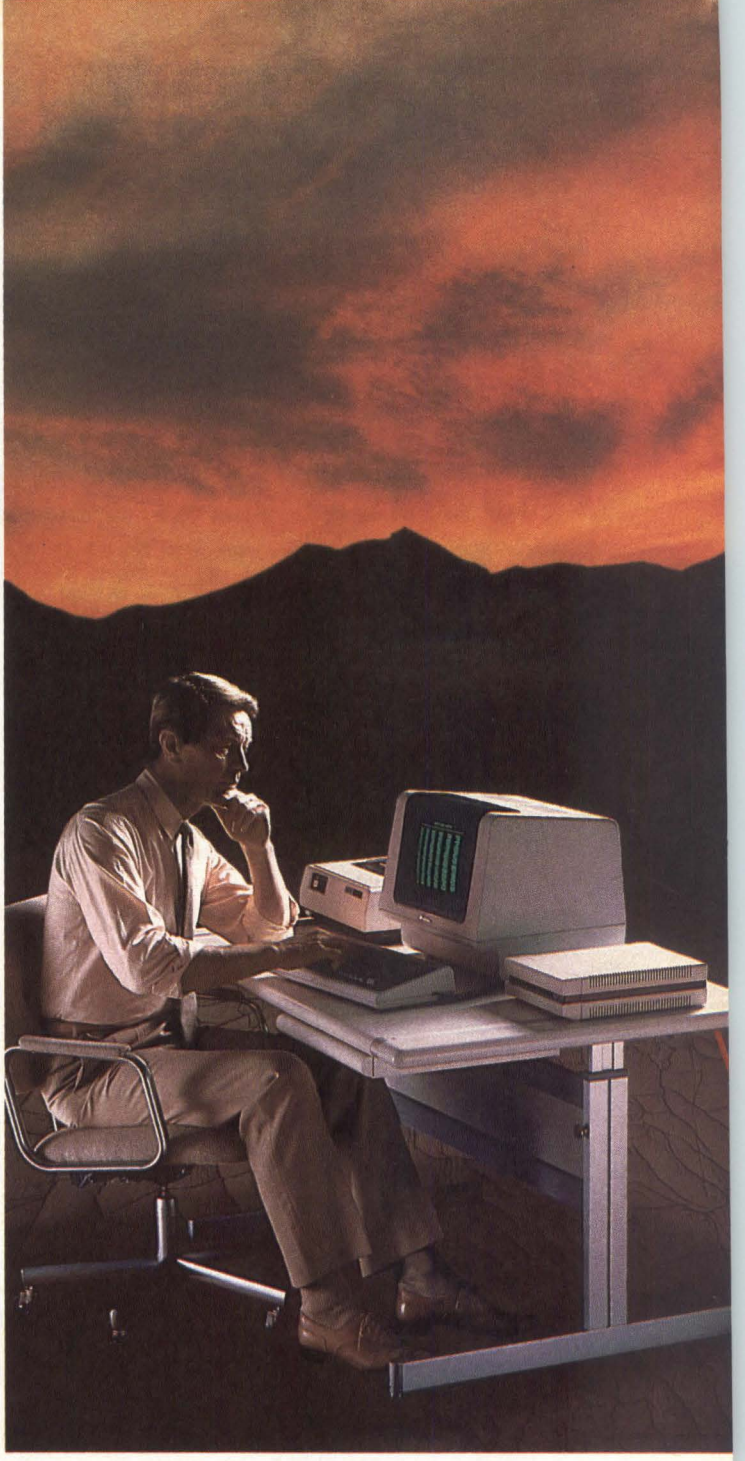
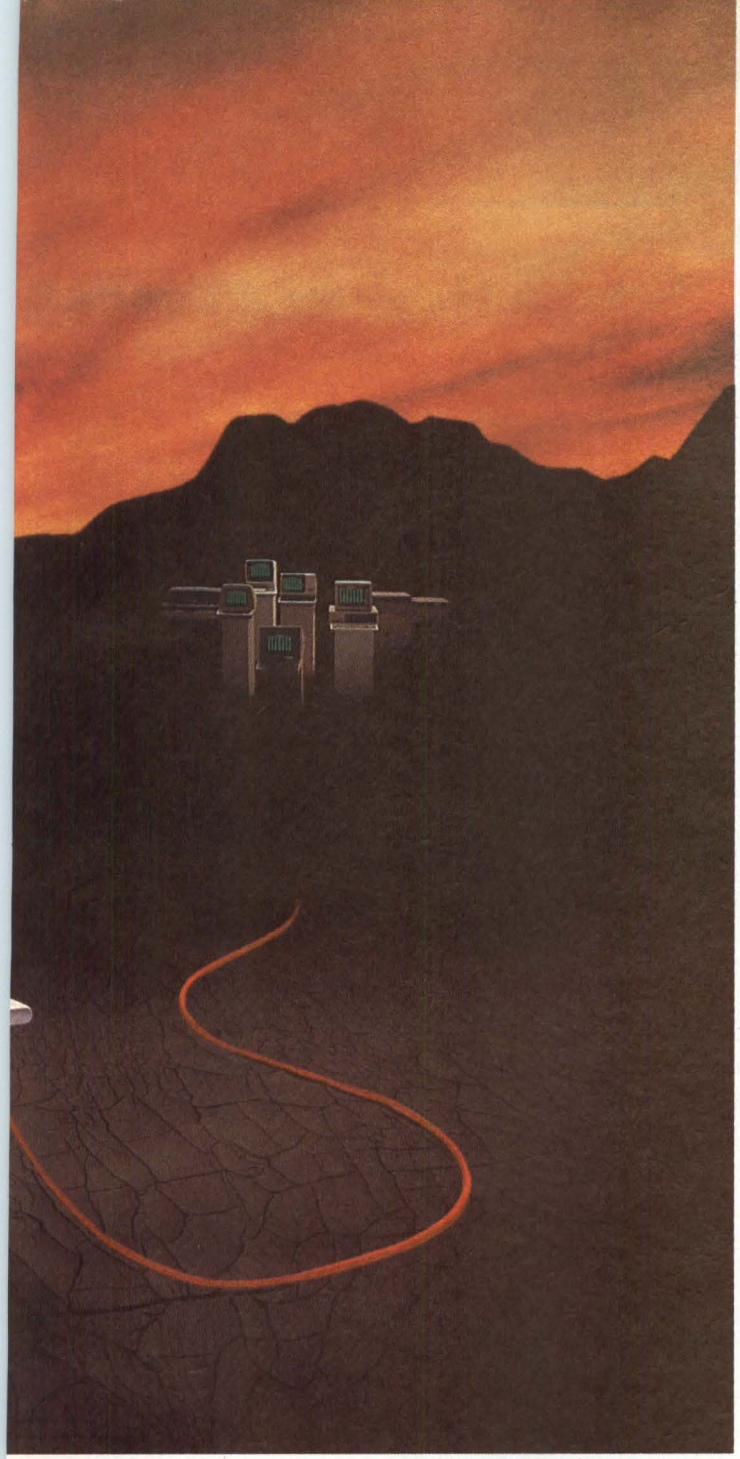


Net/One brings connections out wh



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Bill Johnson, 1984 Olympic Gold Medalist, Downhill

Bill Johnson shot out of obscurity to win the men's downhill and the first ever gold medal for the USA at the Winter Olympics in Sarajevo. He became the new high speed champion! In fact, his years of experience gave him technical superiority and he's kept on winning since. Similarly, Telenetics is the new high speed champion in modems. The company's founders have years of successful experience in telecommunications, the new product family has proven technical superiority.

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HOW TO USE THE COMMUNICATIONS DIGEST

The *Communications Digest* is divided into six sections—five for product categories and one for the directory of manufacturers. Each of the five product categories begins with a staff-written article followed by one or more product tables.

Each of the product tables contains pricing and specification information, arranged alphabetically by company name. These tables are based on mail- and telephone-survey information.

The directory of manufacturers, the last section of the digest, is a consolidated alphabetical listing of all the vendors. Each directory entry provides a vendor's mailing address and telephone number, as well as a circle number for the reader service card. The main directory is followed by a supplementary directory of manufacturers. This directory, also in alphabetical order, lists known vendors of data communication products who did not respond to our survey.

To use the *Communications Digest* effectively, use the tabs to find the desired product category. To find addresses or phone numbers, use the directory of manufacturers. To check product prices or specifications:

- Turn to the appropriate product category
- Find the product table
- Find the alphabetically listed vendor

To select a product:

- Turn to the appropriate product category
- Refer to the product table
- Refer to the directory of manufacturers for the supplier's address

To comment on the *Communications Digest* or to suggest future product coverage or entries, contact the Editor-in-Chief, *Mini-Micro Systems, Communications Digest*, 221 Columbus Ave., Boston, Mass. 02116.

The *Communications Digest* research and editing staff includes Frances Michalski, associate editor; Megan Nields, assistant editor; and Pamela Gorski, assistant editor. Production assistant Carole Smith provides editorial support.

John Trumbull. *The Declaration of Independence*, 1786-1797. Courtesy The Bettmann Archive.

Installing a worldwide 2400bps dial line data network can save you thousands of dollars in international data communications costs. But before you put your John Hancock on a purchase order, check the facts. To be legally used in most foreign countries, today's 2400bps modems must not only comply with the V.22bis Recommendation, but must also meet dozens of additional design and performance requirements as outlined by each country. And the truth is, most don't. In fact, there is only one company whose family of V.22bis modems has been approved and accepted by *over thirty-five* foreign nations – Concord Data Systems. Concord was the first company to install a V.22bis-compliant 2400bps modem. And, with over 20,000 units in place today, Concord Data is not only the most popular name in 2400bps modems, but is the benchmark for 2400bps modem performance. For complete details on our full line of domestic and international 2400bps full duplex dial line modems, call us at (617) 890-1394 or write 303 Bear Hill Road, Waltham, MA 02154, telex 951793.

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BELL SYSTEM BREAKUP REDIRECTS MODEM MARKET

Dedicated phone line price increases, coupled with decreasing prices for dial-up service, spurs use of higher speed DDD modems

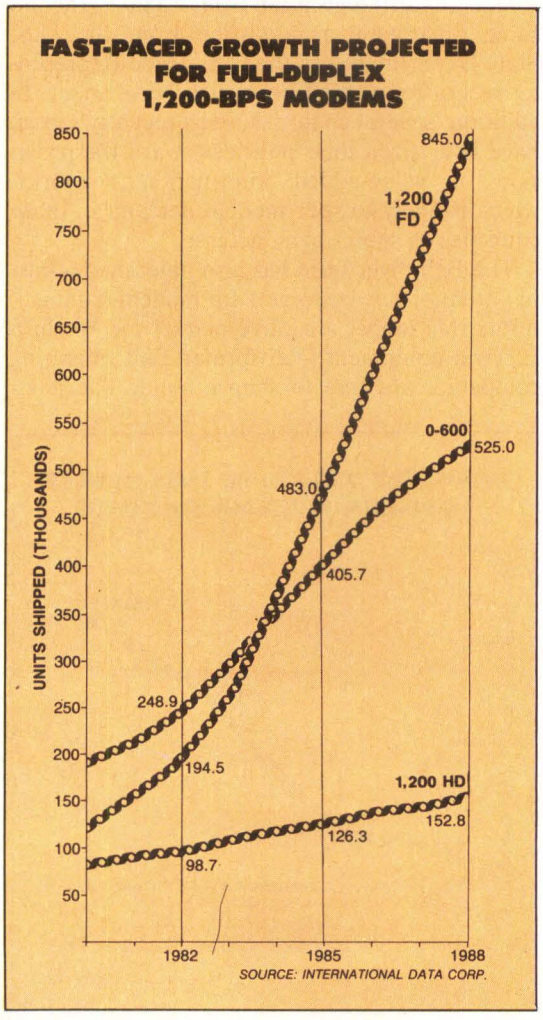
Stephen J. Shaw, Washington Editor

One event has profoundly affected the modem market. The breakup of the Bell System has resulted in sharp price increases for dedicated phone lines and vigorous competition for dial-up service. This has created a market opportunity for the manufacturers of higher speed Direct Distance Dial (DDD) modems, especially those operating at 2,400 bits per second (bps).

The Bell breakup has also created a dearth of technical transmission standards for modems operating at 2,400 bps and higher. The venerable Bell standard specifications for 300- and 1,200-bps, half- and full-duplex modems—103, 113, 212 and 212A—still retain their hold within the U.S. modem market. However, AT&T Information Systems (ATTIS) has not moved to develop, or impose, standards for higher speed equipment.

Filling this void have been specifications formulated by the Comités' Consultatif Internationale Tèléphone et Télégraphique (CCITT), the standards arm of the International Telecommunications Union. U.S. manufacturers are increasingly designing their equipment according to the CCITT specifications for both domestic and international applications.

"There's been a drift away from Bell standards with the breakup," explains Stephen Durham, vice president of product planning and applications for Cermetek Microelectronics Inc., Sunnyvale, Calif. "Even AT&T Information Systems is talking about CCITT-compatible products."



Projected to be the fastest-growing segment *of the modem market, 1,200-bps, full-duplex modem shipments will increase at a compound annual rate of 24.7 percent through 1988.*

The net result is to allow manufacturers to cease what Durham characterizes as the "the insanity" of developing two separate products—one under a Bell standard and the other CCITT-compatible—for identical domestic and international applications.

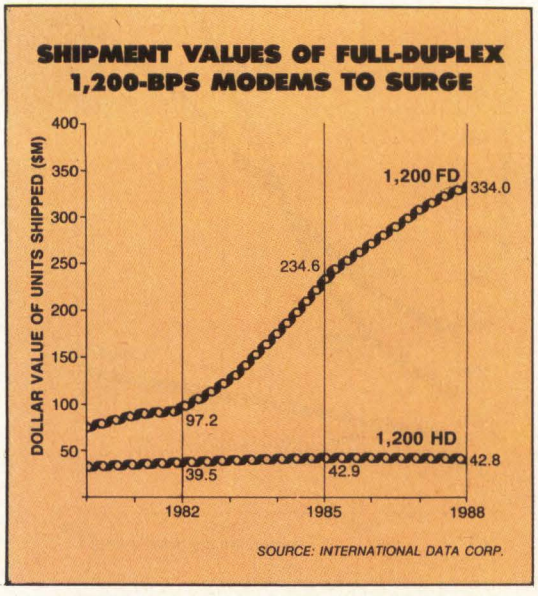
Freed from having to develop U.S.-only versions, manufacturers can devote more resources to designing and marketing products for European, Asian and other countries that adhere to CCITT standards for domestic communications.

U.S. modems resemble foreign counterpart

At the same time as U.S.-made modems more closely resemble their non-U.S. counterparts, many foreign governments have begun to liberalize the procurement of modems and other telecommunications equipment that interconnect with state-owned telephone networks. And the telecommunications agencies of many countries have opened their network-interconnect markets to foreign equipment suppliers. This is partly in response to the AT&T breakup, but also to threats of tariff legislation from Capitol Hill and some diplomatic arm-twisting from the U.S. State Department and the U.S. Trade Representative's office of the Commerce Department. In addition, several countries, most recently Japan, have liberalized their policies toward the provision of value-added information networks, which is likely to spur modem demand in those countries as subscribers increase.

The Bell divestiture has also unleashed a host of potential new customers for modem manufacturers. No longer a captive market for Western Electric equipment, the former Bell operating companies are free to shop around. The independent Bell companies, their subsidiaries, and other OEM customers represent an increasingly significant market, according to Kim Myhre, communications industry analyst at International Data Corp. (IDC), Framingham, Mass.

Despite decreasing per-unit prices, *rising demand for 1,200-bps, full-duplex modems are expected to push the dollar value of units shipped to $334 million in 1988.*



Market shift spawns products at 2,400 bps

With private or dedicated line price increases, the 2,400-bps DDD modem has become very attractive. Modems operating at 2,400-bps have been used generally for business applications to carry data to and from "dumb" or low-speed, remote, batch terminals. The market has been dominated almost exclusively by modems requiring the four-wire connections used for private-line service almost exclusively, according to John Krayeski, ATTIS manager for modem products. However, numerous full-duplex modems have recently been announced that achieve the same 2,400 bps throughput over the two-wire channels used in the public dial-up telephone network.

The market for 2,400-bps, full-duplex modems had once been the exclusive domain of Concord Data Systems Inc., a small, Waltham, Mass., manufacturer. Earning $1.5 million in revenues during 1982, Concord Data's first year in operation, the company recorded $14.9 million in revenues last year from its CDS 224 line of 2,400-bps full-duplex modems. "We had the market to ourselves for almost two years," says C. Kenneth Miller, Concord Data's president, "but there's a lot of people coming into the market now."

By late last year, only two other manufacturers, Codex Corp., Mansfield, Mass., and Micom Systems Inc., Chatsworth, Calif., were shipping 2,400-bps, full-duplex modems for dial-up applications. But that situation is about to change dramatically. Other vendors who have either announced similar modems recently, or are rumored to have a 2,400-bps full-duplex modem under development, include: ATTIS, Case/Rixon Communications Inc., Cermetek Microelectronics Inc., Gandalf Data Inc., General Datacomm Industries Inc., Hayes Microcomputer Products Inc., Multi-Tech Systems Inc., Novation Inc., Penril/Datacomm Inc., Racal-Vadic Inc. and U.S. Robotics Inc.

The sudden appearance of so many vendors in what was once considered a specialized market niche can be explained by the convergence of three distinct industry trends, explains IDC's Myhre. First, users are nervous about private-line rate increases and are looking for dial-up alternatives that can satisfy their medium-speed, data communications requirements. Secondly, the growing use of personal computers in business is pushing users to demand more speed and

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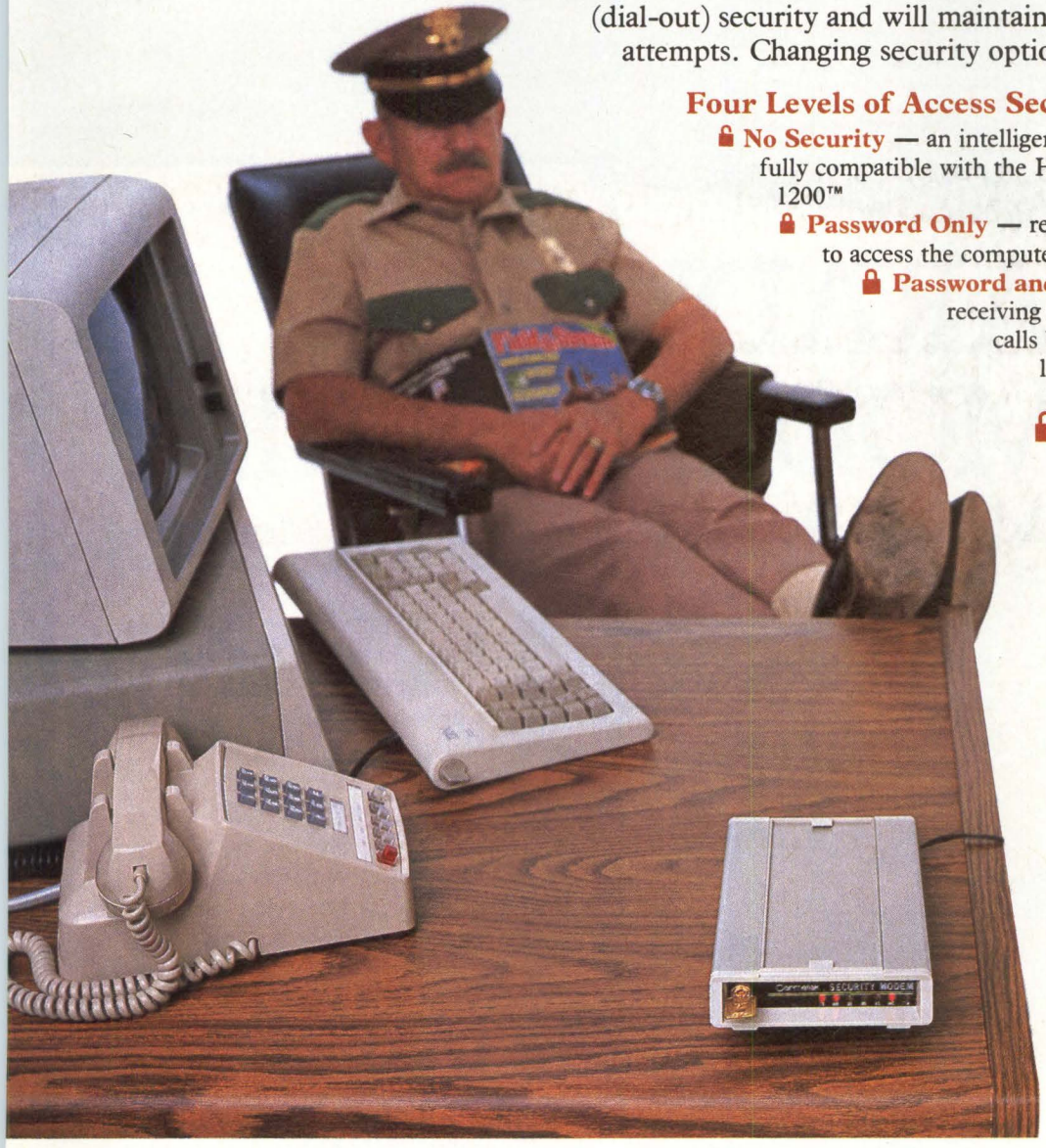

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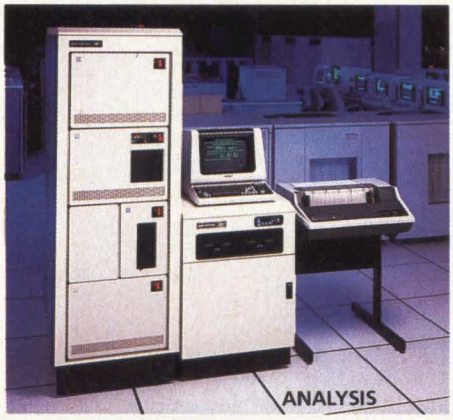

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data throughput from dial-up modems. Finally, VLSI technology is allowing manufacturers to introduce 2,400-bps modems that are only roughly 50 percent more expensive than 1,200-bps units, but deliver twice as much information in the same amount of time.

Prices, delays deter customers

"Private-line costs are going up while long-distance (dial-up) rates are dropping," says Myhre. As a result, more businesses are looking at dial-up switched service as a cost-effective solution for their data communications needs. Full-duplex, dial-up modems are also finding applications as an interim measure for customers waiting to receive private-line service from AT&T. That has taken up to 160 days.

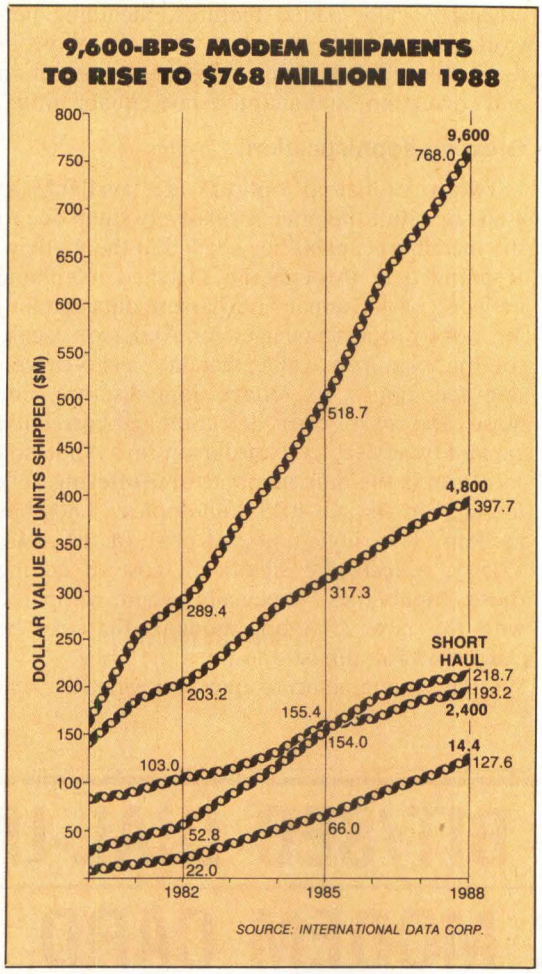
Manufacturers concur that development of these new modems for business applications has been driven by user demands for increased data-transfer rates. "We're reacting to user need, and users have been crying for more speed over the past year," comments Gary Betty, marketing and sales director for Hayes Microcomputer Products, Norcross, Ga. "Everybody else in the industry has seen the same trends and performed the same market analysis that we have."

It may not be too long before 2,400-bps, full-duplex modems show up in the home, predicts John Borden, a home computer analyst with The Yankee Group, Boston. He says that acceptance of the medium-speed modems for home-computer applications depends on two factors: reducing retail prices to below $700, the approximate level at which 300 to 1,200 bps began to attract home consumers two years ago, and increasing use of home information subscription services and communications software packages that offer graphics capabilities.

At 1,200 bps, Borden continues, a single frame of videotex takes 20 seconds to create. A 2,400-bps modem would, obviously, cut that time in half and could make graphic-based information services more attractive to home users. "I anticipate that by late 1985 we may see some 2,400-bps modems begin to be available in the home," Borden suggests. "But a lot depends on how well home information services are received."

2,400-bps modems sold to Tymnet

Support of 2,400-bps, full-duplex data transmission by commercial information and network services is also deemed critical if the spate of new modems for dial-up applications is to become widely accepted. Concord Data Systems has already attracted Tymnet Inc., a value-added data network vendor, as a customer. Tymnet has incorporated Concord's modems by selling them to network subscribers under the TymNet label, says Steve Puchkoff, Concord's vice president of sales.



User demands *for increased data throughput capabilities, coupled with the anticipated development of new full-duplex equipment at 9,600 bps, should push the value of 9,600-bps modem shipments to $768 million in 1988.*

However, only one other commercial information service, NewsNet, currently supports 2,400-bps transmission speeds. Others, including Dialog, Lexis, Telenet, The Source and Uninet are reportedly looking at whether to support 2,400-bps transmission rates in addition to existing 300- and 1,200-bps connections.

Single-unit prices for the new modems range between $800 and $1,500, depending on additional, value-added features. Prices should remain relatively stable through 1985, says Cermetek's Durham, but will drop during the following year by an estimated 10 percent to 15 percent. In the meantime, manufacturers are expected to compete on the basis of capabilities added to differentiate their products in the market. Such features as auto-dial, auto-answer and self-diagnostics are now considered almost mandatory with the new modems. But manufacturers are already starting to incorporate even more

advanced value-added features, including network diagnostics to pinpoint transmission problems along the telephone circuit, error detection and correction, and adaptive line equalization.

Growing sophistication

Two-wire dial-up options are available at 4,800 bps, but the price is relatively steep due to the increased capabilities needed in the modem. Running data through the switched telephone network, says Gunnar Thordarson, data communications product manager for Anderson Jacobson Inc., San Jose, Calif., mandates echo-cancelling techniques to reduce long-distance line noise, and makes error detection and correction capability advisable. Thordarson says Anderson Jacobson is the only manufacturer offering both features in its AJ 4048, full-duplex, 4,800-bps modem. The single-unit, list price of the 4048, $2,595, reflects the significant cost of adding those capabilities, especially when compared with the new 2,400-bps modems that can be purchased for almost one-third the price.

Other manufacturers question whether that added development cost would be better spent on products operating at 9,600 bps. Lee Schank, president of Case/Rixon in Silver Spring, Md., asserts "4,800 is an unnecessary stopping point." Dial-up modems operating at 9,600 bps require both echo-cancelling techniques and equipment that is expensive to develop and manufacture. "The cost differential between 4,800 and 9,600 modems is insignificant. [That is,] if you're going to invest in the VLSI technology and software programs that automatically adjust the modem's data output according to the changing line conditions."

Full-duplex modems operating at 9,600 bps for dial-up applications will make their first appearance by the end of the year, says Hank Morgan, product line manager at Gandalf, in Wheeling, Ill. He adds that international standards for 9,600-bps, full-duplex modems were adopted by the CCITT only in April 1984. "By the end of '85, somebody will be delivering 9,600, full-duplex equipment."

ATTIS quickly made its presence felt in numerous segments of the modem market once it

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was unfettered in 1982 to supply telecommunications hardware and computer equipment. According to the most recent IDC estimates, ATTIS captured, by the end of 1983, 16 percent of the market for modems operating at 0 to 600 bps. In this low-speed market, ATTIS ranked just 0.7 percent behind leader Hayes Microcomputer Products. ATTIS is the leader in the 1,200-bps, half-duplex segment, with 22.2 percent of the market. At 1,200 bps, full-duplex, ATTIS has an 11.7-percent market share, lagging behind Racal-Vadic, Sunnyvale, Calif., (31 percent) and Case/Rixon (22.3 percent).

Half-duplex, 1,200-bps market mature

The market for 1,200-bps, half-duplex modems has matured, with vendors scrambling to remain price-competitive, according to Case/Rixon's Schank. Increased use of very large-scale integration (VLSI) manufacturing techniques are expected to help reduce "plain vanilla" 1,200-bps, half-duplex modems to prices under $200 by the end of 1985, according to The Yankee Group's estimates. Due to a sluggish 7.2-percent predicted annual increase in demand, combined with falling prices, the value of modem shipments is expected to rise from $40.9 million in 1983 to $42.8 million in 1988, a paltry $1.9 million increase over five years.

The slack, in the half-duplex market segment, however, will be taken up by the 1,200-bps, full-duplex equipment. The full-duplex version allows data to be simultaneously transmitted in both directions on two- rather than four-wire telephone circuits. With dial-up business telephone and private-line charges going up, and technological developments such as VLSI techniques bringing costs down, full-duplex, 1,200-bps modems are receiving an enthusiastic reception from users. IDC estimates that this segment will grow at an annual rate of 25.7 percent through 1988. From 268,600 units shipped in 1983, 1200-bps, full-duplex modems are projected to jump to 845,000 units shipped in 1988.

Overall, industry analysts continue to see healthy growth in most sectors of the modem market during the next four years, in spite of the increasing availability of digital-transmission lines in local and wide-area data networks. According to IDC's market projections, growth in unit shipments is expected to average 18.7 percent annually through 1988. □

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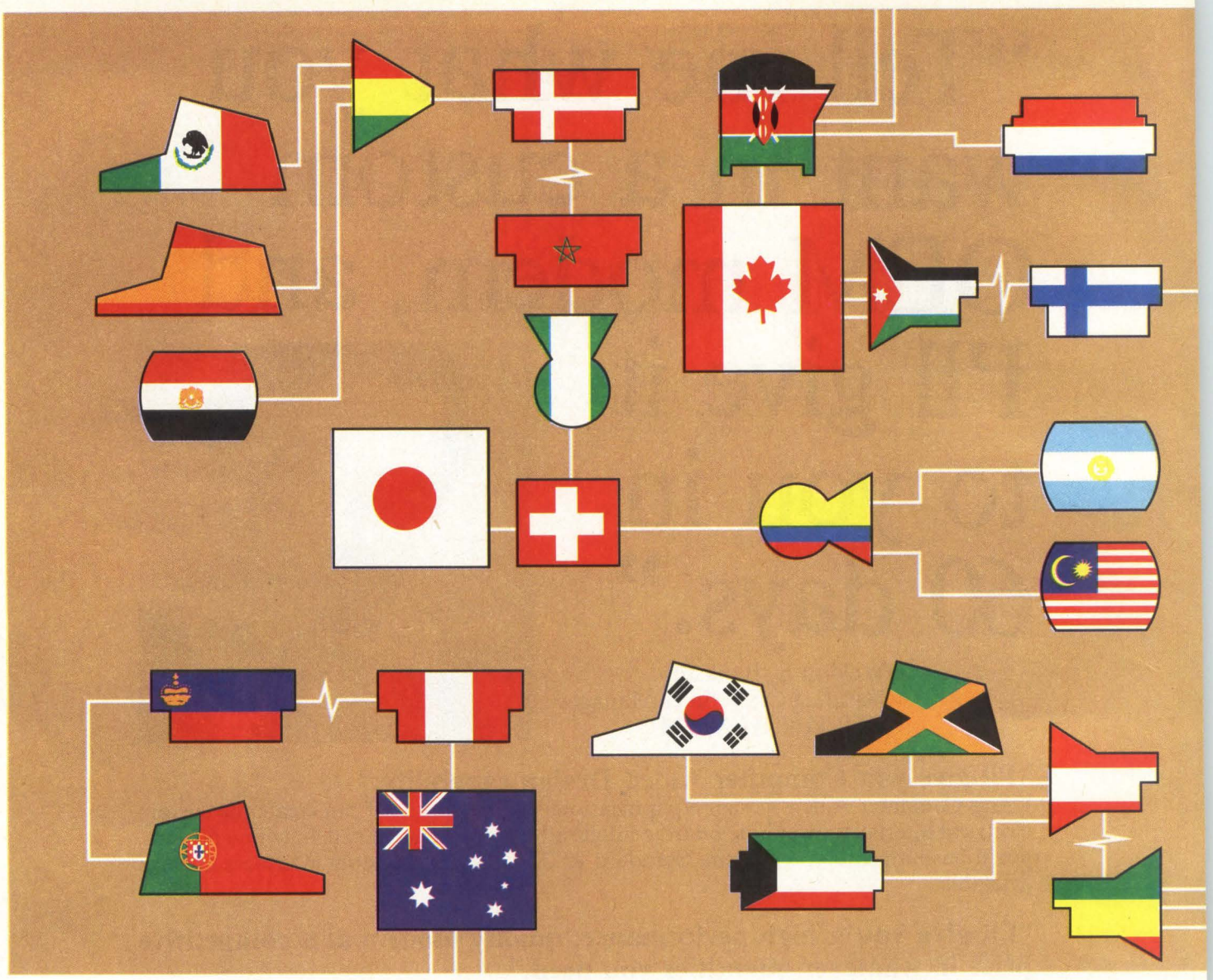

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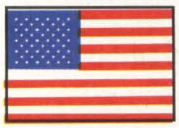

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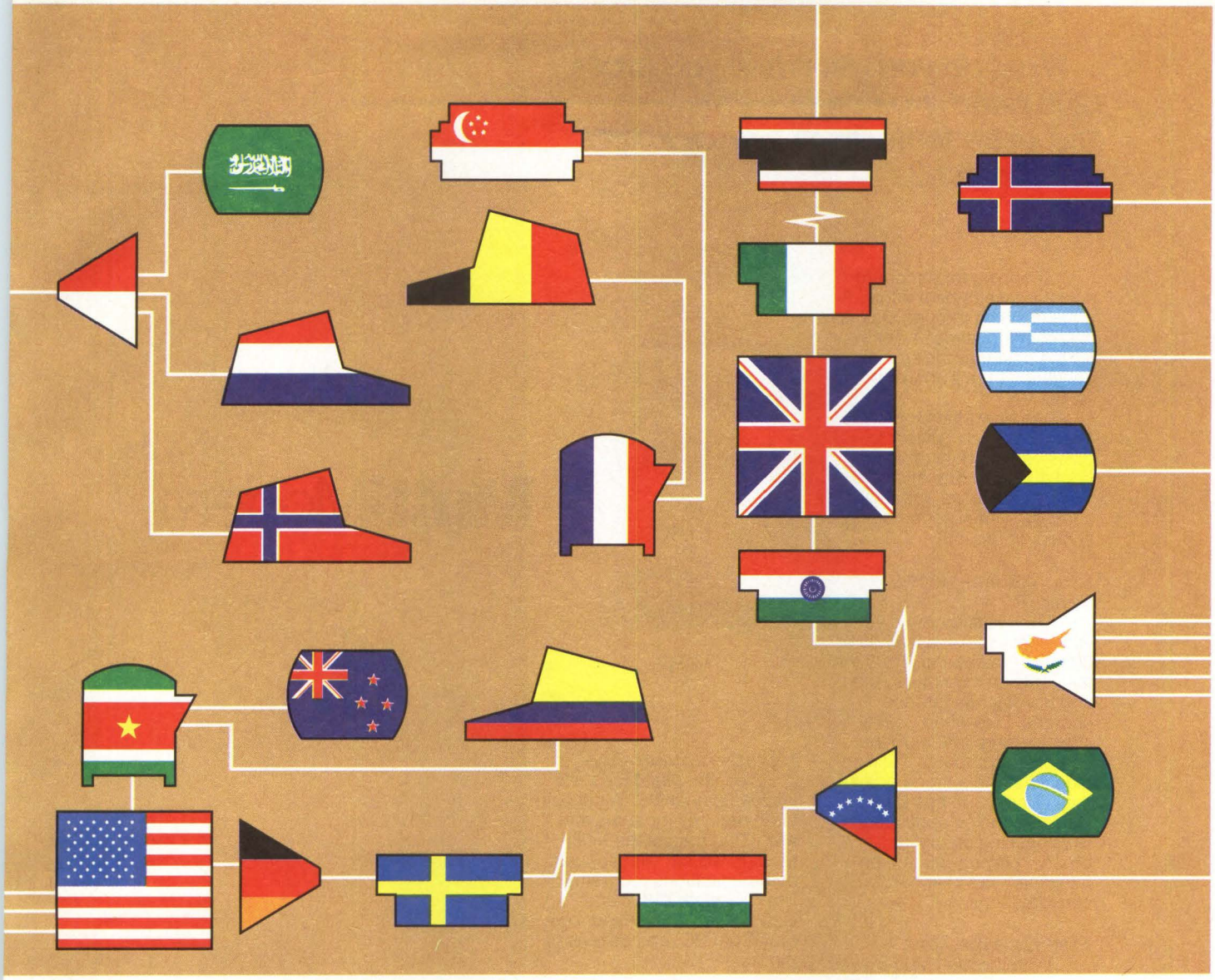

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With the MultiModem you get CompuServe's DemoPak—a free two-hour demonstration of their service, and up to seven more free hours of on-line time if you subscribe. You also get a $50 usage credit from NewsNet, a service which lets you tap into 150 different specialized business newsletters.

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Of course, the MultiModem automatically dials, answers, and disconnects. But it does a few extra things too, things the Hayes Smartmodem 1200™ doesn't. Like recognize dial tones and busy signals, so the MultiModem will automatically redial, or automatically try a different number. And it remembers phone numbers too, up to six of them, in its battery-backed memory.

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Yes, the MultiModem is Hayes-compatible. (Most software requires modems that are.) That means the MultiModem will run with popular communications programs like Crosstalk XVI, Data Capture, PC-Talk III, our own MultiCom PC, and dozens of others.

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VOICE GRADE DDD MODEMS

TABLE 1

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price ($)	Notes, features, options
AMERICAN MICROSYSTEMS INC. (AMI)								
S35212/S35213	1200	FSK, DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback		Bell 103-, 212A-compatible
ANCHOR AUTOMATION								
Signalman XIII	300, 1200	FSK	full duplex	asynch	auto dial/ auto answer		399 (Q1)	Bell 103-, 212A-compatible
Signalman Express	300, 1200	PSK	half, full duplex	asynch	auto dial/ auto answer	local and remote analog loopback, self-test	439 (Q1)	Bell 103-, 212A-compatible
Volksmodem	300, 1200	FSK	full duplex	asynch	auto dial/ auto answer		299 (Q1)	Bell 103-, 212A-compatible
APPLE COMPUTER INC.								
Apple Modem 1200	0–300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local analog loopback	495	Bell 212A-compatible
AST RESEARCH								
REACH!	1200	DPSK	half, full duplex	asynch	auto dial/ auto answer	local analog and remote digital loopback, self-test	549 (Q1)	includes CROSSTALK XVI software; Bell 103-, 113-, 212A-compatible; board-level modem plugs into IBM PC
BIZCOMP								
PC IntelliModem	300, 1200		half, full duplex	asynch	auto dial/ auto answer		499 (Q1)	includes software, Bell 212A-compatible, board-level modem plugs into IBM PC
IntelliModem XL	300, 1200		half, full duplex	asynch	auto dial/ auto answer		549 (Q1)	includes software; Bell 212A-, Hayes-compatible; board-level modem plugs into IBM PC
BYTCOM								
212AD	0–300, 1200	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	495 (Q1)	Bell 103-, 113-, 212-compatible; includes BCN software
CASE RIXON COMMUNICATIONS INC.								
R2424	1200, 2400	QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,295 (Q1)	Bell 212A-compatible
R2424 Auto Diatek	1200, 2400	QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,395 (Q1)	Bell 212A-compatible
R96	9600	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	2,595 (Q1)	CCITT V.29-compatible, point-to-point
R96FP	9600	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	2,995 (Q1)	Bell 212A-compatible, point-to-point or polling
Executive 212	300–1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer			Bell-compatible
PC212A	300–1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer			Bell-compatible
R212A	300–1200		full duplex	asynch/synch	auto dial/ auto answer	local and remote digital loopback		Bell-compatible
R212 Intelligent	1200	FSK	half duplex	asynch	manual orig./ auto answer	local analog and remote digital loopback		Bell 103-, 113-, 212A-compatible
RV.22 bis	1200–2400	PSK, QAM	full duplex	synch		remote digital and analog loopback, self-test		Bell 202-compatible

VOICE GRADE DDD MODEMS
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T202S	0–1200	FSK	half duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test		Bell-compatible
T202T	0–1800	FSK	half, full duplex	asynch		local and remote, digital and analog loopback, self-test		Bell 202-compatible
TA201C	2400		half, full duplex	synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test		Bell 2018-, 201C-, 801-compatible
CERMETEK MICROELECTRONICS INC.								
Cermetek 1200 MODEM	110, 300, 1200	FSK, PSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	595 (Q1)	voice/data switch; electronic call; progress on screen or speaker; Bell 103-, 212A -, Hayes-compatible
Cermetek 1200PC MODEM	110, 300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	495 (Q1)	includes CROSSTALK communication software; board-level modem plugs into IBM PC/XT; Bell 103-, 212A-, Hayes-compatible
Cermetek Security MODEM	110, 300, 1200	FSK, PSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	695 (Q1)	includes CROSSTALK communication software; board-level modem plugs into IBM PC/XT; Bell 103-, 212A-, Hayes-compatible
CODEX CORP.								
2231	1200, 2400	DPSK, QAM	half, full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	995 (Q1)	Bell 212-compatible
2232	1200, 2400	DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,195 (Q1)	Bell 212-compatible
COHERENT COMMUNICATIONS SYSTEMS CORP.								
DAM-SD	1200		half, full duplex	asynch/synch	manual orig./ manual answer	local digital loopback, self-test	482 (Q1)	
COMDESIGN INC.								
TM-2400	2400	DPSK	full duplex	synch	auto dial/ auto answer	local digital and analog loopback, self-test	750 (Q1)	Bell 201B-compatible
TM-4800	4800	DPSK	full duplex	synch	auto dial/ auto answer	local digital and analog loopback, self-test	1,750 (Q1)	Bell 208A-, B-compatible
TM-9600	9600	DPSK	full duplex	synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	2,750 (Q1)	CCITT V.29-compatible
COMREX INTERNATIONAL								
CR-212	1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, self-test		Bell 103-, 212A-, Racal-Vadic-compatible; board-level modem plugs into Epson QX 10
CONCORD DATA SYSTEMS INC.								
CDS 224	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	845 (Q1)	Bell 212-, 2224-compatible
CDS 224 AD	1200, 2400	DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	995 (Q1)	compatible with most software packages; Bell 212-, 2224-compatible
CDS 224 ARQ	2400	QAM	full duplex	asynch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	1,295 (Q1)	includes error correction

VOICE GRADE DDD MODEMS
TABLE 1

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price ($)	Notes, features, options
CDS 224 ARQ/AD	2400	QAM	full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	1,395 (Q1)	includes error correction
CDS 224 SD	2400	QAM	full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	1,695 (Q1)	includes 3-port statistical multiplexer, error correction
V.22	300, 600, 1200	DPSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loop-back, self-test	795 (Q1); 710 (Q100)	Bell 212A-compatible
V.22 Bis	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loop-back, self-test	845 (Q1); 785 (Q100)	Bell 212A-, 224-compatible; international version of CDS 224
V.22 Bis A/D	1200, 2400	DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	995 (Q1); 895 (Q100)	Bell 212A-, 224-compatible; international version of CDS 224 A/D
DATABIT INC.								
SA212		PSK	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test		Bell 212A-compatible
DATA COMMUNICATIONS BROKERS INC.								
PL 48	4800	QAM	full duplex	synch		local digital and analog loopback, self-test	1,300 (Q1)	external power supply, CCITT V.27-compatible
PL 9.6	9600	QAM	full duplex	synch		local digital and analog loopback, self-test	1,600 (Q1)	external power supply, CCITT V.29-compatible
PL 14.4	14.4K	QAM	full duplex	synch		local digital and analog loopback, self-test	2,900 (Q1)	external power supply, CCITT V.29-compatible
DATAGRAM CORP.								
D224	2400	PSK	full duplex	asynch/synch	auto dial/ auto answer		995 (Q1)	CCITT V.22 bis-compatible
D4800	4800	DSPK, QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	1,395 (Q1)	CCITT V.27-compatible
D9600	9600	DSPK, QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	1,995 (Q1)	CCITT V.29-compatible
D14400	14.4K	DPSK, QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	4,895 (Q1)	
DATEC								
212S		DPSK	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	695 (Q1)	Bell-, Hayes-compatible
DATEC 212A	300, 1200	FSK, DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	595 (Q1)	Bell 103-, 113-, 212A-compatible
DATEC 212R/ACU	300, 1200	FSK, DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	695 (Q1)	Bell 103-, 113-, 212A-compatible
PAL 212	0–300, 1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local analog loopback	497 (Q1)	Bell 103-, Hayes 113-, 212A-compatible
PAL Plus		FSK, DPSK	full duplex	asynch	auto dial/ auto answer	self-test	595 (Q1)	includes CROSSTALK XVI software; board-level modem plugs into IBM PC/XT; Bell 103-, 113-, 212A-, Hayes-compatible
DEVELCON ELECTRONICS INC.								
201B	2400	PSK	full duplex	synch		local analog loop-back, remote digital loopback, self-test		anti-streaming, Bell 201B-compatible

VOICE GRADE DDD MODEMS
TABLE 1

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201BR	2400	PSK	full duplex	synch		local analog loopback, remote digital loopback, self-test		anti-streaming
208 A/B	4800	PSK	half, full duplex	synch	auto answer	local digital loopback		anti-streaming, adaptive equalization, Bell 208A-/B-compatible
208 A/BR	4800	PSK	half, full duplex	synch	auto answer	local digital loopback		anti-streaming, adaptive equalization, Bell 208A-/B-compatible
212RD	1200	PSK	full duplex	asynch/synch	auto answer	local digital and analog loopback, remote digital loopback, self-test		own power supply; Bell 103-, 212A-compatible
2X212	1200	PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test		2 channels; Bell 103-, 212A-compatible
6212	1200	PSK	full duplex	asynch/synch	auto dial/ auto answer	local analog loopback		microprocessor controlled, programmable hang-up code, speed dialing, Bell-212 compatible
7212	1200	PSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test		Bell 103-, 212A-compatible
9202C	1200	PSK	full duplex	asynch				9 status leads, Bell 202-compatible
9600 A/B	4800, 7200, 9600	QAM	half, full duplex	synch	auto answer	local digital and loopback, remote digital and analog loopback, self-test		automatic adaptive equalization
9600 A/BR	7200, 9600	QAM	half, full duplex	synch	auto answer	local and remote, digital and analog loopback, self-test		automatic adaptive equalization
DIGITAL COMMUNICATIONS ASSOCIATES INC. (DCA)								
DCA 910	1200, 2400	PSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,095 (Q1)	LCD display; CCITT V.26-, V.26 bis-compatible
DCA 911	1200, 2400	PSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	1,195 (Q1)	Bell 212A-, CCITT V.22-compatible
DCA 920	2400, 4800	PSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1, 695 (Q1)	eye pattern generator, CCITT V.27 bis-/ter-compatible
DCA 930	2400, 4800, 7200, 9600	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	2,795 (Q1)	LCD display, built-in 4-channel multiplexer, CCITT V.29-compatible
DCA 940	4800, 7200, 9600, 14.4K	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	5,395 (Q1)	LCD display, eye-pattern generator, built-in 6-channel multiplexer, CCITT V.29-compatible
GAMMA TECHNOLOGY								
FAXT-96	9600	QAM	half duplex	synch	auto dial/ auto answer	self-test	1,995 (Q1); 1,195 (Q100)	CCITT V.29-, V.27 ter-compatible; board-level modem plugs into IBM PC
GANDALF DATA INC.								
SAM 201	1200, 2400	DPSK	half, full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	725 (Q1)	CCITT V.26-, Bell 201C-compatible; rackmount ($650)
SAM 212A	300, 1200	DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	618 (Q1)	Bell 103-, 113-, 212A-compatible

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SM 9600	9600	QAM	full duplex	synch		local analog loopback, remote digital and analog loopback, self-test	2,800 (Q1)	rackmount; CCITT V.24-, V.28-compatible; opt. integral 4-channel multiplexer
GENERAL DATACOMM INDUSTRIES INC.								
202-9D	1200, 1800	FSK	half, full duplex	asynch		local digital and analog loopback	420 (Q1)	WECO 202C-, 202D-compatible
212A/ED	300, 1200	FSK	full duplex	asynch	manual orig./ auto answer	local digital and analog loopback, self-test	575 (Q1)	Bell 103-, 113-, 212A-compatible; digital adaptive equalizer, standalone
212A/SL	300, 1200	FSK, DPSK	full duplex	asynch	manual orig./ auto answer	local digital and analog loopback, self-test	445 (Q1)	Bell 103-, 113-, 212A-compatible; standalone
DC 201C	1200, 2400	DPSK	half, full duplex	synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	895 (Q1)	Bell 201B-/C-, CCITT V.26 bis-compatible; rackmount ($805)
DC 201C-K	1200, 2400	DPSK	half duplex	synch	auto dial/ auto answer	local analog loopback, self-test	795 (Q1)	Bell 201C-, CCITT V.26 bis-compatible; rackmount ($705); opt. asynch
DC 201-7	1200, 2400	DPSK	half, full duplex	synch		local digital and analog loopback, remote digital loopback, self-test	695 (Q1)	Bell 201C-compatible, rackmount ($605); opt. signal-quality monitor
DC 202S/T	1200, 1800	FSK	half, full duplex	asynch	auto dial/ manual answer	local digital and analog loopback, self-test	535 (Q1)	Bell 202-compatible, rackmount ($445)
DC 202T	1200, 1800	FSK	half, full duplex	asynch		local digital and analog loopback, self-test	485 (Q1)	Bell 202T-compatible, rackmount ($395)
DC 208B/A	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,695 (Q1)	Bell 208A-/B-compatible, rackmount
DC 212A/L	300, 1200	FSK, DPSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	675 (Q1)	Bell 103-, 113-, 212A-compatible; rackmount ($585)
DC 2400ASM	300, 600, 1200, 1800, 2400	DPSK	full duplex	asynch/synch		local digital and analog loopback	825 (Q1)	Bell 201B-/C-compatible, rackmount ($135), point-to-point or polling
DC 2412	1200, 2400	QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,195 (Q1)	Bell 212A-, CCITT V.22-, V.22 bis-compatible; stores 30 numbers, rackmount ($1,105)
DC 4800	4800	DSPK	half, full duplex	asynch/synch		local and remote, digital and analog loopback, self-test	1,495 (Q1)	Bell 208A-compatible, point-to-point or polling
DC 4800S	4800	DPSK	half duplex	asynch/synch	auto dial/ auto answer	local analog loopback, self-test	1,595 (Q1)	Bell 208-compatible; opt. asynch operation
DC 4827	4800	DPSK	half, full duplex	asynch/synch		local and remote, digital and analog loopback, self-test	1,495 (Q1)	CCITT V.27 bis-compatible
DC 9600	4800, 7200, 9600	QAM	half, full duplex	synch		local digital and analog loopback, self-test	1,995 (Q1)	CCITT V.29-compatible
DC 9600EP	4800, 7200, 9600	QAM	half, full duplex	synch		local digital and analog loopback, remote digital loopback, self-test	2,150 (Q1)	CCITT V.29-compatible
DC 9600QPS	4800, 7200, 9600	QAM	half, full duplex	synch		local digital and analog loopback, self-test	2,295 (Q1)	CCITT V.29-compatible

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DC 14400	1200, 9600, 14.4K	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	5,995 (Q1)	CCITT V.29-compatible, point-to-point
GDC 9604	2400, 4800, 7200, 9600	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	2,895 (Q1)	CCITT V.29-compatible
GOULD AMI								
S3521312	1200	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test		2-chip CMOS modem; Bell 103-, 212A-compatible; board-level modem plugs into any computer terminal or bus
HALCYON								
H414	14.4K	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	4,995 (Q1); 3,995 (Q100)	CCITT V.29-compatible; opt. trellis modulation, 6-port TDM multiplexer
H424	1200, 2400	PSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	795 (Q1); 595 (Q100)	CCITT V.22- bis-, Bell 212A-compatible
H448	4800	PSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	2,055 (Q1); 1,250 (Q100)	CCITT V.27 bis-/ter-compatible; opt. trellis modulation, 6-port TDM multiplexer
H496	9600	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,495 (Q1); 995 (Q100)	CCITT V.29-compatible; opt. trellis modulation, 4-port TDM multiplexer
HAYES MICROCOMPTUER PRODUCTS INC.								
Smartmodem 1200	0–300, 1200	PSK	half, full duplex	asynch	auto dial/ auto answer	local analog loop-back, self-test	699 (Q1)	Bell 212A-compatible
Smartmodem 1200B	0–300, 1200	PSK	half, full duplex	asynch	auto dial/ auto answer	local analog loop-back, self-test	539 (Q1)	Bell 212A-compatible, board-level modem plugs into IBM and compatibles
INFINET INC.								
CM2020	1200	FSK	half duplex	asynch	auto dial/ auto answer	self-test	275 (Q1)	Bell 202-compatible
M1200	1200	FSK	half duplex	asynch	manual orig./ manual answer	local digital and analog loopback, self-test	525 (Q1)	Bell 202-compatible
M2400		PSK	half, full duplex	synch	manual orig./ manual answer	local digital and analog loopback, self-test	725 (Q1)	Bell 201-compatible
INFOTRON SYSTEMS CORP.								
DL212B	300, 1200	FSK, PSK	full duplex	asynch/synch	auto answer	local and remote, digital and analog loopback	825 (Q1); 715 (Q100)	Bell 103-, 212A-compatible
DMS/Triple	300, 1200	FSK, PSK	full duplex	asynch/synch	auto answer	local and remote, digital and analog loopback	855 (Q1); 770 (Q100)	Bell 103-, 212A-, Vadic VA3400-compatible
INMAC/DATACOM DIV.								
1970	4800	PSK	half, full duplex	synch	manual orig./ manual answer	local and remote, digital and analog loopback, self-test	1,750 (Q1)	Bell 208A-/B-compatible
1971	4800, 7200, 9600	PSK	half, full duplex	synch	manual orig./ manual answer	local and remote, digital and analog loopback, self-test	1,995 (Q1)	CCITT V.29-, V.27-compatible
8044	0–300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer		499 (Q1)	includes CROSSTALK XVI software; Bell 103-, 113-, 212A-compatible; board-level modem plugs into IBM PC or compatible
8071	1200	PSK	half, full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	295 (Q1)	Bel 103-, 113-compatible

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8077	0–300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer		449 (Q1)	Bell 103-, 212A-compatible
8079	1200, 2400	PSK, DPSK	full duplex	asynch/synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	995 (Q1)	Bell 212-compatible
KINEX CORP.								
48/208AB	2400, 4800	DPSK	half, full duplex	synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	1,700 (Q1)	Bell 208A-/B-, 212-compatible; auto adaptive equalizer, rackmount ($1,650)
2400/FDX	1200, 2400	DPSK	half, full duplex	synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	1,695 (Q1)	CCITT V.26 ter-compatible, auto adaptive equalizer
4800/27	2400, 4800	QAM	half, full duplex	synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	2,100 (Q1)	CCITT V.27 bis-ter-compatible, auto adaptive equalizer
9600/29	4800, 7200, 9600	QAM	half, full duplex	synch	manual orig./ manual answer	local digital and analog loopback, self-test	2,700 (Q1)	CCITT V.29-compatible, rackmount
9600/DCM	4800, 7200, 9600, 14.4K	QAM	full duplex	synch	manual orig./ manual answer	local digital and analog loopback, remote analog loopback, self-test	3,650 (Q1)	CCITT V.29-compatible
9600/FP	4800, 7200, 9600	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	3,350 (Q1)	
9600/M	4800, 7200, 9600	QAM	half, full duplex	synch	manual orig./ manual answer	local digital and analog loopback, remote digital loopback, self-test	3,650 (Q1)	CCITT V.29-compatible
14,400/M Data Express	9600, 12K, 14.4K	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	4,295 (Q1)	CCITT V.29-compatible, multiport
SAB 284	up to 19.2K		half, full duplex	asynch/synch		local digital and analog loopback, remote analog loopback, self-test	345 (Q1)	
LEXICON CORP.								
LEX-15	1200	FSK	half duplex	asynch	manual orig.		325 (Q1)	Bell 202S-compatible; opt. TTL interface
LEX-15B	1200	FSK	half duplex	asynch	manual orig.		395 (Q1)	Bell 202S-compatible, built-in battery pack; opt. TTL interface
MICOM SYSTEMS INC.								
M3012	0–300, 1200	FSK, DPSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	495 (Q1)	standalone; Bell 103-, 212-compatible
M3012+	0–300, 1200	FSK, DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	595 (Q1)	standalone; Bell 103-, 212-compatible
M3012T+		FSK, DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795 (Q1)	standalone; Bell 103-, 212-, Vadic VA3400-compatible
M3012TA	0–300, 1200	FSK, DPSK	full duplex	asynch/synch	auto answer	local digital and analog loopback, remote digital loopback, self-test	695 (Q1)	Bell 103-, 212-, Vadic VA3400-compatible
M3024	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	795 (Q1)	standalone; Bell 212-, CCITT V.22 bis-compatible

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M3024+	1200, 2400	DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	895 (Q1)	standalone; Bell 212-, CCITT V.22 bis-compatible
M3212	0–300, 1200	FSK, DPSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loop-back, self-test	445 (Q1)	Bell 103-, 212-compatible
M3212+		FSK, DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	545 (Q1)	Bell 103-, 212-compatible
M3212T+	0–300, 1200	FSK, DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	745 (Q1)	Bell 103-, 212-, Vadic VA3400-compatible
M3212TA	0–300, 1200	FSK, DPSK	full duplex	asynch/synch	auto answer	local digital and analog loopback, remote digital loop-back, self-test	645 (Q1)	Bell 103-, 212-, Vadic VA3400-compatible
M3224	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loop-back, self-test	745 (Q1)	Bell 212-, CCITT V.22 bis-compatible
M3224+	1200, 2400	DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	845 (Q1)	Bell 212-, CCITT V.22 bis-compatible
MICROPLEX INC.								
VersaCom 212	1200	DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback	289 (Q1); 150 (Q100)	Bell 212-compatible; opt. headset
VersaCom 1200	1200	FSK	half duplex	asynch	auto dial/ auto answer	local digital and analog loopback	187 (Q1); 125 (Q100)	Bell 202-compatible; opt. headset
MULTI-TECH SYSTEMS INC.								
MT212AD	300, 1200	FSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local analog loop-back, remote digital loopback	695 (Q1)	Hayes Smartmodem 1200-, Bell 103-, 113-, 212A-compatible
MT224AD	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch/synch		local digital and analog loopback, remote digital loopback	949 (Q1)	Hayes Smartmodem 1200-, CCITT V.22 bis-, Bell 103-, 113-, 212A-compatible
MultiModem	300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback	549 (Q1)	Hayes Smartmodem-, Bell 103-, 113-, 212A-compatible
MultiModem PC	300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	local analog loop-back, self-test	549 (Q1)	Hayes Smartmodem 1200B-, Bell 103-, 113-, 212A-compatible; board-level modem plugs into IBM PC
MultiModem 212C	1200	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local analog loop-back, self-test	550 (Q1)	board-level modem plugs into IBM PC, menu driven firmware
NCR COMTEN INC.								
7164-0100	4800	DPSK	half, full duplex	synch		local analog loop-back, remote digital loopback, self-test	3,700 (Q1); 2,553 (Q100)	IBM 3864-1-compatible
7164-0200	4800	DPSK	half duplex	synch	auto dial/ auto answer	local analog loop-back, remote digital loopback, self-test	3,850 (Q1); 2,657 (Q100)	IBM 3864-2-compatible
7165-0100	9600	DPSK, QAM	half, full duplex	synch		local analog loop-back, remote digital loopback, self-test	5,800 (Q1); 4,002 (Q100)	IBM 3865-1-compatible
7165-0200	9600	DPSK, QAM	half, full duplex	synch		local analog loop-back, remote digital loopback, self-test	5,800 (Q1); 4,002 (Q100)	IBM 3865-2-compatible

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NOVATION INC.								
CAT COMMU-NICATION SYSTEM	0–300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	499 (Q1)	Bell 103-, 212A-, Hayes-compatible; includes software
CAT COMMU-NICATION SYSTEM	0–300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	499 (Q1)	Hayes-, Bell l03-, 212A-compatible; board-level modem plugs into IBM PC/XT and compatibles; includes software
212 APPLE-CAT	0–300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	self-test	595 (Q1)	Bell 103-, 202-, 212A-compatible; board-level modem plugs into Apple II, II+, IIc; includes software
PARADYNE CORP.								
BTA 1200	1200	DPSK	half, full duplex	asynch	auto dial/ auto answer		655 (Q1)	Bell 212A-compatible
ISP-48	2400, 4800	DPSK	half duplex	synch	manual orig./ auto answer	local digital and analog loopback, self-test		CCITT V.27-compatible
Challenger 24/24	300, 600, 1200, 2400	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	1,100 (Q1)	Bell 103-, 212-, CCITT V.22-, V.22 bis-compatible
Challenger 12000	1200, 9600	QAM	half duplex	synch	manual orig./ auto answer	local digital and analog loopback, self-test		
PENRIL DATACOMM								
AD300/1200	1200	PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	650 (Q1)	Bell 212A-compatible; opt. security access system, rackmount
2024	1200, 2400	PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	895 (Q1)	Bell 212A-, 224-compatible
2127	2400, 4800	DPSK	half duplex	synch	manual orig./ auto answer	local analog loop-back, self-test	1,695 (Q1)	CCITT V.27-compatible
8201-DN	1200, 2400	PSK	half duplex	synch	manual orig./ auto answer	local analog loop-back, self-test	795 (Q1)	Bell 201C-compatible
RACAL-MILGO INFORMATION SYSTEMS								
24 LSI Mark II	2400	DPSK	half, full duplex	synch	manual orig./ auto answer		1,450 (Q1)	point-to-point, central site version; CCITT V.26B-, Bell 201B-, C-compatible
1200 Mark II	0–1200	FSK	half, full duplex	asynch/synch		local and remote, digital and analog loopback, self-test	1,150 (Q1)	rackmount
CMS 12	0–1200	FSK	half, full duplex	asynch/synch		local and remote, digital and analog loopback, self-test	1,900 (Q1)	central site version
CMS 24	2400	DPSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	2,200 (Q1)	standalone, central site version; Bell 201 B-/C-, CCITT V.26B-compatible
Com-Link III	1200–19.2K	delay modulation	half, full duplex	synch		local and remote, digital and analog loopback, self-test	920 (Q1)	central site version, 9 selectable operating speeds, Bell Pub 43401-compatible
Com-Links IIIS	1200–19.2K	delay modulation	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,520 (Q19)	9 selectable operating speeds, 43401-compatible
Mark 48	4800–9600	QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,515 (Q1)	polled multidrop applications; CCITT V.27 bis-, Omnimode-, Racal-Milgo MPS series-, Federal Standard 1006-compatible

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TABLE 1

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Mark 96	4800–9600	QAM	half, full duplex	synch			2,500 (Q1)	polled multidrop applications; CCITT V.29-, Omnimode-, Racal-Milgo MPS series-, Federal Standard 1007-compatible
Omnimode 14.4	14.4K	DPSK, QAM, conventional coded modulation	full duplex	synch		local and remote, digital and analog loopback, self-test	10,000 (Q1); 9,500 (Q100)	central site version
Omnimode 48	2400, 4800	DPSK	full duplex	synch		local and remote, digital and analog loopback, self-test	2,450 (Q1); 2,400 (Q100)	central site version, multiport 2/4 port, CCITT V.27 bis-compatible
Omnimode 48 D	2400, 4800	DPSK	half, full duplex	synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	2,450 (Q1); 2,400 (Q100)	central site version, multiport 2/4 port, CCITT V.27 bis-/ta Ter Comp-compatible
Omnimode 96	9600	DPSK, QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	4,150 (Q1); 4,100 (Q100)	central site version; CCITT V.29-, Racal-Milgo MPS 9601-, 9269-compatible
RACAL-VADIC								
212LC		DPSK	full duplex	asynch	manual orig./ auto answer	local digital and analog loopback, self-test	395 (Q1)	Bell 103-, 212-compatible
212PA		DPSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loop-back, self-test	695 (Q1)	Bell 103-, 212-compatible
1200PC		DPSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback	545 (Q1)	Bell 103-, 212-compatible; George software available, board-level modem plugs into IBM-compatible
1200V		DPSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback	595 (Q1)	Bell 103-, 212-compatible
2400PC		QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback	795 (Q1)	CCITT V.22 bis-, Bell 103-, 212-compatible; George software available; board-level modem plugs into IBM PC
2400V		QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	795 (Q1)	alternate voice/data; internal speaker; CCITT V.22 bis-, Bell 103-, 212-compatible
TANDY CORP./RADIO SHACK								
DC2212	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local analog loopback	399 (Q1)	Bell 212A-compatible
TECH-NEL DATA PRODUCTS LTD.								
Viewdata	75, 1200	FSK	full duplex	asynch	auto dial/ auto answer		295 (Q1); 207 (Q100)	rackmount, Viewdata-compatible
V22 Data Modem	1200	PSK	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	665 (Q1); 532 (Q100)	rackmount, error correction, CCITT V.23-compatible
V23 Data Modem	1200	FSK	half duplex	asynch	auto dial/ auto answer		287 (Q1); 229 (Q100)	rackmount, CCITT V.23-compatible
V26 Data Modem	2400	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	427 (Q1); 341 (Q100)	CCITT V.26-compatible, rackmount
TECMAR INC.								
Modem 1200	1200	FSK	full duplex	asynch	auto dial/ auto answer		695 (Q1)	board-level modem plugs into IBM PC; Bell 103-, 212A-compatible
TEK-COM CORP.								
202T/202S	0–1800	FSK	half, full duplex	asynch	manual orig./ auto answer	local and remote digital loopback, self-test	225 (Q1); 150 (Q100)	Bell 202T-/C-/D-/F-/R-/S-compatible; rackmount

VOICE GRADE DDD MODEMS
TABLE 1

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price ($)	Notes, features, options
212A	300, 1200	FSK, PSK	half, full duplex	asynch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	330 (Q1); 270 (Q100)	rackmount, Bell 212A-compatible
TIMEPLEX INC.								
AIM 2400	2400	DPSK	full duplex	synch		local and remote, digital and analog loopback, self-test	1,050 (Q1)	board-level modem plugs into Timeplex Microplexer family, Bell 3002-compatible, rackmount
AIM 4800	4800	DPSK	full duplex	synch		local and remote, digital and analog loopback, self-test	1,850 (Q1)	board-level modem plugs into Timeplex Microplexer family, Bell 3002-compatible, rackmount
AIM 9600	9600	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	2,000 (Q1)	board-level modem plugs into Timeplex Microplexer family, rackmount
TRANSEND CORP.								
IPI 1200	1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local analog loopback, self-test	599 (Q1); 367 (Q100)	voice/data switching, electronic mail software; Bell 103-, 113-, 212A-, Hayes-compatible; board level modem plugs into IBM PC and compatibles
IPX 1200	1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local analog loopback, self-test	674 (Q1); 413 (Q100)	voice/data switching, electronic mail software; Bell 103-, 113-, 212A-, Hayes-compatible
TRENDATA CORP.								
Ala Modem	1200	PSK	half, full duplex	asynch	auto dial/ auto answer	self-test		Hayes-, Bell 212A-compatible; includes support software, security passwords and dial-back
TRI-DATA								
OZ 533	1200		half, full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	750 (Q1); 515 (Q100)	Bell 212-compatible
U.S. ROBOTICS								
Auto Dial 212A	1200	PSK	half, full duplex	asynch	auto dial/ auto answer	self-test	599 (Q1)	Bell 212A-compatible, automatic error detection
UNIVERSAL DATA SYSTEMS								
201C	2400	DPSK	half duplex	synch	manual orig./ auto answer	local analog loopback, self-test	775 (Q1)	Bell 201-compatible, full-duplex on 4-wire private line, includes test-pattern generator
202LP	0–1200	FSK	half duplex	asynch	manual orig./ auto answer		195 (Q1)	Bell 202-compatible, operates from telephone line current
202S	0–1200	FSK	half duplex	asynch	manual orig./ auto answer	local analog loopback, self-test	475 (Q1)	Bell 202-compatible, includes test-pattern generator
202S/5	0–1200	FSK	half duplex	asynch	manual orig./ auto answer	local analog loopback, self-test	550 (Q1)	Bell 202-compatible
202S/D	0–1200	FSK	half duplex	asynch	auto dial/ auto answer			Bell 202-compatible
202S/SS	0–1200	FSK	half duplex	synch	manual orig./ auto answer	local analog loopback, self-test	550 (Q1)	Bell 202-compatible, includes test-pattern generator
202SLP	0–1200	FSK	half duplex	asynch	manual orig./ auto answer		245 (Q1)	Bell 202-compatible, operates from telephone line current

VOICE GRADE DDD MODEMS
TABLE 1

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price ($)	Notes, features, options
202S/150	0–1200	FSK	half duplex	asynch	manual orig./ auto answer	local analog loop-back, self-test	620 (Q1)	Bell 202-compatible
208A/B	4800	DPSK	half duplex	synch	manual orig./ auto answer	local digital and analog loopback, self-test	1,750 (Q1)	Bell 208-compatible, includes test-pattern generator
212A	0–300, 1200	FSK, PSK	full duplex	asynch/synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	595 (Q1)	Bell 212A-compatible
212A/D	0–300, 1200	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	645 (Q1)	Bell 212A-compatible
212A LP	0–300, 1200	FSK, PSK	full duplex	asynch	manual orig./ auto answer			Bell 212A-compatible, operates from telephone line current
212LP	0–300, 1200	FSK, PSK	full duplex	asynch	manual orig./ manual answer		345 (Q1)	Bell 212A-compatible, operates from telephone line current
224	1200, 2400	QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loop-back, self-test	995 (Q1)	Bell 212A-, CCITT V.22 bis-compatible; diagnostics
9600A/B	4800, 7200, 9600	QAM	half duplex	synch	manual orig./ auto answer	local digital and analog loopback, self-test	1,995 (Q1)	UDS 9600A-/B-compatible, simulates full duplex operation
FASTALK 1200	0–300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local analog loop-back, self-test		Bell 212A-, Hayes-compatible; includes IBM PC software
VEN-TEL INC.								
ALD-1				asynch		local digital and analog loopback	205 (Q1); 155 (Q100)	
ALD-2				asynch		local digital and analog loopback	250 (Q1); 185 (Q100)	
ALD-3				asynch		local digital and analog loopback	275 (Q1); 190 (Q100)	
EC212PLUS	1200	FSK, PSK	full duplex	asynch	auto dial	local digital and analog loopback, remote digital loop-back, self-test	549 (Q1); 410 (Q100)	Bell 103-, 113-, 212-compatible
EC1200-31	1200	FSK, PSK	full duplex	asynch	auto dial	local digital and ana-log loopback, remote digital loopback, self-test	549 (Q1); 410 (Q100)	Bell 103-, 113-, 212-compatible
EC1200-32	1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local analog loop-back, remote digital loopback	499 (Q1); 370 (Q100)	Bell 212A-compatible
MD201-1	2400	DPSK	half, full duplex	synch	auto dial/ auto answer	self-test	730 (Q1); 550 (Q100)	Bell 201C-compatible
MD201-2E	2400	DPSK	half, full duplex	synch	auto dial/ auto answer	self-test	800 (Q1); 600 (Q100)	Bell 201C-compatible
MD201-3	2400	DPSK	half, full duplex	synch		self-test	605 (Q1); 460 (Q100)	Bell 201B-compatible
MD201-4E	2400	DPSK	half, full duplex	synch		local digital loop-back, self-test	675 (Q1); 510 (Q100)	Bell 201B-compatible
MD212-5E	1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and ana-log loopback, remote digital loopback, self-test	625 (Q1); 465 (Q100)	Bell 212A-compatible
MD212-7E SECURITY PLUS	1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, self-test	675 (Q1) 510 (Q100)	Bell 212A-compatible
MD212-8 SECURITY PLUS	1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, self-test	625 (Q1); 465 (Q100)	Bell 212A-compatible

VOICE GRADE DDD MODEMS
TABLE 1

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price ($)	Notes, features, options
PCM1202	1200	FSK	full duplex	asynch	auto dial/ auto answer		499 (Q1); 370 (Q100)	Bell 212A-compatible
PCM-XT HALF CARD	1200	FSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback	549 (Q1); 410 (Q100)	board-level modem plugs into IBM PC and compatibles; Bell 103-, 212A-compatible
PCMH-150P	1200		half, full duplex		auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	425 (Q1); 310 (Q100)	board-level modem plugs into Hewlett-Packard 150; Bell 103-, 212A-compatible
SLD-1				synch		local analog loopback	380 (Q1); 285 (Q100)	
SLD-3E				synch		local analog loopback	450 (Q1); 340 (Q100)	
202-1	0–1200	FSK	half, full duplex	asynch	manual orig./ auto dial	local digital and analog loopback	310 (Q1); 240 (Q100)	Bell 202S-compatible
202-2E	0–1200	FSK	half, full duplex	asynch	auto dial	local digital and analog loopback	380 (Q1); 285 (Q100)	Bell 202S-compatible
202-5	0-1200	FSK	half, full duplex	asynch	auto dial	local digital and analog loopback	280 (Q1); 190 (Q100)	Bell 202T-compatible
212-6	1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	585 (Q1); 435 (Q100)	Bell 212A-compatible
2026E	0–1200		half, full duplex	asynch	auto dial	local digital and analog loopback	350 (Q1); 250 (Q100)	Bell 202T-compatible
VISIONARY ELECTRONICS								
VISIONARY 1200	1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer		795 (Q1)	Bell 212A-compatible, converts word processor to sophisticated telex
WANG LABORATORIES INC.								
WA3451	0–1200	FSK	half, full duplex	asynch/synch	manual orig./ auto answer	local and remote digital loopback, self-test	1,050 (Q1); 850 (Q100)	switchable data rates; Bell 103-, 212-; Vadic 3400-compatible
WOLFDATA INC.								
WD-212-II	1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital loopback, self-test		Bell 272A-compatible, board-level modem plugs into IBM PC; opt. external serial port
WD-212-X	1200	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital loopback		CCITT V.22-, X.25-, Bell 212A-compatible; board-level modem plugs into IBM PC

Information was solicited but not received from the following manufacturers:

Black Box Corp.

Bo-Sherrel Co. Inc.

Digital Equipment Corp.

IBM Corp.

Rockwell International Semiconductor/Products Div.

For information on their products, consult the Supplementary Directory of Manufacturers on page 113.

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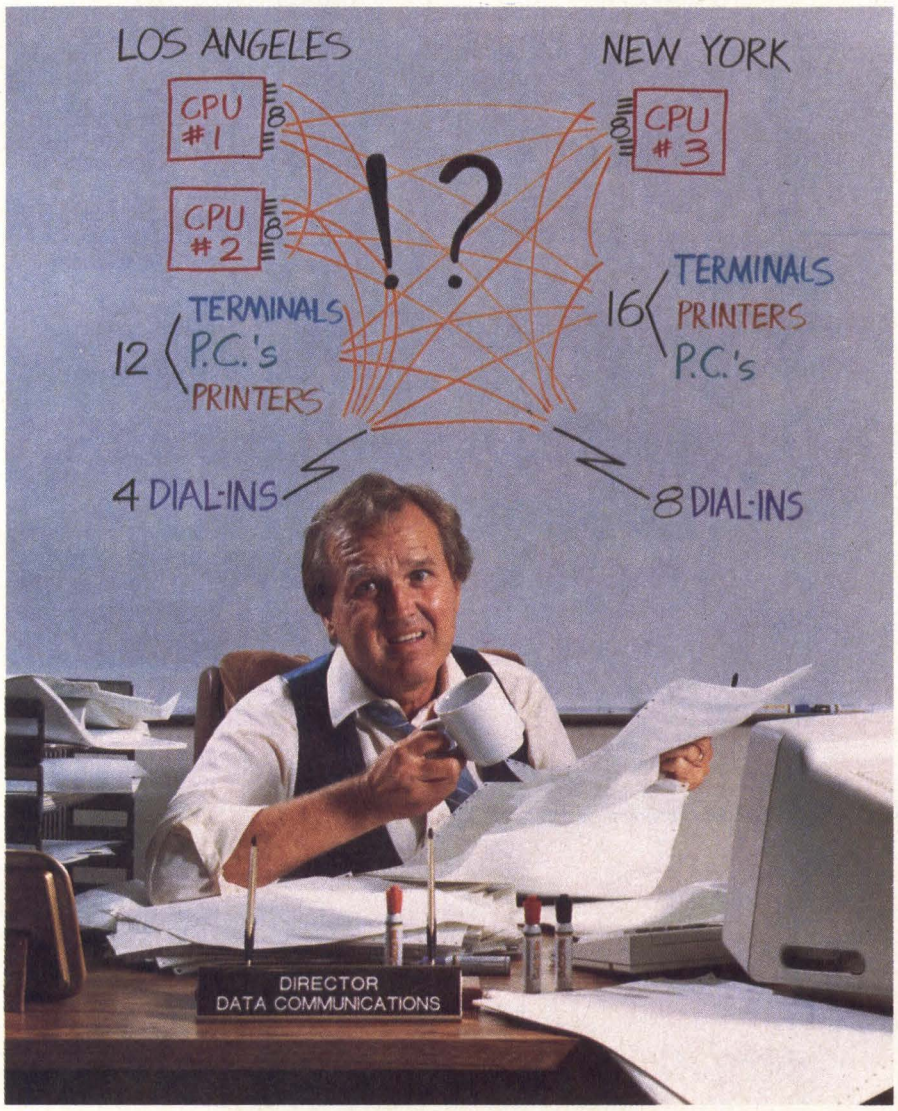

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MULTIPLEXERS KEEP PACE WITH DATACOMM NEEDS

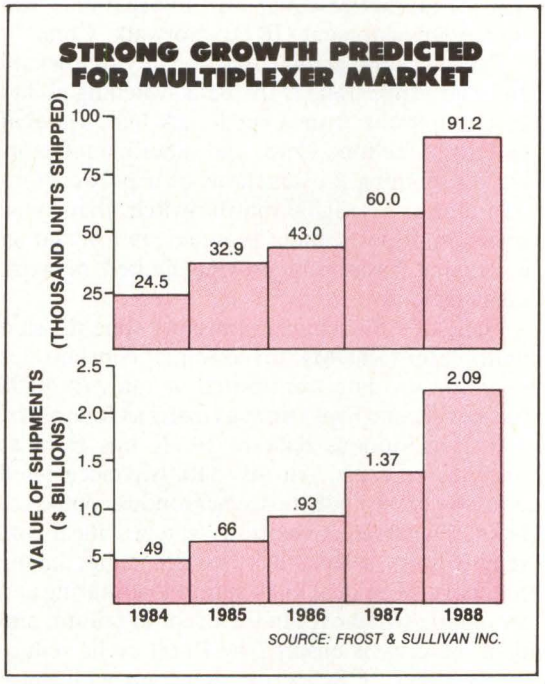
As communications networks increase in size and complexity, multiplexers are meeting the challenges of proliferating terminals, rising datacomm costs and T1, X.25 and satellite links

Jesse Victor, Associate Editor

As the proverbial terminal begins to appear on every proverbial desktop, spiraling data-transmission costs threaten the proverbial bottom line of every company, laboratory, factory or university faced with growing communications needs. Terminals and PCs have to be connected to host computers in the next building, another city or on another coast. Installing cabling for each device or leasing multiple dedicated telephone lines can be expensive for five terminals and prohibitive for 500.

Multiplexers' key role in reducing datacomm line costs has thus assumed added importance in today's complex communications networks. Technologically, too, they have kept pace with users' needs by adding functionality— integrating functions previously performed by other types of datacomm equipment. Low-end and mid-range units are providing data-switching and control capabilities, diagnostics, integrated modems and are performing rudimentary network managment. High-end devices are beginning to take over some of the functions of communications processors and meeting the demands for greater bandwidth and higher transmission speeds by furnishing packet assembly/disassembly (PAD) for X.25 packet-switching systems and by interfacing with satellite links.

Communications planners and system integrators are increasingly turning to multiplexers capable of interfacing with AT&T Communications' T1 digital lines as a cost-effective means of integrating large numbers of remote terminals and providing quality voice, data, facsimile and live-action TV conferencing services. T1 multiplexer developers are also looking ahead to emerging standards and the challenges of future integrated services digital networks (ISDNs).



Multiplexers adding capabilities

"Multiplexers and modems are starting to be commodity products," asserts Richard Amster, director of data communications research at The Yankee Group, Boston. "Vendors are trying to

differentiate their products by integrating functions, increasing capabilities and putting in some network-management features."

"Smaller vendors, particularly, are adding more features at the same product price," adds Laura Schlafly, product line manager for multiplexers at Racal-Milgo, Fort Lauderdale, Fla. "Data-communications functions are merging," agrees Pat Jordan, senior consultant at Datapro Research Corp., Delran, N.J. "They all now have their niche but are starting to overlap. High-end multiplexers, for example, are merging into front-end processors."

"The normal interval we quote customers is a nine-to-12-month delay for installing a T1 line'

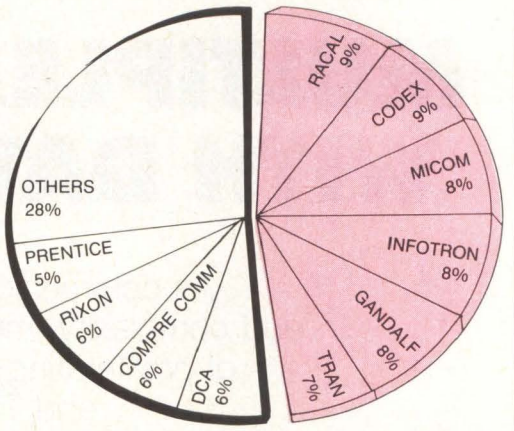
The greater capabilities of today's multiplexers and upward integration of functions is good news for end users and system integrators who need datacomm systems that perform a greater variety of services at lower cost. "The [multiplexer] buyer has a much greater variety of very sophisticated equipment at reasonable prices than ever before," emphasizes Ken Bosomworth, president of market research firm International Resource Development (IRD), Norwalk, Conn.

Typical of the greater functionality of low-end and mid-range units is the data-switching ability of multiplexers from Comdesign Inc., Gandalf Data Inc., Teltone Corp. and other manufacturers. Combining the functions of a port-contention unit and a digital matrix switch, they allow selection of ports under program control and on a demand basis, and provide limited network management.

Gandalf's Switchmux statistical time-division multiplexer (STDM), for example, concentrates synchronous data transmitted at rates to 4,800 bits per second (bps) from as many as four users, and asynchronous data to 19.2K bps from as many as 16 users. All this data is concentrated into one or two 64K-bps synchronous composite links. Dynamic contention switches local and remote users, selectable by service name, among free ports. The dual links permit loadsharing and automatic switchover in the event of failure, and data integrity is ensured by 16-bit cyclic redundancy check (CRC) error detection with automatic request for repeat (ARQ) of transmitted data. Passwords protect access to the system console and user ports. System-management functions include usage and error statistics and diagnostics.

Offering even higher capacity, Teltone's M-861 handles as many as 32 full-duplex, 9,600-bps asynchronous channels or eight 9,600-bps synchronous data streams at composite-link speeds to 76.8K bps. Two to 18 composite links can be supported.

SIX MANUFACTURERS CONTROL NEARLY HALF OF THE 1984 U.S. MULTIPLEXER MARKET



SOURCE: FROST & SULLIVAN INC.

For widely dispersed terminals, multidrop STDMs, such as the 670 Series from Codex Corp., permit dumb asynchronous terminals to share one four-wire, 4,800-bps leased line to the host-computer site. With the master unit at the host computer and slave units in as many as eight remote sites, the master polls the slaves for activity, allowing as many 16 terminals to operate as if each had a dedicated line to the host.

STDMs take over

Indeed, most analysts see intelligent statistical multiplexers, such as the Codex, Gandalf or Teltone units as supplanting time-division multiplexers (TDMs), and particularly data concentrators, in most datacomm applications. STDMs constitute one of the fastest growing areas of the multiplexer market, asserts Bosomworth: "STDMs are taking over. Stat muxes are going way beyond statistical techniques. They are using other techniques such as data compression to get more effective utilization of the data line. TDMs are a fading market." Another market researcher, Frost & Sullivan Inc., New York, forecasts a "dramatic switch" by users from the older time-division multiplexers to "more advanced" statistical multiplexers.

Other analysts, however, don't see such a quick demise for TDMs. These units sequentially gather data from connected terminals, assign each a fixed number of time slots, then transmit the data sequentially in blocks over the high-speed line for separation by the receiving multiplexer. TDMs are generally most efficient when

all terminals transmit at or near their maximum rate; bandwidth is wasted when fill bits are transmitted in place of data. The generally more expensive STDMs, in contrast, assign bandwidth (and time slots) dynamically according to the amount of terminal activity, not according to a fixed pattern, thus maximizing bandwidth utilization.

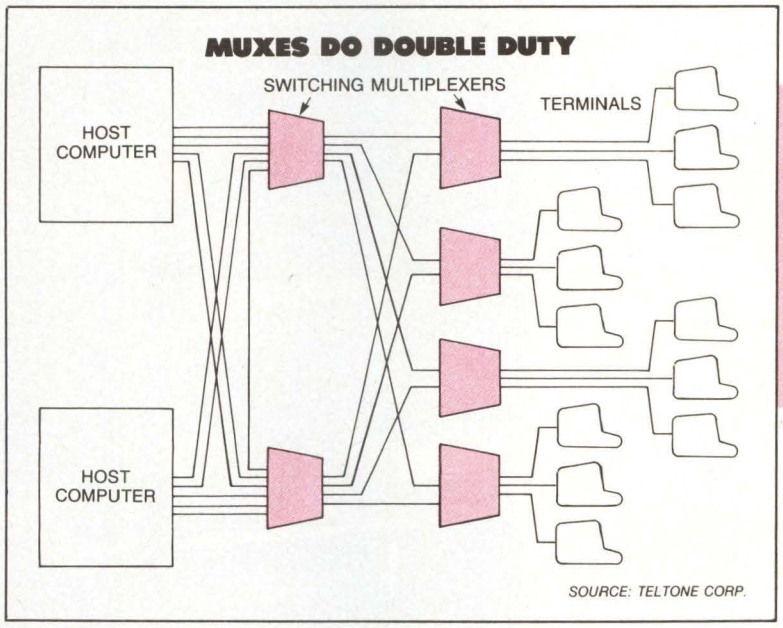
"STDMs generally offer more effective utilization of the line," explains Datapro's Jordan, "but there are applications where the TDM is still most effective. In an IBM Corp. 3270 SNA environment, for example, you are better off with a TDM because SNA does what a stat mux does and fills the line. It's not cost-effective to use a stat mux in this environment." System integrators and end users should select the most cost effective, not necessarily the most technologically advanced, device for their application, Jordan emphasizes. "Saving money is the bottom line in the multiplexer market."

"STDMs do not work very well at high speeds," says Kevin O'Connor, account manager for multiplexers at Timplex Inc., Woodcliff Lake, N.J. "There is no delay with TDMs on a wideband pipe." O'Connor is skeptical of exaggerated claims for STDMs, which he says are sometimes propagated by multiplexer vendors who don't offer a broad line of devices. "The TDM market is still very strong," he claims, "and it's going to increase, [even] if not to the level to which the STDM market is going to grow."

Predicting strong market growth

Despite disagreement on technology, most analysts concur that the overall multiplexer market will enjoy solid growth. Bosomworth predicts 15- to 20-percent "steady" annual growth through the end of the decade. Racal-Milgo's Schlafly sees the market as growing 35 percent to 40 percent "depending on the market segment." Frost & Sullivan is equally optimistic, forecasting greater than 35-percent annual growth in dollar value of shipments through 1988, with the fastest market growth toward the end of the period. Over the same period, unit shipments will increase annually at a greater-than-31-percent rate, the company says.

Data compression, combined with statistical multiplexing, is another technique multiplexer manufacturers are using to boost their products' effective data throughput. "If you can't go to a higher-cost line," stresses Datapro's Jordan, "data compression is one way to squeeze more information onto the line." Chung Communications' Turbo-MUX-2, for example, employs a proprietary compression technique to support two 2,400-bps, full-duplex channels over one 212A data link. Providing automatic error detection and correction, it supports built-in diagnostics and switchable X-on/X-off flow control.



Switching multiplexers *can serve as front-end switches to multiple host computers as well as control access to ports in a redundant network.*

Compressing text, graphics, facsimile and other data at a 2:1 ratio, the Datamizer from Simplex Communications Corp. doubles the net throughput of a 9.6K-bps line to 19.2K bps, allowing four asynchronous or synchronous devices to share the line. The statistical multiplexer supports both bit-oriented (X.25, SDLC, HDLC) or byte-oriented (binary synchronous 2780, 3780, 3270) protocols.

As traffic densities increase and datacomm networks expand across national boundaries, multiplexers are expanding their capabilities to interface with satellite links, X.25 packet-switching systems and digital T.1 lines, as well as the standard dedicated, private or direct dial system (DDS) lines.

Satellite hookups, however, can present special problems for multiplexers, especially for STDMs using the common GO-BACK-N ARQ error-protection scheme. The transmitting multiplexer stores N frames of data, typically seven, for retransmission should an error occur. However, in satellite links, the round-trip delay frequently exceeds the time it takes to send and acknowledge the seven frames. Multiplexers must therefore be able to handle a sufficient number of unacknowledged frames before considering the transmission to be in error. Codex's

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6001 Intelligent Network Processor, for example, offers variable-length ARQ, where N can be as large as 127. It supports as many as eight asynchronous devices at speeds to 9,600 bps and a synchronous trunk rate to 14.4K bps. Optional integral modems operate at 4,800 or 9,600 bps.

X.25 market expands

Links to X.25 packet-switched communications networks are offered by an increasing number of vendors. "X.25 nets are a growing market area," comments The Yankee Group's Amster. "According to our data, 70 percent of all people with DECnets [from Digital Equipment Corp.] intend to have X.25 capability by early this year."

Typical of these multiplexers is Digital Communications Associates Inc.'s INA Terminal Interface Processor. Connecting as many as 32 asynchronous devices and operating to 9.6K bps with a public data network, it supports the three levels of the X.25 protocol. Its X.3 PAD facility interfaces to the network according to Comité Consultatif Internationale Téléphone et Télégraphique (CCITT) X.29 standards. Interfacing to character-mode terminals and hosts follows X.28 recommendations. It also provides automatic baud-rate detection, local Echoplex, firmware-based diagnostics and network-management functions.

The X.25 Link Module for the Infotron Systems Corp.'s 990NP/992NP Network Processor handles as many as 255 channels over a link running at speeds to 72K bps. Either NRZ or NRZ1 bit-transmission format can be selected. Other X.25-compatible multiplexers include Micom Systems Inc.'s M 800/X.25 PAD, Databit Corp.'s ANP 2520 Advanced Network Processor and General Datacomm Industries Inc.'s 1261.

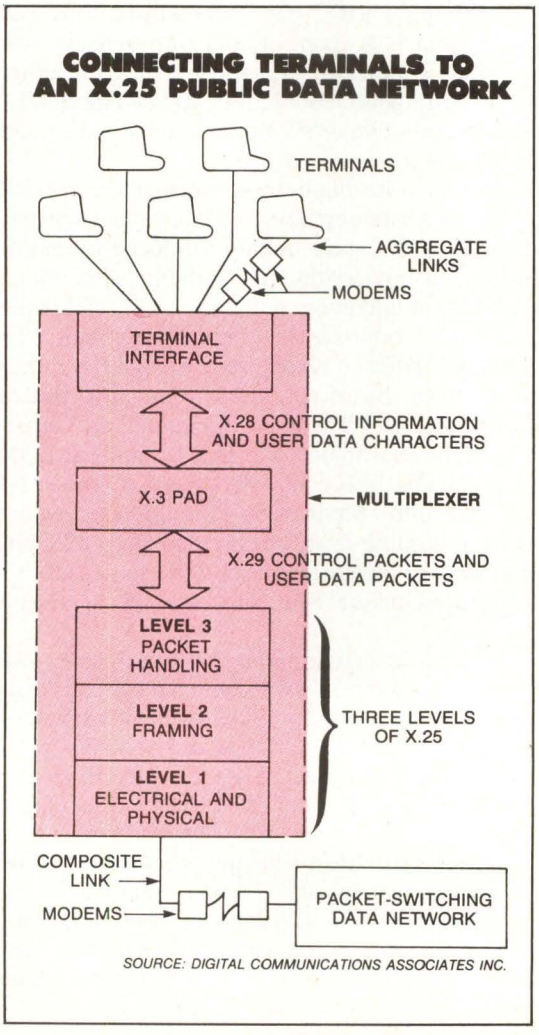
Satellite links and X.25 interfaces notwithstanding, most of the excitement in the multiplexer arena is focused on links to AT&T Communications' T1 1.544M-bps leased digital line. "T1 multiplexers are a hot market item," emphasizes Datapro's Jordan. "For a very large firm, they can multiplex a large number of terminals cost-effectively."

T1 lines slash datacomm costs

"The hottest development in the marketplace today is that all big users are looking at T1 transmission to lower their costs," agrees Timeplex's O'Connor. "T1 gives users the ability to crank both voice and data over the wideband network, eliminating the cost of multiple 9,600- or 56,000-bps lines."

"Companies are replacing a multitude of private lines with one T1 circuit," says P. Christensen, president of T1 multiplexer vendor, Aydin Monitor Systems Division, Fort Washington, Pa. "They are less concerned about the cost of the equipment and more worried about the monthly line charges, which can be rather astronomical. Any money you save on the telephone bill goes right to the bottom line. The incentive is there, the payback is very short, and the cost savings can be dramatic. One large company's [Rockwell International] reduced telephone bill alone will pay for the equipment in only six months."

Christensen points to users' needs for higher capacity and flexibility as driving forces in the T1 multiplexer market. "The T1 leased line rate was set to be slightly less than the equivalent cost of 24 private circuits," he notes. "Obviously, if you can put more than 24 channels on the line, you



Multiplexers connecting terminals *to a public packet-switching network must accommodate three levels of the X.25 standard and perform packet assembly/disassembly (PAD) functions. CCITT recommendations X.28 and X.29 govern interfacing respectively between the PAD unit and the terminals and the X.25 packet-forming facilities.*

get a large savings." In addition, large firms want the flexibility to be able to run several types of services over wideband lines, Christensen says, including facsimile transmissions via modem ("very important to large corporations"), efficient hook-ups for computer data circuits, live-action TV conferencing ("without paying the price the phone company charges") and toll-line-quality voice communications.

'Stat muxes are going way beyond statistical techniques'

Good voice quality is crucial

Christensen particularly stresses the importance of quality digitized-voice transmission. "It's crucial not to degrade voice quality as you add services," he says. "In a large corporation, the senior people get rather sensitive when they can't recognize the voice at the other end." The voice quality of acoustic-modem data transfer, for example, is extremely difficult to control. And the complexity of today's large networks can cause further problems when users have to go through a PBX, get a second dial tone and dial again. "A poor modulation scheme will produce distortion," he warns. "On the other hand, with good modulation, you can modulate/demodulate five or six times and still have good voice quality."

Not all voice digitization schemes are created equal, Christensen says, and he is particularly critical of the voice quality produced by multiplexers using continuous variable slope delta (CVSD) modulation schemes. "The technique does not produce a toll-grade voice circuit," he asserts. "You can recognize a man with a rather deep voice. But if you put a woman on, you've got problems." This type of equipment, Christensen claims, can only transmit facsimile at 1,200 or 1,400 bps. This contrasts, he says, to the 9,600 bps of Aydin's Model 6296 T1 multiplexer, which uses a variable quantum level (VQL), 32K-bit, pulse-code-modulation (PCM), voice-digitization technique and supports 48 aggregate channels.

Racal-Milgo's Omnimux T-1 multiplexer also consolidates multiple voice and data circuits over one high-speed facility. Supporting 48 asynchronous channels to 19.2K bps and as many as 96 synchronous channels to 460.8K bps, it accommodates voice-channel rates to 64 kHz and furnishes centralized network-management and diagnostic capabilites. Channel parameters can be down-line loaded, and the unit is software-configurable from ASCII terminals. The multiplexer also supports synchronous composite transmission at the 2.048M-bps rate available for T1-type services in European networks.

Another TDM product, Timeplex's LINK/1 Facilities Management System, also offers a composite link to 2.048M bps as well as traffic-balancing capability, automatic alternate routing, dynamic bandwidth contention with programmable port priorities and single-point network control. It handles as many as 200 data ports with data rates to 576K bps.

TDMs, such as the Omnimux or LINK/1, are superior to statistical TDMs in T1 applications combining voice and data on the digital line, asserts The Yankee Group's Amster. "STDMs are not very good for voice communications," he says, because the STDM is a store-and-forward device that accepts data and puts it on the line in the next available time slot. But the slot might be delayed, and average delays with a heavy traffic load can run to 150 or 250 msec.

"You start getting unacceptable degradation of voice communications with 150-msec delays," Amster says. "Furthermore, if you want to transmit video using an STDM for T1, you'll have the same kind of problem. You can't have these random delays." For this reason, in the T1 range at least, "the TDM is coming back in," he maintains.

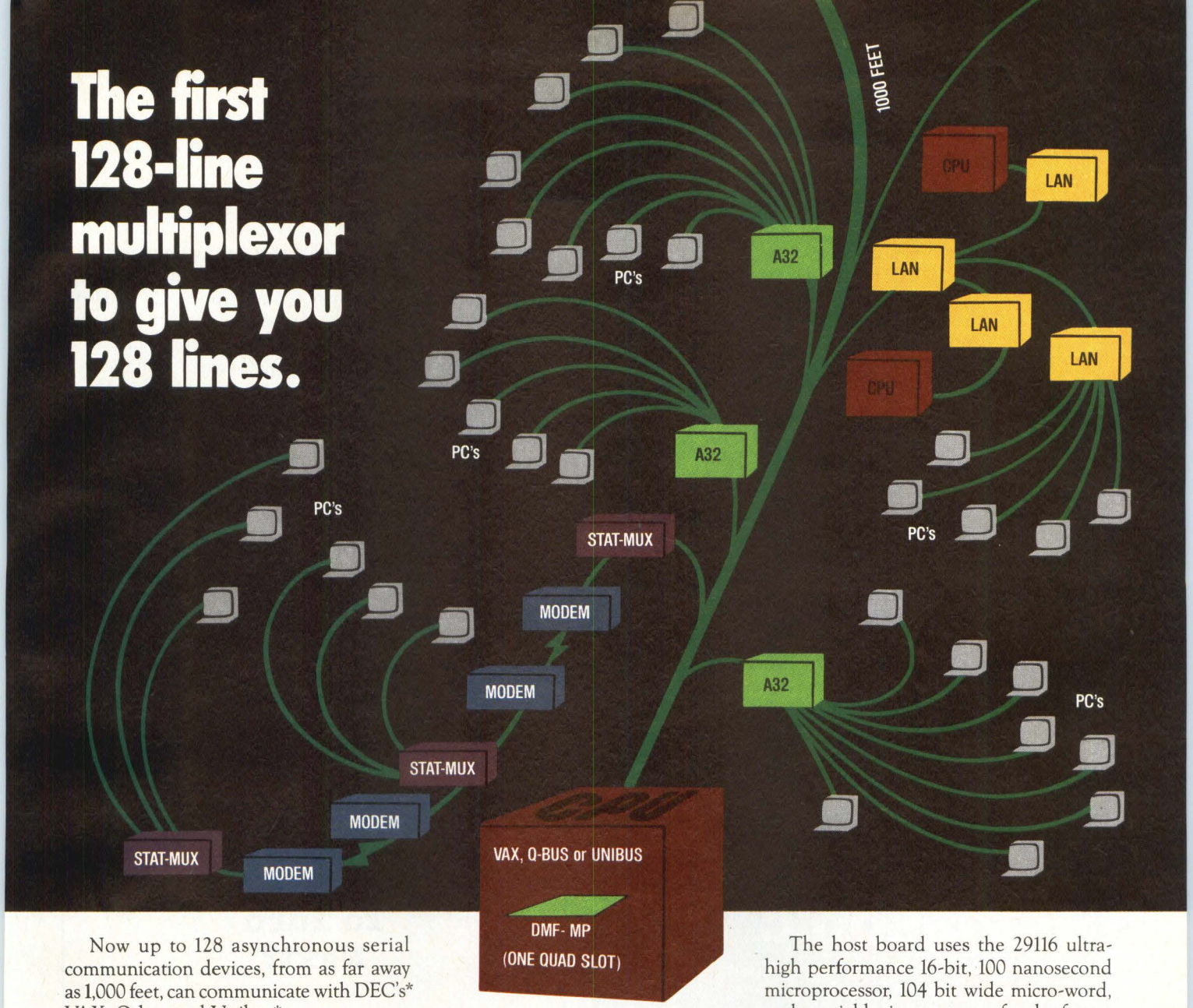
T1 delay decreasing

Clouding the T1 picture for system integrators and end users is the delay in getting T1 lines, which has been pegged at 24 to 28 months by some analysts. This assessment, however, is considered overly pessimistic by sources at AT&T Communications, who say that the situation is finally coming back to normal after the impact of deregulation.

"The normal interval we quote customers is a nine-to-12-month delay for installing a T1 line," stresses Jim Shannon, staff manager of new services development, AT&T Communications, Bedminster, N.J., "and we have been meeting that. As the phone network becomes more digital, and we get all our fiber-optic links in place, the digital service interval should shrink." Service managers would like to see the wait reduced to six months, Shannon adds, but he doesn't anticipate that happening for a few years.

Definitely in the cards for T1 service, though, is a future American National Standards Institute (ANSI) standard and eventual compliance with international CCITT recommendations. "AT&T is represented on the ANSI T1 Committee," says Shannon. "We've taken the position that whatever standards come out of that committee, we will adopt as the interim North American standard until our network has clear-chan-

The first 128-line multiplexor to give you 128 lines.



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nel capability, at which time we will adopt CCITT standards." Clear-channel capability, Shannon says, permits 64K-bps traffic to be transmitted as 64K bps and not as 56K bps to allow for control bits and other overhead.

Further down the road for T1 multiplexer vendors is the challenge of the proposed worldwide integrated services digital network (ISDN). CCITT objectives for ISDN include the integration of voice, data, Telex, X.25 and X.21 interfaces, videotex, electronic mail and electronic funds transfer.

A look at tomorrow's products

Whatever the future impact of the ISDN on product specifications, multiplexers will continue to offer a wider range of functions, analysts say. Racal-Milgo's Schlafly, for example, sees further progress in network control and diagnostics as well as an extension of the access-control features of high-end products. "Access control is becoming available on modems," she observes. "Perhaps we will see secure multiplexers with encryption features on the aggregate links."

"You are going to see the box containing more and more," predicts Amster. "It's going to start containing protocol conversion and gateway software as well as a modem. And it's probably going to have hooks back into network management capability." As multiplexers continue to integrate functions, Amster says, high-end units will be increasingly pressured by digital private branch exchanges (PBXes), which will encroach on multiplexer functions. "PBXes are starting to absorb multiplexers and modems and use them in a shared environment."

Microprocessors and very large-scale integration (VLSI) technology will continue to have a significant impact on multiplexer development, Amster says. "We are seeing chip sets for things that used to take boxes," he observes. "Multiplexers are getting smaller and easier to make. [Tomorrow's units] will do more features for less." □

Interest Quotient (Circle One)
High 453 Medium 454 Low 455

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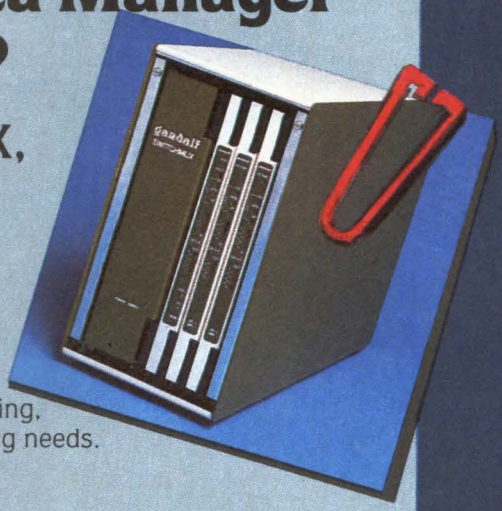

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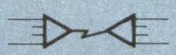

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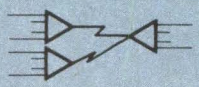

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FREEDOM FOR UNIBUS USERS.

DILOG's 16-channel OPTIMUX/16DMF+ works with all VAX and PDP-11 computers. It's the first one-board controller with all DEC DMF and DH11 functions.

For high-throughput applications, the 16DMF+ offers three important enhancements:

Bidirectional flow control virtually eliminates the potential for data loss.

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The 16DMF+ also offers software-selectable data transfer rates—from 50 bps to 38,400 bps.

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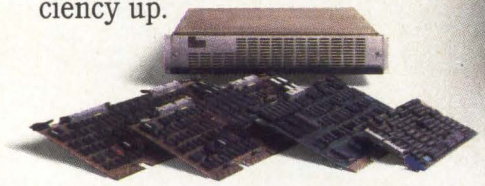
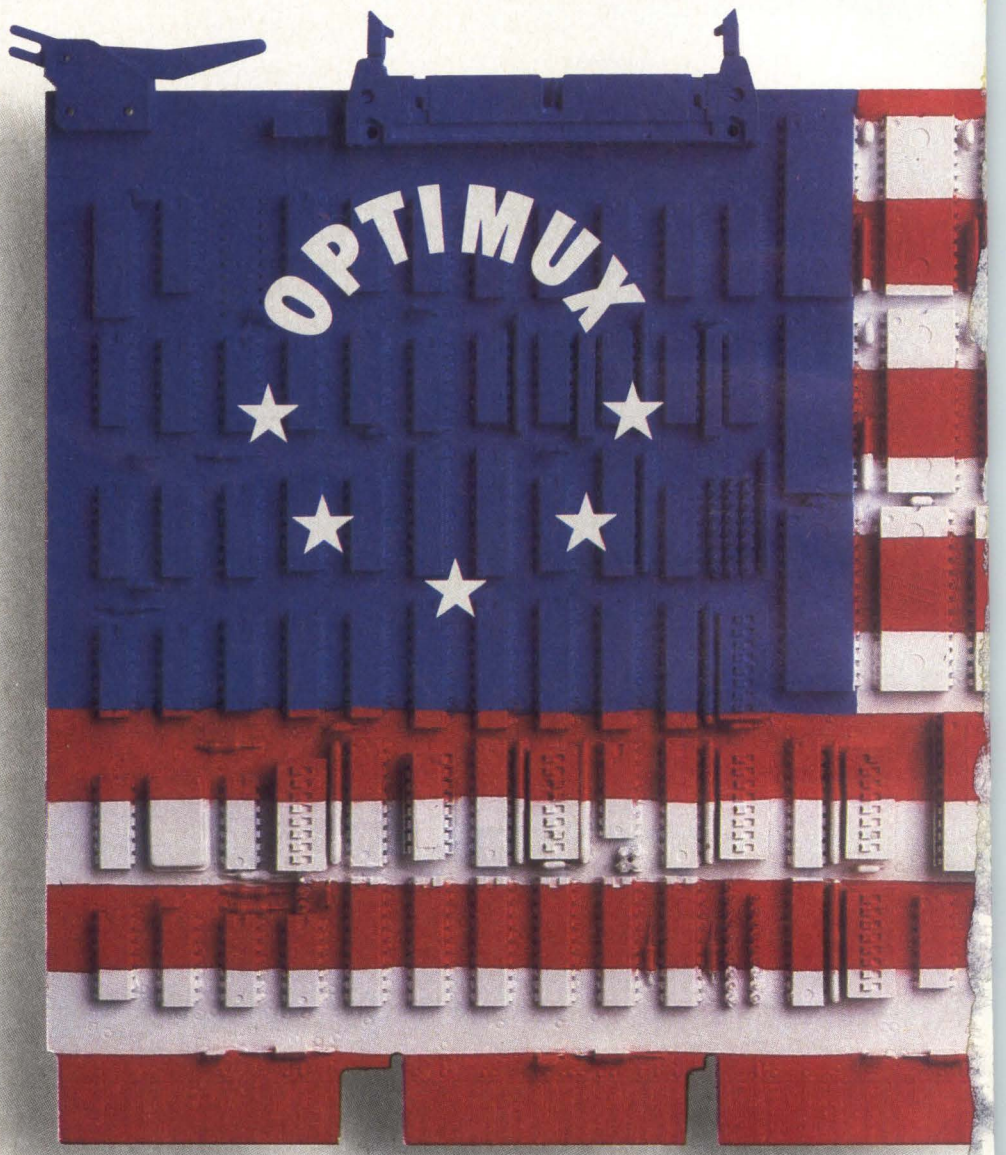


Should you need even greater capacity, there's the add-on 32-channel OPTIMUX/32DMF+. It contains two 16DMF+ boards,



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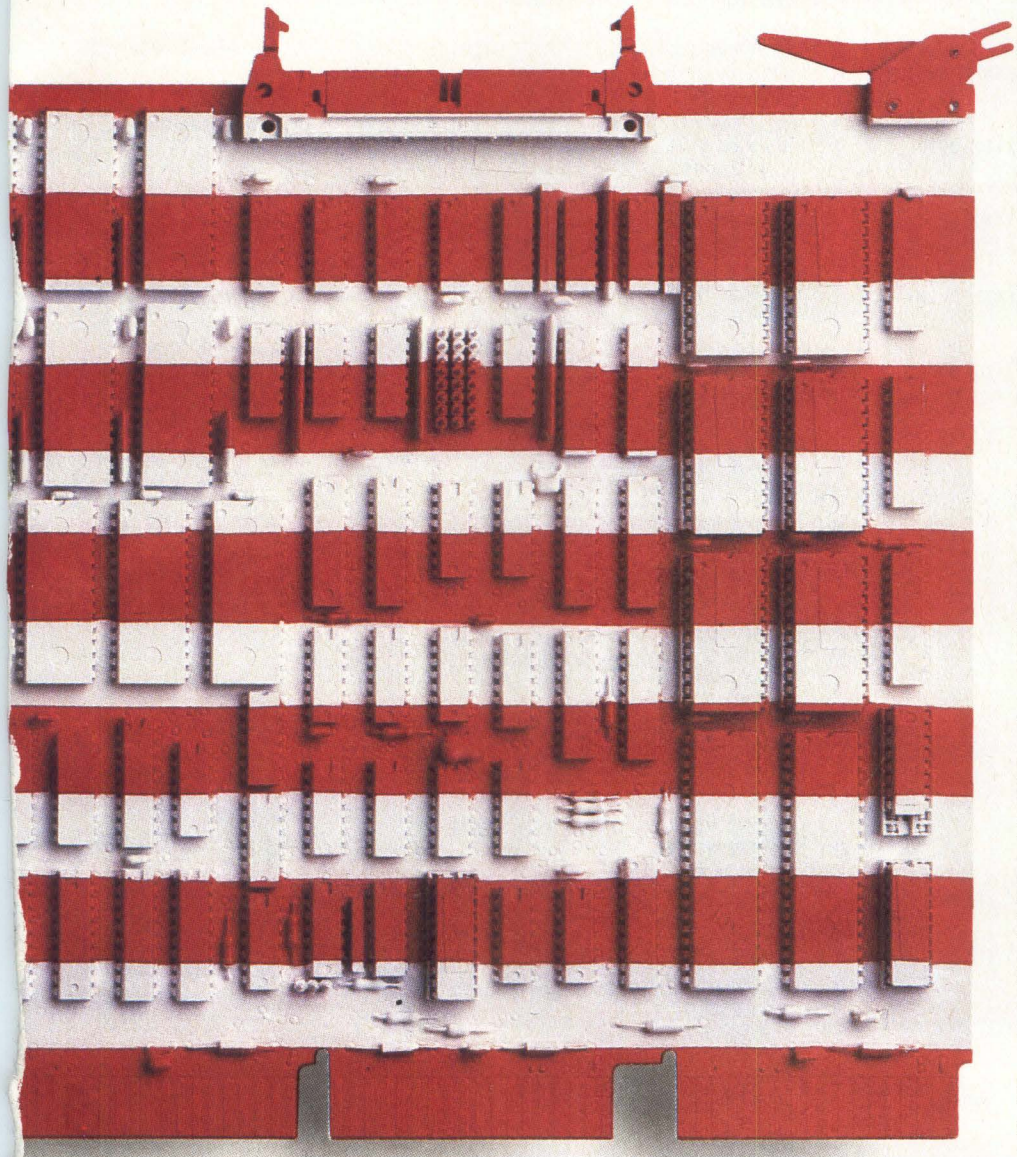

and adds four slots and 20 amps to your host computer. You can daisy-chain two, three, four or more of these units to over 128 channels without using any host power or backplane space!

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For LSI-11 systems, the OPTIMUX/64DH exceeds all the capabilities of DEC's DH11.

Occupying just one backplane slot on the QBUS, this single, quad-height board expands up to 64 asynchronous communications channels in 16-channel increments.

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Still another new product for QBUS is the OPTIMUX/8DZ. It multiplexes eight RS232 data channels on a single, dual-height board and is software compatible to the DZ11 driver.

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MULTIPLEXERS
TABLE 2

Company Model	Input channels: Max. asynch (speed–bps)	Input channels: Max. synch (speed–bps)	Output channels: Max. asynch (speed–bps)	Output channels: Max. synch (speed–bps)	Composite link protocols	Buffer size (K bytes)	Automatic bit rate detection?	Technique	Price ($)	Notes, features, options
AVANTI COMMUNICATIONS										
TPAC1.5		4 (up to 1.344M)		1 (up to 1.544M)	transparent		no	TDM		
ULTRA MUX	128	64 (up to 1.344M)		4 (up to 10M)	transparent		yes	TDM		
BAY TECHNICAL ASSOCIATES										
524E	4 (300–19.2K)		1 (300–19.2K)		CCITT V.24, X-on/X-off, DCE, DTE ports	2	no	STDM	319–359	rackmount; opt. 220V
528E	8 (110–9600)		1 (110–9600)		CCITT V.24, X-on/X-off DCE, DTE ports	4	no	STDM	609–694	rackmount; opt. 220V
5218E	17 (110–9600)		1 (110–9600)		CCITT V.24, X-on/X-off, DCE, DTE ports	8	no	STDM	1,750	rackmount; opt. 220V
524ES	4 (300–19.2K)		1 (300–19.2K)		CCITT V.24, X-on/X-off DCE, DTE ports	2	no	STDM	319–359	rackmount, 220V
528ES	8 (110–9600)		1 (110–9600)		CCITT V.24, X-on/X-off DCE, DTE ports	4	no	STDM	609–694	rackmount, 220V
5218ES	17 (110–9600)		1 (110–9600)		CCITT V.24, X-on/X-off DCE, DTE ports	8	no	STDM	1,750	rackmount, 220V
CASE RIXON COMMUNICATIONS INC.										
840	4–240 (9600)			15 (72K)	CCITT V.35, HDLC, RS232C, RS422, X.25	16–256	yes	STDM		
850	4–240 (9600)			14 (72K)	CCITT V.35, HDLC, RS232C, RS422, X.25	16–256	yes	STDM		
DCX 725		4 (9600)	1 (19.2K)		CCITT V.24, V.28; RS232C		no	bit-interleaved TDM		
DCX 812	8 (9600)			1 (19.2K)	CCITT V.24, RS232C	15	yes	STDM		
DCX 817	2–6 (up to 9600)		1 (19.2K)			8	yes	STDM		
DCX 825	4–32 (9600)	4 (9600)	1 (19.2K)	1 (19.2K)	CCITT V.24, HDLC, X.25	16	yes	STDM		
DCX 836	4–60 (9600)			1 (72K)	CCITT V.35, HDLC, RS232C, RS422, X.25	16–256	yes	STDM		
COMMUX	4–8 (9600)		1 (9600)		HDLC, X.25	5.5	yes			
CHUNG TELECOMMUNICATIONS INC.										
Turbomux-2	2 (1200, 2400)			1 (1200)	X-on/X-off	16	no	STDM	995	ARQ error protection, local and remote loopback
CODEX CORP.										
604 TDM		4 (19.2K)		1 (19.2K)			no	TDM	1,650–2,200	loopback diagnostics
670 STDM	16 (110–4800)		1 (2400)	1 (9600)	X.25 level 2	1.5–14	no	STDM	1,350–5,300	multidrop, individual channel loopback

MULTIPLEXERS
TABLE 2

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6001 INP	8 (50–9600)			1 (14.4K)	X.25 level 2	16	yes	STDM	1,500–4,975	
6002 INP	16 (50–19.2K)			1 (19.2K)	X.25 level 2	32	yes	STDM	1,900–7,675	6000 series compatible
6005 INP	16 (50–19.2K)	16 (50–19.2K)		1 (19.2K)	X.25 level 2, HDLC, SDLC, bisynch	32	yes	STDM	3,300–9,925	local and remote loopback, terminal initiated diagnostics
6035 INP	124 (75–4800)	124 (1200–9600)		3 (19.2K)	X.25 level 2, Codex, HDLC, SDLC, bisynch	16–32	yes	STDM	4,500–25,000	6000 series networking capability, local and remote loopback
6050 DCP	120 (50–19.2K)	120 (50–19.2K)		8 (64K)	X.25 level 2	16–200	yes	STDM	25,000–100,000	adaptive routing, centralized network control, ARQ error protection
COHERENT COMMUNICATIONS SYSTEMS CORP.										
DSM-32		3 (9600)		1 (up to 64K)	CCITT X.21, G.703		no	TDM	2,000	
DSMT-7		6 (19.2K)		1 (64K)	CCITT X.21, G.703		no	TDM	1,500–2,500	
TDM-95	12 (19.2K)			1 (1.5M)	RS232C		no	TDM	295	
COMDESIGN INC.										
TC-500A	32 (50–9600)	28 (1200–9600)	1 (1200–19.2K)	1 (1200–19.2K)	X.25 level 2, SDLC, HDLC, ADCCP ANSI X.3.66	64–320	yes	STDM	1,800–8,000	diagnostics, error correction; opt. rackmount
TS-600	32 (50–9600)	28 (1200–9600)	1 (1200–19.2K)	1 (1200–9600)	X.25 level 2, SDLC, HDLC, ADCCP ANSI X.3.66	64–320	yes	STDM	8,500	diagnostics, error correction; opt. rackmount
TX-700	32 (up to 9600)		1 (up to 19.2K)	1 (19.2K)	CCITT V.24, X.25, LAPB	128–320	yes	STDM	1,950–8,150	diagnostics, error correction, non-volatile store
COMPLEXX SYSTEMS INC.										
TX3	3 (9600)			1 (9600)	proprietary packet switching	16	no	STDM	795	diagnostics, speed conversion
TriMux	3 (9600)			1 (9600)	proprietary packet switching	16	no	STDM	995	diagnostics, speed conversion
TriMux.M	3 (9600)		1 (2400)	1 (9600)	proprietary packet switching	16	no	STDM	1,625	speed conversion
TriMux.212	3 (9600)		1 (1200)	1 (9600)	proprietary packet switching	16	no	STDM	1,495	speed conversion
CONCORD DATA SYSTEMS INC.										
224 SUPERDUPLEX	3 (9600)		1 (2400)		SDLC		yes	STDM	1,575–1,695	diagnostics, error correction
DATABIT INC.										
ANP 2520	128 (19.2K)	128 (19.2K)		6 (56K)	X.75 proprietary	512	yes	STDM		
DATA COMMUNICATIONS BROKERS INC.										
LINK 2	2 (9600)		1 (9600)	1 (9600)	proprietary	6	no	STDM	795	
LINK 4	4 (9600)		1 (9600)	1 (9600)	proprietary	12	no	STDM	1,195	
DATAGRAM CORP.										
DM900	9 (75–9600)	1 (1200–9600)	1 (9600)	1 (19.2K)	X.25 level 2, X-on/X-off	16–64	yes	STDM	1,250–2,150	ARQ error protection, local and remote, terminal and channel loopback, self-test
DM1600	16 (75–9600)	2 (1200–9600)	1 (9600)	1 (19.2K)	X.25 level 2, X-on/X-off	16–64	yes	STDM	1,800–4,200	ARQ error protection, local and remote, terminal and channel loopback, self-test

MULTIPLEXERS
TABLE 2

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DM4800	52 (75–9600)	4 (1200–9600)	1 (9600)	1 (19.2K)	X.25 level 2, X-on/X-off	16–64	yes	STDM	3,650–13,250	ARQ error protection, local and remote, terminal and channel loopback, self-test
DATATEL INC.										
DCP5000	4 (9600)			1 (19.2K)	SDLC	16	yes	STDM	1,300	channels configured independently
DCP5020	2 (9600)			1 (19.2K)	SDLC	16	yes	STDM	1,100	channels configured independently
DEVELCON ELECTRONICS INC.										
DS-1600	4–16 (up to 9600)		1 (up to 19.2K)	1 (up to 19.2K)	X.25 level 2	16–64	yes	STDM	2,600–5,000	diagnostics, statistics, error checking
DS-1800	3–9 (up to 9600)		1 (up to 19.2K)	1 (up to 19.2K)	X.25 level 2	16–64	yes	STDM	1,550–2,750	diagnostics, statistics, error checking
DS-4800	4–52 (up to 9600)		1 (up to 19.2K)	1 (up to 19.2K)	X.25 level 2	16–64	yes	STDM	3,650–13,250	diagnostics, statistics, error checking
DIGITAL COMMUNICATIONS ASSOCIATES INC. (DCA)										
System 110	8 (50–9600)			1 (19.2K)	transparent, DDCMP	20	yes	STDM	1,495 (4 port)	buffer allocation, error checking; opt. network management
System 120	32 (50–9600)			1 (19.2K)	transparent, DDCMP	20	yes	STDM	2,450 (4 port)	buffer allocation, error checking, network management
System 125	32 (50–9600)			1 (19.2K)	transparent, DDCMP	26	yes	STDM	3,250 (16 port)	ARQ error correction, dynamic buffer allocation, diagnostics, error checking
System 205	128 (110–9600)			1 (9600)	transparent, DDCMP	6	yes	STDM	4,250	derives power from DEC Unibus, replaces up to 16 DEC DZ11, diagnostics, error checking, network management, board level
System 207	128 (110–9600)			2 (38.4K)	transparent, DDCMP	32	yes	STDM	4,950	board level, replaces up to 16 DEC DMF 32, diagnostics, error checking, network management
System 325 (NetSwitch)	1120			8 (19.2K)	transparent, DDCMP	736	yes	STDM	11,595 (32 port)	host selection, diagnostics, error checking, network management
System 335	42 (110–9600)			4 (4800–56K)	X.25, DDCMP	736	yes	STDM	6,795	diagnostics, error checking, host selection, network management
System 355	126 (110–9600)			44 (4800–56K)	X.25, DDMCP	736	yes	STDM	9,995	diagnostics, error checking, host selection, network management
System 375	126 (110–9600)			22 (4800–56K)	X.25, DDCMP	736	yes	STDM	16,995	diagnostics, error checking, host selection, network management
INA/X.25 PAD	32 (9600)			1 (19.2K)	X.25, X.3 PAD support	25	yes	STDM	2,495 (4 port)	ARQ error control, network management
DOELZ NETWORKS INC.										
ELITE ONE	16 (9600)	16 (9600)		6 (72K)	transparent	128	yes			
ESPRIT ONE	1072 (19.2K)	1072 (19.2K)		67 (72K)	transparent	128–1M	yes			
EMULEX CORP.										
C521/F	16 (50–19.2K)			1	DEC Unibus		no	TDM	2,950	compatible with DEC DMF32
CS01/H	64 (50–19.2K)			1	DEC Q-bus		no	TDM	3,000–13,000	compatible with DEC DH11
CS02/H	16 (50–38.4K)			1	DEC Q-bus		no	TDM	2,300	compatible with DEC DH11, DHV11

MULTIPLEXERS
TABLE 2

Company Model	Input channels: Max. asynch (speed-bps)	Input channels: Max. synch (speed-bps)	Output channels: Max. asynch (speed-bps)	Output channels: Max. synch (speed-bps)	Composite link protocols	Buffer size (K bytes)	Automatic bit rate detection?	Technique	Price ($)	Notes, features, options
CS11/F	48 (50–19.2K)			1	DEC Unibus		no	TDM	4,500–10,500	compatible with DEC DMF32
CS11/H	64 (50–19.2K)			1	DEC Unibus		no	TDM	3,500–13,500	compatible with DEC DH11
CS11/U	64 (50–19.2K)			1	DEC Unibus		no	TDM	3,950–13,950	compatible with DEC DH11
CS11/V	32 (50–19.2K)	32 (1200–9600)		1	DEC Unibus		no	TDM	4,950–9,700	
CS21/H	16 (50–19.2K)			1	DEC Unibus		no	TDM	2,950	compatible with DEC DH11
CS21/U	16 (50–19.2K)			1	DEC Unibus		no	TDM	3,450	includes DEC VAX/VMS driver, compatible with DEC DH11
CS21/2	16 (50–19.2K)			1	DEC Unibus		no	TDM	2,950	compatible with DEC DZ11
CS32/F	128 (50–38.4K)			1	DEC Unibus		no	TDM	5,000–27,400	compatible with DEC DMF32
STATCON SERIES 11	64 (50–9600)			1 (up to 19.2K)	proprietary	15	yes	STDM	7,300	compatible with DEC DH11
STATCON SERIES 21	32 (50–9600)			1 (up to 19.2K)	proprietary	15	yes	STDM	6,300	compatible with DEC DH11, DZ11
STATCON SERIES 32	256 (50–9600)			1 (up to 19.2K)	proprietary	15	yes	STDM	8,100	compatible with DEC DMF32
GANDALF DATA INC.										
Line Miser GLM 504		4 (56K)		1 (56K)	transparent		yes	bit-interleaved synch TDM	1,550	local loopback, remote test modes
Line Miser GLM 510	8 (9600)			1 (270)	transparent		yes	TDM	425–600	opt. rackmount
PIN 9103	32 (9600)			1 (19.2K)	HDLC, X.25 level 1–2, HP ENQ/ACK	4–12	yes	STDM	1,650–2,750	statistics, diagnostics; opt. rackmount
PIN 9106	4 (9600)		1 (9600)	1 (9600)	SDLC	3	yes	STDM	825–1,085	error correction, diagnostics
PIN 9101E	16 (9600)			1 (19.2K)	HDLC, CCITT X.28, X.29, LAPB, X.25 level 1–2–3	4–12	yes	STDM	2,650–5,150	diagnostics; opt. rackmount
SWITCHMUX	16 (19.2K)	4 (4800)		2 (64K)	HDLC	128	yes	STDM	2,050–4,350	local and remote switching, password protection; opt. rackmount
GENERAL DATACOMM INC.										
1223 Telex	46 (50–300)			1 (2400)	synch		no	TDM	7,500	point-to-point, rackmount
TDM 1202	96 (37.5–9600)			1 (72K)	synch		no	non-STDM	6,500	test pattern, message generator
TDM 1205	16 (37.5–9600)			1 (72K)	synch		no	non-STDM	3,600	point-to-point, rackmount
TDM 1209 Series	4 (75–9600)			1 (9600)	synch		no	non-STDM	995	point-to-point, rackmount
Gen Net 1261/4-8	4–8 (50–9600)			1 (19.2K)	X.25		no	STDM	1,330–2,090	point-to-point
Gen Net 1262/08	4 (expandable to 96) (19.2K)			1–4 (256K)	X.25 level 2		no	STDM	4,850	diagnostics

MULTIPLEXERS
TABLE 2

Company Model	Input channels: Max. asynch (speed–bps)	Input channels: Max. synch (speed–bps)	Output channels: Max. asynch (speed–bps)	Output channels: Max. synch (speed–bps)	Composite link protocols	Buffer size (K bytes)	Automatic bit rate detection?	Technique	Price ($)	Notes, features, options
HALCYON										
4001	32 (50–9600)		1 (19.2K)	1 (9600)	X.25 level 2		yes	STDM	1,895–7,895	
4002	32 (50–9600)		1 (19.2K)	1 (9600)	X.25 level 2		yes	STDM	3,290–8,590 (8 port)	
4220	60 (50–9600)	12 (1200–9600)		2 (19.2K)	X.25 level 2		yes	STDM	4,500–21,500	
INFOTRON SYSTEMS CORP.										
790NC	over 600 (9600)	over 600 (9600)		12 (64K)	proprietary		yes	STDM	10,000–50,000	error correction diagnostics
792NC	56 (9600)	56 (9600)		12 (64K)	proprietary		yes	STDM	5,000–15,000	
990NP	640 (9600)	640 (9600)		12 (64K)	proprietary		yes	STDM	16,000–60,000	auto path rerouting, single point network management
992NP	56 (9600)	56 (9600)		12 (64K)	proprietary		yes	STDM	8,000–18,000	auto path rerouting, single point network management
SM380	8 (9600)		1	1 (19.2K)	SDLC	1–2	yes	STDM	1,480	opt. 1 synch channel input with built-in modem
SM480	8 (9600)		1	1 (9600)	SDLC	1–2	yes	STDM	1,900	
SM616	16 (9600)	(9600)			2 (19.2K)	SDLC	2	yes		1,900
SM632	32 (9600)	(9600)			2 (19.2K)	SDLC	2	yes		4,000
MEGADATA CORP.										
SM/5X	4 (up to 19.2K)	4 (up to 19.2K)	1 (up to 19.2K)	1 (up to 19.2K)	bisynch	64	no		995–2,000	self-test, polling, statistics, diagnostics, soft set-up
MICOM SYSTEMS INC.										
M800/X.25	24 (9600)			1 (19.2K)	X.25 level 3	32	yes	STDM	2,050–6,250	opt. channels configured independently
Micro 800/2	2–16 (9600)	4 (9600)	1 (9600)	1 (19.2K)	ADLC (HDLC-like proprietary), HDLC, BSG	16	yes	STDM	1.450–4,600	diagnostics, satellite link support, ARQ error checking
Micro 900/2	1–16 (9600)		1 (9600)	1 (9600)	ADLC (HDLC-like proprietary)	14	no	STDM	900–4,600	diagnostics
MINNTRONICS CORP.										
DL4-11	4 (50–19.2K)		4 (50–19.2K)		serial		no		825–1,100	switch selectable configuration
OCTOMUX	8 (50–38.4K)		8 (50–38.4K)		serial	128	no		647–995	switch selectable configuration
MULTI-TECH SYSTEMS INC.										
MultiMux 402	2 (110–9600)	1 (9600)		1 (9600)	modified HDLC	1–2		STDM	1,195–1,445	error checking; opt. automatic bit rate detection
MultiMux 404	4 (110–9600)	1 (9600)		1 (9600)	modified HDLC	1–4		STDM	1,495–1,745	error checking, diagnostics; opt. automatic bit rate detection
MultiMux 404-201B	4 (110–9600)	1 (9600)		1 (2400)	modified HDLC	1–4		STDM	1,995–2,245	error checking diagnostics; opt. automatic bit rate detection
MultiMux 804	4 (expandable to 8) (9600)	1 (9600)		1 (9600)	modified HDLC	1–4		STDM	1,795–2,795	error checking diagnostics; opt. automatic bit rate detection
MultiMux 808	8 (9600)	1 (9600)		1 (9600)	modified HDLC	1–8		STDM	2,395–2,645	error checking; opt. automatic bit rate detection

MULTIPLEXERS
TABLE 2

Company Model	Input channels: Max. asynch (speed–bps)	Input channels: Max. synch (speed–bps)	Output channels: Max. asynch (speed–bps)	Output channels: Max. synch (speed–bps)	Composite link protocols	Buffer size (K bytes)	Automatic bit rate detection?	Technique	Price ($)	Notes, features, options
NETWORK PRODUCTS INC.										
BabyMux	8 (up to 19.2K)		1 (9600)	1 (19.2K)	HDLC	6–16	no	STDM	1,350–2,300	error correction, full statistics, diagnostics
BabyNet	8 (up to 9600)			1 (9600)	HDLC	6–16	yes	STDM	1,450–2,400	multidrop switch retention, full statistics, diagnostics
LocalMux	8 (up to 19.2K)	8 (38.4)		1 (937.5K)			yes	STDM	850	
PARADYNE CORP.										
DCX 725		4 (1200–9600)	1 (19.2K)			4	no	STDM	4,000	point-to-point, rackmount
DCX 815	8 (50–9600)	4 (1200–9600)	1 (19.2K)		HDLC, X.25 level 2	4	yes	STDM	1,900–2,700	point-to-point
DCX 825	32 (50–9600)		1 (19.2K)		HDLC, X.25 level 2	16	yes	STDM	5,000–11,000	point-to-point
DCX 840	4 (50–9600)	2 (1200–9600)	15 (56K)		HDLC, X.25 level 2	16–64	yes	STDM	600–100,000	point-to-point, rackmount
DCX 850	4 (50–9600)	2 (1200–9600)	14 (56K)		HDLC, X.25 level 2	16–64	yes	STDM	700–150,000	point-to-point, rackmount
DCX 861	8 (50–9600)		1 (9600)		HDLC, X.25 level 2	4	yes	STDM	3,900	point-to-point, rackmount
DCX 871	32 (50–9600)	3–9 (1200–9600)	1 (9600)		HDLC, X.25 level 2		yes	STDM	3,900	point-to-point, rackmount
PENRIL DATACOMM										
6814-01	4 (75–9600)			1 (19.2K)	X.25	4	yes	STDM	1,750	diagnostics, ARQ error protection, rackmount, channels configured independently
6814-02	8 (75–9600)			1 (19.2K)	X.25	4	yes	STDM	2,195	diagnostics, ARQ error protection, rackmount, channels configured independently
PRENTICE CORP.										
SNP 1111	1 (19.2K)			1 (9600)	HDLC, X-on/X-off, HP ENQ/ACK	4	no	STDM	695	CRC error checking, channels configured independently, EIA signals
SNP 1114	4 (19.2K)			1 (9600)	HDLC, X-on/X-off, HP ENQ/ACK	4	no	STDM	1,295	CRC error checking, channels configured independently, EIA signals
SNP 1214	4 (expandable to 8 channel) (19.2K)			1 (9600)	HDLC, X-on/X-off, HP ENQ/ACK	8	no	STDM	1,495	CRC error checking, channels configured independently, EIA signals; opt. synch channel
SNP 1218	8 (110–9600)			1 (1200–9600)	HDLC, X-on/X-off, HP ENQ/ACK	8	no	STDM	1,995	CRC error checking, EIA signals, speed conversion, channels configured independently
SNP 1219	8 (110–9600)	1 (1200–9600)		1 (1200–9600)	HDLC, HP ENQ/ACK	8	no	STDM	2,595	CRC error checking, EIA signals, speed conversion, channels configured independently; opt. synch channel
SNP 1259	8 (110–9600)	1 (1200–9600)		1 (1200–9600)	HDLC, HP ENQ/ACK	8	yes	STDM	2,795	CRC error checking, EIA signal, speed conversion, channels configured independently; opt. asynch channels
RACAL-MILGO INC.										
Omnimux 4	4 (50–9600)			1 (1200–9600)	HDLC (modified)	8	yes	STDM	1,200–2,300	channels configured independently, aggregate/channel loopback, self-test diagnostics

MULTIPLEXERS
TABLE 2

Company / Model	Input channels: Max. asynch (speed–bps)	Input channels: Max. synch (speed–bps)	Output channels: Max. asynch (speed–bps)	Output channels: Max. synch (speed–bps)	Composite link protocols	Buffer size (K bytes)	Automatic bit rate detection?	Technique	Price ($)	Notes, features, options
Omnimux 8	8 (50–9600)			1 (1200–9600)	HDLC (modified)	8	yes	STDM	1,200–2,300	channels configured independently, aggregate/channel loopback, self-test diagnostics
Omnimux 80/160/320	32 (50–9600)	32 (1200–19.2K)		2 (1.2–72K)	HDLC (modified)	8	yes	STDM	2,475–11,700	channels configured independently, aggregate/channel loopback, test message generator, channel, link statistics
Omnimux T-1	48 (110–19.2K)	96 (4.8–460.8K)		1 (up to 2.048M)	bit-interleaved			TDM	8,000–58,000	channels configured independently, diagnostics, redundant power and logic
Omnimux TDM-56		8 (1.2–32K)		1 (9.6–72K)	bit-interleaved			TDM	3,200	channels configured independently, rackmount
RACAL-VADIC										
SCOTSMAN I	8 (50–9600)		1 (9600)		modified HDLC	4–8	yes	STDM	1,850–5,100	diagnostics, error correction, channels configured independently
SCOTSMAN II	8 (50–9600)	8 (up to 9600)	1 (19.2K)	1 (19.2K)	modified HDLC	4–8	yes	STDM	2,950–5,750	diagnostics, error correction, channels configured independently
SCITEC CORP.										
MUX25	4 (50–9600)		1 (9600)	1 (19.2K)	X.25 level 2	2–8	yes	STDM	1,450	local, remote diagnostics; fax message, ARQ error control; opt. satellite
NPX25	32 (50–19.2K)	8 (1200–9600)	2 (9600)	2 (9600)	X.25 level 2	2–8	yes	STDM	2,000–10,000	local, remote diagnostics; fax message, ARQ error control; opt. satellite
NPX25-WB	16 (50–19.2K)	4 (1200–9600)	1	1 (56K)	X.25 level 2	2–8	yes	STDM	2,000–10,000	local, remote diagnostics; fax message, ARQ error control; opt. satellite
SYMPLEX COMMUNICATIONS CORP.										
Datamizer SDC-4	4 (300–19.2K)	4 (1200–19.2K)		1 (up to 9600)	X.25 level 2, X-on/X-off	two 14.5	no	STDM		ARQ error protection, diagnostics, statistics
TELLABS										
330A-F	32 (50–9600)	8 (1200–9600)		1–2 (up to 76.8K)	X.25 level 2	25	yes	STDM	2,400–11,900	dynamic buffer allocation; opt. local line driver interface
331	32 (50–9600)	8 (1200–9600)		18 (up to 76.8K)	X.25 level 2	25	yes	STDM	2,900–12,900	dynamic buffer allocation; opt. line driver/receiver
430	128 (50–9600)	128 (1200–512K)		up to 2 (up to 2.048M)	transparent			TDM	5,900	supports a variety of data channel and aggregate link options
TELTONE CORP.										
M-860A	32 (up to 9600)	8 (1200–9600)		1 (76.8K)	SDLC, HDLC, bisynch	25	yes	STDM	2,600–7,300	self-test diagnostics, system statistics, CRC error correction
M-860C	32 (up to 9600)	8 (1200–9600)		1 (56K)	SDLC, HDLC, bisynch	25	yes	STDM	2,800–7,500	self-test diagnostics, system statistics, CRC error correction
M-860D	32 (up to 9600)	8 (1200–9600)		1 (76.8K)	SDLC, HDLC, bisynch	25	yes	STDM	3,100–7,800	self-test diagnostics, system statistics, CRC error correction
TIMEPLEX INC.										
E/4	4 (up to 9600)	1		1 (up to 9600)	proprietary	16	no	STDM	1,650 and up	
E/8	8 (up to 9600)			1 (up to 9600)	proprietary	16	no	STDM	2,250 and up	
E/12	12 (up to 9600)	1		1 (up to 9600)	proprietary	16	no	STDM	3,450 and up	

MULTIPLEXERS
TABLE 2

Company Model	Input channels: Max. asynch (speed–bps)	Input channels: Max. synch (speed–bps)	Output channels: Max. asynch (speed–bps)	Output channels: Max. synch (speed–bps)	Composite link protocols	Buffer size (K bytes)	Automatic bit rate detection?	Technique	Price ($)	Notes, features, options
E/16	16 (up to 9600)	1		1 (up to 9600)	proprietary	16	no	STDM	4,000 and up	
M8	8 (up to 9600)	8 (up to 9600)		2 (up to 14.4K)	X.25 level 2	up to 48	yes	STDM	2,400 and up	
M24	24 (up to 9600)	24 (up to 9600)		2 (up to 14.4K)	X.25 level 2	up to 112	yes	STDM	3,400 and up	
M48	48	48 (up to 9600)		2 (up to 14.4K)	X.25 level 2	up to 208	yes	STDM	4,200 and up	
SM8	8	8 (up to 9600)		4 (up to 19.2K)	X.25 level 2	up to 48	yes	STDM	3,300 and up	switching
SM24	24	24 (up to 9600)		4 (up to 19.2K)	X.25 level 2	up to 112	yes	STDM	4,000 and up	switching
SM48	48	48 (up to 9600)		4 (up to 19.2K)	X.25 level 2	up to 208	yes	STDM	4,400 and up	switching
WM48	up to 48 (up to 9600)	up to 48 (up to 9600)		1 (up to 72K)	proprietary	352	yes	STDM	8,000 and up	
Link/1		208 (75–576K)		up to 10 (up to 2.048M)	DSX-1, DDS		no	TDM	10,000 and up	
WESTERN DATACOM										
Prism 1003A	3 (up to 2400)		1 (4800)		proprietary asynch	2.5	yes	STDM	875	
Prism 1003B	3 (up to 4800)		1 (9600)		proprietary asynch	2.5	yes	STDM	925	
WESTERN TELEMATIC INC.										
MSU-21	2 (150–4800)		1 (9600)		asynch RS232C		no	TDM	295–590	

Information was solicited but not received from the following manufacturers:

Black Box Corp.

Bo-Sherrel Co. Inc.

Digital Equipment Corp.

For information on their products, consult the Supplementary Directory of Manufacturers on page 113.

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Converts almost any dumb terminal into intelligent workstation with networking capability. Floppy and hard disk options available.

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Finally the software is here that allows LANs to fulfill the promise of shared data

Carl Warren, Western Editor
and **Rick Dalrymple,** Senior Editor

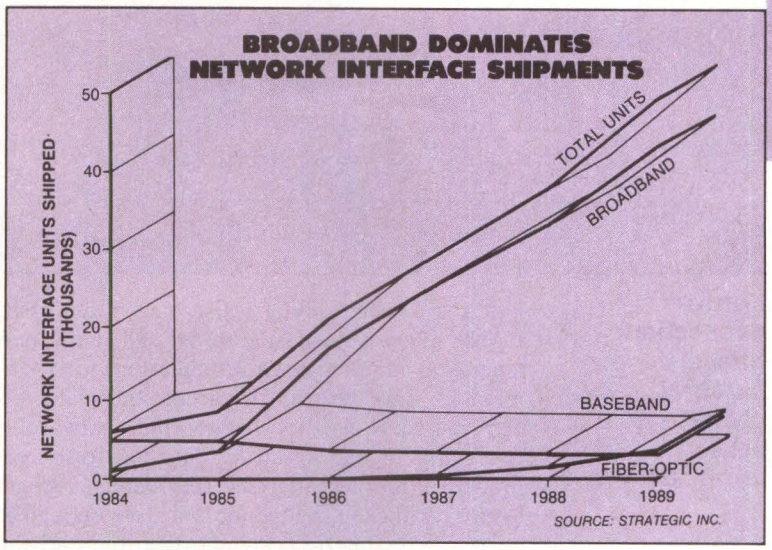
The first flurry of publicity on local area networks (LANs) appeared in 1980. Now, in 1985, LAN sales may actually begin their promised rise to a multibillion dollar market. Early in 1984, Future Computing of Richardson, Texas, predicted that by 1988 personal computer-LAN sales alone would reach $1.5 billion. But in September, when major developments in networking software were being announced, the market research company revised its forecast for the personal computer segment of the LAN market to predict sales of $3 billion by 1987.

Prior to last year, to paraphrase the old real estate adage, the LAN market lacked three things: standards, standards and standards. This year, the long-awaited standards are finally emerging. Among the "standards" that are losing their quotation marks and becoming officially recognized are Ethernet (IEEE 802.3), token-passing bus (IEEE 802.4), token-passing ring (IEEE 802.5) and, in software for PC-LANs, Networks 1.0 from Microsoft Corp., Bellevue, Wash.

"Businesses want to be able to plug any computer into any local area network, like you can plug any lamp into any wall socket without anything blowing up," points out Amy Wohl, president of Advance Office Concepts, Bala Cynwyd, Pa. Toward that end, LAN vendors are beginning to deliver on their early promises that their products would be a magic link connecting all types and brands of computers.

In 1984, several Ethernet vendors announced networking software that connects the network user to the operating system of most popular minicomputers and the IBM Corp. PC. With these software packages, an Ethernet user with an IBM PC can communicate with a Digital Equipment Corp. (DEC) VAX as though he were connected directly to that computer with a DEC VT100 terminal. The reverse is also possible: A user with a VT100 terminal connected to the VAX can access the network and communicate with the IBM PC. The caveat, of course, is that the user must be conversant in the language of the addressed computer and be proficient in operating all those software programs he chooses to call up on the addressed computer.

The new software is a significant step toward linking different computer systems together. For many users, however, the need for competence in several different operating systems made the

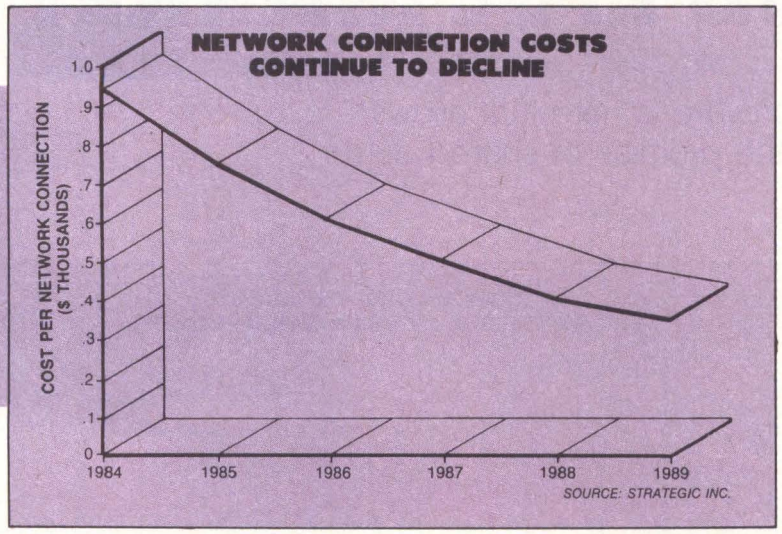


Network interface unit shipment forecasts *do not include network interface boards for personal computers.*

arrangement too complicated. Those users will have to wait until application software developers take advantage of these Ethernet software packages by building application-specific utilities on top of the networking software.

Networking software unlocks the market

Prior to networking software, LAN vendors were trying to sell networking hardware as a solution in itself. During this period only two kinds of overlapping customers purchased LANs: those who desperately needed the new technology and those who could afford to experiment—hardly the mainstream of potential LAN customers. Now that networking software is beginning to make sharing data and resources practical, market analysts are seeing a bright future for those LAN vendors nimble enough to leverage the emerging standards to their advantage.



Network connection prices *are for multiuser computer network interfaces only.*

Probably none of the recently adopted IEEE network standards will totally dominate the LAN market. So far, the favored standard in scientific and engineering applications is Ethernet—IEEE 802.3. Already compatible with almost all minicomputers, Ethernet's 10M-bit- per-second (bps) transmission speed is well suited to the heavy data traffic typically found in scientific and engineering environments.

Early on, Ethernet enjoyed the support of three large corporate backers—DEC, Intel Corp. and Xerox Corp. These corporate backers were joined by the early Ethernet vendors: Advanced Computer Communications, Interlan Inc., 3Com Corp. and Ungermann-Bass. Together these firms pioneered the development of Ethernet hardware interfaces. Today many of the functions these firms first implemented on printed circuit boards are now integrated on a set of silicon chips.

As Ethernet hardware has evolved, network vendors have been able to cut interface costs. Prices for Ethernet interfaces are continuing to fall. According to a forecast from Strategic Inc., Cupertino, Calif., network interface units will fall in price from around $900 today to less than $400 by 1989. These lower prices, along with an increasing number of application-specific network software utilities, should make Ethernet the network of choice in high-volume data environments.

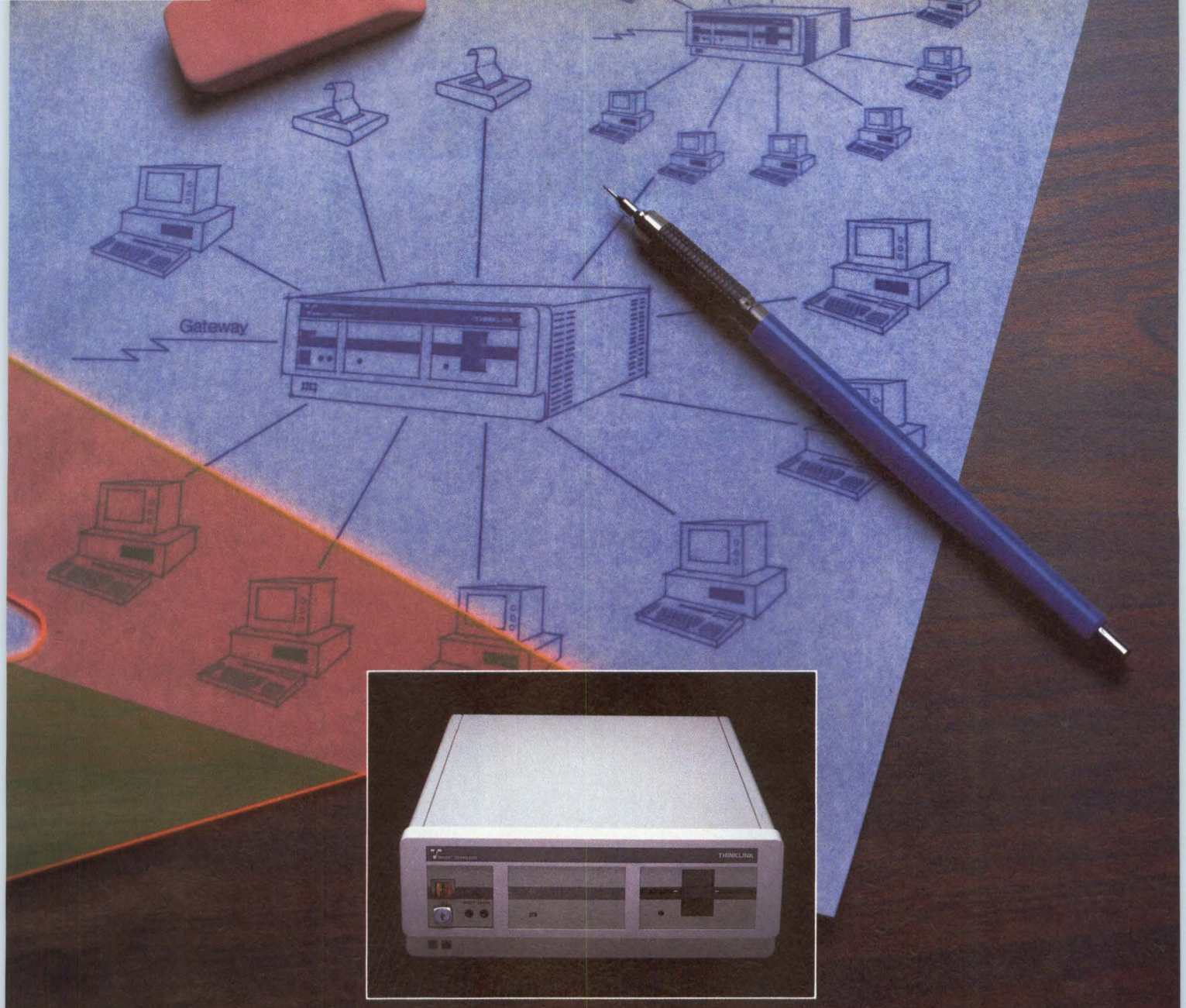
Token bus automates the factory

Attendees at the June 1984 National Computer Conference (NCC) in Las Vegas saw a demonstration of what probably will be the LAN of the factory—IEEE 802.4 token bus. Six factory automation vendors used the token bus to communicate with automated equipment in a booth sponsored by General Motors Corp. GM is working closely with all token bus network vendors and those firms planning to use the network in factory automation applications, and is clearly promoting the standard.

Two major features make the token bus more attractive than Ethernet in factory-automation applications. First, the broadband token bus can transmit television signals, allowing the user to see how the robot is responding to instructions sent over the network. This is done over closed-circuit TV cameras and monitors. Second, Ethernet is only able to transmit signals over a distance of about 2½ kilometers. The token bus is able to transmit signals over much greater distances.

As Ethernet and the token bus were evolving into IEEE standards, a group of people became interested in developing a third standard. This led to the specifications for the token ring—IEEE 802.5. The token ring is associated with last year's now-famous IBM LAN nonintroduction. IBM announced that it would not introduce its token-passing ring LAN for at least two years. IBM publicly demonstrated the token-passing baseband ring technology at Telecom '83 in Geneva, Switzerland (MMS, January 1984, Page 31).

According to David Potter, Interlan's vice-president of research and development at Westford, Mass., and an Ethernet advocate, "IBM appears to be attempting to differentiate itself from Xerox by the adoption of the token ring." While an IEEE standard does exist, the characteristics and marketplace for the token



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The QVT 109 also leads the pack in performance, with 19 programmable function keys (38 functions) that can perform a sequence of tasks at a keystroke. There's a capacitive keyboard that combines the responsive touch of a typewriter with ruggedness that stands up to heavy-duty, all-day use. What's more, you're backed by our nationwide service network, as well as our vast resources and solid experience as an ITT company. You can depend on Qume to keep pace with your needs in the years ahead.

For more information about Qume's new QVT 109, our other alphanumeric and graphics terminals, or our full line of daisywheel printers and disk drives, call (800) 223-2479. Or write Qume Corporation, 2350 Qume Drive, San Jose, CA 95131.

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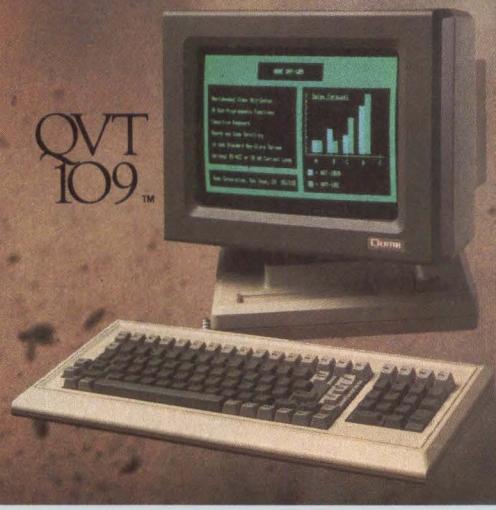


ring is presently unclear. What is clear is that any time IBM adopts a standard it generally has a significant impact on the marketplace.

IBM boosts PC-LAN market

Whether by design or accident, IBM has given PC-LAN vendors a much-needed shot in the arm. As with many other computer products, LANs for personal computers need IBM's blessing. With the announcement that the introduction of the IBM token-ring LAN was two years away and that, in the interim, the company would be marketing its PC Network (MMS, October 1984, Page 37), LAN customers were given a better understanding of their networking options.

IBM's PC Network is designed to offer peer-to-peer communications in offices and small businesses by joining together combinations of the PC, PC/XT, Portable Personal Computer and PC-AT. The network links as many as 72 personal computers, enabling them to share information, programs, messages, printers and mass-storage devices. For LAN vendors, however, the most exciting aspect of the PC Network is the software—the PC Network Program which runs under IBM PC-DOS 3.1.

IBM PC-DOS 3.1 is IBM's implementation of Microsoft's MS-DOS 3.1. When IBM announced its PC Network, Microsoft's Networks 1.0, which runs under MS-DOS 3.1, became an instant industry standard, supported by approximately two dozen computer manufacturers and LAN vendors (MMS, February, Page 47). Microsoft claims that any program written for MS-DOS 3.1 can run under IBM's PC-DOS 3.1. Microsoft has also announced its own LAN, MS-NET, based on MS-DOS 3.1, but according to 3Com president Bill Krause, "MS-DOS 3.1 is the only significant part of MS-NET because that is the part that IBM is using."

The key development that excites IBM's competitors is that they do not need to use IBM's LAN hardware because, according to Microsoft, Networks 1.0 is hardware-independent. This means that LAN vendors can substitute their own network board in place of IBM's and use all the multiuser application software being written for the PC Network operating system. For example, a customer could use one of the network interface boards manufactured by an Ethernet vendor for the IBM PC and link not only IBM PCs (and PC-compatibles) via Ethernet, but also PCs from DEC, Texas Instruments Inc. or Hewlett-Packard Co., as well as several popular minicomputers. In addition, an Ethernet network could transfer data at speeds up to 10M bits per second (bps) versus the 2M-bps transfer rate

PABXes endowed with new functions

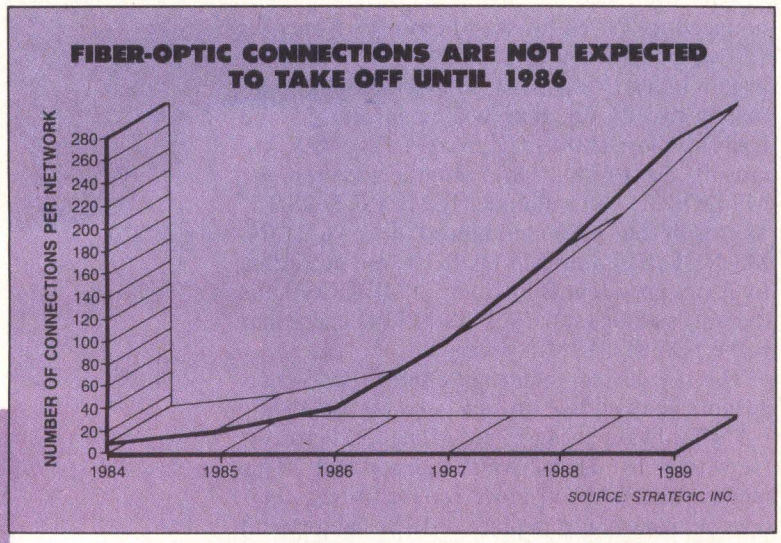
No longer can the programmable automatic branch exchange (PABX) be dismissed as a fancy telephone switch. Todays PABXes offer all of the telephone functions previously associated with these systems plus some significant new capabilities that make them attractive alternatives to LANs.

One example of the versatility available in the newer PABXes is found in Intecom Inc.'s IBX LANmark. Intecom, Allen, Texas, has been a pioneer in developing high-speed internal packet switching, as opposed to the usual telephone-circuit switching, to transfer data between nodes in a network. Intecom claims its Integrated Business Exchange (IBX) Ethernet LAN can achieve speeds up to 10M bits per second (bps) over standard twisted-pair telephone wire, thus eliminating the need to install more-expensive coaxial cable.

LANmark Ethernet may be used to extend existing Ethernet systems, to connect many different Ethernets together or to serve as the entire Ethernet connection infrastructure for the different workstations within a system.

The IBX LANmark system provides the capability for all IBX electronic telephone instruments to attach to Ethernet devices via the 15-pin Ethernet "D" subminiature connector. The electronic telephone instrument routes the information in packets through the IBX to the receiving device, which may be another electronic telephone instrument or a connection to another Ethernet segment. With this scheme, Ethernet workstations may be moved to any location where an IBX telephone jack is installed.

According to Dave Potter, vice-president of research and development at Interlan Inc., Westford, Mass., a coaxial-based Ethernet vendor, "PABXes make sense for office automation functions such as word processing, electronic mail and electronic calendars, and should coexist peacefully with coaxial-based engineering and scientific-oriented LANs." Most LAN industry observers hold the opinion that the PABX has won a place in the office of the future by virtue of its capabilities alone. By adding data transmission, a PABX can be configured to handle almost any office automation application by exploiting the reach and flexibility of standard telephone wire.



Strategic Inc.'s market analysts *believe connection costs are currently too high for fiber-optic networks. If, as expected, a new tap technology reduces connection costs, fiber-optic connections should take off.*

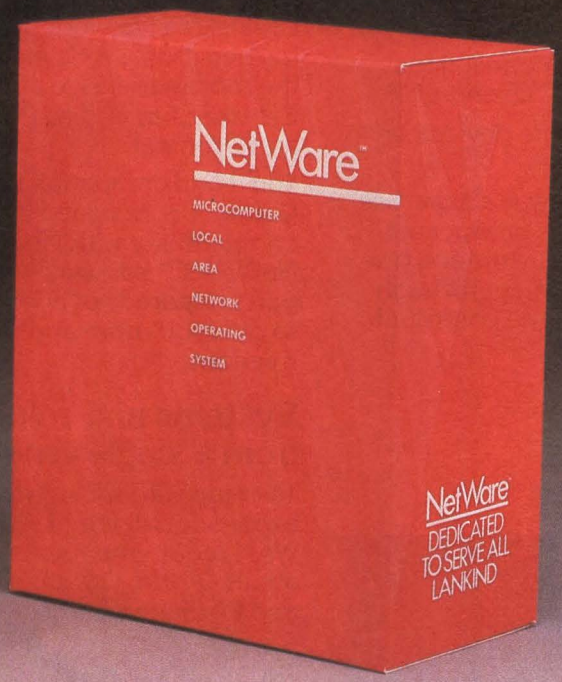
specified for the IBM PC Network.

LAN vendors can achieve compatibility for their network cabling and interface boards provided their interface and driver software are implemented up to Layer 4, the transport layer of the Open Systems Interconnection (OSI) network standard model defined by the International Standards Organization (ISO). Microsoft's group manager for systems product marketing, Leo Nikora, says LAN vendors may follow IBM's lead and implement some of the Networks 1.0 functions in firmware for faster performance.

According to International Data Corp., Framingham, Mass., only 15,800 PC-LANs were shipped in 1983, and an estimated 25,000 in 1984. These are not impressive numbers considering the millions of installed PCs but, 1985 may prove to be the year in which the LAN marketplace finally lives up to its potential. □

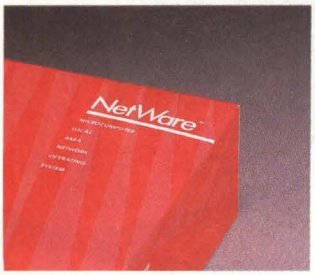
Interest Quotient (Circle One)
High 456 Medium 457 Low 458

Name-dropping just isn't enough to impress the network critics.



Now that the local area network (LAN) industry is booming, some pretty big names in the computer business are jumping on the bandwagon. Their goal is simple: get a LAN on the market and let all those who pay homage to The Name run out and buy it.

At Novell, we don't have a big name to drop when selling NetWare, our high-performance LAN operating system. So we let our technology do the talking. And the network critics are not only listening, they are taking notice.



Performance.

No LAN operating software outperforms NetWare. With speed, flexibility, security and hundreds of multiuser applications, NetWare sets a standard for the entire LAN industry.

Versatility.

NetWare is more than a LAN operating system. Currently, NetWare software is available for 24 LAN hardware systems. Plus, four complete LAN systems are sold and serviced by Novell.

Compatibility.

Because NetWare is compatible with DOS 3.1, it can run any application written for the IBM PC Network Program. And NetWare greatly increases IBM PC Network performance and applications software useability.

Internetworks.

Using bridges, NetWare can connect separate LAN systems into one large internetwork. In fact, every LAN Novell supports can be interconnected—any number, in any of the various topologies.

Remember the name.

The one LAN system making a big impression on the network critics is the one with the not-so-big name: NetWare, from Novell. Remember it when you want a high-performance LAN instead of a high-powered name.

For more information, call or write:

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The experts at Gateway know Networking from top to bottom

When it comes to networking, turn to the company whose business is communications. At Gateway, we provide more than the tip of the iceberg. Our communications systems expertise and networking approach takes the uncertainty out of networking by providing a complete solution. Whether your requirement is a local area network supporting multi-user applications; a LAN connected to another LAN, host, or remote device using X.25 and/or SNA; we provide the hardware, software, systems integration, and service to help you integrate the IBM PC™ and compatible PCs into a complete communications system for your customers.

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Regardless of your LAN, Gateway gives you a total solution for your networking applications. Our unique Network Access Method gives you:

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- LAN to host connections supporting X.25 and SNA
- LAN to remote device connections

In fact, with Gateway's expertise and our complete product set, you'll give your customer a true systems environment through micro to mainframe communications.

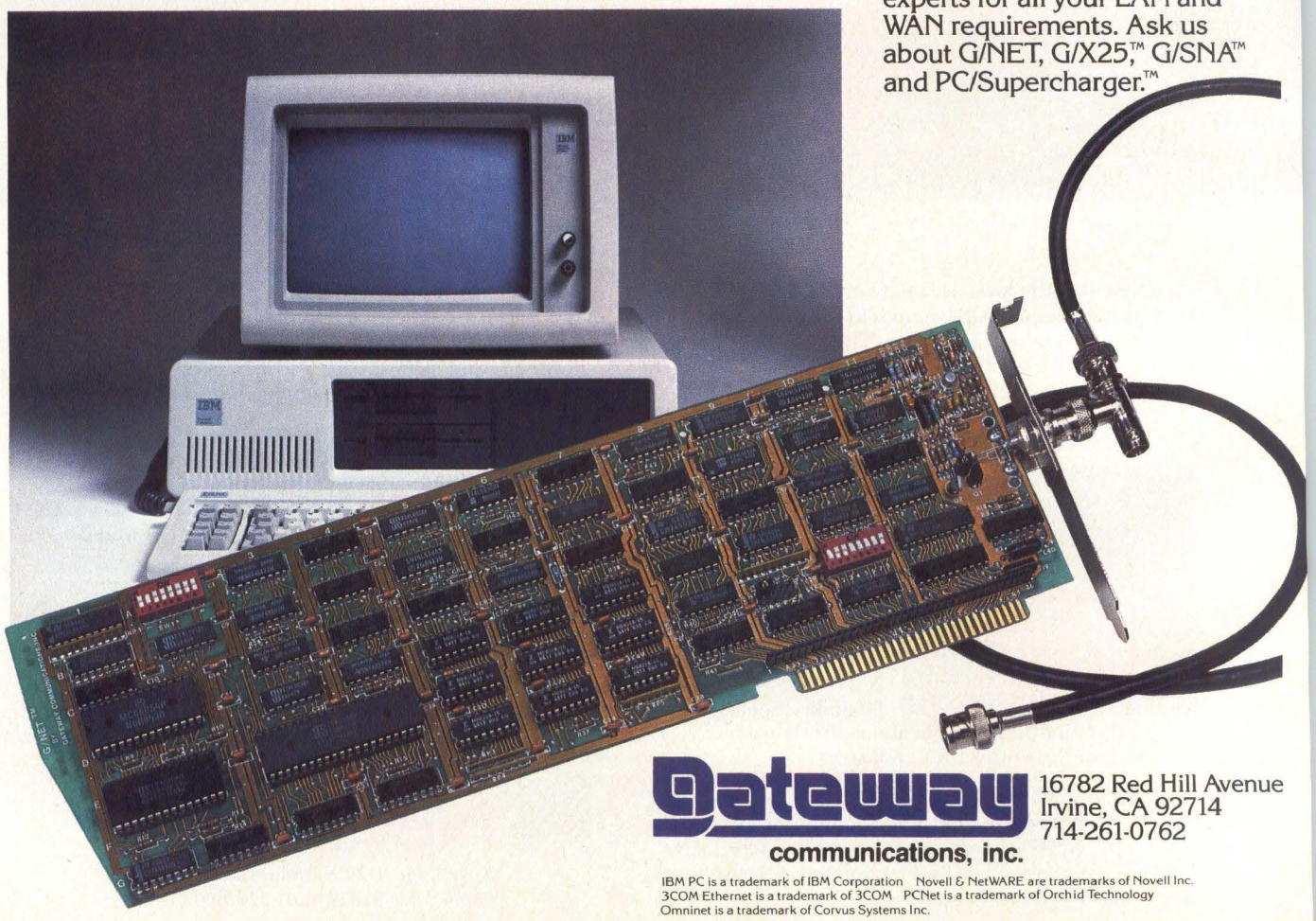
Quality and features no other manufacturer can match

Gateway backs its technical experience with systems that have been proven reliable and innovative. In a benchmark by Novell,™ Gateway's G/NET™ Local Area Network outperformed most LANs including the more expensive 3COM Ethernet,™ as well as PCNET™ and Omninet.™

You'll find compatibility, too. Gateway is designed for full compatibility with Novell NetWARE™ software which supports hundreds of applications to give you more application freedom.

Systems and solutions from a single vendor

Team up with the networking experts for all your LAN and WAN requirements. Ask us about G/NET, G/X25,™ G/SNA™ and PC/Supercharger.™



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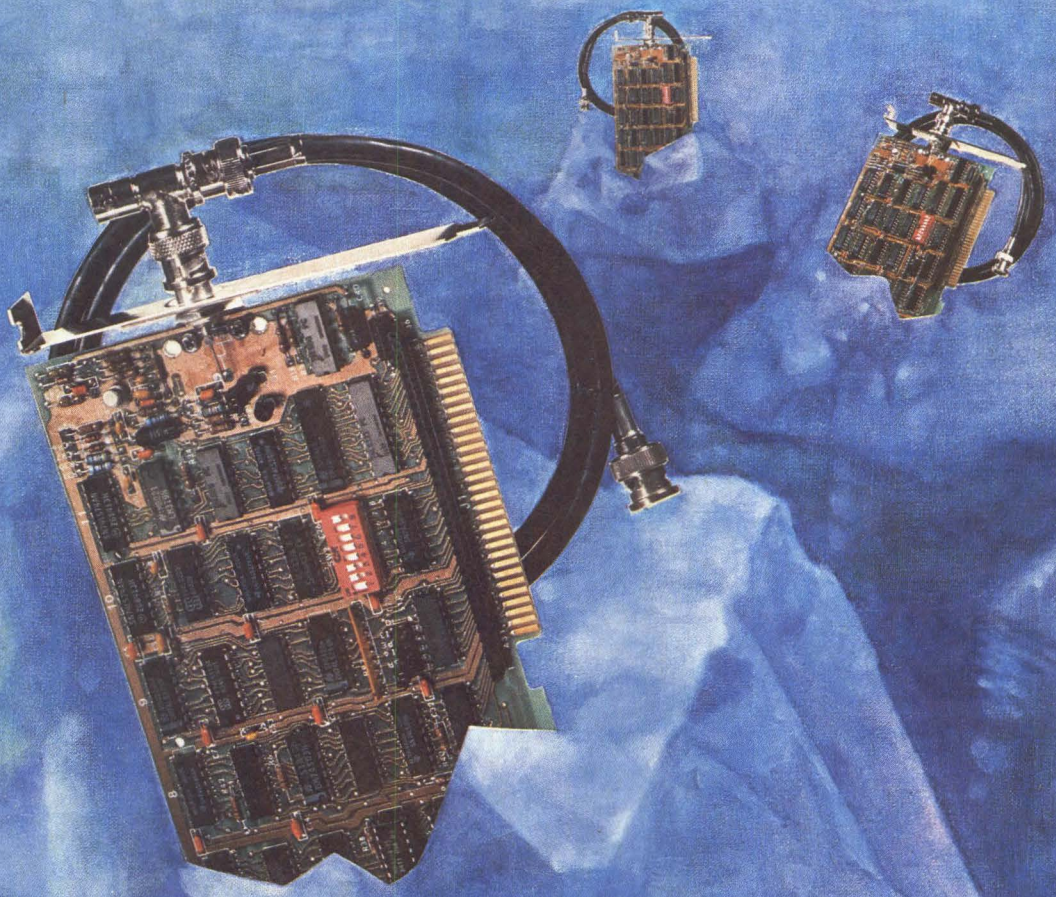
Omninet is a trademark of Corvus Systems Inc.

Resellers, circle 150 for more information

End users, circle 151 for more information

The LAN Is Only The Tip Of The Iceberg



GATEWAYS

BRIDGES

X.25

MICRO TO MAINFRAME

SNA

FILE SERVERS

ELECTRONIC MAIL

LOCAL AREA
TABLE 3

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
APPLITEK CORP.					
UniLAN	broadband	proprietary	1.54M	40,000 stations; 30 miles	Ethernet, X.25
UniLAN	baseband	proprietary	1.54M	1,000 stations; 2.5 miles	Ethernet, X.25
UniLAN	fiberoptic	proprietary	1.54M	1,000 stations; unlimited	Ethernet, X.25
AST RESEARCH INC.					
AST-PCnet	baseband	CSMA/CD	800K	223 stations; 5,000 feet	AST 3780 RJE
AST-PCnet II	twisted-pair	CSMA/CA	800K	160 stations; 3,500 feet	AST 3780 RJE
BRIDGE COMMUNICATIONS INC.					
Ethernet	baseband	CSMA/CD, IEEE 802.3	10M	100 stations; 2,500m	X.25, Bridge Communications GS/1, GS/3
CODENOLL TECHNOLOGY CORP.					
Codenet-Fiber Optic Ethernet	fiberoptic	CSMA/CD, IEEE 802.3	10M	1,024 stations; 2.8 km	
COHERENT COMMUNICATIONS SYSTEMS CORP.					
Linemate 192	broadband, twisted-pair	transparent format or protocol	19.2K	unlimited stations; 7 miles	
3COM CORP.					
EtherSeries Network	baseband	CSMA/CD	10M	1,024 stations; 2.5km	EtherTerm (emulates DEC TTY, VT52, VT100)

NETWORKS

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
NI10/T	box	all computers	16 asynch, 16 synch, 4 IEEE 488, 4 parallel	256K	included	
NI10/T	box	all computers	16 asynch, 16 synch, 4 IEEE 488, 4 parallel	256K	included	
NI10/T	box	all computers	16 asynch, 16 synch, 4 IEEE 488, 4 parallel	256K	included	
AST-PCnet	board	IBM PC/XT/AT and compatibles	none	none		1,090
AST-PCnet II	board	IBM PC/XT/AT/PCjr and compatibles	none	none		1,090
CS/1-A	box	any asynch ASCII terminal or host port	32 asynch	128K	opt. SW/1-A/BSC software ($150)	9,900–15,600
CS/1-AX	box		32 asynch			
CS/1-BSC	box	bisynch terminal or host ports, IBM, Honeywell, Sperry, Control Data Corp.	32 synch	128K	opt. SW/1-A/BSC software ($150)	9,900–15,600
CS/1-BSCX	box		32 synch			
CS/1-HSM	box and board	DEC VAX 11/7XX	none	128K	opt. SW/1-HSM software ($150)	15,500
CS/1-SNA	box	IBM 4300, 303X, 308X	1 synch	128K	SW/1-SNA (IBM 3270) software ($1,000)	14,000
CS/1-X.25	box	Prime, Tandem, Hewlett-Packard	2 synch	128K	opt. SW/1-X.25 software ($2,000)	10,500
CS/100-488	box	any IEEE 488-compatible	1 IEEE 488	128K	SW/100-488 software ($150)	5,100
CS/100-A	box	any ASCII asynch terminal or host ports	14 asynch	128K	SW/100-A/BSC software ($150)	3,900–5,100
CS/100-AX	box		14 asynch		SW/100-NCS software ($1,500)	3,600–5,100
CS/100-BSC	box	bisynch terminal or host ports, IBM, Honeywell, Sperry, Control Data Corp.	10 synch	128K	SW/100-A/BSC software ($150)	3,900–5,100
CS/100-BSCX	box		10 synch		SW/100-NCS software ($1,500)	3,600–4,600
Gateway Servers/1	box		4 synch	128K	opt. SW/2-CS/ICS software ($2,000)	10,500
Gateway Server/3	box		8 synch	128K	opt. SW/3 software ($300)	10,500
NCS/100	box		none	128K	SW/100 NCS software ($1,500)	4,900
Codelink-2000	board	Ethernet-compatible computers	1 asynch, 1 IEEE 488			595–1,024
Codelink-3000	box	Ethernet-compatible computers	1 asynch, 1 IEEE 488			595–1,024
SPM-192C	board	any computer with RS232C port	1 asynch, 1 synch, 1 IEEE 488, 1 parallel	none	none	175–195
SPM-192R	box	any computer with RS232C port	1 asynch, 1 synch, 1 IEEE 488, 1 parallel	none	none	200–245
EtherLink 3C500B	board	IBM PC/XT/AT, Compaq DeskPro, AT&T PC			EtherShare ($395); opt. EtherPrint ($150), EtherMail ($550), EtherStart ($100)	650

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
COMMTEX INC.					
Cx-Net	twisted-pair, coaxial	Datapoint Arcnet		unlimited stations	X.25, IBM 3274 BSC, SNA/SDLC
COMMUNICATIONS MACHINERY CORP.					
Ethernet	baseband	CSMA/CD, IEEE 802.3	10M	1,024 stations: 2,500m	
COMPLEXX SYSTEMS INC.					
XLAN	baseband, twisted-pair, coaxial	CMSA/CA	1M	192 stations; 8,000 feet	
CONCORD DATA SYSTEMS INC.					
Token/Net	broadband	token-passing		5M	up to 1,000 stations; up to 25 miles
CORVUS SYSTEMS INC.					
Omninet	baseband, twisted-pair	CSMA/CA	1M	64 stations; 4,000 feet	SNA
CYB SYSTEMS INC.					
Unite	baseband, twisted-pair	CSMA/CD, IEEE 802.3	10M	255 stations; 1,500 miles	

TABLE 3

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
Cx-83	box	all ASCII asynch, IBM BSC or SNA, Control Data and Honeywell supporting IBM 3270	10 asynch, 2 synch (3274), 1 synch (X.25), 20 coaxial	64K		3,900–5,750
Cx-86	box	all ASCII asynch, IBM BSC or SNA, Control Data and Honeywell supporting IBM 3270	25 asynch, 2 synch (3274), 1 synch (X.25), 25 coaxial	192K		5,850–12,750
Cx-Net	box (2)	all ASCII asynch, IBM BSC or SNA, Control Data and Honeywell supporting IBM 3270	125 asynch, 10 synch (3274), 5 synch (X.25), 125 coaxial	2M		8,400–75,000
ENP-10	board	Motorola VME/10, Ironics, Mostek, computers with UNIX operating systems		128K	K-1 Kernel Communications Executive Software	2,050–3,150
ENP-20	board	Motorola EXORmacs, Charles River Data Systems, computers with UNIX operating systems	2 asynch	128K	K-1 Kernel Communications Executive Software	1,950–3,000
ENP-30	board	Callan, Masscomp, computers with UNIX operating systems	2 asynch	128K	K-1 Kernel Communications Executive Software	1,550–2,400
ENP-44	board	DEC VAX, PDP-11	2 asynch	128K-512K	K-1 Kernel Communications Executive Software	2,550–3,900
IP-3	box	any asynch RS232C ASCII port	3 asynch, 2 parallel	16K	included	258–430 (port)
HR 105	box	any computer with RS232C, RS449, RS422 port	none	none		
RF modem, access unit, control unit	3 board set	any computer with RS232C, RS449, RS422 port	4 asynch, 4 synch	8K–64K	included	600 (port)
TIM 200	box	any computer with RS232C, RS449, RS422 port	4 asynch, 4 synch, (2) RS449, RS422	8K–64K	included	500–700 (port)
TIM 220	box	any computer with RS232C, RS449, RS422 port	12 asynch, 12 synch, (2) RS449, RS422	8K–64K		500–700 (port)
Apple	board	Apple IIe, III, Macintosh	none	none	opt. Constellation software ($150–495)	495
DEC Rainbow	board	DEC Rainbow	none	4K	opt. Constellation software ($150–495)	495
IBM PC	board	IBM PC/XT/AT/jr.	none	4K	opt. Constellation software ($150–495)	495
Zenith Z100–150	board	Zenith Z100–150	none	4K	opt. Constellation software ($150–495)	495
Unite 1i	box	IBM PC/XT/AT and PC compatibles	2 asynch, 2 synch, 1 parallel	256K–1.5M	included	8,995
Unite 4i	box	IBM PC/XT/AT and PC compatibles	6 asynch, 6 synch, 1 parallel	256K–1.5M	included	9,995
Unite 8i	box	IBM PC/XT/AT and PC compatibles	10 asynch, 10 synch, 1 parallel	256K–2.5M	included	16,995
Unite 16i	box	IBM PC/XT/AT and PC compatibles	18 asynch, 18 synch, 1 parallel	256K–4.5M	included	24,445
Unite 32i	box	IBM PC/XT/AT and PC compatibles	34 asynch, 34 synch, 1 parallel	256K–8.5M	included	53,995

If you've looked at other data switches then you already know how big and bulky they can be. Some require racks as high as six feet and weigh as much as 600 pounds. And almost all of them need a forklift just to move them about.

But with Emulex's CommXchange you have a lean, compact design. One that can easily be moved around and weighs one sixth as much as those other bulky models.

In fact, the only time other data switches look light-weight next to CommXchange is when you start comparing features and benefits. That's when the CommXchange becomes a heavyweight.

*DEC and VAXcluster are registered trademarks of Digital Equipment Corporation.

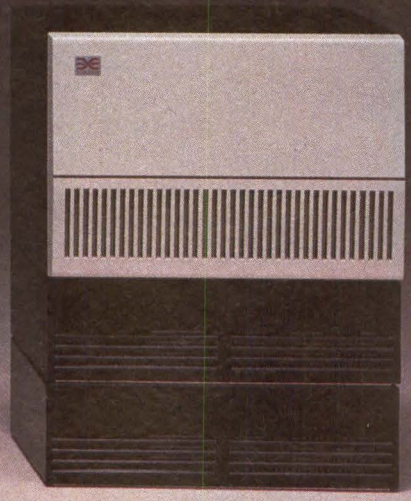
NOW, VIRTUALLY ANY TERMINAL CAN ACCESS ANY CPU, PARTICULARLY DEC'S* MINI-COMPUTERS AND VAXCLUSTER SYSTEMS. The CommXchange is an advanced, microprocessor-based data switching system designed to let you effortlessly tie together large groups of terminals to one or more computers. It allows essentially any asynchronous terminal to selectively communicate with a variety of host computers. This means you can now build on the investment you have already made on existing equipment. You'll also improve efficiency, since users no longer have to take turns at terminals or waste time going from one office to another to use a terminal dedicated to a particular computer.

REALIZE OPTIMUM TERMINAL SWITCHING FLEXIBILITY. A basic CommXchange is capable of routing 360 terminals and computer port lines. Thanks to a port contention feature, there can actually be a larger number of terminals attached to the system than computer ports. This allows the ports to be shared by a number of part-time terminal users, reducing the need to add costly multiplexers as a user's terminal requirements expand. You can add expansion units for an additional 960 lines. And all lines can run simultaneously at speeds up to 9600 bps.

DELIVER A NETWORKING DATA SWITCH... WITHOUT A FORKLIFT?

INTRODUCING COMMXCHANGE.

A COMPLETE DATA SWITCH THAT CONNECTS TERMINALS TO MULTIPLE COMPUTERS.



GET COMPLETE REDUNDANCY, ACCESS SECURITY AND TOTAL NETWORK CONTROL. From the day you put your CommXchange network on line, you will be able to count on maximum reliability. The CommXchange is configured with standby logic modules and dual power supplies that will keep the system operating despite component failure. Security is assured because access is limited to specific pass-words, and any unauthorized access attempts are logged. And the CommXchange produces a transaction log that gives you a continuous and accurate record of all network traffic.

INSTALLATION, CONFIGURATION AND OPERATION ARE A SNAP. CommXchange is so easy to install, it can be done by a telephone installation crew using ordinary telephone wire and connectors. To configure your system, simply connect your terminal to the supervisory control board located within the central unit. Menu-driven software provides step-by-step instructions for routing terminal lines to designated computers. And once the system is configured, users are able to request access to available computers by sending simple keyboard commands from their terminals.

LET'S NOT FORGET LOW-COST AND COMPATIBILITY WITH ALL CURRENT EMULEX COMM CONTROLLERS. If you're looking for a competitively-priced, high-performance data switching system that allows large numbers of terminals to be linked between several host adapter computer systems, then talk with Emulex. And if you're using any of our current communications multiplexer products, they work perfectly with the CommXchange. Not only can we deliver the right solution with our CommXchange, we can do it without a forklift.

Call toll-free (800) 854-7112. In California (714) 662-5600. Or write: Emulex Corporation, 3545 Harbor Boulevard, P.O. Box 6725, Costa Mesa, California, 92626.

EMULEX

CIRCLE NO. 32 ON INQUIRY CARD

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
DATA GENERAL CORP.					
Ethernet	baseband	CSMA/CD	10M	1,024 stations; 2,500m	bisynch, SNA, X.25
Multiprocessor Communications Adapter	parallel bus	proprietary		4–15 stations; 30–140 feet	bisynch, SNA, X.25
Network Bus System (NBS)	baseband	token-passing, proprietary	2M	32 stations; 1 mile	bisynch, SNA, X.25
DATAPOINT CORP.					
ARC LAN	baseband	token-passing	2.5M	255 stations; 4 miles	X.25
DAVONG SYSTEMS INC.					
MultiLink	baseband	token-passing	2.5M	255 stations; 22,000 feet	
DIGITAL MICROSYSTEMS INC.					
HiNet	baseband	proprietary	500K	unlimited stations; 7,000 feet	IBM BSC, Sperry Univac Uniscope
EQUINOX SYSTEMS					
Equinox Data PBX	twisted-pair	TDM	9.6K	1,320 stations; 2 miles	
EXCELAN INC.					
Ethernet	baseband	CSMA/CD, IEEE 802.3	10M	1,024 stations; 500m	
GANDALF DATA INC.					
PACXNET	twisted-pair	proprietary	19.2K	2,048 stations; unlimited	IBM 3270 SNA/BSC, X.25 auto-dialers, PBX, TI multiplexers
GATEWAY COMMUNICATIONS INC.					
G/NET	baseband	CSMA/CD, CSMA/CA	1.43M	255 stations; 7,000 feet	X.25, SNA, BSC
IDE ASSOCIATES INC.					
IDEAnet	baseband	CSMA/CD	800K	20 stations; 2,000 feet	
INTECOM INC.					
LANmark Ethernet	baseband, twisted-pair, fiberoptic	CSMA/CD, IEEE 802.3	1M	8,192 stations; 54,000 feet	X.25, IBM 3270 InteNet Packet Controller (IPC)

TABLE 3

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
Interlan Ethernet/802.3 Communications Controller	board	Data General MV, Eclipse computers		16K	Xodiac	
802.3 LAN Micro Controller	board	Desktop Generation 10SP, 20, 30; S/20, C/30, CS/100B		32K	Xodiac	
MCA	board	Data General MV, Eclipse computers			Xodiac	
NBS	board	Data General MV, Eclipse computers				
COM 9026	board	Data Point 1560, 3200, 8400, 8600, 8800; VISTA-PC; IBM PC/XT/AT	2 asynch	2K	included	
Network Multifunction	board	IBM PC/XT/AT, Compaq, AT&T 6300	none	2K–512K	included	1,700
DMS-3/B	board	any standard terminal or microcomputer with a console monitor and RS232C port	3 asynch, 1 parallel, 1 RS422	64K	opt. HiNet software ($1,500)	1,195
DMS-86	board	any standard terminal or microcomputer with a console monitor and RS232C port	3 asynch, 1 parallel, 1 RS422	256K–1M	opt. HiNet software ($1,500)	1,995–3,995
HiNet PC/Adapter Card	board	IBM PC/XT/AT, Compaq, Eagle, NCR PC, Olivetti M24, TeleVideo PC, Zenith	1 asynch, 1 RS422	64K	opt. HiNet software ($1,500)	495
DSS-1	box	all standard asynch computers	1,320 asynch	none	none	10,600–127,700
EXOS 101	board	computers with Multibus		64K–128K	opt. EXOS 8010 TCP/IP protocol package ($10,000)	
EXOS 200 Series	board	computers with Multibus, Unibus, VMEbus, Q-bus		128K–256K	opt. EXOS 8010 TCP/IP protocol package ($10,000)	2,100–3,820
PACX 1000	box	computers with RS232C, current loop, mil 188C, and RS449 port	1,024 asynch, 1,024 synch	none	included	10,000–270,000
PACX 2000	box	computers with RS232C, current loop, mil 188C, and RS449 port	896 asynch, 896 synch	none	included	11,000–290,000
PACX IV/IV SE	box	computers with RS232C, current loop, mil 188C, and RS449 port	1,024 asynch, 1,024 synch	none	included	10,000–270,000
PC-LNIM	board	IBM PC/XT/AT, Corona, Columbia, Compaq, Eagle, Sperry		none	opt. Netware G software ($1,495), electronic mail ($295)	2,495–137,898
NPR-001	board	IBM PC/XT/Portable		none	included	870–9,895
S/10	box		2,048 asynch, 2,048 synch	64K–2M	opt. LANmark software ($10,000)	

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
INTERLAN INC.					
NET/PLUS	baseband	CSMA/CD, IEEE 802.3	10M	1,024 stations; 2.5 km	
INTERTEC DATA SYSTEMS CORP.					
Data Networking System	baseband	polling, proprietary	3M	255 stations; 3,000 feet	
MAGNOLIA MICROSYSTEMS INC.					
MAGnet	baseband, twisted pair	token-passing	500K	64 stations; 2,000 feet	
METAPATH INC.					
ROBIN	baseband	proprietary, ATDM	2M	225 stations; 1.5 km	SNA/SDLC, Robin, X.25
NATIONAL INSTRUMENTS					
Net 488	baseband	token-passing	4M	15 stations; 2 km	

TABLE 3

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
S/40	box		4,096 asynch, 4,096 synch	64K–2M	opt. LANmark software ($10,000)	
S/80	box	Ethernet-compatible computers	8,192 asynch, 8,192 synch	64K–2M	opt. LANmark software ($10,000)	
NI1010A Unibus Ethernet Communications Controller	board	DEC Unibus VAX-11, PDP-11	none	15K	opt. NS4230 ITP/VMS software ($2,500)	3,190
NI2010A Q-bus Ethernet Communications Controller	board	DEC LSI-11, Q-bus PDP-11	none	15K	opt. NS4210 ITP/RSX software ($2,500)	2,290
NI3210 Multibus Ethernet Communications Controller	board	Multibus-based 68000, 8086, 28000 processors	none	15K	NS4244 ITP/UNIX System V software ($2,500)	1,290
NI4010A Data General Ethernet Communications Controller	board	Data General Nova, Eclipse, Eclipse/MV	none	15K		2,490
NI5010 IBM PC Ethernet Communications Controller	board	IBM PC/XT, Compaq Personal Computer	none	4K	opt. NS4290 ITP/MS-DOS software ($500)	575–775
NP100 Unibus Ethernet Protocol Processor	board	DEC Unibus VAX-11, PDP-11	none	128K–256K		3,790–4,290
NP200 Q-bus Ethernet Protocol Processor	board	DEC Q-bus system	none	128K–256K		2,190–2,690
NP300 Multibus Ethernet Protocol Processor	board	Multibus-based 68000, 8086, 28000 processors	none	128K–256K		2,190–2,690
NTS510 Network Terminal Server	box	computers with asynch RS232C port	8 asynch	none	included	3,200
INTS/VMS Integrated Network Terminal Server	board	DEC VAX	32 asynch	none		6,190
Data Storage System 20	box	HeadStart 128, 512, 1000			LAN-DOS utilities	2,495
Data Storage System 50	box	HeadStart 128, 512, 1000			LAN-DOS utilities	6,995
XM-422-96	board	Zenith Z100, IEEE 696	none	64K	opt. DR/NET software ($250)	695
XM-422-EMZ80	box	Altos, Xerox, Epson	none	64K	opt. CP/NET software ($250)	895
XM-422-PC	board	IBM, Corona, Zenith, PC compatibles	none	64K	opt. DR/NET software ($250)	695
XM-422-TS	box		1 asynch	64K–256K	opt. CP/NET software ($250)	895–1,295
XM-422-Z89	board	Zenith Z89, Z90	none	64K	opt. CP/NET software ($250)	695
CPS-080		DEC VAX, most computers with RS232C ACSII port	64 asynch, 64 synch, 16 parallel	256K	opt. CROSSTALK, Blast, Move-it, Micnet, VVCP, Kermet software	
DPS 005	box	DEC VAX, most computers with RS232C ASCII port	4 asynch, 4 synch, 1 parallel	16K	opt. CROSSTALK, Blast, Move-it, Micnet, VVCP, Kermet software	375 (port)
DPS 020	box	most computers with RS232C ASCII port	16 asynch, 16 synch, 4 parallel	64K	opt. CROSSTALK, Blast, Move-it, Micnet, VVCP, Kermet software	
	board	Apollo, Sun, NCR Tower, VME, IBM PC and compatibles, DEC VAX, PDP-11, LSI-11	15 IEEE 488	none		2,000

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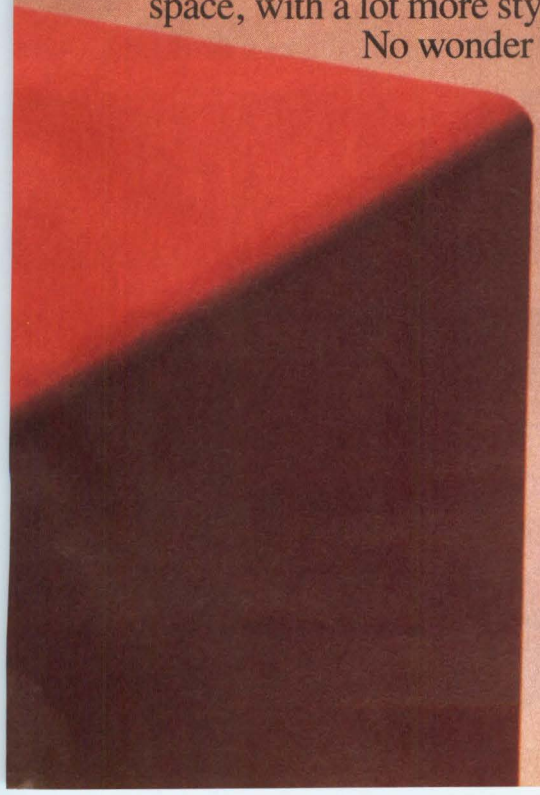

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CIRCLE NO. 33 ON INQUIRY CARD

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
NEC INFORMATION SYSTEMS INC.					
BRANCH 4670	twisted-pair	CSMA	1M	64 stations; 1.2km	
NESTAR SYSTEMS INC.					
PLAN Series	baseband, broadband, twisted-pair, fiber-optic	token-passing	2.5M	255 stations; 22,000 feet	bisynch, asynch, SNA
NORTHERN TELECOM INC./DATA SYSTEMS DIV.					
Omnilink	baseband	proprietary	56K	8 stations; 40,000 feet	none
NORTHERN TELECOM INC.					
SL-1/SL-100 Digital PBX	twisted-pair		up to 56K	30,000 stations 40 miles	X.25, IBM 3270 System 34/36/38, computer to PBX interface, Digital Trunk Interface
NOVELL INC.					
NetWare	baseband, broadband, twin-ax, twisted-pair, fiberoptic	CSMA/CD, CSMA/CA, token-passing, proprietary	500K–10M	24 to unlimited stations; unlimited	SNA, X.25, bisynch
ORCHID TECHNOLOGY					
PCnet	baseband	CSMA/CD	1M	255 stations; 7,000 feet	
PRIME COMPUTER INC.					
PRIMENET/RINGNET	twin-ax, fiber-optic	token-passing	10M	128 stations; 3,280 feet	bisynch, SNA, X.25
PROTEON INC.					
ProNET	baseband, twin-ax, twisted-pair, fiber-optic	token-passing, IEEE 802.5	10M	255 stations; 50km	

TABLE 3

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
APC III	board	APC 3	3 asynch, 3 synch, 1–2 parallel	64K	Corvus OMNINET software	
ASTRA 300 Series	board	ASTRA 330–300, ASTRA 350–300, ASTRA 370–300	32 asynch, 32 synch, 3–25 parallel	64K	opt. ITOS-NET	
Apple II	board	IBM PC; Apple II, III	6 asynch, 6 parallel	8K	Apple DOS, CP/M, any software run on IBM PC/XT or compatibles	595
Apple III	board	IBM PC; Apple II, III	6 asynch	8K	SOS, CP/M, any software run on IBM PC/XT or compatibles	595
IBM PC family	board	IBM PC; Apple II, III	1 parallel, 2 serial	8K	any software run on an IBM PC/XT or compatible	
4575	board	Northern Telecom 445, 405, 435, 565, 685	1–14 asynch, 2 synch, parallel (varies)	none	included (up to $400)	1,200–1,600
SL-1 PBX	box and board	most ASCII asynch compatibles, variety of synch compatibles	3,000 asynch, 3,000 synch		proprietary	600–1,100
SL-100 PBX	box and board	most ASCII asynch compatibles, variety of synch compatibles	30,000 asynch 30,000 synch		proprietary	600–1,100
NetWare/ARCNET	box	IBM compatibles	2–5 asynch, 1–3 synch 1–2 parallel	256K–2M		6,900
NetWare/G-Net	box	IBM compatibles	1–2 parallel	256K–2M		6,900
NetWare/Omninet	box	IBM compatibles	2–5 asynch, 1–3 synch, 1–2 parallel	256K–2M		6,900
proprietary (S)	board	IBM compatibles, Victor 9000, Texas Instruments, DEC Rainbow	5 asynch	500K–2M		12,295
	board	IBM compatibles	2–5 asynch, 1–3 synch, 1–2 parallel	256K–2M		6,900
PCnet BLOSSOM	board	IBM and compatibles	none	384K	included; opt. PCnet Cluster Kit ($100)	795–1,295
PCnet PLUS RAM	board	IBM and compatibles	none	256K	included; opt. PCnet Cluster Kit ($100)	595–975
PCnet Rev D	board	IBM and compatibles	none	none	included; opt. PCnet Cluster Kit ($100)	495
PRIMENET Node Controller	board	Prime 50 series systems	none		opt. Primenet software ($7,500), File Transfer Service ($2,000)	5,000
P1000	board	DEC VAX, PDP-11		2K	opt. TCP/IP, Ringway software	3,150–1.5m
P1100	board	DEC LSI-11, PDP-11		2K	opt. TCP/IP software	3,150–1.5m
P1200	board	all Multibus computers		2K	opt. TCP/IP software	3,150–1.5m
P1300	board	Columbia, Compaq, Eagle, IBM PC/XT/AT, AT&T 6300		2K	opt. NetWare/P, TCP/IP software	795–200,000
P1400	board	Gould, Perkin-Elmer, Texas Instruments 9900		8K		2,700–1.5m
P4000	box	Data General, IBM, Prime, Wang	16 asynch	4K		8,000–1.5m

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
RACAL-MILGO INC.					
Planet	baseband	token-passing, proprietary	9.216M	500 stations; 13 miles	RS232C interface
SANTA CLARA SYSTEMS INC.					
PCnet	baseband	CSMA/CD	1M	50 stations; 6,000 feet	ARCNET, Omninet, Starnet
SIECOR FIBERLAN					
Net 10	baseband, fiber-optic	CSMA/CD, IEEE 802.3	10M	1,024 stations; 2.5km	Ethernet Version 1.0, 2.0
SYTEK					
LocalNet 20	broadband	CSMA/CD	120K	35 miles	
TANGENT TECHNOLOGIES LTD.					
ThinkLink	twisted-pair	proprietary	1M	24 stations; 3,000 feet	IBM 3270, X.25, Ethernet
TEXAS INSTRUMENTS INC.					
Ethernet	baseband	CSMA/CD	10M	1,024 stations; 2,500m	X.25; Bridge Communications GS/1, GS/3; Texas Instruments Business System
UNGERMANN-BASS INC.					
Net/One	baseband, thin coaxial baseband	CSMA/CD	10M	1,024 stations; 2,800m	X.25
Net/One	broadband	CMSA/CD	5M	1,500 stations; 10 miles	X.25
VLSI NETWORKS INC.					
1553-NET	baseband	CSMA/CD, CSMA/CA	3M	255 stations; 8,000 feet	
WANG LABORATORIES, INC.					
WangNet	broadband	CSMA/CD, IEEE 802.3, token-passing, proprietary	up to 10M		

TABLE 3

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
PL 2000 TAP	box	all computers with RS232C port	2 asynch, 2 synch	none	none	1,200–1,600
PL 2003 TAP Card	board	all computers with RS232C port	4 asynch, 4 synch	none	none	1,400–1,800
PCnet	board	IBM, AT&T, Compaq, Tele-Video, Corona, Columbia	3 parallel	none	included	495–2,095
PCterminal		IBM, AT&T, Compaq, Tele-Video, Corona, Columbia	2 asynch, 4 IEEE 488, 3 parallel	64K–640K	software ($1,495)	1,595–2,195
Interface hardware from Bridge Communications		DEC, Xerox, Ungermann-Bass				
20/100	box		2 asynch			350–500 (per user)
20/105	box		2 synch			350–500 (per user)
20/220	board					350–500 (per user)
801	box	IBM PC and compatibles	8 asynch, 24 synch, 2 parallel	512K–16M	TNOS software	15,000–235,000
EI300	board	Texas Instruments Business System 300	3 asynch	128K	opt. Distributed Network I/O (DNIO)	2,950
EI990	board	Texas Instruments Business System 600, 800		128K	opt. Distributed Network I/O (DNIO)	2,950
Ether-Link	board	IBM PC/XT, Texas Instruments Professional Computer, Portable Professional Computer	none	2K	opt. 3M Ether-Series ($500)	585–899
Network Interface Unit 2A	box	any computer with RS232C, IEEE 488 port	24 asynch, 20 synch		opt. Net/One, Virtual Circuit, Datagram software	11,525
Network Interface Unit 130	box	any computer with RS232C, IEEE 488 port	2 asynch, 2 synch		opt. Net/One, Virtual Circuit, Datagram software	1,400
Network Interface Unit 150	box	any computer with RS232C, IEEE 488 port	6 asynch, 4 synch		opt. Net/One, Virtual Circuit, Datagram software	2,900
Personal Network Interface Unit 1	board	IBM PC and compatibles			opt. DiskShare, PrintShare, MailShare software	1,095
Personal Network Interface Controller	board	IBM PC and compatibles		16K	opt. DiskShare, PrintShare, MailShare software	595
1553-A	board	Apple II, IIe				349 (board)
1553-I	board	IBM PC/XT/Portable and most compatibles	4K–64K	PC-LAN software ($250 per network)		349 (board)
1553-S	board	Zenith Z-100				349 (board)
CMUX-3270						
Ergo-II WN2, Ergo-III WN3						
FFM66449, FFM96232						
PC-PM075						
Netmux						
Cable Interface Unit (CIU)						

LOCAL AREA NETWORK

Company Network name	Networking media	Network access	Data rate (bps)	Max. no. stations max. distance (end to end)	Gateways available
WESTERN TELEMATIC INC.					
RS232C Smart Switch	twisted-pair		9600K	16 stations; 2,000 feet	ASCII, RS232C port
XYPLEX INC.					
XYPLEX System	broadband, fiberoptic	CSMA/CA	1M	32,000 stations; 6 miles	XP-3270 SNA, bisynch
ZTEL INC.					
Private Network Exchange (PNX)	baseband, twisted-pair, fiberoptic	token-passing, IEEE 802.5	4M	250 stations; 64 km	

Information was solicited but not received from the following manufacturers:

Cadmus Computer Systems
David Systems
Digital Equipment Corp.
Hewlett-Packard Co.
Honeywell Information Systems

For information on their products, consult the Supplementary Directory of Manufacturers on page 113.

TABLE 3

NETWORK INTERFACE HARDWARE

Network interface model name	Interface product type	Computers supported	Ports	Buffer memory size (bytes)	Networking software	Price ($)
SS-8	box	any CPU with RS232C ASCII port	8 asynch	none		895
SS-16	box	any CPU with RS232C ASCII port	16 asynch	1K per port		1,600
XP-CC8	box	computers with RS232C asynch port	8 asynch			5,000
XP-IPC	board	IBM PC	1 asynch			960
XP-UN64	board	DEC VAX	64 asynch			5,700–9,500
Data Adapter	board	all computers compatible with RS232C port	1 asynch, 1 synch		included	
Data Server	box	all computers compatible with RS232C port	1 asynch, 1 synch		included	
Ztel Processing Element		all computers compatible with RS232C port		up to 16M	included	

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8 Plus 16 resident emulations you can switch at the touch of a key. Including the TeleVideo 910, 910+, 912, 920 or 925*..

9 The Lear Siegler ADM 3, ADM 3A, 3A+ or ADM 5*..

13 What's more, we'll add more. In OEM quantities, we'll customize our 210's appearance, personality and programming so it's perfectly suited to your needs.

14 And if you need a more powerful terminal with even more features, consider the next step up in our family of terminals: the Ampex 230.

15 We back every Ampex terminal with a six month warranty and a worldwide service network.

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5 And with a soothing, flicker-free amber screen for easy reading. (If you prefer, you can have the option of green at no extra cost.)

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10 The Esprit (Hazeltine) 1400, 1410 or 1500*..

11 ADDS Regent 20, 25 and Viewpoint.†..

12 And Qume's QVT 102*

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17 So if you need a well-designed, full-featured terminal, call us at 800 621-0292. Or 800 821-9473 in California. We'll show you how you can be very comfortably situated for just $549.

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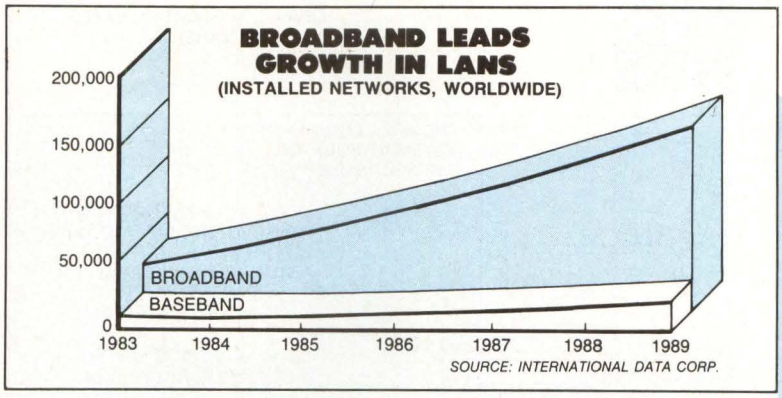
CIRCLE NO. 37 ON INQUIRY CARD

THE SEARCH IS ON FOR STANDARDS, SECURITY

Networking software is matching hardware to hardware while opening up application opportunities for value-added resellers and system integrators

Carl Warren, Western Editor



Software is rushing to the rescue of networks. The purpose of a network is to provide terminals with mutual access to many devices and to share data among them. What makes a network operational is software, and newer, sophisticated approaches are rapidly becoming available.

Independent software consultant Robert Anton Byers explains, "Computers are primarily useful for handling large databases. The network extends the availability of the database; the trick is to maximize the network's use." And according to Robert G. Brown, general manager for communications products of Quadram Corp., Norcross, Ga., the growing interest in networks stems from "increasing productivity, by making the best use of [those] databases."

Leo Nikora, group manager of systems product marketing, Microsoft Corp., Bellevue, Wash., says networking software must provide:

- A standard interface for applications which makes the networking hardware transparent to the software developer and end user
- File security, both from a restricted-use standpoint and to prevent accidental corruption due to a number of users accessing the same file.

Brown says of hardware transparency: "Application developers want to develop to a standard interface and not worry what's below it. In most cases, they don't understand the full system architecture needs anyhow, and they shouldn't be worried about it."

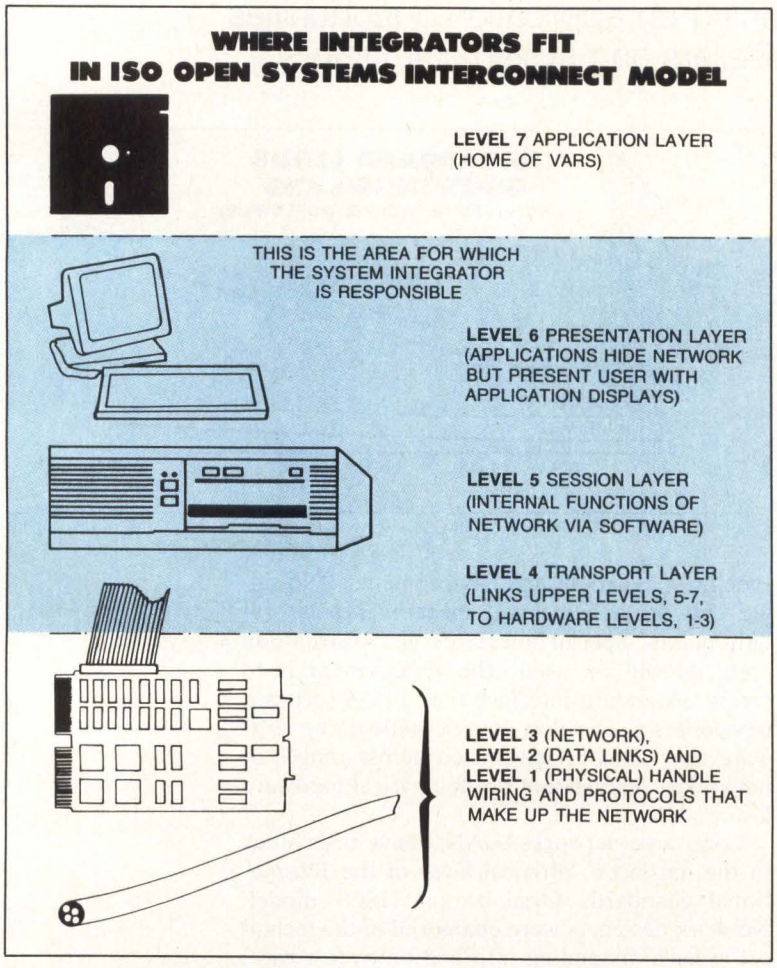
Nikora says there will be many networks that offer a range of cost-performance attributes for specific applications and environments. "No single network scheme will meet everyone's requirements. Special interfaces and distribution methods will be used...the requirement is to create a standard interface that allows software developers to develop generic networking software that can be transported across ranges of networks, independent of the physical hardware layer."

Local area networks (LANs) have been stuck in the hardware, physical layer of the International Standards Organization (ISO) model. Network designers were enamored of the technical aspects of sending information over a wire, not of the actual application of the network. Network watchers like Sherry Geddes, vice president, communication systems for Strategic Inc., Cupertino, Calif., says this fixation on technology for technology's sake hindered the growth of networks. "That isn't the case now. Forget the

hardware. The card will take care of the wire. The software guy can worry about applications and forget the guts of the network."

Many manufacturers of networking software are coming up with "standard" interfaces. Among these are Novell Inc., with its Netware software; Applied Intelligence Inc., with PC-NOS, and Network Research Corp., with Fusion. The Fusion network software works with a number of LANs and operating systems including MS-DOS, UNIX and Digital Equipment Corp.'s VMS. Digital Research Inc. (DRI) has developed a standard Concurrent PC-DOS interface.

Although there may be no true standard interface, most companies planning on implementing networks are excited about the prospect of having device-independent application software.



Networking software *has moved up the International Standards Organization model to cover the fourth through the seventh layers. Because of that, application developers can concentrate on the operation of the software rather than on the guts of the network. Industry consultants agree that the application layer will push the acceptance of networks.*

Nissan Motor Corp. is developing a shared-resource network based on IBM Corp. PCs. According to a company spokesman, one of the inhibiting factors has been the lack of a consistent way to create applications. Nissan wants to create a series of applications that would be transportable across a range of networks, and they are looking forward to having a common interface from which to work.

File security is important

The use of a network implies a multiuser system and file sharing and therefore the necessity for file security. One difficulty facing software developers is the need to cobble their own methods of file locking and file sharing. "Everyone had their own way of doing things, and that resulted in confusion," says Jean Yates, chairwoman of marketing research firm Yates Ventures, Palo Alto, Calif. Hardware vendors such as AST Research Inc., Corvus Systems Inc. and Western Digital Corp. agree that having a single, common approach to solving interface and file-security problems is an important step forward for networks.

Virtually all vendors of network hardware and software agree that very few applications are network-oriented. In most cases, applications are input/output bound—they sit and wait for data input from somewhere, usually a keyboard. This represents a bottleneck because data has to be put into the applications manually, typically moving the data from a remote storage device to the local desktop computer. Flags are set to advise other members of the network that the file is in use and can't be updated until released.

Open system a must

Ian Wallace, director of product support for Applied Computer Techniques (ACT) Plc., Birmingham, England, contends that having an open software architecture is a must for networking systems. "We are using the Corvus Omninet chipset on a board of our design as the physical layer of our network. We could have used anything since it has to be transparent. What we wanted, and got, was a transportable operating network system from Microsoft with Networks 1.0. It gave us the level of integration we wanted and makes it easy for our value-added resellers (VARs) to add value to our Point 32 system with specialized network applications."

The Microsoft Networks 1.0 is an extension of Microsoft's operating system MS-DOS. The software permits multiple microcomputer systems to share resources. Currently 26 vendors of networking systems, including IBM, have implemented Networks. Some industry observers are

Managing the data on a network

With local area networks (LANs) appearing to provide sharing of resources such as disk storage, system integrators face a new problem: how to find the data.

Many of the systems now available, such as Applied Computer Techniques' Apricot Point 32, can support multiple file servers. What's needed in such systems is a conscious effort to manage the data store. Microsoft Corp.'s Leo Nikora says that what is at issue is not technology but rather deciding how to line up the data.

Since most networking software provides some form of device-naming convention (Microsoft's MS-DOS uses full English names), each file server can be given a specific name. For example, the file server where word-processing documents will be stored would be called "Document," the one for spreadsheet data, "Financial," and so on. One method of finding a specific piece of data would be asking for a directory of each file server.

Another approach would use a standard device name. Under that approach, /DOCUMENT/THANKYOU.LTR, would retrieve the "Thankyou.ltr" file from the file server designated "Document." The slashes (/) denote typical network convention under MS-DOS or UNIX to define a specific path.

Because most of the newer operating systems, such as IBM Corp.'s PC-DOS and MS-DOS, provide UNIX-like sub-directories in a tree structure under parent directories, the file management problem can become more difficult. But an approach similar to one used to locate a flat file can be executed to find files in hierarchy-based operating systems like PC-DOS or UNIX. /DOCUMENT/LETTER/SPECIAL/THANKYOU.LTR, would first find the file server called "Document," then the parent directory "Letter," the sub-directory "Special" and finally the specific file "Thankyou.ltr." The system integrator must decide how to relate the sub-directories to the total system and how to develop a road map for the network users.

The next generation of networking software should provide a better solution to the problem. Network operating systems that automatically locate files by using virtual objects as pointers are expected by late this year. Thus, a user can find any file on any server in any network simply by asking for it.

betting that Microsoft, in concert with IBM, has established a de facto standard not only for the overall network operation but also for the integration interface.

The Networks concept is totally hardware-independent, but the software is dependent on MS-DOS 3.1. It provides the integration level at the ISO transport interface layer. Networks is designed to establish virtual circuits to the hardware network. Thus, reading, writing and error correction are taken care of without intervention on the part of the user or application software.

ACT's Apricot Point 32 system takes advantage of the networking software. The system permits as many as 10 file servers to reside on the system. "We can't limit the network, or the cleverness of the software developer. The open architecture means that software can be written that recognizes all the devices on the network and maximizes their usefulness," says Wallace.

Moving to a higher level

Removing the application programmer from the primitives of the hardware and operating system is clearly a benefit. This has been a much-sought-after goal by most system designers, as evidenced by the major industry trends toward standard software interfaces. But Microsoft's Nikora says that providing a common interface just moves the application developer to a higher level and doesn't inhibit his designs.

Strategic's Geddes says that the transport, session and presentation layers are the most important levels of the ISO model. The move to the higher levels of the model are making it easier to handle file sharing and security problems. "That's going to have a strong impact on the viability of networks in general," says Geddes. Quadram's Brown agrees, but he isn't convinced that the VAR, user or software developer should be completely restricted from the basic operating system altogether. "We don't know exactly what someone will want to do. We shouldn't inhibit creativity. So we can't hide everything; just make it easier."

DRI's president and chief executive officer, John Rowley, says integrators require a consistent architecture, as well as portability of the application. "UNIX and UNIX-like operating system approaches appear to offer a viable solution. The key, however, isn't necessarily the actual operating system, but rather a consistent interface approach."

Nikora and Brown warn that licensing may be a problem. Typically, single-user application software is licensed to one machine. If it is put on a file server for use by many users, it can violate the license. To get around this, companies such as Ashton-Tate, and Probase Group, are offering network versions of their database products that provide the required license, as well as file lockouts and sharing semaphores. □

Interest Quotient (Circle One)
High 459 Medium 460 Low 461

NETWORKING SOFTWARE

TABLE 4

Company Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price ($)	Function
APPLIED INFORMATION SYSTEMS INC.						
BURCOM	proprietary	DEC	DEC VAX/VMS, PRO/POS, MICRO/RSX, PDP-11/RSX		695 (PRO); 1,995 (MICRO); 4,400 (PDP-11); 5,000 (VAX)	allows communications between DEC and Burroughs computers, supports the Burroughs point-to-point conversational and poll-select protocols to give high throughput data transmission
BRIDGE COMMUNICATIONS INC.						
SW/1-A/BSC	Ethernet, XNS, asynch, bisynch support, Ethernet systems products	CS/1-A or CS/1-BSC Bridge Communications Server/1	independent operating systems		150 (per server)	provides multiplexed virtual circuits for 32 terminal devices connected with hosts across Ethernet; supports clearinghouse logical naming
SW/1-HSM	Ethernet, XNS, Ethernet systems products	CS/1-HSM	DEC VMS, Berkeley UNIX Version 4.2 supporting multiple DEC DMF32	operating systems supporting DEC DMF32	150 (per server)	provides multiplexed virtual circuits for up to 64 users in a DEC VAX system; supports clearinghouse logical naming
SW/1-SNA (3270)	Ethernet, XNS, SNA 3270, Ethernet systems products	CS/1-SNA (3270)	IBM MVS VTAM; NCP/ACF; supporting IBM 3274 Model 51-C	SNA network supporting IBM 3274 devices	1,000 (per server)	provides protocol conversion for ASCII (asynch) terminals to access IBM or compatible mainframes supporting SNA; emulates 3274 Model 51.C; allows TeleVideo 925, IBM 3101, ADM 1178, DEC VT100 terminals to perform as 3278 displays
SW/1-X.25	Ethernet, XNS X.25 host support, Ethernet systems products	CS/1-X.25 Bridge Communications Server/1	independent operating systems supporting X.25 interface	X.25 software on host, high speed hardware interface to 64Kbps	2,000 (per server)	provides multiplexed virtual circuits to hosts supporting X.25; local network appears to host as PDN
SW/2-CS/ICS	Ethernet, XNS, X.25, X.29, X.28, X.3, TYMNET, TELENET	GS/1			2,000	connects physically isolated Ethernet via X.25 network; supports 48 sessions
SW/3	Ethernet, XNS, HDLC	GS/3			300	performs internetwork routing for up to 8 remote Ethernets
SW/100-488	Ethernet, XNS, IEEE 488 support	CS/100-488	independent operating systems	IEEE 488 interface driver	150 (per server)	provides host or system connection service for IEEE 488 compatible devices; functions as an IEEE 488 controller
SW/100-A/BSC	Ethernet, XNS, asynch, bisynch support	CS/100-A or CS/100-BSC Bridge Communications Server 100	independent operating systems		150 (per server)	provides multiplexed virtual circuits for 32 terminal devices connected with hosts across Ethernet; supports clearinghouse logical naming
SW/100-NCS	Ethernet, XNS, asynch, bisynch support	NCS/100 with network of CS/1-A, CS/1-BSC, CS/100-A, CS/100-BSC, CS/1-AX, CS/1-BSCX, CS/100-AX, CS/100-BSCX	independent operating systems		1,500	a network control server which supports up to 40 CS/1 or CS/100 servers; provides centralized control and boot loading servers; maintains clearinghouse logical naming and configuration files on single unit
CINCOM SYSTEMS INC.						
NET/MASTER	SNA	IBM 43XX, 30XX; FACOM	IBM MVS, VS/1	IBM VTAM	15,000–75,000	integrates a multi-application IBM network into a single, integrated operating unit
CODEX CORP.						
Codex 4000 Series LAN	Net/One	Codex 4001, 4002 Entryway, PC Entryway	IBM PC, MS-DOS	Codex Personal Computer Network, Network Operating Systems Software (NOSS)		allows sharing of disks and printers on the LAN
COMMUNICATION MACHINERY CORP.						
TCP-IP	Ethernet	Communication Machinery Corp. ENP-10, ENP-20, ENP-30, ENP-40	UNIX, DEC VAX/VMS		400	implements TCP-IP protocols with ARPANET FTP, SMTP; TELENET; Berkeley UNIX Version 4.2, RCP, RSH, RLOGIN

NETWORKING SOFTWARE
TABLE 4

Company Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price ($)	Function
XNS	Ethernet	Communication Machinery Corp. ENP-10, ENP-20, ENP-30, ENP-40	UNIX, DEC VAX/VMS, VERSAdos		500	implements XNS protocols
COMMUNICATIONS SOLUTIONS INC.						
Access/SNA	SNA	synch interface	MS-DOS, UNIX			emulates IBM full cluster controller products; written in C; off-the-shelf emulations for IBM 3270, 3770, 5251; bisynch 3270 available
CORVUS SYSTEMS INC.						
Constellation II	OMNINET	Corvus OmniDrive, Disk Server plus transporter cards	IBM PC-DOS 1.X, 2.X, 3.0; Apple DOS; CP/M Pascal; UCSD P-system; Pro-DOS; Texas Instruments; MS-DOS 1.1, 2.1	multicomputer applications software	150–495 (per operating system)	shared Corvus hard disk access and management; user/password access; diagnostics; configuration utilities
OmniShare	OMNINET	transporter cards	IBM PC-DOS 2.X, 3.0	multicomputer applications software	795–995 (includes interface transporter card for IBM XT/AT)	shared Corvus hard disk access and management; user/password access; diagnostics; configuration utilities
COSI						
Communique	proprietary	RS232C	IBM PC and compatibles, computers with UNIX	none	PC package ($195), opt. UNIX package ($295)	connects IBM PC running DOS with UNIX-based micro- and minicomputers; emulates DEC, IBM, Tektronix (graphics) terminals
DATA GENERAL CORP.						
Xodiac	Ethernet, IEEE 802.3, Net/One	Ethernet 802.3 Micro Controller, Interlan Communications Controller, Data General NBS, MCA	Data General AOS, AOS/VS	Data General Remote Infos Agent (RIA), Remote Database Agent (RDA)		provides virtual terminal; resource management applications, file transfer and electronic mail capabilities
DAVONG SYSTEMS INC.						
MultiLink	MultiLink	ARCNET	IBM PC-DOS 1.1, 2.0, 2.1, 3.0	LAN electronic mail		provides IBM PC users with the ability to share Davong hard disk drives; acts as file server to other PCs in network
DIGITAL MICROSYSTEMS INC.						
HiNet	proprietary HDLC, SDLC, Master/Slave polling	HiNet PC/Adapter Card; DMS-3/B or DMS-86 Network Interface; DMS-86 or DMS-5086 Network Workstation	MS-DOS; CP/M-86, HIDOS (proprietary)		1,500 (bundled with Master, includes MS-DOS); 2,000 (unbundled); 500 (additional for MS-DOS); 500 (additional for CP/M-86)	provides hard disk storage utilities; 3 level password protection; fault tolerance; support for multiple operating systems
EXCELAN INC.						
EXOS 8010 TCP/IP Protocol Package	Ethernet, ARPANET	EXOS Ethernet front-end processors	UNIX using TCP-IP protocol package		10,000 (TCP-IP protocol module)	self-contained, single-board LAN subsystem addresses issues of high-level protocol software integration
GATEWAY COMMUNICATIONS INC.						
Netware/G	G/NET	Gateway Communications PC-LNIM	IBM PC, MS-DOS		1,495; 295 (electronic mail)	provides file server operating system; a complete set of tools for coordinating multiuser access to data
H&A COMPUTER SYSTEMS INC.						
PCAM	IBM PC Access Method Network	asynch modem, IBM Series/1 card	IBM EDX, PXS, PC-DOS		950	allows IBM PC to communicate with IBM Series/1; accesses and copies files to and from Series/1 and PC

NETWORKING SOFTWARE
TABLE 4

Company Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price ($)	Function
RSS	Remote IBM Series/1 Network	asynch, bisynch modem; IBM Series/1 card	IBM EDX, PXS		3,500	provides communication and networking of IBM Series/1 minicomputers; includes remote program execution, file access and copy, RS 3270 emulation
HONEYWELL INC.						
DPS6-DSA	proprietary (Distributed Processing System 6-Distributed System Architecture)	synch modem, modem by-pass	Honeywell MOD 400	host file transceiver	435–790 (license fee software); 55–1,040 (networking modules)	functions as a distributed information processor, a switch, an end-point or as an interface to a public or value-added network
DPS6-SNA	SNA	synch modem, modem by-pass	Honeywell MOD 400		160–290 (software annual license fee), 40–2,435 (networking modules)	supports communications between DPS 6/Level 6 and IBM SNA network; includes SNA transport, interactive terminal, remote job entry facilities
RNP/6	proprietary (Remote Network Processor/6)	synch modem, modem by-pass	Honeywell MOD 400	host file transceiver	165–300 (software license fee); 85–355 (networking modules)	offers networking facilities and transport mechanisms for linking various processors in a distributed environment; combines the functions of remote job entry, terminal concentration, file transmission, application-to-application communications; networking support tools
INNOVATEK MICROSYSTEMS INC.						
ComLINK	asynch	DEC DLV11, DL11	DEC PDP-11/RT-11, LSI-11/RT-11, PRO 300 Series/RT-11		775 [license (per site)]	remote communications enhancement software; provides speed and flexibility for serial line communications on DEC systems; enables systems to emulate an ASR terminal to a remote host computer
ComLINK-Plus	asynch	DEC DLV11, DL11	DEC PDP-11/RT-11, LSI-11/RT-11, PRO 300 Series/RT-11		1,255 [license (per site)]	remote communications enhancement software allows automated tasks to be developed by users; provides interactive commands and 20 special directives
INTELLIGENT TECHNOLOGIES INTERNATIONAL CORP.						
Exchange Series	SNA, bisynch, asynch network	asynch, bisynch, modem	IBM PC/XT/AT and compatibles, IBM PC-DOS	file exchange, coax exchange	695–1,395	supports data communication between IBM PC, PC and mainframe; capacity to share, transfer and file on-line information
INTERLAN INC.						
NP100 Unibus Ethernet	Interlan NET/PLUS, Ethernet		DEC VAX/VMS, Berkeley UNIX Version 4.2		4,290	provides on-board XNS/ITP or TCP/IP networking protocols which offload host from extensive CPU protocol processing
NP200 Q-bus Ethernet Protocol Processor	Interlan NET/PLUS, Ethernet		DEC RSX-11M/M+		2,690	provides on-board XNS/ITP networking protocols which offload host from extensive CPU protocol processing
NP300 Multibus Ethernet Protocol Processor	Interlan NET/PLUS, Ethernet		UNIX System V		2,690	provides on-board XNS/ITP or TCP/IP networking protocols which offload Multibus systems from extensive CPU processing
NS4210 ITP/RSX	Interlan NET/PLUS, Ethernet	Interlan NI1010A Unibus, NI2010A Q-bus Ethernet controller	DEC RSX-11M/MX	RSX-11M/M device driver, application software	2,500 (distribution kit); 25,000 (source code)	allows DEC RSX-11M/MX host to communicate over an Ethernet or internetwork of Ethernets; implements XNS/ITP specifications
NS4230 ITP/VMS	Interlan NET/PLUS, Ethernet	Interlan NI1010A Unibus Ethernet controller	DEC VAX/VMS	DEC VMS device driver, application software	2,500 (distribution kit); 25,000 (source code)	allows a DEC VAX/VMS host to communicate over an Ethernet; implements XNS/ITP specifications

NETWORKING SOFTWARE
TABLE 4

Company Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price ($)	Function
NS4244 ITP/UNIX System V	Interlan NET/PLUS, Ethernet	Interlan NI3210 Multibus Ethernet controller	UNIX System V	UNIX System V device driver, application software	2,500 (distribution kit); 25,000 (source code service)	allows a 68000 UNIX System V host to communicate over an Ethernet; implements XNS/ITP specifications; provides transport system for one or more user-written application programs
NS4280 ITP/VS	Interlan NET/PLUS, Ethernet	Interlan NI4010A Data General Ethernet controller	Data General AOS/VS	Data General AOS/VS device driver, application software		allows a Data General MV-series computer host to communicate over an Ethernet; implements XNS/ITP specifications; provides transport system for user-written application programs
NS4290 ITP/MS-DOS	Interlan NET/PLUS, Ethernet	Interlan NI5010 IBM PC Ethernet controller	MS-DOS	MS-DOS device driver, application software	500 (distribution kit); 25,000 (source distribution kit)	allows IBM PC/XT, Compaq PC to communicate over an Ethernet; provides a complete transport system for user-written application programs
NS7430 NFS/VMS Network File Server Protocols	Interlan NET/PLUS, Ethernet	Interlan NI1010A Unibus Ethernet controller, NS4230 ITP/VMS	DEC VAX/VMS	XNS/ITP protocol software package	1,195 (distribution kit)	allows DEC VAX/VMS host system to share disk-based information with other hosts in family; forms file servers and permits files in one system to be accessed from another system on the same or remotely connected Ethernet
NS7444 NFS/UNIX File Server Protocols	Interlan NET/PLUS, Ethernet	Interlan NI3210 Multibus Ethernet controller	UNIX System V	device driver, XNS/ITP protocol software package	895 (distribution kit)	allows 68000 UNIX System V host system to communicate over an Ethernet; provides a complete transport system for user-written application programs
NS7490 NFS/MS-DOS Network File Server Protocols	Interlan NET/PLUS, Ethernet	Interlan NI5010A IBM PC Ethernet controller	MS-DOS	device driver, XNS/ITP protocol software package	195 (distribution kit)	allows MS-DOS based systems to communicate over an Ethernet; provides a complete transport system for user-written applications
METAPATH INC.						
CNM-001	ROBIN NET	IBM PC/XT/AT with asynch port	MS-DOS 2.0 or higher	MS-DOS 2.0, 2.1, 3.0 or 3.1		provides configuration and management of a Metapath network; connection logging; data generation; statistics on net operation; transverification tests
DFS-001 Network File Server	ROBIN NET	IBM PC/XT with asynch, parallel port	MS-DOS 2.0, or higher	file-client software that uses netfile server		provides file access, storage, retrieval, print spooling, file security
NETWORK APPLICATIONS INC.						
transNET	SNA	synch, asynch modem; SDLC	IBM MVS, VM	IBM VTAM, NCP, TSO	35,000 (base); 2,000–25,000 (options)	maintains editability on IBM, Wang, Data General and DEC office system workstations; electronic document distribution
NETWORK RESEARCH CORP.						
FUSION	Ethernet, OMNINET, proNet	XNS TCP/IP	DEC VAX/VMS, PRO-350 VENIX; IBM-PC/MS-DOS, XT VENIX; UNIX		750–6,000	a communication interface connecting PCs, micros and mainframes which facilitates remote execution, virtual terminal capabilities, internet routing and high-speed file transfer
NORTHERN TELECOM INC./DATA SYSTEMS DIV.						
3274 Emulator	SNA	bisynch modem, Northern Telecom intelligent communications adapter	Northern Telecom 4.1 Omnitask		1,850 (one-time license); 93 (monthly license)	allows Northern Telecom 4XX, 5XX systems to emulate IBM 3274 cluster controller
Network Control Program	Northern Telecom Network Control	autodialer, bisynch modem, Northern Telecom intelligent communications adapter	Northern Telecom 4.1 Omnitask		500 (one-time license)	allows Northern Telecom systems to network together; unattended data transfer between remote systems

NETWORKING SOFTWARE
TABLE 4

Company Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price ($)	Function
OMNIMAIL		autodialer, bisynch modem, Northern Telecom intelligent communications adapter	Northern Telecom 4.1 Omnitask		1,995 (one-time license)	proprietary electronic mail system for use with Northern Telecom 4XX, 5XX systems
ORCHID TECHNOLOGY						
PCnet	IBM PCnet	PCnet adapter card, PCnet PLUS RAM, PCnet BLOSSOM	IBM PC-DOS, MS-DOS	PCnet Mail, Command Spooler, LANComm-Multitasking	495 (PCnet); 695 (PCnet BLOSSOM); 595 (PCnet PLUS RAM)	PC to PC communication, disk sharing, caching, partitioning
ORION SOFTWARE INC.						
Network Orion	proprietary	2400, 4800 bisynch modem	IBM System 34/36/38			modular communications software may be used for singular or multiple installations; electronic mail to PC in 5251 emulation mode or Telex address; document transmission between IBM System 34/36/38 computer and Wang or IBM word processor
Telex/38	ITT Databridge	2400, 4800 bisynch modem	IBM 38 CPF		5,100–6,300	interface with Telex network; users may establish public and private distribution lists; switched communications line
PACER SOFTWARE INC.						
pcLINK	proprietary	asynch modem	Prime Primos, IBM PC, MS-DOS		2,000 (host, 5 PCs)	functional microcomputer interconnect package for Prime Computer 50 Series; IBM PC/XT/AT are target PC
PATHWAY DESIGN						
pcPATH	SNA, BSC	synch modem, communications adapter	IBM PC, MS-DOS, IBM compatibles		595; 295 (communications adapter)	allows IBM PC/XT/AT to emulate SNA, BSC; supports variety of host, communications controllers, multiple sessions; provides programmatic interface for writing custom applications
netPATH	SNA, BSC	synch modem	IBM PC, MS-DOS, IBM compatibles	DEC VAX/VMS Version 3.0–3.6, RSX-11M Version 4.1 (patch level A or B), RSX-11M+ Version 2.1	795; 295 (communications adapter)	allows IBM PC/XT/AT to emulate SNA, BSC; supports variety of host, communications controllers, access methods, applications, multiple sessions; provides programmatic interfaces for writing custom applications
uniPATH	SNA, BSC	synch modem	UNIX System III, V; UNOS, XENIX		795 (5 sessions); 1,395 (16 sessions); 1,995 (32 sessions)	allows UNIX-based computer systems to emulate SNA, BSC; supports variety of IBM hosts communications controllers, access methods; up to 32 concurrent sessions; provides programmatic interfaces for writing custom applications
PRIME COMPUTER INC.						
PRIMENET	PRIMENET/RINGNET	PRIMENET Node Controller	PRIMOS	PRIMOS	7,500 (single license)	facilitates terminal connection to many network hosts, access to remote files, file transfer and information routing
TECHNOLOGY CONCEPTS INC.						
Broadway	DECnet	Ungermann-Bass NIU series	DEC VAX/VMS Version 3.0–3.6, RSX-11M Version 4.1 (patch level A or B) RSX-11M+ Version 2.1	DECnet	2,500 (minimum 4 nodes); 500 (per node)	provides 5Mbps on 6MHz channel up to 9.5 miles between any DEC VAX, PDP-11 CPU
Etherway	DECnet, DEC VAX/VMS, RSX-11M	Interlan NI1010 Unibus, NI2010 controller	DEC VAX/VMS Version 3.0–3.6, RSX-11M version 4.1 (patch level A or B), RSX-11M+ Version 2.1	DECnet	2,500 (minimum 4 nodes); 500 (per node)	provides 10Mbps Ethernet CSMA/CD across up to 2500m between DEC VAX, PDP-11 CPU

NETWORKING SOFTWARE
TABLE 4

Company Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price ($)	Function
Ringway	DECnet	Proteon p1000 Unibus proNET, p1100 Q-bus, proNET controller	DEC VAX/VMS Version 3.X, RSX-11M Version 4.1 (patch level A or B), RSX-11M+ Version 2.1	DECnet	2,500 (minimum 4 nodes), 500 (per node)	provides 10, 80Mbps token-passing ring; multiaccess up to 1.5 miles between DEC VAX, PDP-11 CPU
TEXAS INSTRUMENTS						
Distributed Network I/O (DNIO)	Ethernet, X.25	Texas Instruments EI300, EI990, XNS internet bridges	Texas Instruments Distributed Network Operating System (DNOS)	Texas Instruments Distributed Network Communications System (DNCS) required for X.25 network access	3,500 (DNIO object); 1,300 (DNCS)	provides transparent I/O to files, devices, or other programs; allows sharing of files, printers and communication gateways in a LAN or wide area network; virtual terminal capability; transparent internetwork routing
EtherSeries	Ethernet	EtherLink	MS-DOS 2.1	EtherPrint, EtherMail, EtherVoice, Business System Access	500 (EtherPrint); 750 (EtherMail); 195 (Business System Access)	provides PC disk, print and mail servers; allows client PC's to share disk, print and mail servers
TRANSACTION DATA SYSTEMS INC.						
Freedom Network System	PNF-Packet Network Facility	bisynch protocol	Perkin Elmer 0S/32		5,000 (PNF license)	provides PAD services, packet switching, adaptive routing, multiple priority levels, connected virtual channels; opt. encryption by user choice
UNISOFT SYSTEMS						
ACCESS/SNA for UniPlus+	SNA	SDLC	UNIX		10,000 (basic porting fee); 100–210 (license)	provides level of SNA protocol support used by most IBM distributed processing, office automation products
B-Net	Ethernet	Ethernet	UniPlus+	UniPlus+	400	allows any system running UniPlus+ to communicate with any other machine using TCP/IP compatible protocol; features remote file transfer, virtual terminal facilities

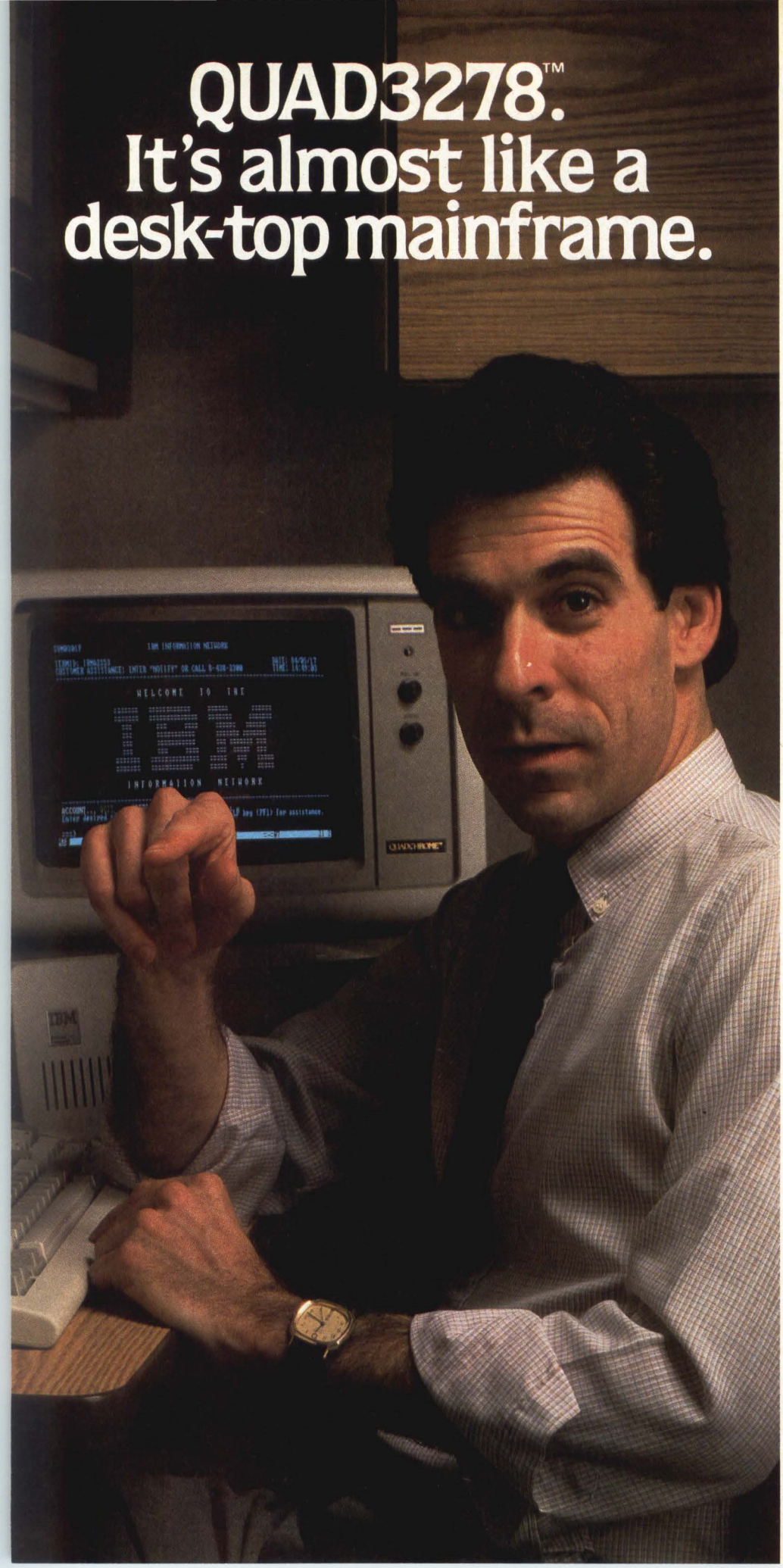
Information was solicited but not received from the following manufacturers:

Cadmus Computer Systems

Digital Equipment Corp

For information on their products, consult the Supplementary Directory of Manufacturers on page 113.

QUAD3278™. It's almost like a desk-top mainframe.



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CIRCLE NO. 38 ON INQUIRY CARD

VOICE-DATA INTEGRATION ENTERS WAR FOR DESKTOPS

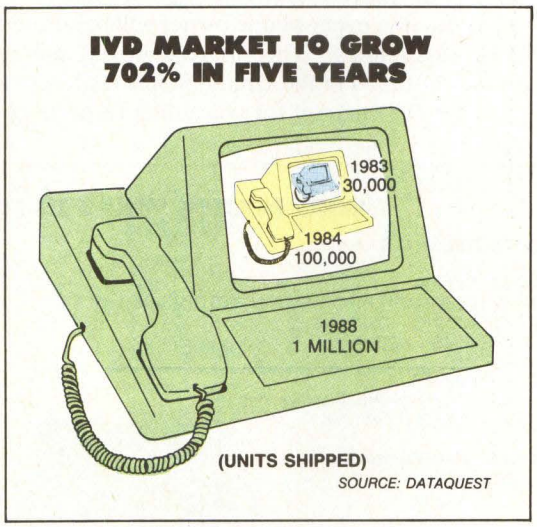
Telephone, computer and terminal manufacturers try a new mix of product capabilities to secure larger shares of the office-automation marketplace

Jerry Borrell, Senior Western Editor

The desktop represents the battleground for vendors seeking a share of the office-automation marketplace. Until recently, firms within the computer and telephone industries competed separately. However, as each industry reached for the technology of the other, rivalry between them increased dramatically. In addition, this merging of communication and computer technology has created a new product market. The result? Integrated voice-data (IVD) products are now appearing as fierce competitors to dedicated terminals and personal computers.

Greg Carlsted, industry analyst for Dataquest Inc., San Jose, Calif., contends that IVD shipments will expand from 100,000 units in 1984 to around one million units in 1988.

As expected, each industry brings its own approach to the integration of voice and data. However, all manufacturers seek to unite telephone features (auto-dialing, electronic messaging and voice communication) and terminal functions (alphanumeric display, database access) with personal computer operations (word processing, spreadsheets). Consequently four categories for the IVD market have emerged: integrated voice-data terminals, voice-data terminals with local processing, additions to existing computers and private branch exchange (PBX) products. Although each category has its champions, industry analysts suggest that the acquisition of Rolm Corp. by IBM Corp. has positioned IBM to move into any or all of the categories.



Major market targeted

Each of the categories has a market niche, but it is difficult for system integrators to choose which features to build into their IVD products when the market is still largely undefined. Jack Conroy, chief executive officer at Santa Barbara Laboratories Inc., Santa Barbara, Calif., says

Add-on products represent the market with the greatest potential for fast, near-term growth.

300,000 office executives represent one target audience for IVD products. Another is the "knowledge worker," estimated to include 60 percent of all employed people in the United States. Specific job categories in this market include clerical workers who use terminals for data entry, airline employees who require programmable functions, professionals in medicine and law and specialists in finance and brokerage who require local processing as well as terminal functions.

Phone features desired

Some IVD manufacturers enjoy a market among users desiring access to a database, or among those who use an electronic calendar or electronic mail. These applications suit real estate, finance, banking and brokerage markets.

IVD vendors, then, offer such electronic telephone features as auto-dialing, memory, conferencing and a wide range of ASCII terminal emulation. Phone manufacturers dominate this market segment, but terminal manufacturers, notably Liberty Electronics USA, San Francisco, Calif., and TeleVideo Systems Inc., Sunnyvale, Calif., have established a presence.

Eventually, every phone owner will be offered IVD capabilities. The more-than-100-million phones installed in the United States represent a lucrative IVD market for voice-data technology.

Richard Larson, vice president for sales at Matra Communications Inc., Cupertino, Calif., thinks that, "IVD terminals are not suited for commodity-market competition because they require some software adaptation for specific users." Matra focuses on value-added-resale markets in areas such as real estate, finance, banking, brokerage and electronic mail.

Laura J. Peck, senior analyst at L.F. Rothschild, Unterberg, Towbin and Co., San Francisco, is less than sanguine about the IVD market. She points out the likelihood of "price erosion, particularly for terminal products, occurring as functionality increases." The result is likely to be the cutthroat pricing practices that affect terminal markets.

Save money with add-on products

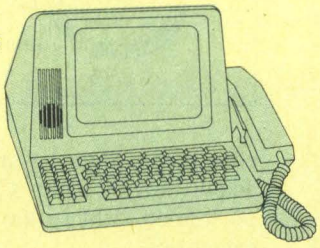
According to industry analysts, add-on products represent the market with the greatest potential for fast, near-term growth. Manufacturers cite the large installed base of IBM PCs as having lucrative potential for add-on telephony and data-function units.

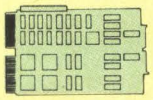
The strength of the add-on market is found, according to Charles Foskett, president of Natural MicroSystems Corp., Natick, Mass., "in the knowledge-based industries that are communications-intensive. As much as 50 percent of the small businesses in the United States fit this

WHO MAKES WHAT IN IVD PRODUCTS

INTEGRATED VOICE-DATA TERMINALS

AMBI CORP.—Ambiterminal, Ambiset
AMERICAN TELEPHONE & TELEGRAPH INFORMATION SYSTEMS—515 BCT
BASIC TELECOMMUNICATIONS INC.—Datavoice 20
GTE COMMUNICATION SYSTEMS—XT 300E
INTEGRATED OFFICE SYSTEMS—Unity 100
LIBERTY ELECTRONICS—Freedom 212, 222
NORTHERN TELECOM INC.—Displayphone, Displayphone Plus
TELEVIDEO SYSTEMS INC.—Personal Terminal
TELRAD—Info 3000
MATRA COMMUNICATIONS INC.—Scanset XL and 415
ZAISAN INC.—ES.1



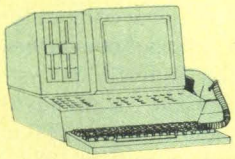


ADD-ON PRODUCTS FOR VOICE-DATA CAPABILITY

BIZCOMP CORP.—Intellimodem (IBM PC family)
CYGNET TECHNOLOGIES INC.—Cosystem (Standalone and IBM PC family)
GANDALF DATA INC.—LineMiser (IBM PC family)
NATURAL MICROSYSTEMS—Watson (IBM PC family)
NORTHERN TELECOM INC./DRI—Starlink (IBM PC family)
SYDIS INC.—VoiceStation (IBM PC family)
WILCOM INC.—Asher (IBM PC family)
VOAD SYSTEMS—Keyboard Phone (IBM PC family)

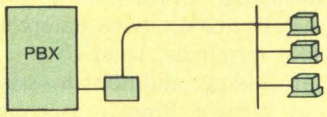
VOICE-DATA TERMINALS WITH LOCAL PROCESSING

MITEL CORP.—Kontact
SANTA BARBARA LABORATORIES—Centerpoint 1000
WANG LABORATORIES INC.—Intecom
ZAISAN INC.—ES.3



MULTIUSER OR PBX-RELATED

AMERICAN TELEPHONE & TELEGRAPH INFORMATION SYSTEMS—Merlin
DAVID SYSTEMS—Information Manager
DAVOX COMMUNICATIONS CORP.—Davoxnet, Davox Workstations
HONEYWELL INC.—Deltaplex
ROLM CORP.—Cypress (terminal), Juniper (IBM PC add-on), Cedar (IVD terminal with local processing)
SYDIS INC.—Voice Station One, Voice Station 110



profile, and each one of these professionals, managers, executives and assistants might have access to a PC." The company's Watson add-on board for the IBM PC is an expensive alternative to an IVD. It costs about $1,000. "The most important consideration in IVD," says Foskett, "is voice communications. Typically, 90 percent of office communications is verbal." The single Watson board incorporates the three principles that Foskett believes are needed in this market: telephone management (including records of the number dialed and the duration of each call), voice communications (including voice storage and forwarding) and data communications (including auto-logon and terminal emulation).

Amy E. Smith, senior research analyst for The Yankee Group, Boston, agrees that "this product category has the largest growth potential in the short term because of the large number of PCs installed. Over the longer term, PBX and PC vendors will be offering IVD products, but probably not until the next PC cycle."

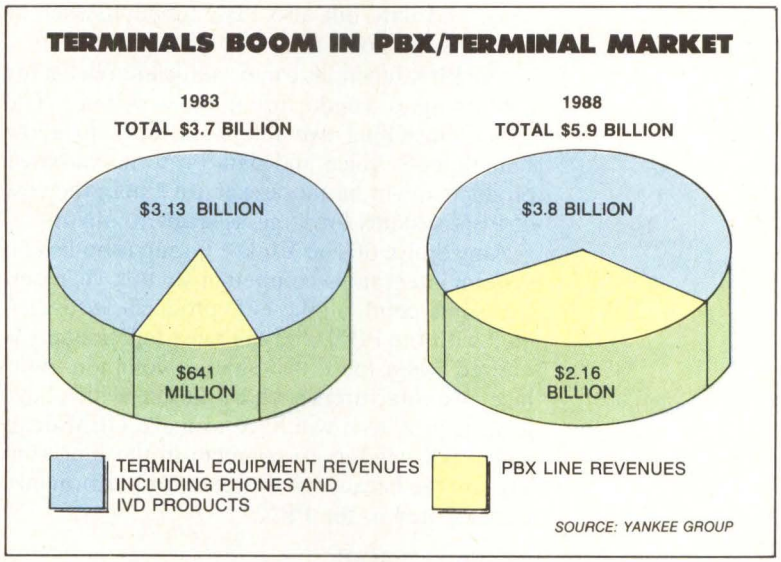
Dennis Haar, product manager for Rolm, Santa Clara, Calif., notes that the "footprint" factor is important. If the professional already has a PC on the desktop, use of an add-on card provides the PC with more productivity without loss of desk space.

A second category of add-on products concerns external products connected to the IBM PC. Such products include Cosystem from Cygnet Technologies Inc., Sunnyvale, Calif.; Line Miser from Gandalf Data Inc., Wheeling, Ill.; and Keyboard Phone from Voad Systems Inc., Los Angeles. Jerry Klein, vice president of marketing for Cygnet, says, "Cosystem provides a concurrent multitasking environment for the IBM PC, allowing the user to do more than one job at once." Few add-on products have this capability, which merely requires, for example, "that the user leave the PC on in order to receive or make a phone call." Both the Gandalf and Voad products can be used with any computer or terminal, a telephone and an RS232 port.

Stretches the PC dollar

The addition of voice and data capability to desktop computers provides dual advantages for system integrators. One set of advantages is best demonstrated in the consolidation of functions found in existing desktop products. If a Rolodex, phone-answering device, note pad, typewriter, phone, word processor and computer are integrated into a single product, system integrators can claim cost savings along with productivity improvements.

Of the five companies currently selling computers with IVD capability, none are among the top sellers of desktop computers. Peck of L.F. Rothschild, Unterberg, Towbin expects there to be 10 companies in the IVD local processing sector next year at this time. "Personal computer manufacturers, such as Apple, Compaq and Hewlett-Packard, must realize," he says, "that these products present formidable competition for them, while PBX manufacturers, such as Intecom and Ztel, recognize this sector as a natural add-on sale for the PBX." In fact, two PBX companies have recently formed joint OEM agreements: Intecom Inc., Allen, Texas, with Wang Laboratories Inc., and Santa Barbara Development Laboratories with Hewlett-Packard Co., Palo Alto, Calif. A third agreement, between AT&T and Convergent Technologies Inc., Santa Clara, Calif., was tentatively scheduled for last month.



Zaisan Inc., Houston, participates in both the terminal and the terminal/personal computer markets. Steve Fowler, director of marketing and one of the company's founders, says Zaisan is seeking the white-collar professional: "...sales people, insurance agents, lawyers and stock brokers." The Zaisan product operates independently of any PBX, but requires two lines for simultaneous voice and data transmissions. The trade-off, declares Fowler, "is that we are able to offer telephony, terminal and computer functions at a price competitive with a plain PC, and at half the cost of Rolm's Juniper/PC combination, which still requires a proprietary PBX."

IVD products can be tied directly to a central communications controller, such as a PBX. There are advantages and disadvantages to this

approach. Rolm's Harr summarizes the benefits to buyers. "The first advantage is speed. With proprietary software, we can transmit data over twisted pair at rates to 19.2K baud. When corporate users want to access a central database, the advantage of a high transmission rate is obvious.

The second advantage relates to the mainframe. When 20 users want to access five ports on the mainframe, the PBX can handle all the queuing. Finally, by using proprietary software, we can use one twisted pair and offer not only voice and data but also PBX functions such as call parking, hold, transfer and speedcall."

The PBX functions can be sufficient reason for purchasing a vendor-proprietary system. The cost of installing two telephone lines to allow simultaneous voice and data on terminal-based products might be more expensive than the cost of PBX systems for large-user environments.

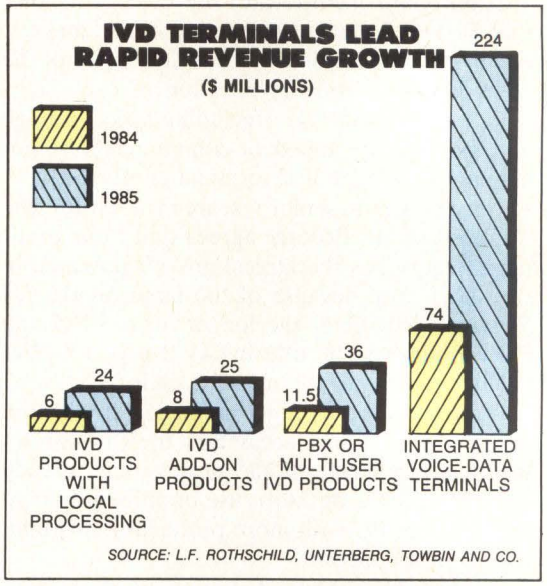
Amy Smith of The Yankee Group is bullish on system integrators competing in this segment. "At some point, all the IVD products are associated with the PBX, and the most functionality is offered when these two share a common interface. Manufacturers such as Zaisan, which have generic products, will have to make OEM deals with PBX vendors to compete in the long run. This is true because of the need for performance features tied to the PBX."

Caution advised

Nevertheless, OEMs and large-volume end users must consider this option carefully. By integrating IVD equipment tied to a PBX, they are constrained to use only those IVD products compatible with the PBX's software. Also, system integrators tie their fortunes to the fortunes of a chosen PBX vendor.

Although Honeywell Inc., Minneapolis, Minn., and Rolm have an early lead in developing IVD devices for proprietary PBXes, two other companies, Davox Corp., Billerica, Mass., and Sydis Inc., San Jose, Calif., are the first companies to supply multiuser IVD systems. Davox chose to provide IVD for the IBM 3270 marketplace. Deirdre Searles, director of marketing for Davox, divides the IVD market into two classes: "...one for high-speed synchronous products, such as those from IBM, and one for asynchronous environments, which must use protocol converters. The asynchronous market is more appropriate for executive workstations, such as those from Zaisan."

Davox expects to have more than one million units in the synchronous 3270 market by 1988 with its IVD terminal and its multiuser, minicomputer network facility called DavoxNet. It is in large-user networks, says Searles, "that Davox offers the greatest advantage. The new Cedar product from Rolm, for example, costs about $5,000, whereas our system in a multiuser environment can bring the individual terminal cost down to $2,500." Davox also allows the system to be configured over existing twisted-pair phone connections.



Sydis has chosen a proprietary multiuser computer system for its voice-data products. According to Ken Gilbert, director of product marketing, Sydis sells multiuser computers to the management information systems market. Part of the impetus for this market, says Gilbert, "was given by the IBM PC. As they went into office environments, users began to connect the PC to the IBM mainframe, demanding CPU time and forcing the MIS group to find independent supporting computers to offload the host." The Sydis product performs this work in addition to offering the user IVD capability.

The Sydis multiuser computer works with the customer's existing analog PBX. Gilbert explains that, "85 to 90 percent of existing PBX equipment is analog. Sydis offers an advantage to all PBX owners, allowing them to retain their current systems for five to seven more years, rather than forcing them to add digital PBX equipment to obtain an IVD system." □

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VOICE/DATA TERMINALS

TABLE 5A

Company Model	Terminal type	Display size, color (diagonal inches)	Screen format (col. x lines)	Interfaces (protocols)	Emulations	Price ($)	Notes, features, options
AMBI CORP.							
Ambiset	intelligent	9-inch, b&w	80 x 8	RS232C, RJ11 (2)	DEC VT100	1,195	10 programmable function keys, portable, electronic mail, interfaces with Bell 103, 212A modem
Ambiterminal	intelligent	9-inch, green	80 x 24	RS232C, RJ11 (2)	DEC VT100	1,195	10 programmable function keys, electronic mail, interfaces with Bell 103, 212A modem
BASIC TELECOMMUNICATIONS INC.							
Datavoice Model 10	intelligent	9-inch, green	80 x 24	RS232C (X-on/X-off)	Lear Siegler ADM 31, ADDS Viewpoint, DEC VT52		Z80 microprocessor with 16K RAM, program memory, RJ11C network interface
Datavoice Model 20	intelligent	9-inch, green	80 x 24	RS232C (X-on/X-off)	Lear Siegler ADM 31, ADDS Viewpoint, DEC VT52	1,995	tape deck for electronic voice mail, RJ11C network interface
BIZCOMP CORP.							
Intellimodem XL add-on device to IBM PC				RJ11C (2) (X-on/X-off, asynch modem)	DEC VT52, VT100, TTY		includes Intellisoft software, auto dial, auto redial, auto answer, RJ11C network interface
CYGNET TECHNOLOGIES INC.							
Cosystem external add-on device for IBM PC						1,495–1,845	36 function keys, auto dial, auto redial, electronic phone directory, speakerphone
DAVOX CORP.							
811 Intelligent Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52	1,795	24 programmable function keys
821 Intelligent Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52	1,995	24 programmable function keys
911 Intelligent PC Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52, VT100	1,980	24 programmable function keys
921 Professional PC Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52, VT100	2,180	24 programmable function keys
DavoxNet 1821 Intelligent Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52	2,310	24 programmable function keys, simultaneous voice/data on twisted-pair telephone wires
DavoxNet 1911 Intelligent PC Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52, VT100	2,295	24 programmable function keys
DavoxNet 1921 Professional PC Workstation	intelligent	12-inch; amber, green	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3278/2, 3178; DEC VT52, VT100	2,495	24 programmable function keys

VOICE/DATA TERMINALS
TABLE 5A

Company Model	Terminal type	Display size, color (diagonal inches)	Screen format (col. x lines)	Interfaces (protocols)	Emulations	Price ($)	Notes, features, options
2911 Professional Color Workstation	intelligent/graphics	12-inch; blue, green, pink, red, turquoise, yellow, white	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3279; DEC VT52, VT100	5,600	24 programmable function keys, bit-mapped graphics
2921 Professional Color Workstation	intelligent/graphics	12-inch; blue, green, pink, red, turquoise, yellow, white	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3279; DEC VT52, VT100	5,700	24 programmable function keys, bit-mapped graphics
3911 Professional Color Workstation	intelligent/graphics	12-inch; blue, green, pink, red, turquoise, yellow, white	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3279; DEC VT52, VT100	5,915	24 programmable function keys, bit-mapped graphics
3921 Professional Color Workstation	intelligent	12-inch; blue, green, pink, red, turquoise, yellow, white	80 x 25	DavoxNet, RS232C (asynch, bisynch, SDLC, SNA)	IBM 3279; DEC VT52, VT100	6,015	24 programmable function keys, bit-mapped graphics
GTE COMMUNICATION SYSTEMS							
XT300	intelligent/graphics	9-inch, b&w	80 x 25	RS232C, RJ11, RJ12, RJ13 (X-on/X-off)	DEC VT100	1,295	mosaic graphics, interfaces with 1200 bps modem, built-in RS232C port
XT300E	intelligent/graphics	9-inch, b&w	80 x 25	RS232C, RJ11, RJ12, RJ13 (X-on/X-off)	DEC VT100	1,395–1,695	16 programmable function keys, dedicated stop/start, interfaces with 1200-bps modem, built-in RS232C port
HONEYWELL INC.							
Deltaplex Series 2000	PBX system	b&w	80 x 3	coaxial, twisted-pair, fiberoptic (proprietary)			32 channel pulse code modulation
INTECOM INC.							
InteCom/Wang Integrated Workstation	intelligent	9-inch, green	80 x 25	RS232C (asynch, bisynch, SNA, SDLC)	DEC VT100, IBM 3101, 3270		available mid-1985, InteCom Intelligent Branch Exchange (IBX) network interface
INTEGRATED OFFICE SYSTEMS							
Unity 100	intelligent	6.5-inch, grey	40 x 8	RS232C, RJ11C, TTY (SDLC, IBM 2780/3780, bisynch)		3,600	5 programmable function keys, data input, remote access file, portable
LIBERTY ELECTRONICS							
Freedom 212	editing	12-inch; green, amber	80 x 24	RS232C, RJ11, RJ12, RJ13	Liberty 200, TeleVideo 950, Lear Siegler ADM 31	1,295	10 function keys, auto dial, auto answer, auto log-on
Freedom 222	editing	12-inch; green, amber	80 x 24	RS232C, RJ11, RJ12, RJ13 (X-on/X-off, DTR)	DEC VT52, VT100, VT220	1,395	10 function keys, auto dial, auto answer, auto log-on
MATRA COMMUNICATION INC.							
Scanset 415HS	intelligent	9-inch, green	80 x 24	RS232C, RJ11C (X-on/X-off)		1,095	6 function keys, auto dial, auto log-on, RJ11C network interface
Scanset XLHS	intelligent	9-inch, green	80 x 24	RS232C, RJ11C (X-on/X-off)		1,395	6 function keys, auto dial, auto log-on, RJ11C network interface

VOICE/DATA TERMINALS
TABLE 5A

Company Model	Terminal type	Display size, color (diagonal inches)	Screen format (col. x lines)	Interfaces (protocols)	Emulations	Price ($)	Notes, features, options
NORTHERN TELECOM INC.							
Displayphone	editing	7-inch, white	80 x 25	RS232C		1,295	2 pages of memory, 5 programmable function keys, calendar/clock, auto dial
Displayphone Plus	intelligent	7-inch, amber	80 x 25	RS232C, RS470, RS478	DEC VT100, VT52, IBM 3101, ADDS Viewpoint, Regent	1,595	5 programmable function keys, auto dial, auto answer, calendar/clock
Starlink add-on device to any IBM PC family and compatibles						1,800 (station)	
RACAL-MILGO INC.							
8000 Series	editing	15-inch; green	80 x 24	RS232C (Bell 8A1, DEC VT220, IBM 3270, Univac 400)			
SYDIS INC.							
Voice Station 110 add-on hardware and software device to IBM PC					any ANSI 3.64, DEC VT100		RJ11C network interface
TELEVIDEO SYSTEMS INC.							
Personal Terminal	editing	9-inch; yellow, green	80 x 24	RS232C, RJ11 (X-on/X-off, DTR, asynch, ASCII)		499–1,127	14 programmable function keys; non-volatile setup mode; alternate character set; interfaces with 300- 1200-bps asynch modem; Bell 103-, 212A-compatible; portable
TELRAD							
INFO 4000	dumb	9-inch, green	80 x 25	RS232C, TTY, opt. RS422 (asynch, ASCII)	DEC VT52, VT100, IBM 3101		12 function keys, touch screen, auto log-on, auto dial
VOAD SYSTEMS							
Keyboard Phone Peripheral add-on device to any RS232C port						209–249	wake-up, phone directory, auto dial, interfaces with RJ11, RJ31X
WILCOM INC.							
Asher II add-on device to any IBM model					IBM PC		help function, calendar, auto dial

VOICE/DATA COMPUTERS

TABLE 5B

Company Model	Display size, color/screen format (col. x lines)	CPU type	Minimum (maximum) memory size in bytes	Operating system	Programming languages (terminal emulations)	Price ($)	Notes, features, options
MITEL CORP.							
KONTACT WORKSTATION	12-inch, green (31 x 80)	Motorola 6809	256K (256K)	proprietary, SB-80	major languages through SB-80 (emulates DEC VT52, VT100; IBM 3278)	4,900	two 350K-byte 5¼ inch diskette drives, 10M-byte hard disk drive, CP/M-80-compatible, electronic mail
NATURAL MICROSYSTEMS							
Watson			192K (192K and up)	IBM PC-DOS		849–998	IBM PC-compatible
POLYMORPHIC SYSTEMS							
Poly 186	14-inch, 16-color (80 x 26)	Intel 80186	512K (2M)	PC-DOS, UNIX	BASIC, Assembler, Pascal C, FORTRAN (emulates DEC VT100, VT220; IBM 3270; Tektronix)		up to four 800K-byte 5¼ inch diskette drives, 80M-byte hard disk drive; opt. light pen, mouse, digitizer
ROLM CORP.							
CEDAR	9-inch, 8-color (80 x 25)	Motorola 8088	512K (512K)	MS-DOS 2.11	GW BASIC (emulates DEC VT100, IBM 3270)	4,245	two 360K-byte 5¼ inch diskette drives, battery backup, speakerphone, auto dial, IBM PC-compatible
SANTA BARBARA LABORATORIES INC.							
Centerpoint 1000	14-inch, green (84 x 24)	Intel 80186	512K (2M)	MS-DOS, CP/M-86	Personal BASIC (emulates DEC VT100)	60,000 (4 users)	one 512K-byte 5¼ inch diskette drive, 80M-byte hard disk drive, spreadsheet, touch screen, electronic mail
ZAISAN INC.							
ES.3	16-color	Motorola Z.80, CMOS 6805, 8088	128K (640K)	MS-DOS 2.0	GW BASIC (emulates TTY, Lear Siegler ADM 3A)	2,595	13 programmable function keys, IBM PC-compatible

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AVANTI COMMUNICATIONS
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Newport, RI 02840
(800) 535-3550
Table 2
Circle 342

BASIC TELECOMMUNICATIONS INC.
4414 E. Harmony Rd.
Fort Collins, CO 80525
(303) 226-4688
Table 5A
Circle 343

BAY TECHNICAL ASSOCIATES
Highway 603, P.O. Box 387
Bay St. Louis, MS 39520
(800) 523-2702
Table 2
Circle 344

BIZCOMP CORP.
532 Mercury Dr.
Sunnyvale, CA 94086
(408) 733-7800
Table 1, 5A
Circle 345

BRIDGE COMMUNICATIONS INC.
1345 Shorebird Way
Mountain View, CA 94043
(415) 969-4400
Table 3, 4
Circle 346

BYTCOM
2169 Francisco Blvd. Unit H
San Rafael, CA 94901
(415) 485-0700
Table 1
Circle 347

CASE RIXON COMMUNICATIONS INC.
2120 Industrial Pkwy.
Silver Spring, MD 20904
(301) 622-2121
Table 1, 2
Circle 348

CERMETEK MICROELECTRONICS INC.
1308 Borregas
Sunnyvale, CA 94088
(408) 752-5000
Table 1
Circle 349

CHUNG TELECOMMUNICATIONS INC.
4046 Ben Lomand Dr.
Palo Alto, CA 94306
(415) 858-2456
Table 2
Circle 350

CINCOM SYSTEMS INC.
2300 Montana Ave.
Cincinnati, OH 45211
(513) 662-2300
Table 4
Circle 351

CODEX CORP.
20 Cabot Blvd.
Mansfield, MA 02048
(617) 264-2576
Table 1, 2, 4
Circle 352

CODENOLL TECHNOLOGYCORP.
1086 North Broadway
Yonkers, NY 10701
(914) 965-6300
Table 3
Circle 353

COHERENT COMMUNICATIONS SYSTEMS CORP.
60 Commerce Dr.
Hauppauge, NY 11788
(516) 231-1550
Table 1, 2, 3
Circle 354

COMDESIGN INC.
751 S. Kellogg Ave.
Goleta, CA 93117
(805) 964-9852
Table 1, 2
Circle 355

COMMUNICATIONS MACHINERY CORP.
1421 State St.
Santa Barbara, CA 93101
(805) 963-9471
Table 3, 4
Circle 356

COMMUNICATIONS SOLUTIONS INC.
992 S. Saratoga-Sunnyvale Rd.
San Jose, CA 95129
(408) 725-1568
Table 4
Circle 357

COMPLEXX SYSTEMS INC.
4930 Research Dr.
Huntsville, AL 35805
(205) 830-4310
Table 2, 3
Circle 358

COMREX INTERNATIONAL
3701 Skypark Dr., #120
Torrance, CA 90505
(213) 373-0280
Table 1
Circle 359

COMMTEX INC.
2411 Crofton Lane
Crofton, MD 21114
(301) 721-3666
Table 3
Circle 360

CONCORD DATA SYSTEMS INC.
303 Bear Hill Rd.
Waltham, MA 02154
(617) 890-1394
Table 1, 2, 3
Circle 361

CORVUS SYSTEMS INC.
2100 Corvus Dr.
San Jose, CA 95124
(408) 559-7000
Table 3, 4
Circle 362

COSI
313 N. 1st St.
Ann Arbor, MI 48108
(313) 665-8778
Table 4
Circle 363

CYB SYSTEMS INC.
6448 Highway 290 E, D-111
Austin, TX 78723
(512) 458-3224
Table 3
Circle 364

CYGNET TECHNOLOGIES INC.
1296 Lawrence Station Rd.
Sunnyvale, CA 94089
(408) 734-9946
Table 5A
Circle 365

DATABIT INC.
110 Ricefield Lane
Hauppauge, NY 11788
(516) 435-4000
Table 1, 2
Circle 717

DATA COMMUNICATIONS BROKERS INC.
4 Henson Place
Champaign, IL 61820
(217) 352-3207
Table 1, 2
Circle 367

DATA GENERAL CORP.
4400 Computer Dr.
Westboro, MA 01580
(617) 366-8911
Table 3, 4
Circle 368

DATAGRAM CORP.
11 Main St.
E. Greenwich, RI 02818
(800) 235-5030
Table 1, 2
Circle 369

DATAPOINT CORP.
9725 Datapoint Dr.
San Antonio, TX 78284
(512) 699-7000
Table 3
Circle 370

DATEC INC.
200 Eastowne Dr. Suite 116
Chapel Hill, NC 27514
(800) 334-7722
Table 1
Circle 371

DATATEL INC.
Cherry Hill
Industrial Center
Pin Oak & Springdale Rds.
Cherry Hill, NJ 08003
(609) 424-4451
Table 2
Circle 372

DAVONG SYSTEMS INC.
217 Humboldt Ct.
Sunnyvale, CA 94086
(408) 734-4900
Table 3, 4
Circle 373

DAVOX CORP.
4 Federal St.
Billerica, MA 01821
(617) 667-4455
Table 5A
Circle 374

DEVELCON ELECTRONICS INC.
744 Nina Way
Warminster, PA 18974
(215) 443-5450
Table 1, 2
Circle 375

DIGITAL COMMUNICATIONS ASSOCIATES INC. (DCA)
303 Technology Park
Norcross, GA 30092
(404) 448-1400
Table 1, 2
Circle 376

DIGITAL MICROSYSTEMS INC.
1840 Embarcadero
Oakland, CA 94606
(415) 261-1034
Table 3, 4
Circle 377

DOELZ NETWORKS INC.
18581 Teller Ave.
Irvine, CA 92715-1693
(714) 851-2223
Table 2
Circle 378

EMULEX CORP.
3545 Harbor Blvd.
Costa Mesa, CA 92626
(714) 662-5600
Table 2
Circle 379

EQUINOX SYSTEMS
12041 SW 144 St.
Miami, FL 33186
(305) 255-3500
Table 3
Circle 380

EXCELAN INC.
2180 Fortune Dr.
San Jose, CA 95131
(408) 945-9526
Table 3, 4
Circle 381

GTE COMMUNICATION SYSTEMS
12502 Sunrise Valley Dr.
Reston, VA 22096
(703) 435-7400
Table 5A
Circle 382

GAMMA TECHNOLOGY INC.
2452 Embarcadero Way
Palo Alto, CA 94303
(415) 856-7421
Table 1
Circle 383

GANDALF DATA INC.
1019 S. Noel
Wheeling, IL 60090
(312) 541-6060
Table 1, 2, 3
Circle 384

GATEWAY COMMUNICATIONS INC.
16782 Redhill Ave.
Irvine, CA 92714
(714) 261-0762
Table 3, 4
Circle 385

GENERAL DATACOMM INDUSTRIES INC.
Middlebury, CT 06762-1299
(203) 574-1118
Table 1, 2
Circle 386

GOULD AMI
3800 Homestead Rd.
Santa Clara, CA 95051
(408) 246-0330
Table 1
Circle 387

H&A COMPUTER SYSTEMS INC.
30 Hotaling Place
San Francisco, CA 94111
(415) 434-3517
Table 4
Circle 388

HALCYON
2121 Zanker Rd.
San Jose, CA 95131
(408) 293-9970
Table 1, 2
Circle 389

HAYES MICROCOMPUTER PRODUCTS INC.
5923 Peachtree Industrial Blvd.
Norcross, GA 30092
(404) 449-8791
Table 1
Circle 390

HONEYWELL INC.
Honeywell Plaza
Minneapolis, MN 55408
(612) 870-5842
Table 5A
Circle 391

HONEYWELL INC.
200 Smith St.
Waltham, MA 02154
(617) 895-6000
Table 4
Circle 392

IDE ASSOCIATES INC.
35 Dunham Rd.
Billerica, MA 01821
(617) 663-6878
Table 3
Circle 393

INFINET INC.
6 Shattuck Rd.
Andover, MA 01810
(617) 681-0600
Table 1
Circle 394

INFOTRON SYSTEMS CORP.
9 North Olney Ave.
Cherry Hill Industrial Center
Cherry Hill, NJ 08003
(609) 424-9400
Table 1, 2
Circle 395

INMAC/DATACOM DIV.
2350 Zanker Rd.
San Jose, CA 95131
(408) 945-1800
Table 1
Circle 396

INNOVATEK MICROSYSTEMS INC.
Smithfield Rd.
Millerton, NY 12546
(914) 373-9003
Table 4
Circle 397

INTECOM INC.
601 InteCom Dr.
Allen, TX 75002
(214) 727-9141
Table 3, 5A
Circle 398

INTEGRATED OFFICE SYSTEMS
20740 Valley Green Dr.
Cupertino, CA 95014
(408) 257-0171
Table 5A
Circle 399

INTELLIGENT TECHNOLOGIES INTERNATIONAL CORP.
151 University Ave.
Palo Alto, CA 94301
(415) 328-2411
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Circle 400

INTERLAN INC.
3 Lyberty Way
Westford, MA 01886
(617) 692-3900
Table 3, 4
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INTERTEC DATA SYSTEMS CORP.
2300 Broad River Rd.
Columbia, SC 29210
(803) 798-9100
Table 3
Circle 402

KINEX CORP.
6950 Bryan Dairy Rd.
Largo, FL 33543
(800) 237-8121
Table 1
Circle 403

LEXICON CORP.
1541 N.W. 65th Ave.
Ft. Lauderdale, FL 33313
(305) 792-4400
Table 1
Circle 404

LIBERTY ELECTRONICS
625 Third St.
San Francisco, CA 94107
(415) 543-7000
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Circle 405

MAGNOLIA MICROSYSTEMS INC.
4039 21st Ave. W.
Seattle, WA 98199
(206) 285-7266
Table 3
Circle 406

MATRA COMMUNICATIONS INC.
20705 Valley Green Dr.
Cupertino, CA 95014
(408) 446-6701
Table 5A
Circle 407

MEGADATA CORP.
35 Orville Dr.
Bohemia, NY 11716
(516) 589-6800
Table 2
Circle 408

METAPATH INC.
737 Lincoln Centre Dr.
Foster City, CA 94404
(415) 345-7700
Table 3, 4
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MICOM SYSTEMS INC.
1400 Los Angeles Ave.
Simi Valley, CA 93063
(805) 583-8600
Table 1,
Circle 410

MICOM SYSTEMS INC.
20151 Nordhoff St.
Chatsworth, CA 91311
(213) 998-8844
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MICROPLEX INC.
1977 State College Blvd.
Anaheim, CA 92806
(714) 634-1535
Table 1
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MINNTRONICS CORP.
2599 White Bear Ave.
St. Paul, MN 55109
(212) 770-5247
Table 2
Circle 413

MITEL CORP.
350 Legget Dr.
Kanata, Ontario
K2K-1X3, Canada
(613) 592-2122
Table 5B
Circle 414

MULTI-TECH SYSTEMS INC.
82 Second Ave. S.E.
New Brighton, MN 55112
(612) 631-3550
Table 1, 2
Circle 415

NCR COMTEN INC.
2700 Snelling Ave. N.
St. Paul, MN 55113
(612) 638-7777
Table 1
Circle 416

NEC INFORMATION SYSTEMS INC.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000
Table 3
Circle 417

NATIONAL INSTRUMENTS
12109 Technology Blvd.
Austin, TX 78727
(512) 250-9119
Table 3
Circle 418

NATURAL MICROSYSTEMS
971 Concord St.
Framingham, MA 01701
(617) 875-3821
Table 5B
Circle 419

NESTAR SYSTEMS INC.
2585 E. Bayshore Rd.
Palo Alto, CA 94303
(415) 493-2223
Table 3
Circle 420

NETWORK APPLICATIONS INC.
Great Hills Corporate Ctr.
9020 Capital of Texas Hwy. N.
Austin, TX 78759
(512) 474-2084
Table 4
Circle 421

NETWORK PRODUCTS INC.
P.O. Box 13239
Research Triangle Park, NC 27709
(919) 549-8210
Table 2
Circle 422

NETWORK RESEARCH CORP.
1101 Colorado Ave.
Santa Monica, CA 90401
(213) 394-7200
Table 4
Circle 423

NORTHERN TELECOM INC.
565 Marriott Dr.
Nashville, TN 37210
(615) 885-3510
Table 5A
Circle 424

NORTHERN TELECOM INC.
2100 Lakeside Blvd.
Richardson, TX 75081
(214) 437-8000
Table 3, 4
Circle 425

NORTHERN TELECOM INC. DATA SYSTEMS DIV.
P.O. Box 1222
Minneapolis, MN 55440
(612) 932-8000
Table 3, 4
Circle 426

NOVATION INC.
20409 Prairie St.
Chatsworth, CA 91311
(818) 996-5060
Table 1
Circle 427

NOVELL INC.
1170 Industrial Park Dr.
Orem, UT 84057
(801) 226-8202
Table 3
Circle 428

ORCHID TECHNOLOGY
47790 Westinghouse Dr.
Fremont, CA 94539
(415) 490-8586
Table 3, 4
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ORION SOFTWARE INC.
222 Third St.
Cambridge, MA 02142
(617) 576-0470
Table 4
Circle 430

PACER SOFTWARE INC.
1227 Pearl St.
La Jolla, CA 92037
(619) 454-0565
Table 4
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PARADYNE CORP.
8550 Ulmerton Rd.
Largo, FL 33540
(813) 530-2000
Table 1, 2
Circle 431

PATHWAY DESIGN
177 Worcester Rd.
Wellesley, MA 02181
(617) 237-7722
Table 4
Circle 432

PENRIL DATACOMM
207 Perry Pkwy.
Gaithersburg, MD 20877-2197
(301) 921-8600
Table 1, 2
Circle 434

POLYMORPHIC SYSTEMS
5330 Debbie Rd.
Santa Barbara, CA 93111
(805) 967-0468
Table 5B
Circle 435

PRENTICE CORP.
266 Caspian Dr.
Sunnyvale, CA 94088-3544
(408) 734-9810
Table 2
Circle 436

PRIME COMPUTER INC.
Prime Park
Natick, MA 01760
(617) 655-8000
Table 3, 4
Circle 437

PROTEON INC.
4 Tech Circle
Natick, MA 01760
(617) 655-3340
Table 3
Circle 438

RACAL-MILGO INFORMATION SYSTEMS
6950 Cypress Rd.
P.O. Box 15662
Plantation, FL 33318
(305) 584-4242
Table 1
Circle 439

RACAL-MILGO INFORMATION SYSTEMS
1601 N. Harrison Pkwy.
Sunrise, IL 33323
(305) 475-1601
Table 2, 3, 5A
Circle 440

RACAL VADIC
1525 McCarthy Blvd.
Milpitas, CA 95035
(408) 946-2227
Table 1, 2
Circle 441

ROLM CORP.
4900 Old Ironsides Dr.
Santa Clara, CA 95054
(408) 986-1000
Table 5B
Circle 442

SANTA BARBARA LABORATORIES INC.
224 Anacada St.
Santa Barbara, CA 93101
(805) 965-4519
Table 5B
Circle 443

SANTA CLARA SYSTEMS INC.
1860 Hartog Dr.
San Jose, CA 95131
(408) 287-4640
Table 3
Circle 444

SCITEC CORP.
850 Aquidneck Ave.
Middletown, RI 02840
(401) 849-4353
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Circle 445

SIECOR FIBERLAN
P.O. Box 12726
Research Triangle Park, NC 27709
(919) 554-3791
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SYDIS INC.
410 E. Plumeria Dr.
San Jose, CA 95134
(408) 945-1100
Table 5A
Circle 447

SYMPLEX COMMUNICATIONS CORP.
2002 Hogback Rd., Suite 17
Ann Arbor, MI 48104
(313) 973-1164
Table 2
Circle 448

SYTEK
1225 Charleston Rd.
Mountain View, CA 94039
(415) 966-7330
Table 3
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TANDY CORP. / RADIO SHACK
1800 One Tandy Ctr.
Ft. Worth, TX 76102
(817) 390-3100
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TANGENT TECHNOLOGIES LTD.
5720 Peachtree Pkwy.
Suite 100
Norcross, GA 30092
(404) 662-0366
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TECH-NEL DATA PRODUCTS LTD.
8 Haslemere Way
Banbury, Oxon
OX16 8TY, England
(0295) 65781
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Circle 304

TECHNOLOGY CONCEPTS INC.
Old Country Rd.
Sudbury, MA 01776
(617) 443-7311
Table 4
Circle 305

TECMAR INC.
6225 Cochran Rd.
Solon, OH 44139
(211) 349-0600
Table 1
Circle 306

TEK-COM CORP.
1887 O'Toole Ave., C103
San Jose, CA 95131
(408) 263-7400
Table 1
Circle 307

TELEVIDEO SYSTEMS INC.
1170 Morse Ave.
Sunnyvale, CA 94086
(408) 745-7760
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Circle 308

TELLABS
4951 Indiana Ave.
Lisle, IL 60532
(312) 969-8800
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Circle 309

TELRAD
510 Broad Hollow Rd.
Melville, NY 11747
(516) 420-1350
Table 5A
Circle 310

TELTONE CORP.
10801 120th Ave. N.E.
Kirkland, WA 98033
(206) 827-9626
Table 2
Circle 311

TEXAS INSTRUMENTS INC.
12501 Research Blvd.
Austin, TX 78759
(713) 895-3113
Table 3, 4
Circle 312

TIMEPLEX INC.
400 Chestnut Ridge Rd.
Woodcliff Lake, NJ 07675
(201) 930-4600
Table 1, 2
Circle 313

TRANSACTION DATA SYSTEMS INC.
5750 Major Blvd.
Orlando, FL 32819
(305) 351-1210
Table 4
Circle 314

TRANSEND CORP.
2190 Paragon Dr.
San Jose, CA 95131
(408) 946-7400
Table 1
Circle 315

TRENDATA CORP.
3400 W. Segerstrom Ave.
Santa Ana, CA 92704
(714) 540-3605
Table 1
Circle 316

TRI-DATA
505 E. Middlefield Rd.
Mountain View, CA 94043
(415) 969-3700
Table 1
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UNGERMANN-BASS INC.
2560 Mission College Blvd.
Santa Clara, CA 95050
(408) 496-0111
Table 3
Circle 318

UNISOFT SYSTEMS
739 Allston Way
Berkeley, CA 94710
(415) 644-1230
Table 4
Circle 319

U.S. ROBOTICS
8100 McCormack
Skokie, IL 60076
(312) 982-5010
Table 1
Circle 320

UNIVERSAL DATA SYSTEMS / MOTOROLA-INFORMATION SYSTEMS GROUP
5200 Bradford Dr.
Huntsville, AL 35805
(205) 837-8100
Table 1
Circle 321

VEN-TEL INC.
2342 Walsh Ave.
Santa Clara, CA 95051
(408) 727-5721
Table 1
Circle 322

VISIONARY ELECTRONICS
141 Parker Ave.
San Francisco, CA 94118
(415) 751-8811
Table 1
Circle 323

VLSI NETWORKS INC.
2631 Manhattan Beach Blvd.
Redondo Beach, CA 90278
(213) 536-0781
Table 3
Circle 324

VOAD SYSTEMS
12301 Wilshire Blvd.
Suite 101
Los Angeles, CA 90025
(213) 207-8866
Table 5A
Circle 325

WANG LABORATORIES INC.
1 Industrial Ave.
Lowell, MA 01851
(617) 459-5000
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Circle 326

WESTERN DATACOM
5083 Market St.
Youngstown, OH 44481
(216) 788-6583
Table 2
Circle 327

WESTERN TELEMATIC INC.
2435 S. Anne St.
Santa Ana, CA 92704
(714) 979-0363
Table 2, 3
Circle 328

WILCOM INC.
1009 Mansell Rd.
Roswell, GA 30075
(404) 993-4590
Table 5A
Circle 329

WOLFDATA INC.
187 Billerica Rd.
Chelmsford, MA 01824
(617) 250-1500
Table 1
Circle 330

XYPLEX INC.
100 Domino Dr.
Concord, MA 01742
(617) 371-1400
Table 3
Circle 331

ZAISAN INC.
14511 Falling Creek
Houston, TX 77014
(713) 580-6191
Table 5B
Circle 332

ZTEL INC.
181 Ballardvale St.
Wilmington, MA 01887
(617) 657-8730
Table 3
Circle 333

SUPPLEMENTARY DIRECTORY OF MANUFACTURERS

Information from the following companies involved in communications was solicited but not received.

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Pittsburg, PA 15241
(412) 746-5500

BO-SHERREL CO. INC.
36133 Niles Blvd.
Fremont, CA 94536
(415) 792-0354

CADMUS COMPUTER SYSTEMS
600 Suffolk St.
Lowell, MA 01853
(617) 453-2899

DAVID SYSTEMS INC.
45 Cabot Ave.
Santa Clara, CA 95051
(408) 985-6400

DIGITAL EQUIPMENT CORP.
200 Baker Ave.
Concord, MA 01742
(617) 264-1669

HEWLETT-PACKARD CO.
3000 Hanover St.
Palo Alto, CA 94304
(415) 857-1501

IBM CORP.
900 King St.
Rye Brook, NY 10573
(914) 934-4836

ROCKWELL INTERNATIONAL SEMICONDUCTOR/ PRODUCTS DIV.
P.O. Box C, 4311 Jomboree Rd.
Newport Beach, CA 92660
(714) 978-0262

LOOKING AHEAD IN MMS

MMS's Spring edition of the Peripherals Digest is coming April 19. The issue is divided into product categories containing pricing and specification tables arranged alphabetically by company, and features a staff-written market overview. A directory of manufacturers, keyed to each table is also included. The product categories include:

- 8- and 14-inch disk drives
- ½-inch tape cartridge drives
- graphics terminals
- printers

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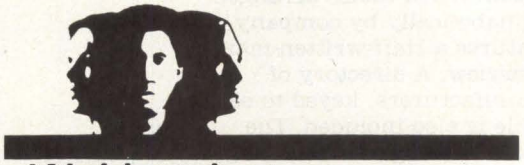

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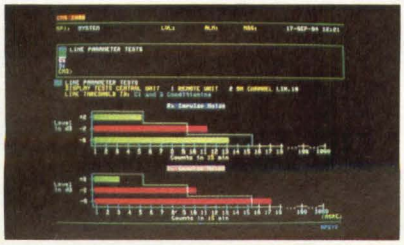

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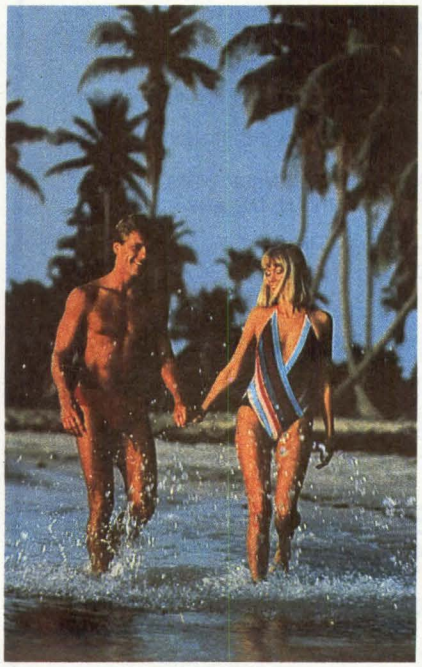

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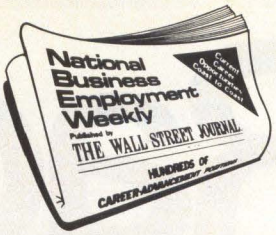

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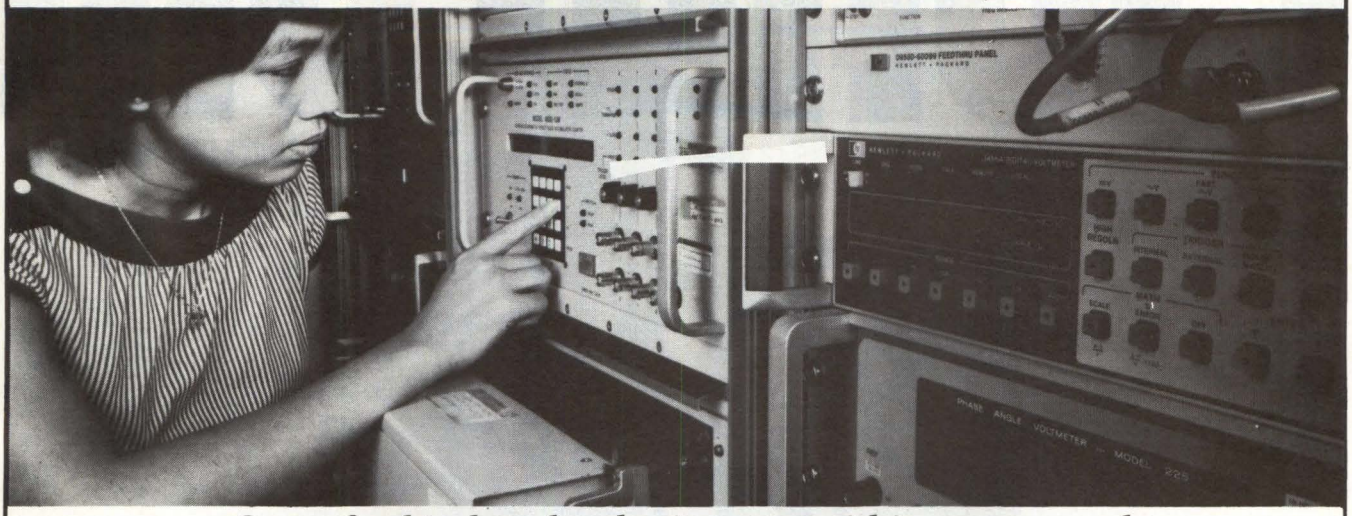

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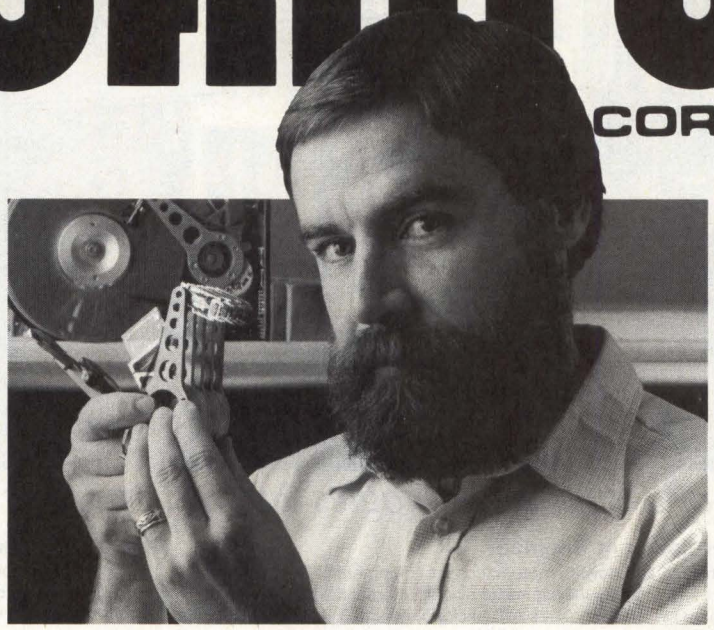

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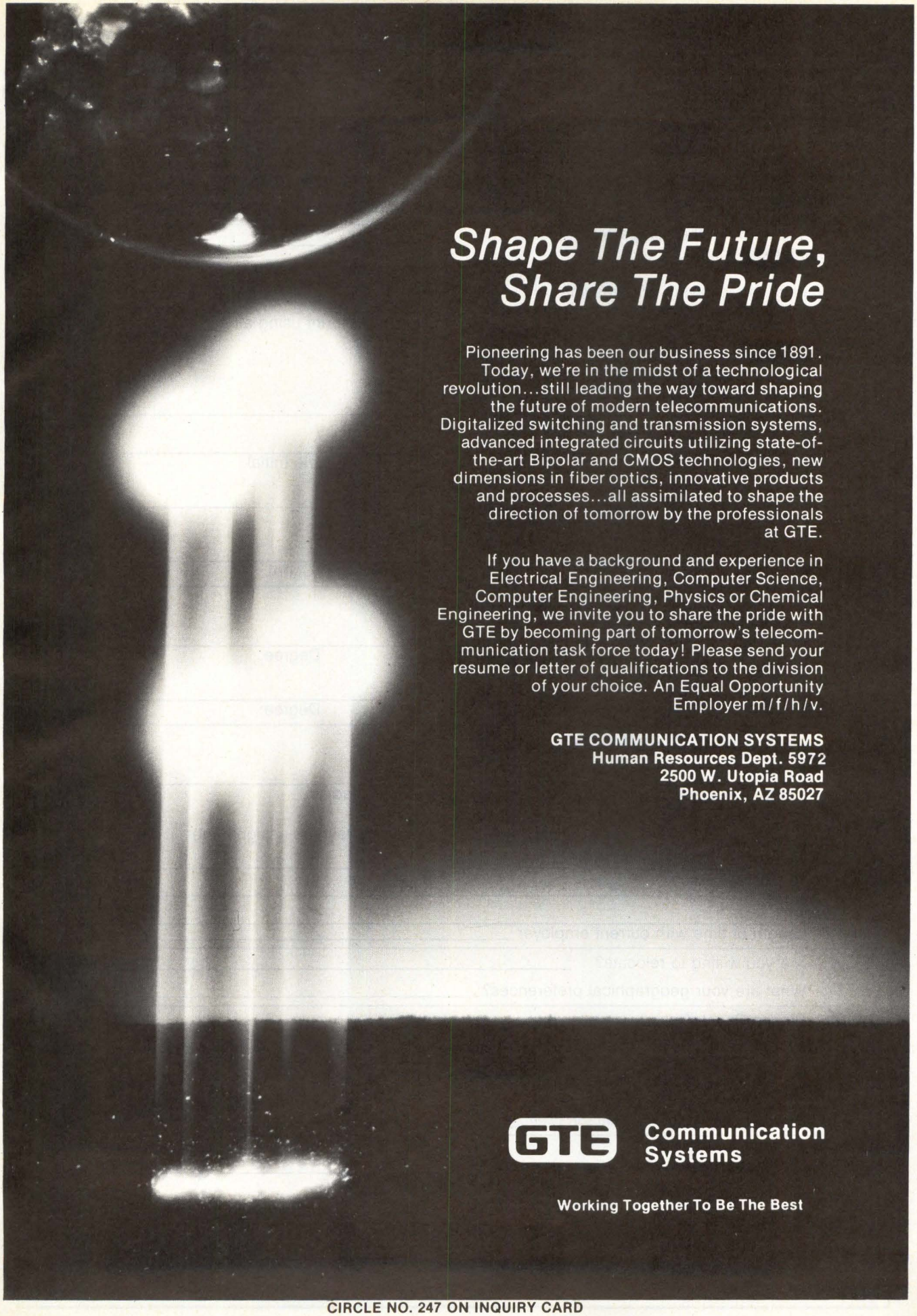

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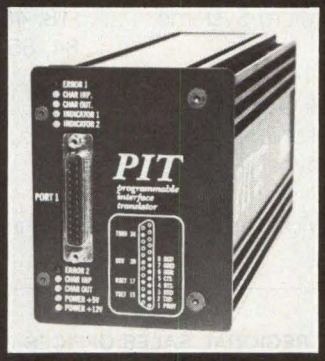

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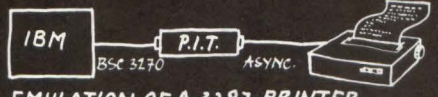
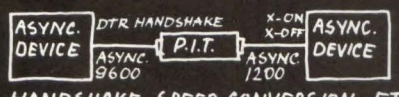


EMULATION OF A 3287 PRINTER

INTERFACING COMPUTERS OF DIFFERENT MAKES



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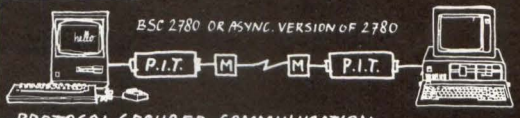

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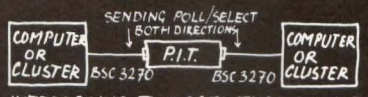

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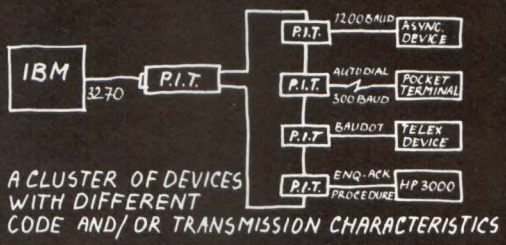

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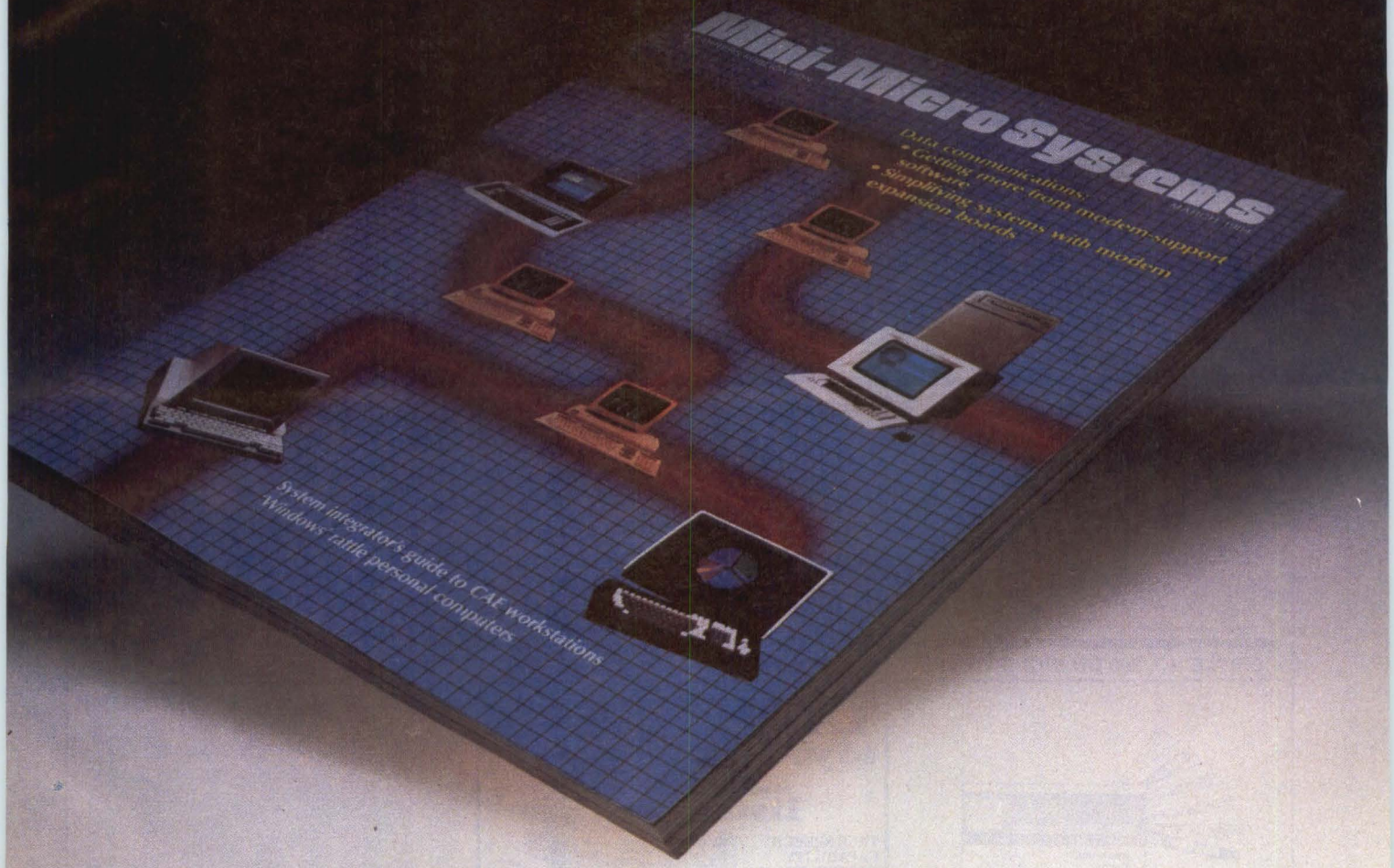

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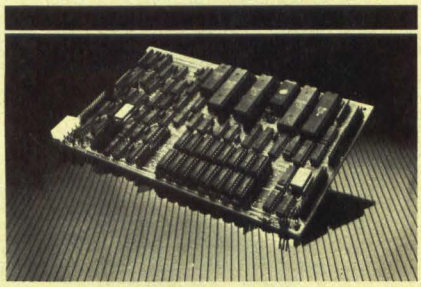

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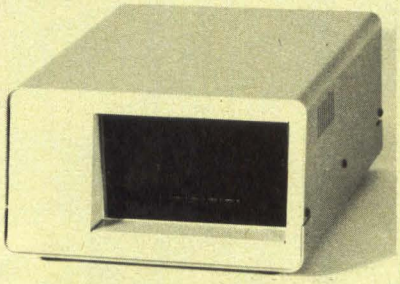

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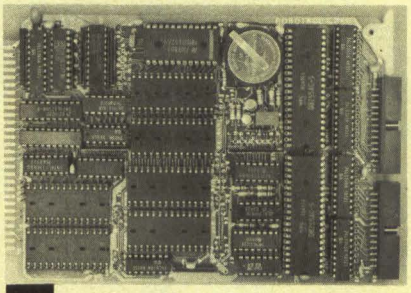

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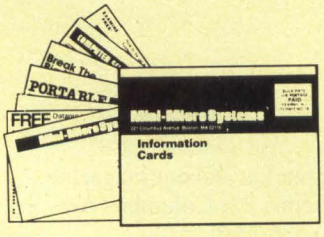

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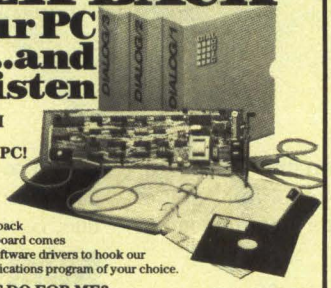

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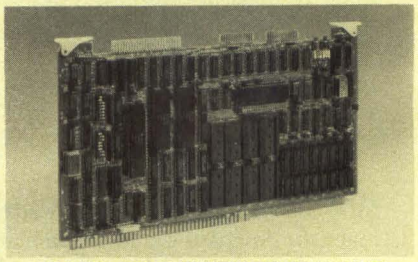

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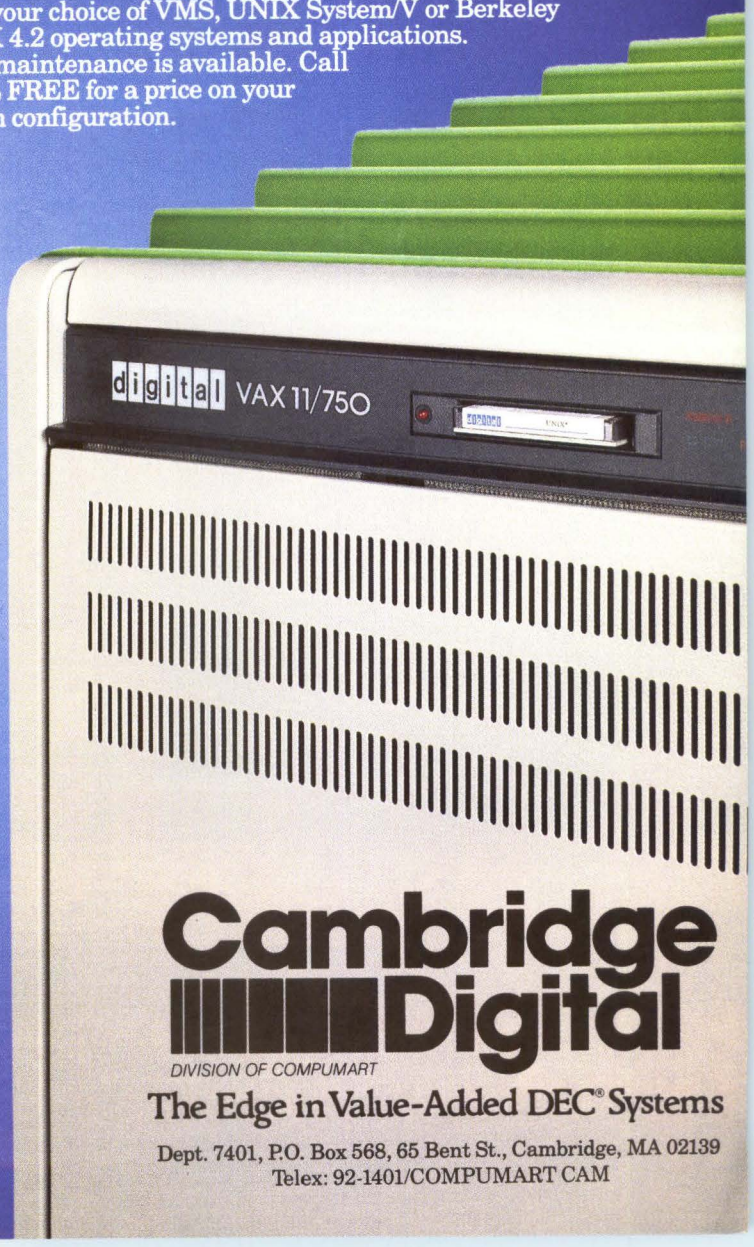

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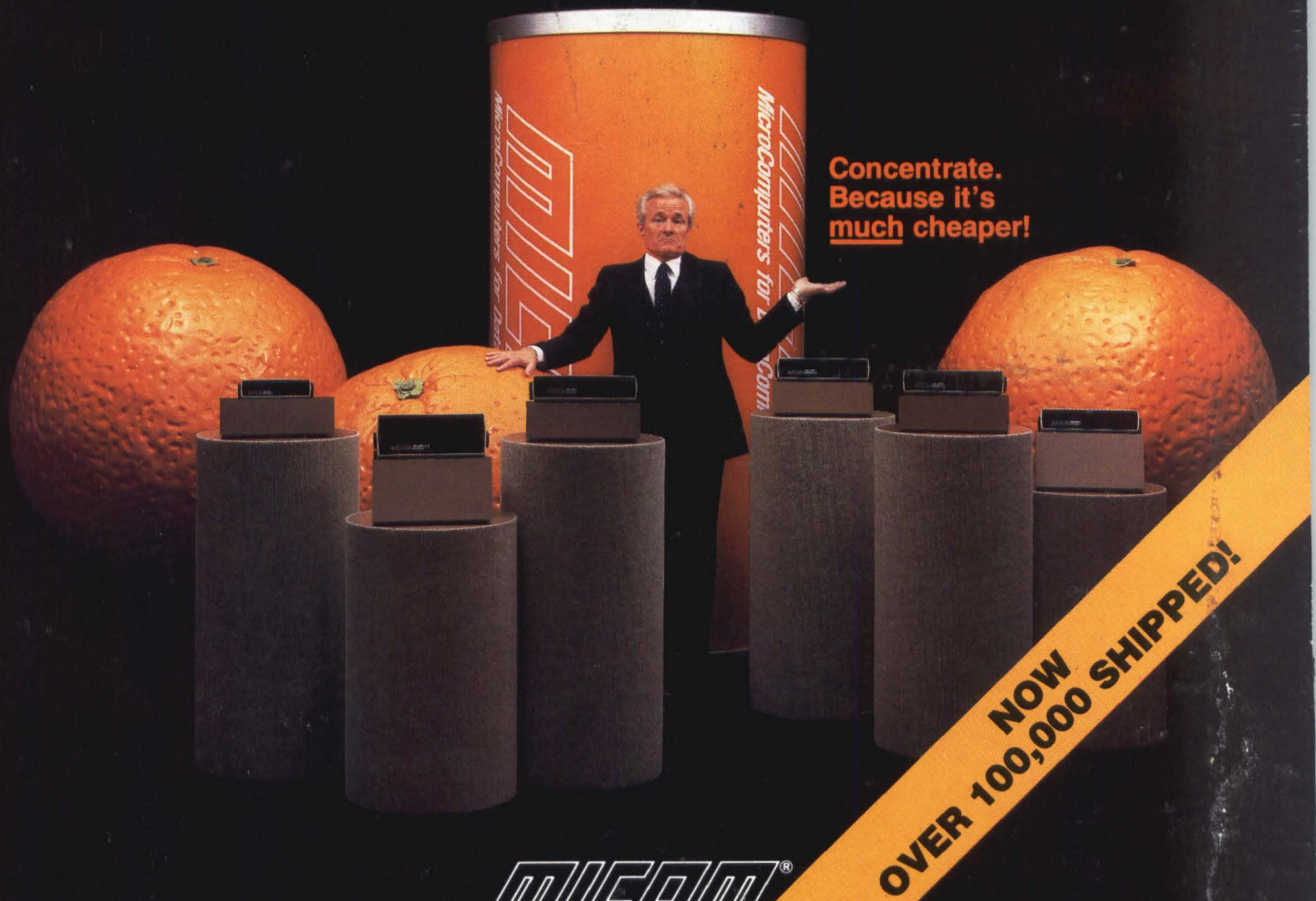

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