Communications Handbook

Mini-Micro Systems

A CAHNERS PUBLICATION

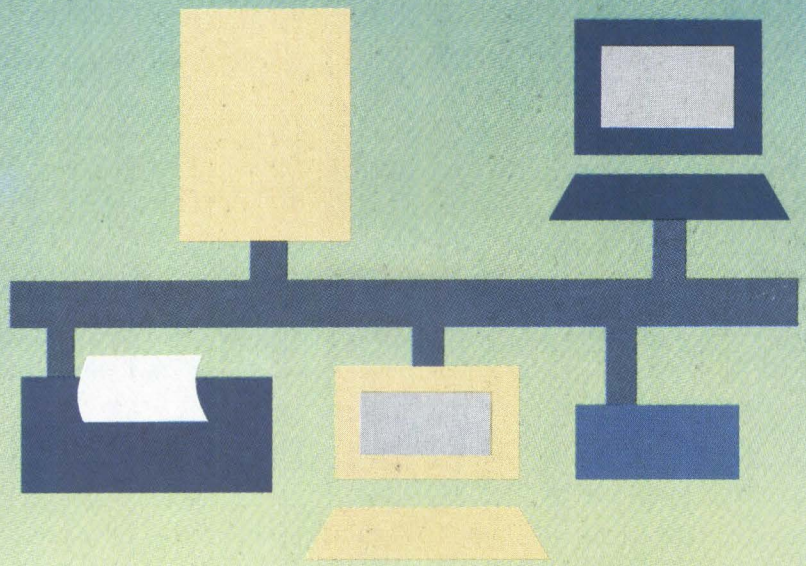
FEBRUARY 14, 1986/$15.00

The source book for system integrators

YOUR Problem-Solving Handbook

Network print servers: Software drivers control network printers

Local area networks: Software helps solve LAN-selection puzzle



Product Reference File

Networking Software

Modems

Local Area Networks

SECOND FEBRUARY ISSUE

We demo our Data PBX on-site. (They just send brochures.)

Since we introduced our first Data PBX two years ago we've been doing things that other vendors would like to do . . . but can't. Things like on-site demos, 30 day free trials and packing more data switching features into less space for less money than anyone else. Today over 100,000 terminals and computer ports are connected to over 500 Equinox Data PBX's.

We're a tough act to follow.
Our new DS-5 (shown above) gives you more of a good thing in an even smaller package. A fully featured Data PBX, the DS-5 is smaller than an IBM PC and provides keyboard controlled switching and port sharing for 120 async terminals and computer ports at $120 per line. It can be expanded to 1320 lines and is completely compatible with its bigger brother, the DS-15.

We're easy on your wires.
All Equinox products are designed for fast, easy installation using modular telephone wiring accessories and in most cases your existing wiring can be used.

Let's get together.
Whether you need to connect 50, 100 or 1000 terminals and computer ports together and are looking at Data PBX's, Port Selectors, or LAN's, we've got a switch for you. Don't just settle for brochures – see for yourself how easy data switching can be.

Call 1-800-Data PBX* for a no-hype demonstration.

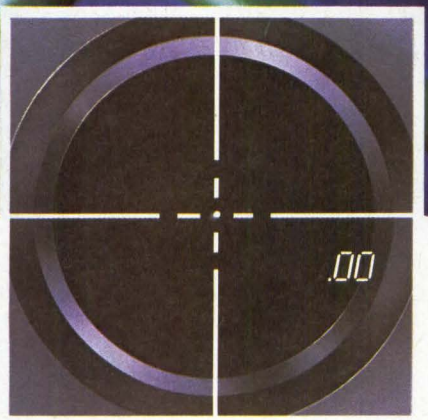
Equinox Systems
12041 S.W. 144th Street
Miami, FL 33186-6108
*In Florida call
(305) 255-3500

EQUINOX
Systems

We Make The Right Connections

CIRCLE NO. 1 ON INQUIRY CARD

See the light.



The hole story about fiberoptic connectors

The more concentric the hole in a fiberoptic connector, the more precise the alignment ...the lower the signal loss... the greater the efficiency of the system.

Augat Fiberoptic Connectors are produced with a hole tolerance held to an incredible +4, −0 microns. Concentricity is maintained within 2 microns of geometric center. (Ferrules are machined in Augat's Swiss facility by the world masters of precision components.)

Augat Rhode Island further ensures optimal alignment by subjecting its connectors to profile magnification and laser optical power measurements on uniquely revealing instruments. No other manufacturer dares take such a close and potentially unflattering look at itself.

Best of all, you pay no more for the superior excellence of the finest fiberoptic connectors.

Our complete line of SMA style multimode connectors are available in Arcap and Nickel Plated Brass. We also offer a field installable single mode connector with less than .5dB insertion loss.

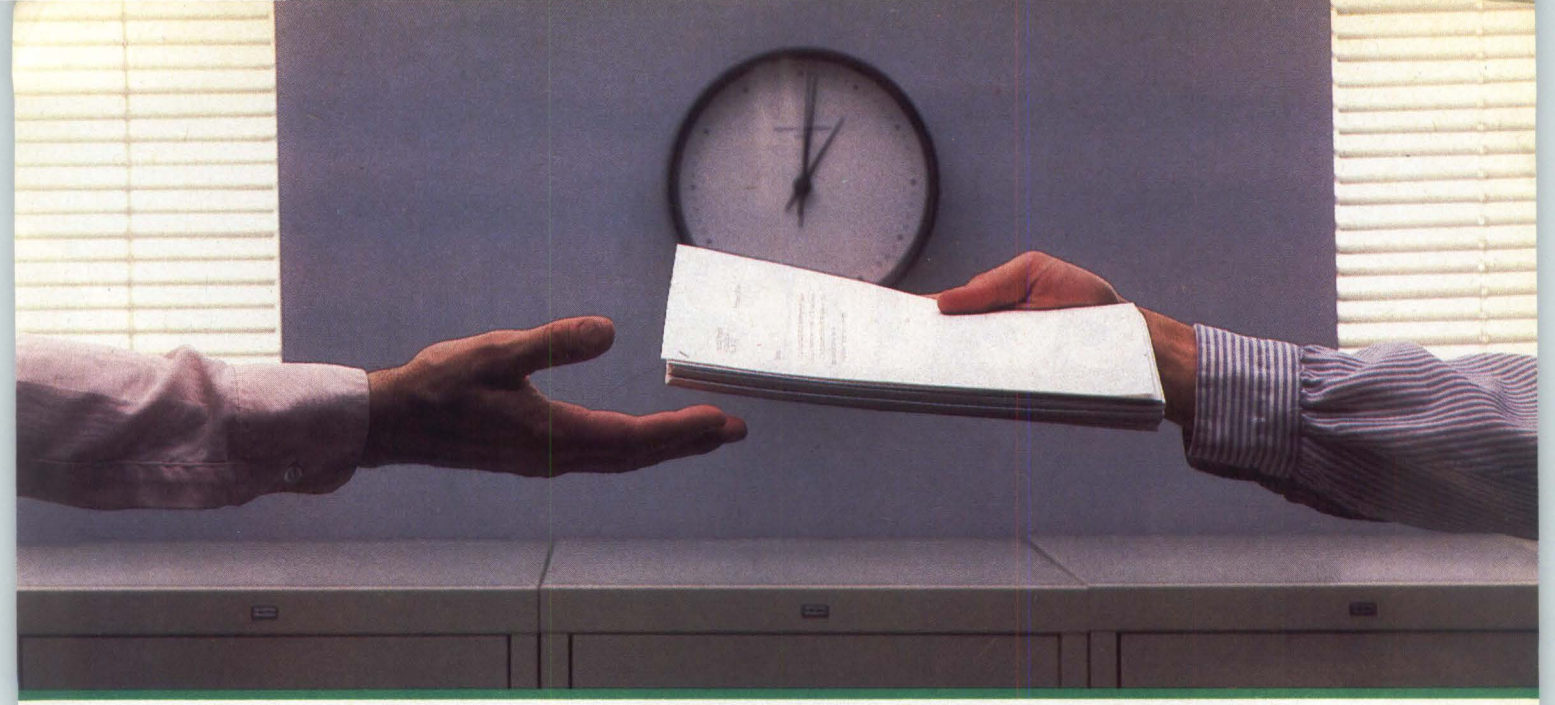
You'll find Augat Fiberoptics refreshing to do business with...the substantial resources of a large corporation combined with the responsiveness and service you require.

See the light with AUGAT FIBEROPTICS, 710 Narragansett Park Drive, Pawtucket, RI, 02861. Telephone (401) 724-4400. Telex–511450.

AUGAT® FIBEROPTICS

Quality and Innovation

CIRCLE NO. 2 ON INQUIRY CARD



2400 bps modems: Do you Really need another speed?

- Is the shift from 300 to 1200 bps going to repeat itself at 2400 bps? The answer is both yes and no. There certainly are applications for 2400 bps asynch dial-up modems, but we shouldn't expect 1200 bps to die overnight.
- 2400 bps modems can improve throughput, thereby getting tasks done quicker and more economically. However, 1200 bps has become the virtual standard for professional dial-up communications, and most users are satisfied with it. So why consider a 2400 bps modem at all?
- One reason is flexibility. If the modem you select operates at all three speeds (300, 1200 & 2400) in accordance with accepted industry standards, it will serve virtually all dial-up applications now and in the foreseeable future.
- The modem you select should be the MultiModem224. It is Bell 212A and 103 compatible at 1200 and 300 bps, and CCITT V.22bis compatible at 2400. It is also 100% compatible with the Hayes command set, meaning that it will work with virtually all communications software packages, at all three speeds. Other features include both synchronous and asynchronous operation, full intelligence and a phone number memory.
- The MultiModem224 is available in both desktop and IBM PC™ internal card versions. (There is also a rack-mounted version for central sites.) And as a bonus, we provide free offers from ten of the most popular on-line information services, including CompuServe™, Dow Jones™ and The Source.™
- A 2400/1200/300 bps modem is just a plain good investment. Why not let the MultiModem224 provide your communications for both today and tomorrow?

For more information, call us toll-free at **1-800-328-9717** (in Minnesota, call **1-612-631-3550**).

MultiTech Systems

The right answer every time.

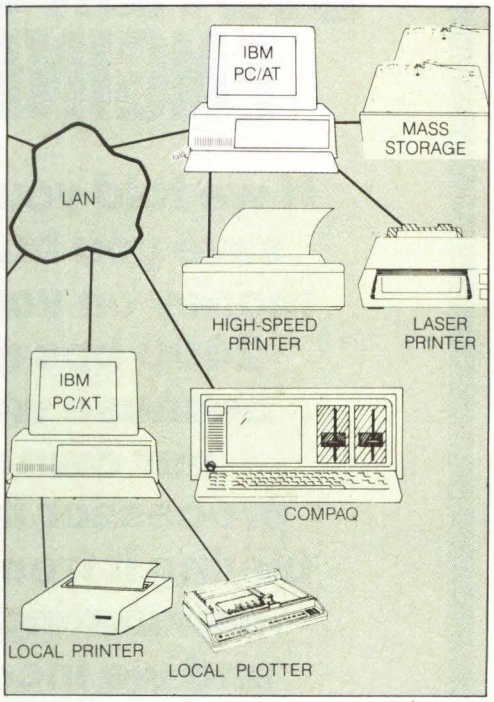
82 Second Ave. S.E., New Brighton, MN 55112 (612) 631-3550, TWX: 910-563-3610

CIRCLE NO. 3 ON INQUIRY CARD

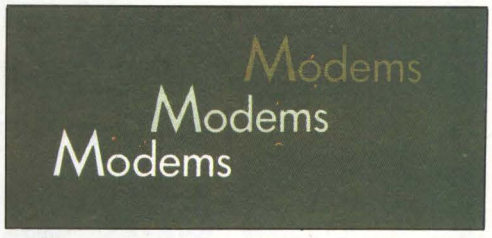
Communications Handbook
Mini-Micro Systems

A CAHNERS PUBLICATION

VOL. XIX NO. 3 FEBRUARY 14, 1986



p. 11 . . . . . Network print servers



p. 25 . . . . . Modems aplenty

Cahners Publishing Company • Publishers of specialized business magazines in • Building and Construction • Electronics and Computers • Foodservice • Manufacturing • Medical/Health Care.
MINI-MICRO SYSTEMS (ISSN 0364-9342) is published monthly with additional issues in February, April, June and November by Cahners Magazine Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158. William M. Platt, President; Terrence M. McDermott, Executive Vice President. Norman L. Cahners, Honorary Chairman; Saul Goldweitz, Chairman; Ronald G. Segel, President; Robert L. Krakoff, Executive Vice President. Circulation records are maintained at Cahners Publishing Co., 270 St. Paul St., Denver, CO 80206. Second class postage paid at Denver, CO 80202 and additional mailing offices. Postmaster: Send address changes to MINI-MICRO SYSTEMS, 270 St. Paul St., Denver, CO 80206. MINI-MICRO SYSTEMS is circulated without charge by name and title to U.S.- and Western European-based corporate and technical management, systems engineers and other personnel who meet qualification procedures. Available to others at the rate of $65 per year in the United States; $70 in Canada and Mexico; $95 surface mail in all other countries; air mail surcharge, $35 (16 issues). Special HANDBOOK issues, $15. Single issues, $5 in the United States; $6 in Canada and Mexico; $7 in all other countries.

STAFF

Vice President/Publisher
S. Henry Sacks

Editor-in-Chief
George V. Kotelly

Managing Editor
James F. Donohue

Assistant Managing Editor
Bruce J. MacDonald

Senior Projects Editor: **Rick Dalrymple**
Western Editor: **Carl Warren**
Irvine, (714) 851-9422
Senior Associate Editor: **David Simpson**
European Editor: **Keith Jones**
London: (011-441-661-3040)
Associate Editor: **Frances T. Granville**
Associate Editor: **Lynn Haber**
Associate Editor/Research: **Frances C. Michalski**
Associate Western Editor: **Mike Seither**
San Jose, (408) 296-0868
Associate Editor: **Gregory Solman**
Associate Editor: **Michael Tucker**
Associate Editor: **Jesse Victor**
Assistant Editor/New Products: **Megan Nields**
Assistant Editor/Research: **Pamela Gorski**

Contributing Editors

Andrew Allison
Mini/Micro Computer
Product Consultant
Raymond C. Freeman Jr.
Freeman Associates
Special Features Editor: **Wendy Rauch-Hinton**
Dix Hills, N.Y.
(516) 667-7278
Washington, D.C.: **Stephen J. Shaw**
(202) 387-8666
Gene R. Talsky
Professional Marketing Management Inc.
Edward Teja
Freehold Corp.

Editorial Production

Senior Copy Editor: **Arsene C. Davignon**
Production Editor: **Mary Anne Weeks**

Editorial Services

Carey Highley, Terri Gellegos

Assistant to the Publisher: **Linda L. Lovett**

Art Staff

Art Director: **Vicki Blake**
Assistant Art Director: **Cynthia McManus**

Director of Art Dept.: **Norm Graf**

Production Staff

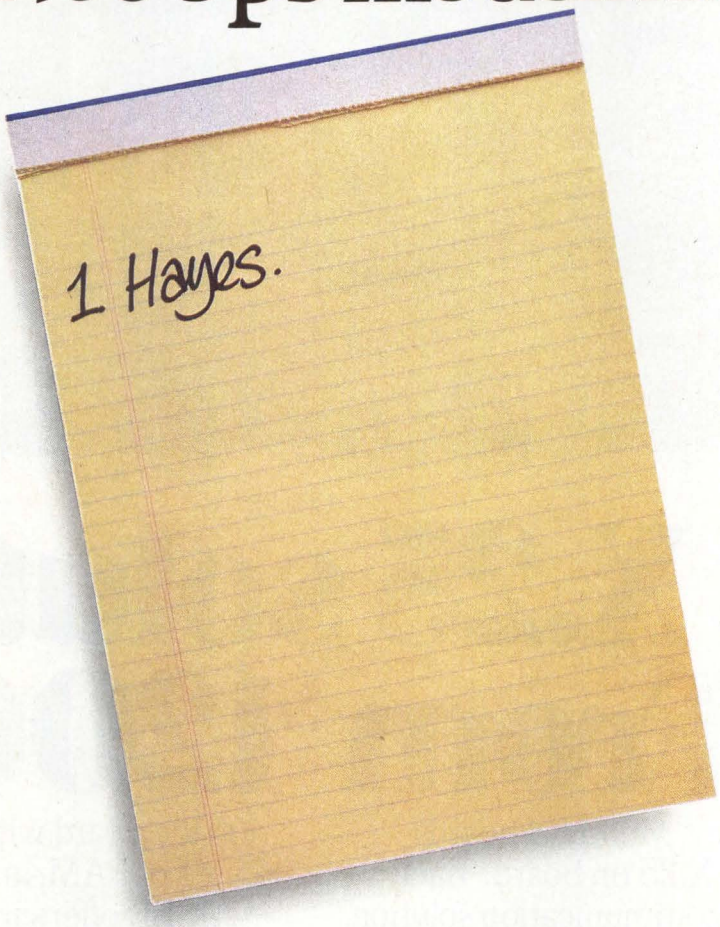
VP Production: **John Sanders**
Supervisor: **William Tomaselli**
Production Manager: **Betsy Cooper**
Composition: **Diane Malone**

Editorial Offices

Boston: 275 Washington St., Newton, MA 02158, (617)964-3030. **Irvine:** 2041 Business Center Dr., Suite 109, Irvine, CA 92715. **Los Angeles:** 12233 W. Olympic Blvd., Los Angeles, CA 90064. **San Jose:** 3031 Tisch Way, San Jose, CA 95128. **London:** P.O. Box 37E, Worcester Park, Surrey, KT4 8RQ, England.

Reprints of Mini-Micro Systems articles are available on a custom printing basis at reasonable prices in quantities of 500 or more. For an exact quote, contact Art Lehmann, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., Box 5080, Des Plaines, IL 60018. Phone (312)635-8800.

A complete list of things to know about 2400 bps modems.



Now that you've memorized that, here's a partial list of why a Hayes® Smartmodem 2400™ is best for you.

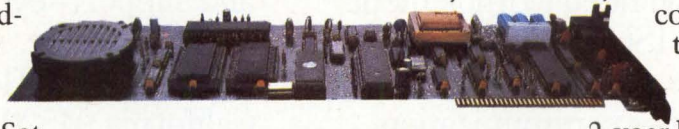
1. The Hayes Smartmodem 2400 allows you to communicate with the vast installed-base of 300, 1200 and 2400 bps "Hayes-compatible" modems. The Hayes Standard "AT" Command Set allows you to use Smartcom II® and other software that communicates.

2. Through synchronous/asynchronous technologies, the Smartmodem 2400 permits your PC to access mainframes, minis, and on-line services previously inaccessible through asynchronous-only modems.

3. The Hayes Smartmodem 2400 is efficient...it pays for itself in just 4 hours of annual use over long distance.

4. The technology of the Smartmodem 2400 allows you to transfer volumes of files with confidence across the city or across the ocean using Bell and CCITT standards.

5. The new Smartmodem 2400B™—a plug-in board for the IBM PC and compatibles—allows synchronous and asynchronous communication through the same Com port.



6. You will also get the Hayes standard 2-year limited warranty and the opportunity to extend the warranty to 4 years.

Best of all...you get Hayes. And that's all you ever really have to know!

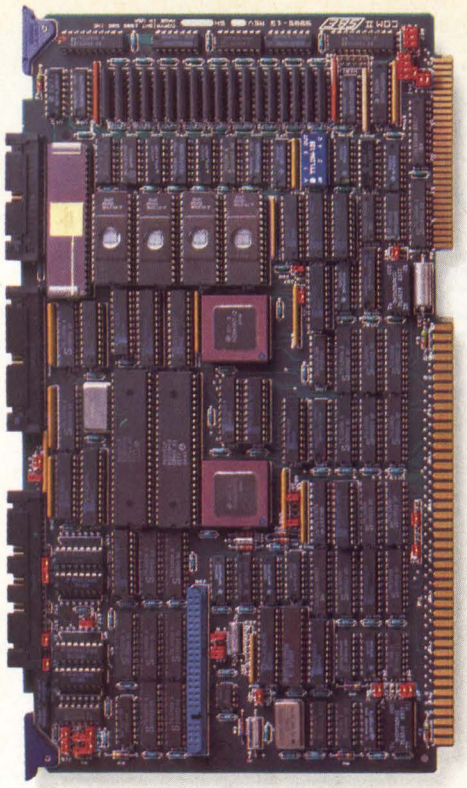
For more information or technical specs, contact your authorized Hayes dealer. Or Hayes directly at (404) 441-1617.

Hayes Microcomputer Products, Inc., P.O. Box 105203, Atlanta, Georgia 30348.

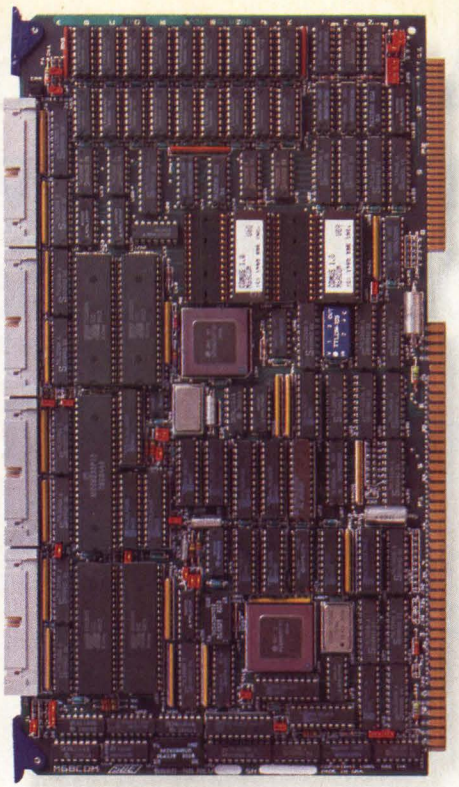
Hayes®

Say yes to the future with Hayes.

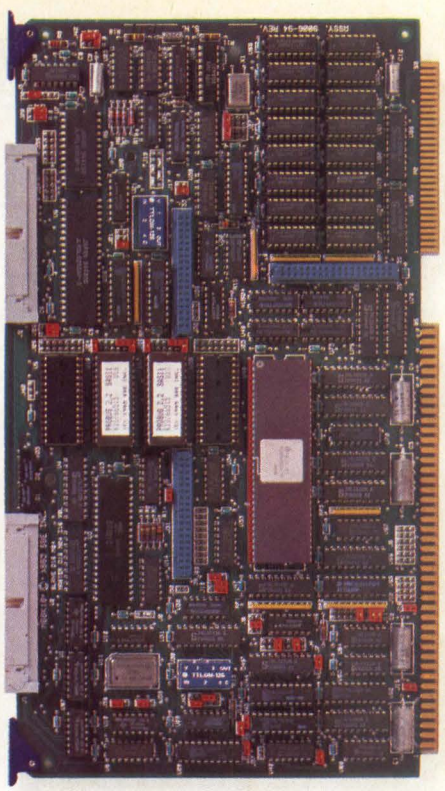
CIRCLE NO. 4 ON INQUIRY CARD



COM-2



COM-8



M68K10

New X.25 solutions. From $1200.*

Three intelligent Multibus† boards from SBE, all with X.25 on board. Each is a complete X.25 communication solution. Each offers multiple hardware options. And all three are ready to use right out of the box.

There's no extra software to buy. You get everything you need to implement levels 1, 2 and 3 of the ISO model in your Multibus system.

Your choice of three communication boards gives you unprecedented hardware flexibility. Choose up to 8 serial ports. Baud rates from 1 bit to 3 megabits per second. DMA channels–2, 4, or none. And on-board RAM–128K, 256K, 512K, or 1 Megabyte.

The starting price is $1200 in quantity 100 for a card with two serial ports, 128K bytes of RAM, and X.25 in EPROM.

SBE offers in-depth technical support hard to find elsewhere. A phone call puts you right on the line with one of our top technical people.

We provide hardware, software and support–everything you need from a single source.

SBE, Inc., 2400 Bisso Lane, Concord, California 94520. Phone us for literature mailed the same day.

1-800-221-6458. In California 1-800-328-9900 or (415) 680-7722. TWX 910-366-2116.

SBE

Your partner in computer boards and systems.

*In quantity 100. Consult factory for other quantity prices.
†Multibus is a trademark of Intel.

CIRCLE NO. 5 ON INQUIRY CARD

HOW TO USE THE PRODUCT GUIDES

This edition of the *Communications Handbook* contains three Product Guides beginning on Page 25. Each Product Guide contains price and specification information, arranged alphabetically by company name. These tables are based on mail- and telephone-survey information.

Accompanying each vendor's name is the mailing address, telephone number and a circle number with which you may request additional information using the reader-service card located at the end of the *Handbook*.

At the end of each Product Guide is a list of vendors that did not respond to our survey. Accompanying each name is the company's mailing address and telephone number.

To check product prices or specifications:

- Turn to the appropriate product category using the colored tabs
- Find the appropriate product table
- Find the alphabetically listed vendor.

To select a product:

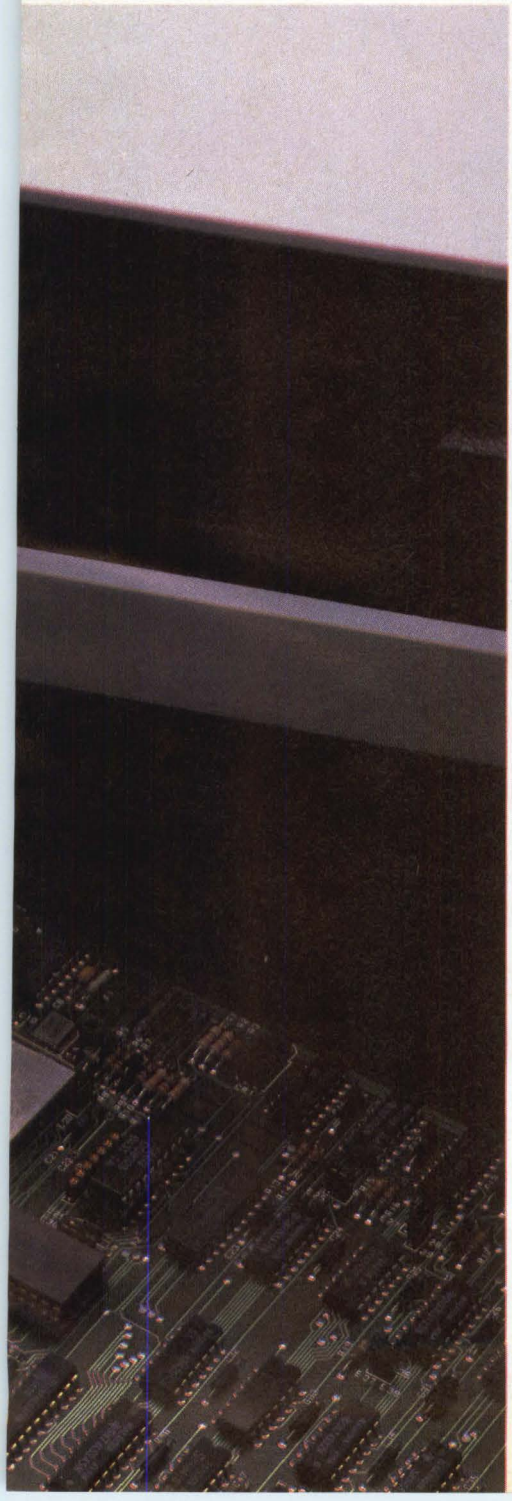
- Turn to the appropriate product category using the colored tabs
- Find the appropriate product table
- Study the product offerings
- Use the address information found with the company name to contact the vendor.

To comment on the *Communications Handbook,* or to suggest future product coverage or entries, contact the Editor-in-Chief, *Mini-Micro Systems, Communications Handbook,* Cahners Publishing Co., 275 Washington St., Newton, Mass. 02158-1630.

The *Communications Handbook* research and editorial staff includes Frances Michalski, associate editor and Pamela Gorski, assistant editor.

THE GREATEST ADVANCE IN COMPANY NETWORKING SINCE THE WATER COOLER.

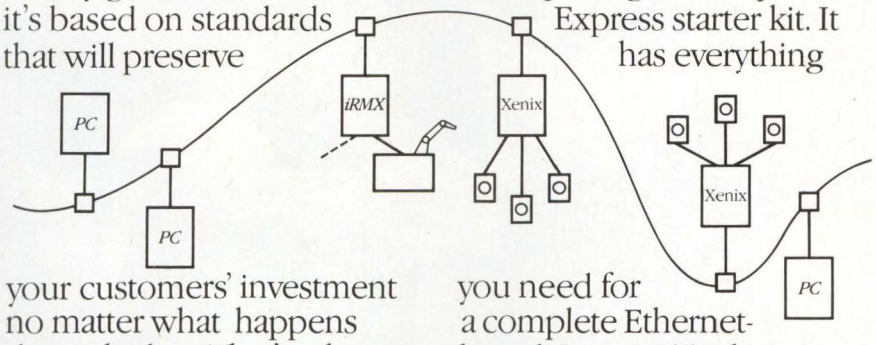
It's Intel's OpenNET™ product family. The open networking hardware and software system that allows people using different computers in the factory, office and lab to interoperate. Meaning, any user can now access any file anywhere in the network—whether it's on iRMX,™ MS-DOS* or XENIX*—as easily as if that file resided right there in their own desktop computer.



So by using his PC, the president of a company can get real time data out of his factory control manager's iRMX system real fast. And just as easily, pull a file from the lab where they use multi-user systems.

In effect, OpenNET lets iRMX, XENIX and MS-DOS speak a common language. Which opens up a better line of communication across the entire network.

But better communication is only good for business if it's based on standards that will preserve your customers' investment no matter what happens down the line. That's why OpenNET was designed to meet standards set by ISO, IEEE and IBM.



For instance, based on the ISO 7 layer model, OpenNET offers the most complete product solution at every level of integration. Layers one and two are supported by Intel's IEEE 802.3 Ethernet board; three and four by our iNA 960 Transport Software (ISO 8073); and layers five, six and seven are covered by XENIX, iRMX, and Microsoft networking software, whose software protocols were developed by Microsoft, IBM and Intel.

Of course, you have the option of going with our fully integrated 286/310 supermicro system or configuring your own system to meet your own special needs.

With support like this, OpenNET provides a long term promise of compatibility, which translates into a long term promise of competitiveness.

Even as standards and technology grow and change, your customers' systems can, too. Because OpenNET is modular, it will support emerging standards like MAP. At every level with both hardware and software products.

But to get you going today, we've packaged an OpenNET Express starter kit. It has everything you need for a complete Ethernet-based OpenNET solution: a 286/310 with all the networking software, a LAN PC board, installation, and four days of training.

If you think you're ready to get everyone on the same line, but you'd like a little more information, call us at (800) 538-1876. Or if you're more than ready to get going, order our OpenNET Express starter kit from your local distributor or Intel sales office at a special introductory price.

Then say goodbye to an era. Because after OpenNET, the only reason people will have to go to the water cooler is because they're thirsty.

intel®

*MS-DOS and XENIX are trademarks of Microsoft Corporation. © 1985 Intel Corporation

CIRCLE NO. 6 ON INQUIRY CARD

MICOM LINE DRIVERS IMPROVE FRINGE AREA COMMUNICATIONS

The fringe area. Close enough to the host computer for direct cable attachment. But far enough away to cause unpredictable communications.

To get a perfect picture forget about RS-232 cables, or modems, or even local area networks. Instead, use a MICOM Line Driver: the most versatile, least expensive solution for limited distance communications problems.

THE $85 SOLUTION

Small enough to hold in the palm of your hand, the Micro 400 Local Dataset offers an impressively big list of capabilities:

1. Assures error-free local data transmission up to 18 miles.
2. Operates asynchronously at 19,200 bps for over one mile.
3. Uses inexpensive twisted pair wiring in place of RS-232 cables.
4. Protects computers and terminals from line signal overloads.
5. Requires no external power.

TUNE-IN TO MICOM

For application information write to MICOM Systems, Inc., 4100 Los Angeles Avenue, Simi Valley, CA 93062.

MICOM®

1-800-MICOM U.S.

CIRCLE NO. 7 ON INQUIRY CARD

SOFTWARE DRIVERS CONTROL PRINTERS

A sophisticated approach to device software allows networked PCs to share printers

Steve Bostwick, Local Data Inc.

Local area networks are emerging as the standard method of linking system resources in an automated-office or software-development environment. However, LANs suffer from inconsistencies in handling network resources such as printers. And, although several solutions exist, not a great deal of attention has been paid to the system software that runs on the individual components of the network.

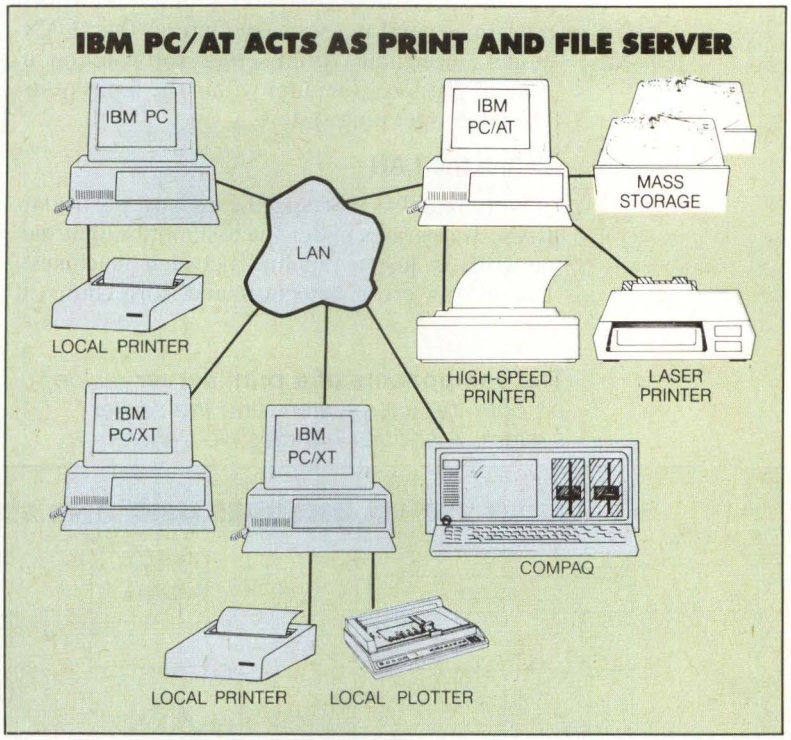
This article describes a hypothetical LAN with print-serving capabilities that solves most networking software problems. This LAN limits integration techniques to IBM Corp. PC machines. But, with modifications, you can apply these techniques to systems using UNIX or, for that matter, any LAN system.

Map the basic topology

In the LAN model, the individual PCs are intelligent processing stations, each with its own, limited, mass storage. Some units attach locally to dedicated peripheral devices, such as printers, plotters and tape drives.

In addition to their own peripherals, each PC has access via the LAN to network peripherals attached to the network-server system—in this case, a PC/AT. This setup adds the significantly greater mass storage of the server system to the PC's own local storage. Furthermore, the printers are either high-speed (several hundred lines per minute) or of high quality such as that provided by laser printers.

File servers contain parts of the network system software that control access to the server system's mass storage. The programs that control the server system's printers, and the necessary hardware, are collectively called print servers. Implementing a print server on a PC system is a complex process, but not insurmountable.



A typical IBM PC-based network *consists of individual PCs acting as intelligent workstations. Each PC can possess local resources, such as rigid disk drives or printers, or, in the case of the IBM PC/AT, act as both a print and a file server.*

The goal of setting up a network system is to make the server system's peripherals appear to the user system as though they are its own. However, this requires modification to the user's

The programs that control the server system's printers are called print servers.

operating system. Fortunately, the PC's disk operating system (DOS) allows for such modifications. For instance, you can install a software print-intercept routine in the user system so that all print requests are intercepted, examined, and—if they are to be printed remotely—passed through the network to the server system and its printer. The user system processes all other print requests in a normal fashion.

When the server system receives print requests, it directs them to the print server. The print-server function requires two pieces of code. One piece intercepts and formats print data from the user machine, then transmits it to either a temporary file or to the other piece of code, which decodes and prints the data on the server machine.

On some networks, print servers involve the use of specialized computers; other networks rely on general-purpose computers. Our LAN model implements print-server software on a general-purpose computer within the limits of its MS-DOS operating system.

Define the LAN

Our model is not specific to any particular LAN. It operates under the assumption that the network is just a pipeline between machines. Except for error detection and correction, it never modifies the data going through it. This condition means, however, that you cannot take advantage of certain features. For instance, station identification might be available on a network implementation, but it is not used in this model; instead, a source identifier is placed into each record.

Create the print-server system

Part of the server installed on the user system consists of a spooler. This collection of software programs intercepts and examines all print requests destined for the logical device (denoted by lpt1:, lpt2:, etc.). The print-request data to be routed over the network is written to a temporary disk file. Data for all other printers is passed on to the PC's basic input/output system print routine.

The spooler consists of three programs:

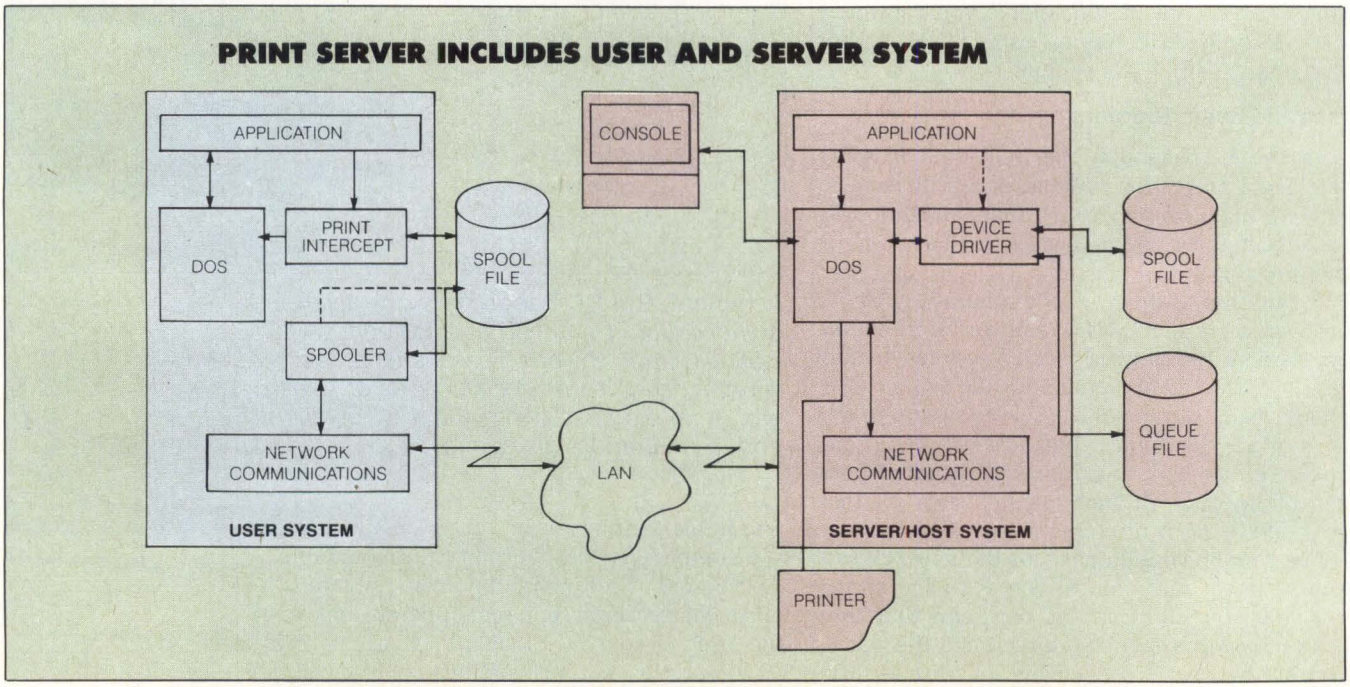
SPINTCPT: the resident print-intercept routine

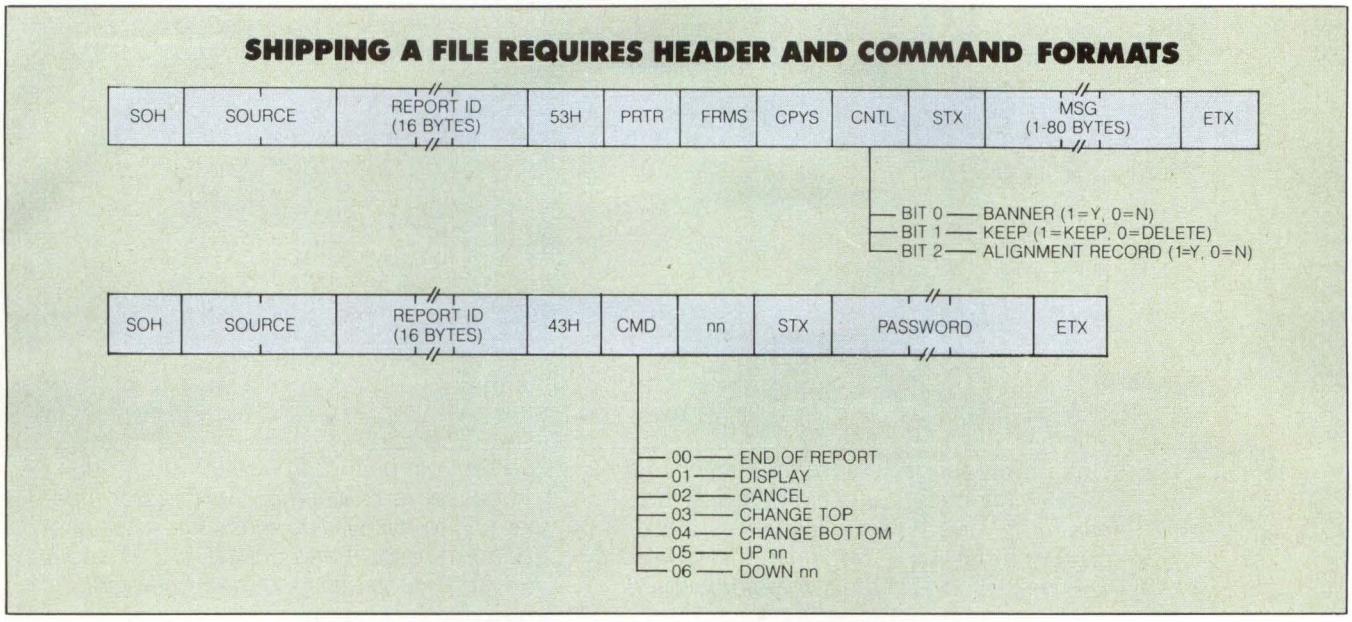
SPOOL: an application program that controls the spool process and writes to the temporary file

DESPOOL: an application program that sends collected print data to the server.

The spool program is the control center for the user side of the print server. It allows you to specify information about the data to be printed

The components of a print server *reside on both the user system and the server system. A spooler handles file transfers to and from the network. In addition, the system contains the necessary device drivers and network communications routines.*





Shipping a file to the server *requires a header block (top) to define the source of the file, the report identification and the printer destination. The command format (bottom) establishes the proper link and handles varied tasks, such as passwords for a secured check printer.*

and to request the status of data already sent to the server. It also allows you to send existing print files (those not made through the spool process) to the server. The despool program automatically sends previously collected spool data to the server.

You invoke the spool program by entering:
SPOOL lptn:/switch.../switch//
or
SPOOL pathname/switch.../switch//.

The first variation causes all data destined for lptn: to be intercepted and spooled onto the temporary disk file. The process continues until another spool command, or a despool command, is issued. In either case, the program cancels the current data intercept and transmits the spooled data via the network to the server system.

The second variation of the spool command causes an existing file, such as the print file from a compilation, to be sent directly to the server. The file is specified by a standard DOS pathname and may contain wildcard specifications. If more than one file meets this naming requirement, each file is sent to the server individually. Thus, the information specified by the /switches is sent at the beginning of each file, just as if each had been sent separately.

The /switches modify file printing and request server status. They may have the following values:

/COPIES=nn: prints nn copies of the document. (Default is nn=1.)

/FORMS=nn: prints the document on form number nn. (If the requested form is different from the one in the printer, the system notifies the printer operator to change the forms. The meaning of nn is up to you: nn=1 could mean one-part forms, 2 could mean two-part forms, etc. This value can also be used to command a printer to change pitch or to switch fonts in a laser printer. Default is nn=0.)

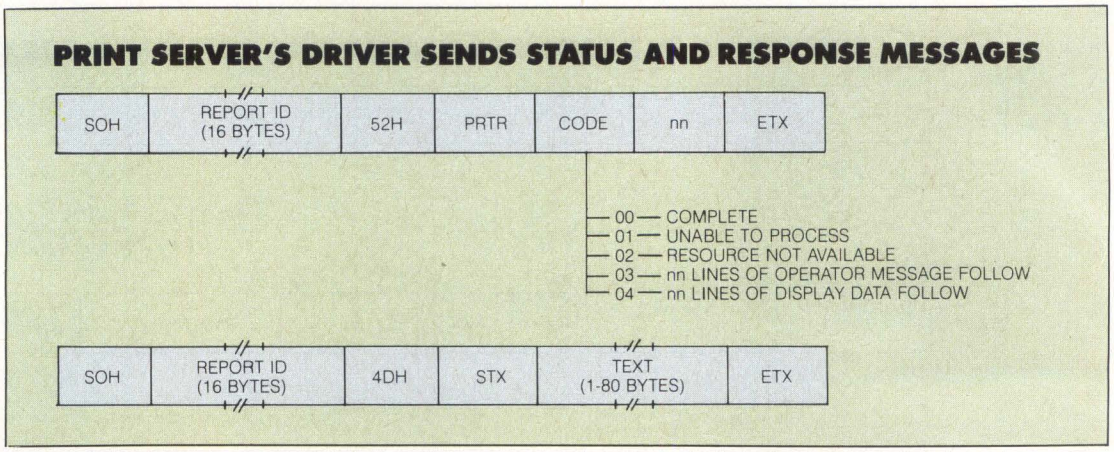
/PRINTER=n: specifies the printer on the server system that will print the report. (The n is 1 for lpt1:, 2 for lpt2:, etc.; default is n=1.)

/ID="text:" identifies the report while it is in the server system. (The text field can be up to 16 characters long and contain any character except double quotes, which are used to enclose the text field. The ID is printed on the banner page that separates printed documents. If not otherwise indicated, the default is the file name —when one is specified—or a number made up of the date and time.)

/TABS=nn: specifies tab spacing (Default is nn=8.)

/BANNER=y/n: specifies whether a banner page is to be printed before the document is printed. (These banners separate and identify documents printed by the spooler. Values of y for yes and n for no are valid. Default is y.)

/ALIGN=y/n: specifies whether an alignment record is included in the file. (If present, the alignment record must actually be the first page of the document, which must always end



Once a message is sent *to the print server, the associated driver processes the command and sends a status response (top) to the IBM PC originating the request. This response tells the originator whether the request has been accepted and can be processed and whether an operator message is to follow. The message response (bottom) reports on queuing or any special function preestablished in the network.*

with a form feed (0CH). The server allows the printer operator to repeatedly print this page when aligning the forms. Default is n.)

/DISP=k/d: specifies the disposition of the spool file after it has been shipped to the server. (Enter k for keep and d for delete. Files marked delete are discarded after despooling. Where a filename is specified, the default is k; otherwise, the default is d.)

/MSG="text:" specifies a message to be sent to the printer operator before printing the document. (The text field can be up to 80 characters long and contain any character except double quotes. The text field, though, must be enclosed in double quotes. The default is no message.)

/CMD=command: sends instructions to the print server to retrieve the status of the server or to modify a specific document in the print queue. The valid commands within the last subheading are:

DISPLAY: shows the current status of all the documents in the print queue.

CANCEL ("ID"): cancels printing of a specifically identified report. (The ID is specified within the /ID field and must be enclosed in parentheses and double quotes. The ID is optional. If omitted, the current spool command is reset and the spooled data is discarded. To change the position of the report in the print queue, proceed as follows:

TOP
CHANGE("ID",BOTTOM)
UP n
DOWN n.

The report ID must be present and enclosed in double quotes. One of the four options must also be present. The top command places the report at the first position in the queue; the bottom command puts it at the last position in the queue. Commands UP and DOWN move the report up or down n positions in the queue. (If omitted, n defaults to 1.)

Special commands need approval

Commands that cancel or change the queue position of reports require an authorizing password. Although our server does not address this level of security, some provision has been made to accommodate passwords in control blocks.

When a report is ready for shipment to the server, the spooled file is opened and transmitted via the network to the server. A header block is written at the head of the report data. In short, this block is assembled from information specified by the /switches on the spool command or from their default values. Two formats of the header block exist: the first is for reports, the second, for commands.

Each format begins with a start-of-header (SOH) character, a hexadecimal 01 (01H) followed by a 2-byte source ID and a binary number with the most significant byte first. This ID specifies the user system that is originating the request. The number is set when the spooler system is installed on the user machine. Next comes the ID field that identifies the report. The two formats are identical up to this point. The header type field is a 53H for report data or a 43H for command request.

The remaining fields in the report data header have the following functions:

PRTR: the printer to receive the report,
FRMS: the forms number,
CPYS: the number of copies to make,
TABS: tabs spacing,
CNTL: control flags, (The meaning for the bits are as follows:
bit 0, banner (1=y,0=n)
bit 1, keep (1=keep,0=delete)
bit 2, alignment record (1=yes, 0=no.)
STX: start-of-text character (02H), (Present only if an optional message to the operator follows.)
MSG: message to the operator,
ETX: end-of-text character (03H). (Always terminates a header.)

The command format (43H) fields have the following meanings:

CMD: the command to be executed; the bits of which have the following values:
00, end of report
01, display queue data
02, cancel report specified in ID field
03, change specified report to top of queue
04, change specified report to bottom of queue
05, move specified report up nn positions in queue
06, move specified report down nn positions in queue
nn, the number used in conjunction with the move commands;
STX: start-of-text character (02H); (Present only if an optional password follows.)
PSWD: the optional command password.

When our model server system receives data from the network, it writes the data to a device driver installed in the server system. This driver is called PSERV:. It is always running, receiving and printing data, even if the server system is running another job. That is, it's running in the background, as opposed to the foreground.

When a data header is received, a file is created with a name made from the sequential number and the source field of the header block. The header block is held in memory; the header and report data are written to the open file. Also, there must be enough room in memory to hold one header from each user on the network, plus one for the server systems' DOS session. In addition, there have to be sufficient handles—points for the files to grab onto—for each of these files. (The number of handles is set by using the FILES= entry of the CONFIG.SYS file.) When the report data has been written to the data file, the file is closed and an entry is added to the print queue. This queue is maintained in memory and on a disk file.

As the report data is written to the server spool file, the number of lines and pages are counted. In order to count pages, the file must use form feeds to separate pages.

The data placed on the queue for each entry consists of:
SOURCE: source system identification,
ID: the ID field from the header,
PAGES: the number of pages in the report,
LINES: the number of lines in the report,
FILENAME: the name of the file containing the report data,
PRNTR: printer to receive data,
COPIES: number of copies to make,
NCOPY: number of copies printed,
FORMS: form number for this report,
STATUS: a flag byte that indicates the status of the current job:
bit 00, print complete
bit 01, print canceled
bit 02, print suspended
bit 07, printing.

When the driver has processed the data-header block and its associated data, or the command block, the driver sends a response to the user system originating the request.

There are two types of response formats—the status-response format and the message format. Each begins with an SOH character (01H) followed by a 16-byte ID field, which identifies the report. The next byte in the record identifies the format, with 52H signifying a status response and 4DH signifying a message format.

The remaining fields of the response format have the following functions:
PRTR: the printer on which the report is to be printed;
CODE: the response status code:
0, requested function complete
1, unable to process
2, resource not available
3, nn lines of operator message follow
4, nn lines of display follow
nn, the number associated with code 3 or 4;
ETX: end-of-text character (03H), which terminates a response.

The message format response follows the 4DH type code with the following commands:
STX: start-of-text character (02H), which indicates the start of the message field;
TEXT: any of one to 80 characters except ETX;
ETX: end-of-text character (03H), which terminates a response.

In an actual implementation of our model print server, the device driver, PSERV:, also manages the printing of the reports queued on

The spool program is the control center for the user side of the print server.

ENDL AND TECHNOLOGY FORUMS

PRESENT

IPI FORUM/BOSTON '86

After a successful West Coast Conference in June of 1985, the IPI Forum plans to move East in March of 1986 with a 2-1/2 day Technical Program devoted to discussing IPI issues, hearing about the latest IPI developments, learning about IPI, and promoting industry standardization.

WHERE The Parker House on Tremont and School Streets in downtown Boston.

WHEN March 11-14, 1986

WHO Engineers, planners, and marketing personnel of companies using IPI or who are considering its use should not miss this conference.

TOPICS/ISSUES

- What is the market for IPI components, products and systems?
- Who is committed to IPI?
- What is the status of IPI with ANSI, ECMA, and ISO?
- How does IPI compare with other interfaces?
- How is IPI being used?
- Is IPI-2 only a high performance disk interface?
- Is specialized silicon being developed for IPI-2? For IPI-3?

WORKSHOP In addition to covering "Leading Edge" IPI topics, Delegates may attend an optional IPI Principles and Concepts Workshop on March 11th so that attendees may derive more benefit from the technical sessions to come.

RECEPTION Delegates will also have an opportunity to see the latest in IPI Products during the Exhibitors Reception scheduled for Wednesday evening.

SPONSORS The IPI Forum is sponsored by ENDL, Technology Forums, and the IPI Forum Advisory Board consisting of:

- Control Data Corporation
- NEC Information Systems, Inc.
- Siemens, A.G.
- Prime Computer
- Fujitsu America, Inc.

FEE The registration fee of $895.00 for the 2-1/2 day IPI Forum covers attendance at the scheduled sessions, a Delegate Information Binder containing the Speakers' presentations and other material, a Welcome Reception, 2 Luncheons, the Exhibitors Reception, 3 Continental Breakfasts, Cocktails and Buffet Dinner, refreshments during breaks, gratuities and taxes.

ATTENDANCE Attendance is limited to preserve an appropriate atmosphere within which to learn and interact with other Delegates. It is therefore recommended that your registration form and payment be mailed early.

CANCELLATIONS Registration fees are refundable, subject to a 10% service charge; if cancellation occurs before February 18th, substitutions may be made at any time at no charge. Cancellations and substitutions must be in writing.

HOTEL ACCOMMODATIONS A block of rooms has been set aside for IPI Forum Delegates at the Parker House. Reservations will be guaranteed upon receipt of the fee for the first nights lodging.

CONFIRMATION Shortly after registration, Delegates will receive a confirmation kit by mail containing conference and hotel registration confirmation, a map, receipt and general information.

Please register me for the IPI Forum to be held at the Parker House in Boston on March 11-14, 1986. Enclosed is my $895 registration fee. Please print the following information as you want it to appear on your name tag and the list of delegates.

NAME _____

TITLE _____ ***PHONE*** _____

COMPANY _____

ADDRESS _____

Please reserve a room at the Parker House-Boston as indicated below. A deposit for the first night's lodging is enclosed as a guarantee. Daily rates are shown below:

☐ Standard Single, $100. ☐ Standard Double, $125. ☐ Deluxe Single, $125. ☐ Deluxe Double, $150.

Arrival Date & Time: _____ Departure Date & Time _____

IPI Forum registrations and Parker house reservations cannot be accepted unless accompanied by proper payment. Please make checks payable to IPI Forum and mail to:

Technology Forums • 3425 Pomona Boulevard, Suite F, Pomona, CA 91768 • (714) 861-7300

CIRCLE NO. 8 ON INQUIRY CARD

Keynote speaker: Ken Olson, President of DIGITAL

disk. In order to print the reports in the background, the following basic steps must be taken:
(1.) Modify the counter responsible for the system tick to produce interrupts more frequently than the default. This increase in frequency depends upon the speed and number of printers being supported. It is suggested that an increase of 256 times be used to simplify Step 2.
(2.) Create a timer-interrupt handler to check the print buffer for characters to be printed, check the status of the target printer and, if the target printer is ready, print the character. Also, the timer must count the number of times it is called until the speed-up factor (from Step 1) is reached. When enough faster-timer interrupts have been received to equal one former tick, the default timer-interrupt routine is called to service any programs depending on the old frequency.

In our demonstration software, the printing function is contained in the control-application program, PCNTL, and will not run in the background. When PCNTL is invoked, status information and the control screen is displayed, as is all the information in the queue file. The names of 16 reports are displayed and the arrow keys can be used to scroll the screen to show other reports that may be in the queue.

The 25th line gives server status; the 24th line is used to enter commands. The available commands are:

START: starts the server and begins printing the first report in the queue;

STOP: stops the server, but continues printing any report in progress;

SUSPEND: suspends printing the report in progress;

RESTART nn [AT P=m] [AT L=m]: restarts report nn; (The optional AT clauses start printing at page m or line m.)

REALIGN: reprints alignment page for currently printing report;

BACKSPACE [P=m] [L=m]: backs up m pages or lines;

SKIP [P=m] [L=m]: skips forward m pages or lines;

DELETE ALL, nn or nn-mm: deletes print requests from the queue. (Deletions can be of all reports; a specific report, nn; or a range of reports, nn-mm.)

The spooler-collection function in the user machine is a resident interrupt handler. The receiving program in the server machine is a device driver. Both functions are independent and can reside in the same machine. Our demonstration program runs in one machine. To run both programs on one machine requires modifying the spool program to write directly to PSERV:, rather than to the network.

The spooling process in the user system is initiated by the spool program. Commands are passed to the resident print-intercept program, which intercepts all print destined for a designated printer and writes it to disk. To assure that print requests are not missed, the intercept routine traps data at the BIOS level. The intercept routine, using INT17H, examines all print requests. Those for the designated printer are spooled; all others are passed on to the normal BIOS routine.

The print-intercept routine, SPINTCPT, is run only once (usually in the AUTOEXEC.BAT file). When it runs, it initializes the spooling process and then returns to DOS, while remaining resident. The first function it performs is saving the address of the standard BIOS print-interrupt handler and replacing it with one of its own. The following code accomplishes this:

```
MOV  AH,35H              ;gets interrupt
                         ;vector function
MOV  AL,17H              ;prints interrupt
INT  21H                 ;executes function
MOV  PINTSAV,BX          ;saves old handler
                         ;address
MOV  PINTSAV+2,ES        ;
MOV  AH,25H              ;sets interrupt
                         ;vector function
MOV  AL,17H              ;prints interrupt
MOV  DX,OFFSET PINT      ;address of new
                         ;print handler
INT  21H                 ;executes function.
```

After the execution of this code, all print requests go to the interrupt handler, PINT, which examines the DX register. This register contains a 0, 1 or 2 to indicate the request-specified printer (lpt1:, lpt2:, etc.). If the spooler is active and DX matches the spooling device set by the control function, the byte is written to disk. Otherwise, the byte is passed to the standard print-interrupt handler at PINTSAV.

The spool program controls the print interceptor via a special control interrupt, which establishes communication between SPOOL and SPINTCPT. Interrupts in the range of 60H to 67H are reserved for user-software interrupts. We chose to use interrupt 67H for controlling SPINTCPT. This interrupt is installed by:

```
MOV AH,25H               ;sets interrupt
                         ;vector function
MOV AL,67H               ;for control interrupt
MOV DX,OFFSET CINT       ;address of control
                         ;handler
INT  21H                 ;executes function.
```

After CINT is installed, the spool program can pass commands by formatting a block of data with the desired switch settings, loading the

DOS uses drivers to provide standard, consistent interfaces between a user program and the system hardware.

address of that block into DX and issuing an INT 67H instruction. Then, CINT processes the command block and begins processing the instructions.

Install print-server device driver

PSERV: is a standard DOS device driver that you can install by including DEVICE=PSERV.SYS in the CONFIG.SYS file.

DOS uses drivers to provide standard, consistent interfaces between a user program and the system hardware. There are two types of device drivers—character and block. Character devices handle serial character I/O. DOS comes with standard character device drivers like CON, AUX and PRN. Block devices are disk drives or similar devices identified only by a letter.

Character devices, on the other hand, are identified by name. Programs can open these devices to perform I/O. Character devices provide the following functions: READ; IOCTL READ; INPUT (READ); NON-DESTRUCTIVE INPUT, NO WAIT; INPUT STATUS; INPUT FLUSH; OUTPUT (WRITE); OUTPUT STATUS; OUTPUT FLUSH; IOCTL OUTPUT.

The IOCTL (I/O control) functions allow the program using the driver to exercise control or read status from the device without using the standard read and write channels. The operator-printer-control program, PCNTL, uses IOCTL to control the printing process. The I/O control for devices is provided by DOS function 44H.

Data is passed to PSERV: using normal DOS I/O functions. The entire data stream, including report headers, is passed to the device driver. The driver writes the reports to individual disk files using temporary names. It also builds the report queue. (The queue, like the printing of reports, is controlled through IOCTL calls.) □

Steve Bostwick, a group manager with Local Data Inc., Torrance, Calif., designs protocol converters and local area network-to-IBM Corp. coaxial-device connections.

NEXT MONTH IN MMS

Artificial intelligence gets the software spotlight in the March issue of Mini-Micro Systems. From small IBM, PC-based packages to powerful mini products, expert systems have matured into solid value-added products.

THE FIRST AND ONLY

Integrated Calculator Data Terminal.

Calculate your cost savings up-front on our 80/132 column **KT-5**, with its easy-to-use integrated calculator.

Add features, economy and multiple emulations, you'll sum up our **KT-7**.

Subtract thousands of dollars from your PC budget by transforming your single-user PC into a multi-user system with our **KT-7/PC** terminal.

Multiply your productivity with our DEC VT-220 compatible **KT-22** with a standard multi-page.

Divide your expenditure for maintenance into a fraction with Kimtron's reliable terminals.

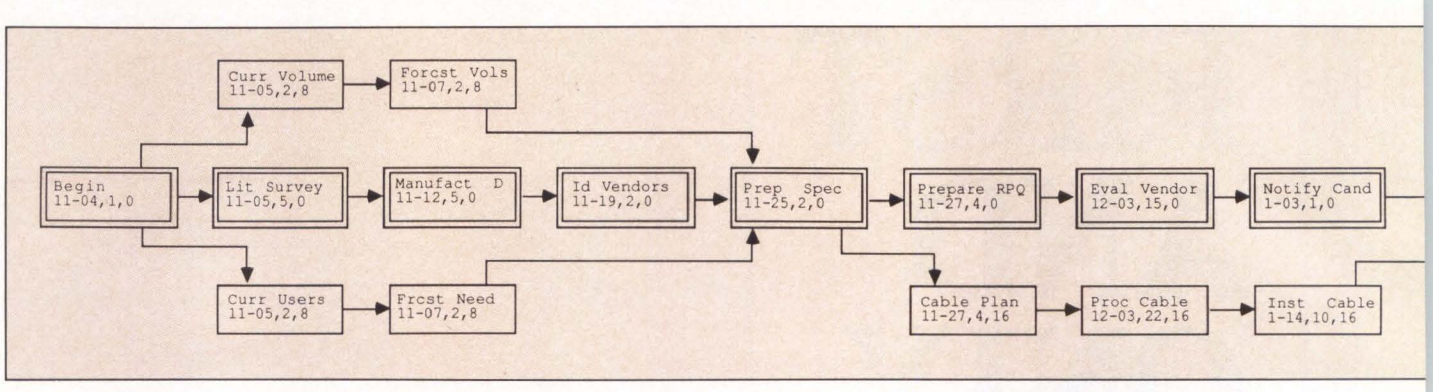
Clear 14" green or amber screen and true ergonomics enhance operator's comfort.

Memorize Kimtron for all of your data terminal requirements and call us today for your nearest Kimtron representative.

CIRCLE NO. 10 ON INQUIRY CARD

Kimtron

1705 Junction Ct., Bldg. #160
San Jose, CA 95112
TWX: 910-338-0237
(408) 286-8790 Ext. 101 (Inside CA)
(800) 828-8899 Ext. 101 (Outside CA)



SOFTWARE HELPS SOLVE LAN-SELECTION PUZZLE

Software management tools can help you save money, time and effort in planning your local area network

Steve Bostwick, Local Data Inc.

The technical decisions and trade-offs involved in choosing, buying and implementing a local area network can make even the most experienced system integrator shudder. And yet, for reasons of overall plant efficiency, corporate managers usually have to direct engineers and programmers on how and when to allocate resources and manpower in LAN selection and installation. However, software management tools can now help the executive fit the pieces of the LAN-procurement puzzle into the right place at the right time.

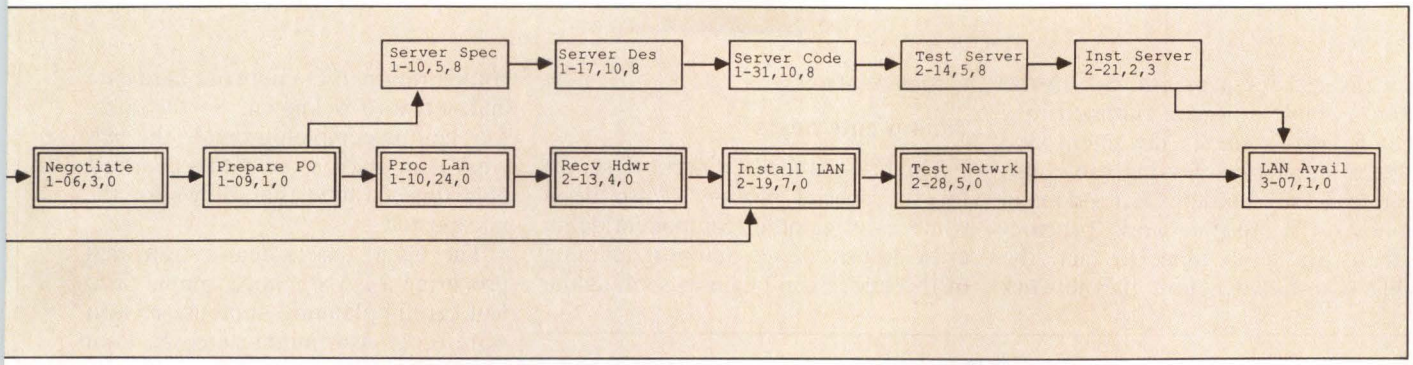
Many of these tools, which have been used for years on mainframe computers, are now available on personal microcomputers. One such tool, which is especially useful for procuring and installing a LAN, is a critical path management (CPM) program. To demonstrate a hypothetical LAN setup, we used software that is part of a package from Applied Business Technology Corp., New York, called Project Manager Workbench. This package is particularly well-suited for our example because, in addition to CPM, it produces resource-loading spreadsheets, reports for managing costs and schedules and project schedules such as Gantt charts.

Consider the following network example. The company procuring the LAN is a moderate-size manufacturing company that needs about 60 nodes around its plant and corporate offices. The nodes consist of peripherals and terminals in the corporate computing center, programmers' offices, management offices, manufacturing floor and warehouse. And, an unusual plotter requiring special software further complicates the company's chore.

The tasks shown on the accompanying charts typify the steps necessary in procuring a moderate-size LAN system. Horizontal bars indicate the dates allotted for a task. The letter C before a bar warns that a task lies on the "critical path:" Changes to this part of the schedule will ultimately delay the project. The scheduling program also accounts for holidays (the H's in the calendar bar at the top of the chart), enabling efficient manpower utilization.

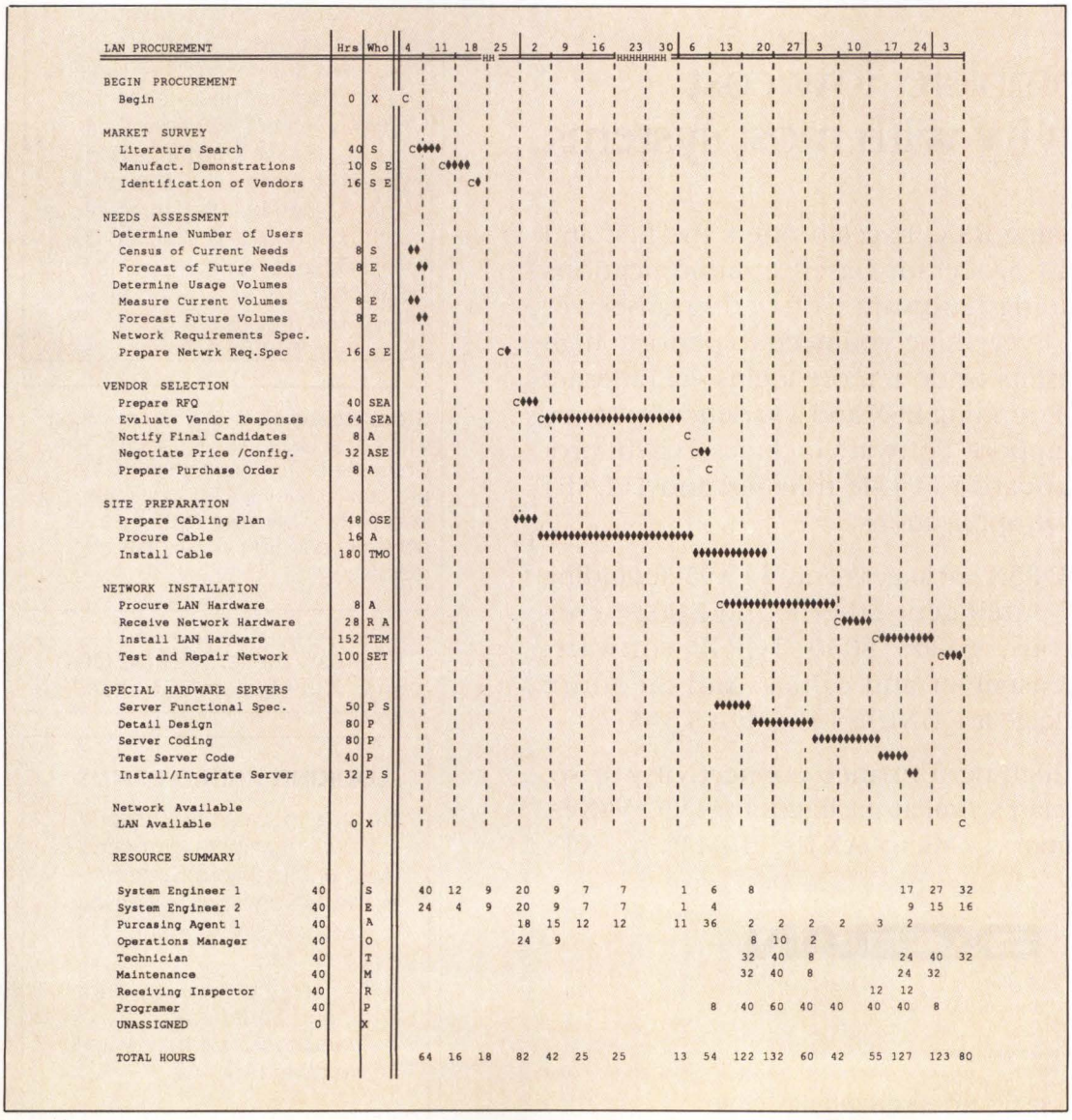
A project of this size might cost over $100,000 and shouldn't be undertaken without serious preparation. The Project Manager Workbench estimates that manpower alone will cost over $15,000. The first task involves surveying available network hardware and software. Parallel with this task, the system-engineering staff must study the current and future network needs in terms of users and volumes. This information is needed to prepare a network-requirements specification.

The requirements specification is used to write



a request for quotation (RFQ). This is sent to the vendors identified in the industry survey. Responses are evaluated, and negotiations are entered into with the candidate vendors. When haggling is completed, a purchase order is cut and the order is placed.

But problems remain. Although the network components ordered are available, they will not



This critical path chart *for LAN procurement is one of several Gantt charts that can be created through the Project Manager Workbench. Numbers give a task's start date and days to completion and identify how long any given task can be delayed. (Zero delay time indicates the task lies within the "critical path.")*

This Gantt chart *enables the tracking and adjustment of the day-to-day resource management of a LAN-procurement project. Specific personnel and their required hours, as well as holiday schedules and "critical path" (C) tasks, are properly noted.*

be delivered for a month. So, in the interim, cable runs are outlined in a network-requirements document and cable is purchased. Buying cable also requires a long lead time but is done in tandem with the network procurement, wasting no time. In fact, the cable is installed before the network hardware arrives.

Timing cuts costs

The preparation of a network server for the special plotter is also done while awaiting other component deliveries. In fact, design and programming of the server can begin as soon as the configuration of the network hardware and software is known. So this task, too, can be completed before the network is in place, even with a comfortable time cushion that allows for the unexpected.

The Gantt charts demonstrate that procuring a LAN is not a simple task. But careful planning—and use of software tools—can minimize costs. Poor planning can cause these costs to expand faster than the network itself. □

LAN-procurement plan available

To obtain a copy of the local area network procurement plan templates described in this article, with a demonstration version of Applied Business Technology Corp.'s Project Manager Workbench, please send a self-addressed, stamped ($1.25 postage), 9-inch-by-12-inch envelope with disk mailer to: Applied Business Technology Corp., Dept. SH0004, 365 Broadway, New York, N.Y. 10013.

Steve Bostwick is a group manager with Local Data Inc., Torrance, Calif., where he heads projects to create protocol converters and establish connectivity between local area networks and IBM Corp. coaxial devices.

Interest Quotient (Circle One)
High 733 Medium 734 Low 735

LOOKING AHEAD IN MMS

Be sure to watch for these editorial highlights in coming issues of Mini-Micro Systems.

- The March issue will cover personal and portable computers
- The second April issue, the Spring Peripherals Handbook, will be coming your way April 15.

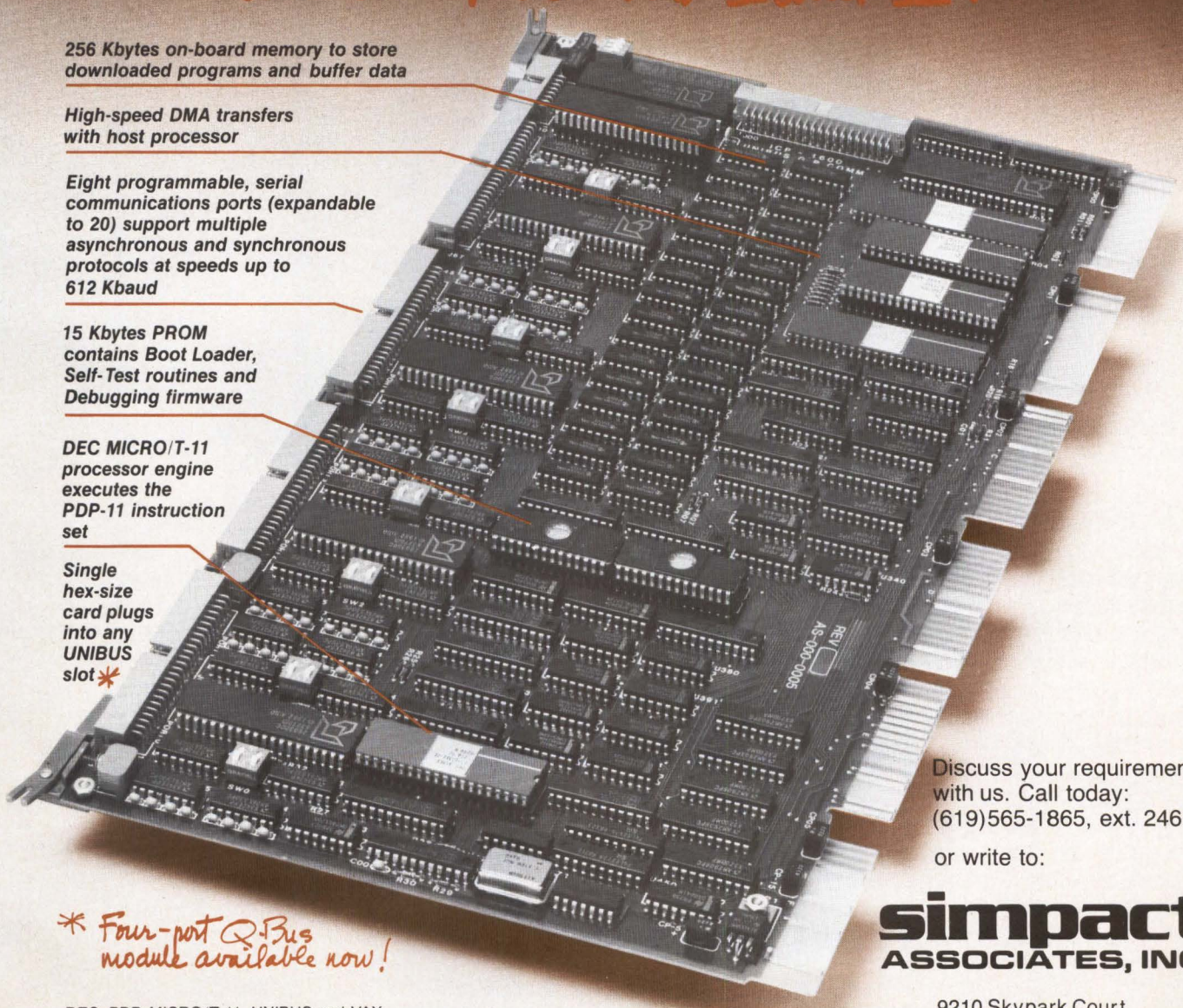
At Last! Communications Processors For DEC Computers That You Can Program

The Simpact ICP1600 Family of Intelligent Communications Processors can offload your host system because they're versatile enough to handle the toughest communication tasks and are compatible with VAX and PDP-11s

Use your host system utilities and our software tool kit to create your custom protocols, or let our communications specialists help you develop them.

X.25 software is available from Simpact now, and more standard packages are on the way.

and now MicroVAX I and II!



* Four-port Q-Bus module available now!

Discuss your requirements with us. Call today: (619)565-1865, ext. 246

or write to:

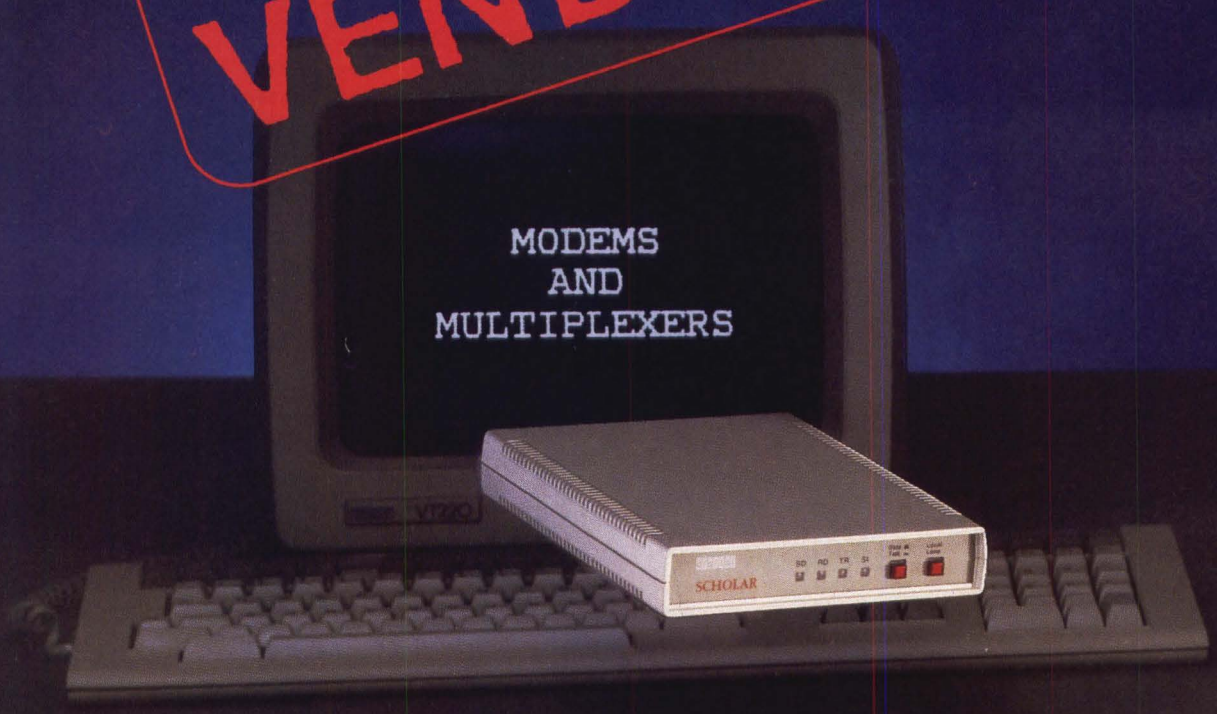
simpact
ASSOCIATES, INC.

9210 Skypark Court
San Diego, California 92123

DEC, PDP, MICRO/T-11, UNIBUS and VAX are trademarks of Digital Equipment Corporation

CIRCLE NO. 12 ON INQUIRY CARD

PREFERRED VENDOR



CLOSE THE GAPS

Need to improve access to valuable computing resources? That's easy. Use Digital modems to link remote terminals and workstations to your host computer. Dial-up models support asynchronous and synchronous full and half duplex operation. Your choice of speeds from 300 to 2400 bps.

Leased/private line models support synchronous full and half duplex operation. Speeds of 2400 to 9600 bps are available. All modems are compatible with popular CCITT and Bell standards.

PROTECT YOUR BUDGET

Are telephone line charges eroding your operating budget? Totally unnecessary. Pack more data onto fewer lines with Digital intelligent statistical multiplexers. Select from 4-,8-,12- or 16-channel units.

All units feature port contention and switching, simultaneous transmission of synchronous and asynchronous data, and speed and flow conversion on every channel. Also available, units that include an integral 4800 or 9600 bps modem.

AVOID MULTIPLE VENDOR HEADACHES

One-stop shopping is more than convenience. When the vendor is Digital, it's quality, reliability, compatibility, performance, availability, and service. Only Digital offers a total solution.

To discuss your application requirements, call Digital's Add-on Consulting Center, 800-343-4040, Ext. 559. Please mention Source Code BZ.

Or, for more information, clip, complete, and mail the reply card.

digital™

CIRCLE NO. 13 ON INQUIRY CARD

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
ANCHOR AUTOMATION 6913 Valjean Ave., Van Nuys, CA 91406 (818) 997-7758								**CIRCLE 201**
Lightning i	300, 1200, 2400	FSK, PSK	full duplex	asynch	auto dial/ auto answer		299-499(Q1)	board-level modem plugs into IBM PC/XT/AT and portables; includes LYNC communications software; Bell 103, 212, CCITT V.22 compatible
Signalman Express	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	analog loopback	399(Q1)	Bell 103, 212, CCITT V.22 compatible
Volksmodem 12	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer		299(Q1)	Bell 103, 212, CCITT V.22 compatible
ANDERSON JACOBSON INC. 521 Charcot Ave., San Jose, CA 95131, (408) 263-8520								**CIRCLE 202**
AJ 1212-AD1/ AJ 1212-AD2	1200		full duplex	asynch,synch	auto dial, auto answer		595/ 695(Q1)	Bell 103, 113, 212A compatible; AJ 1212-AD2 is an intelligent modem
AJ 1222	0-300, 600, 1200		full duplex	asynch/synch	manual orig./ auto answer			CCITT V.21, V.22 compatible
AJ DATA Modem 24 series	1200, 2400	DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback		rackmount, compatible with Bell 212, CCITT V.22 bis
APPLE COMPUTER INC. 20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010								**CIRCLE 203**
Apple Personal Modem	1200		full duplex	asynch	auto dial/ auto answer		399(Q1)	
ASHER TECHNOLOGIES 1009 Mansell Rd., Roswell, GA 30076, (404) 993-4590								**CIRCLE 204**
Dataview 25	1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local and remote digital loopback, self-test	495(Q1); 297(Q100)	includes CROSSTALK software; board-level modem plugs into Dataview 25, Bell 103, 212A compatible
Quadmodem II 1200	1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	495(Q1); 248(Q100)	includes CROSSTALK software; board-level modem plugs into IBM PC/XT/AT; compatible with Bell 103, 212A, CCITT V.22
Quadmodem II 2400	2400	FSK, PSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795(Q1); 358(Q100)	includes CROSSTALK software, board-level modem plugs into IBM PC/XT/AT; compatible with Bell 103, 212A, CCITT V.22
AST RESEARCH INC. 2121 Alton Ave., Irvine, CA 92714, (714) 863-1333								**CIRCLE 205**
AST-201C	2400	DPSK	half, full duplex	synch	manual orig./ auto answer	self-test	705(Q1)	Bell 201 compatible

Modems

MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
AST-208 A/B	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	self-test	1,470(Q1)	Bell 208 compatible
Reach!	300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	remote digital loopback, self-test	549(Q1)	includes CROSSTALK XVI software; board-level modem plugs into IBM PC family and compatibes; compatible with Bell 103, 113, 212A, Hayes
AT&T One Speedwell Ave., Morristown, NJ 07960, (800) 247-1212								**CIRCLE 206**
2212C/FDX	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	549(Q1)	Bell 212A compatible
2224/FDX	300, 1200, 2400	FSK, PSK	full duplex	asynch/ synch	auto dial/ auto answer	local and remote digital and analog loopback, remote digital loopback, self-test	999(Q1)	Bell 212A compatible
BYTCOM INC. 2169 Francisco Blvd., Suite H4, San Rafael, CA 94901, (800) 227-3254								**CIRCLE 207**
24/12EC		FSK, DPSK, QAM	full duplex	asynch/ synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	595(Q1)	board-level modem plugs into IBM computers and compatibles; error checking; compatible with Bell 103, 113J, CCITT V.22 bis
212AD	1200	FSK, DPSK	full duplex	asynch/ synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	495(Q1)	board-level modem plugs into IBM computers and compatibles; Bell 212A compatible
CARTERFONE COMMUNICATIONS CORP. 1341 W. Mockingbird Lane, Suite 1100 West, Dallas, TX 75247, (800) 527-1169								**CIRCLE 208**
ADCoMM 96/48	up to 19.2K		full duplex	asynch	auto dial/ auto answer		1,995(Q)	Bell 103 compatible, supports an independent secondary statistically multiplexed printer channel
CASE COMMUNICATIONS INC. 2120 Industrial Pkwy., Silver Spring, MD 20904-1999, (301) 622-2121								**CIRCLE 209**
R48FP	4800	QAM	half, full duplex	synch	manual orig./ manual answer	local digital and analog loopback, remote digital loopback, self-test	1,495(Q1)	CCITT V.24 compatible
R212A	300-1200		full duplex	asynch/ synch	auto dial/ auto answer	local and remote digital loopback	699(Q1)	Bell compatible
Executive 212	300-1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer		599(Q1)	Bell compatible
CERMETEK MICROELECTRONICS INC. 1308 Borregas Ave., Sunnyvale, CA 94088, (408) 752-5000								**CIRCLE 210**
Cermetek 1200	110, 300, 1200	FSK, PSK	half, full duplex	asynch/ synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	494(Q1)	compatible with Bell 103, 212A, Hayes

A modem by any other name could very well be ours.

Fujitsu modems are sold under many different labels, but they all have one feature in common: outstanding Fujitsu quality. That's why Fujitsu has been a major OEM modem manufacturer for many years.

OEMs depend on Fujitsu's quality, reliability and support. As a world leader in data communications for 20 years, we have the experience and strength to keep our OEMs at the top.

Features that could be yours.

The success of our extensive R&D shows up in the high-performance features of our standalone and board modems. Like powerful automatic equalizers that minimize the effects of line interference, custom digital processors to guarantee reliable transmissions, trellis coding to ensure data dependability and a training time of 7.5 milliseconds.

Fujitsu modems come in speeds of 2400, 4800, 9600 and 14,400 bps. And all the fundamental modem functions are contained on a single printed circuit board so you won't have to design additional circuits.

If you're looking for that kind of added value, the next modem we build could very well be yours. For a modem you'll be proud to put your name on, call us at 408-946-8777.

FUJITSU

FUJITSU AMERICA, INC.
DATA PRODUCTS DIVISION
3055 ORCHARD DRIVE
SAN JOSE, CA 95134
(408) 946-8777

CIRCLE NO. 14 ON INQUIRY CARD

The VME BUS and OS-9:

Ultimate Software for the Ultimate Bus.

Modularity. Flexibility. High Performance. Future growth. These are probably the prime reasons you chose the VME bus. Why not use the same criteria when selecting your system software? That's why you should take a look at Microware's OS-9/68000 Operating System—it's the perfect match for the VME bus.

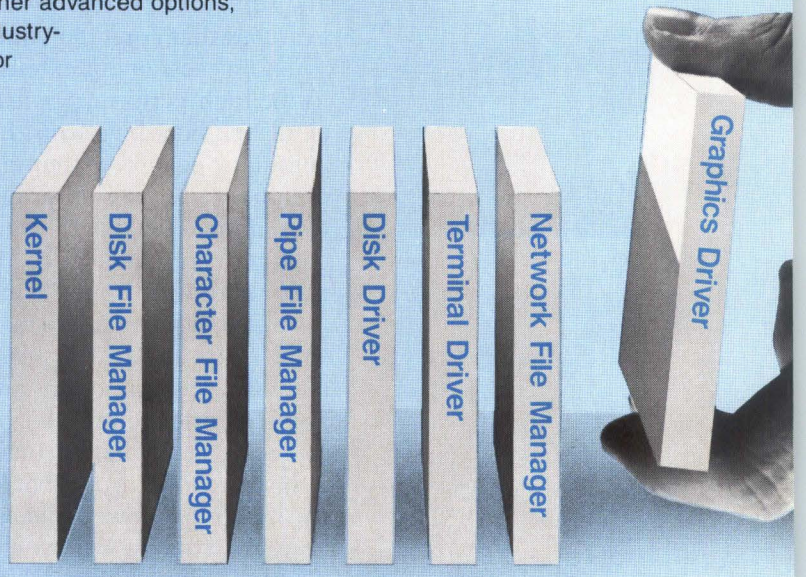
When you're working with VME you must have access to every part of the system. Unlike other operating systems that literally scream KEEP OUT!, OS-9's open architecture invites you to create, adapt, customize and expand. Thanks to its unique modular design, OS-9 naturally fits virtually any system, from simple ROM-based controllers up to large multiuser systems.

And that's just the beginning of the story. OS-9 gives you a complete UNIX-application compatible environment. It is multitasking, real time, and extremely fast. And if you're still not impressed, consider that a complete OS-9 executive and I/O driver package typically fits in less than 24K of RAM or ROM.

Software tools abound for OS-9, including outstanding Microware C, Basic, Fortran, and Pascal compilers. In addition, cross C compilers and cross assemblers are available for VAX systems under Unix or VMS. You can also plug in other advanced options, such as the GSS-DRIVERS™ Virtual Device Interface for industry-standard graphics support, or the OS-9 Network File Manager for high level, hardware-independent networking.

Designed for the most demanding OEM requirements, OS-9's performance and reliability has been proven in an incredible variety of applications. There's nothing like a track record as proof: to date, over 200 OEMs have shipped more than 100,000 OS-9-based systems.

Ask your VME system supplier about OS-9. Or you can install and evaluate OS-9 on **your own** custom system with a reasonably priced Microware PortPak™. Contact Microware today. We'll send you complete information about OS-9 and a list of quality manufacturers who offer off-the-shelf VME/OS-9 packages.



Modular Hardware Deserves Modular Software

MICROWARE®

Microware Systems Corporation
1866 N.W. 114th Street • Des Moines, Iowa 50322
Phone 515-224-1929 • Telex 910-520-2535

Microware Japan, Ltd.
41-19 Honcho 4-Chome, Funabashi City • Chiba 273, Japan • Phone 0474-22-1747 • Telex 298-3472

Micromaster Scandinavian AB
St. Persgatan 7
Box 1309 S-751 43 Uppsala
Sweden
Telex: 76129 microma s
Phone: 018-138595

Dr. Rudolf Keil, GmbH
Porphyrstrasse 15
D-6905 Schriesheim
West Germany
Telex: 465025 keil d
Phone: 06203-6741

Elsoft AG
Bankstrasse 9
CH-5432 Neuenhof
Switzerland
Telex: 57136 elso ch
Phone: 056-862724

Vivaway, Ltd.
36-38 John Street, Luton
Bedfordshire LU1 2JE
England
Telex: 825115
Phone: 0582-423425

Microprocessor Consultants, Ltd.
16 Bandera Avenue
Waga Waga, 2650
NSW Australia
Phone: (069) 312331

CIRCLE NO. 28 ON INQUIRY CARD

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
Cermetek 1200 SPC	110, 300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	495(Q1)	board-level modem plugs into IBM PC; compatible with Bell 103, 212A, Hayes; includes CROSSTALK XVI software
Cermetek 2400/ 2400 EP	300, 1200, 2400	FSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	745/ 795(Q1)	compatible with Bell 103, 212A, CCITT V.22, V.22 bis; error checking
CODEX CORP. 20 Cabot Blvd., Mansfield, MA 02178, (617) 364-2000								**CIRCLE 211**
2206	4800, 7200, 9600	half, full duplex		synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	1,995(Q1)	CCITT V.29 compatible
2215	0-1200	FSK	half duplex	asynch	auto dial/ auto answer	local analog loopback, self-test	495(Q1)	Bell 202S compatible
2232	1200, 2400	QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	745(Q1)	compatible with Bell 212A, CCITT V.22 bis
2271/2272	1200	PSK	full duplex	asynch	auto dial, auto answer	local and remote, digital and analog loopback, self-test	395/ 475(Q1)	2271 is a board-level modem that plugs into IBM PC/XT/AT and compatibles; both are Bell 103, 212A compatible
CLEO SOFTWARE (DIV. OF PHONE 1 INC.) 1639 N. Alpine Rd., Rockford, IL 61107, (800) 233-CLEO								**CIRCLE 212**
SYNCmodem	2400	DPSK	half, full duplex	synch	auto dial/ auto answer		895-1,395 (Q1); 450-720 (Q100)	board-level modem plugs into IBM PC/XT/AT; CLEO emulation software available; compatible with Bell 201C, CCITT V.26 bis
COMDATA 7900 N. Nagle Ave., Morton Grove, IL 60053, (312) 470-9600								**CIRCLE 213**
224E2-42	1200, 2400		half, full duplex	asynch/synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	587(Q1); 537(Q100)	standalone or rackmount, Bell 212A compatible
312E2-422	1200	DPSK	half, full duplex	asynch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	297(Q1); 267(Q100)	Bell 212A compatible
P212A	1200	DPSK	half, full duplex	asynch/synch	manual orig./ auto answer	local and remote, digital and analog loopback, self-test	437(Q1); 397(Q100)	standalone or rackmount, Bell 212A compatible
COMDESIGN INC. 751 S. Kellogg Ave., Goleta, CA 93117, (805) 964-9852								**CIRCLE 214**
CM-4800	2400-4800	DPSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,395(Q1)	compatible with CCITT V.24, V.27 bis, V.28, V.52, V.54; automatic line resynchronization
CM-9600	4800-9600	DPSK, QAM	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,750(Q1)	compatible with CCITT V.24, V.28, V.29, V.52, V.54; automatic line resynchronization

Modems

MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
COMPUTER COMMUNICATIONS SPECIALISTS INC. 6683 Jimmy Carter Blvd., Norcross, GA 30071, (404) 441-3114								**CIRCLE 215**
AUDIOMODEM/ AUDIOMODEM II	1200	FSK	half duplex	asynch	auto dial/ auto answer	local digital and analog loopback, self-test	2,895/5, 995(Q1)	voice response to inputs from touch-tone telephones or hand-held terminals
CONCORD DATA SYSTEMS INC. 303 Bear Hill Rd., Waltham, MA 02154, (617) 890-1394								**CIRCLE 216**
224 PC Card	300, 1200, 2400	FSK, PSK, DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote digital loopback, self-test	695(Q1)	compatible with Bell 103, 212A, CCITT V.22 bis; board-level modem plugs into IBM PC bus; MNP error protection
224 Trispeed	300, 1200, 2400	FSK, PSK, DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795(Q1)	compatible with Bell 103, 212A, CCITT V.22 bis; board-level modem plugs into Concord Data Systems RM16, VA 1680 nest
SERIES II	300, 1200, 2400	FSK, PSK, DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	745(Q1)	compatible with Bell 103, 212A, CCITT V.22 bis; MNP error protection
CTS FABRI-TEK INC. (DATACOMM PRODUCTS DIV.) 6900 Shady Oak Rd., Eden Prairie, MN 55344, (612) 941-9100								**CIRCLE 217**
212AHC	1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local analog loopback, remote digital loopback, self-test	395(Q1)	compatible with Bell 212A, Hayes
2424AD	300, 1200, 2400	FSK, DPSK QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital analog loopback, remote digital loopback, self-test	495(Q1); 395(Q100)	compatible with Bell 212A, CCITT V.22; board-level modem plugs into TTL version
Half-Pak 12	1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local analog loopback, remote digital loopback, self-test	395(Q1)	compatible with Bell 212A, Hayes; board-level modem plugs into IBM computers
DATA COMM FOR BUSINESS INC. 4 Henson Place, Champaign, IL 61820, (217) 352-3207								**CIRCLE 218**
PL4.8 Plus/PL9.6 Plus/PL14.4 Plus	4800/ 9600/14.4K	QAM	full duplex	synch		local and remote, digital and analog loopback	1,600/2,000/ 3,300(Q1); 1,360/1,700/ 2,805(Q100)	CCITT V.27 compatible, point-to-point/CCITT V.29 compatible, point-to-point
DATA RACE INC. 5839 Sebastian Place, San Antonio, TX 78249, (512) 692-3909								**CIRCLE 219**
RACE I/RACE II	9600	DPSK	full duplex	asynch	auto dial/ auto answer	self-test	1,995/ 2,495(Q1)	Bell 103 compatible, error correction, Race II statistically multiplexes a second independent printer channel
DATAGRAM CORP. 11 Main St., E. Greenwich, RI 02818, (800) 235-5030								**CIRCLE 220**
DCE-224	2400	FSK, PSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	795(Q1)	Bell 224 compatible
DCE-4800	4800	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	1,395(Q1)	CCITT V.29 bis/ter compatible

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
DCE-9600	9600	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	1,495(Q1)	CCITT V.29 bit/ter compatible
DATALINK READY INC. P.O. Box 2169, Melbourne, FL 32902-2169, (305) 676-0500								**CIRCLE 221**
208 AB	2400, 4800	DPSK	half, full duplex	synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	1,725(Q1); 1,560 (Q100)	Bell 201C, 208A/B compatible
Ark 24K	300, 600, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	595(Q1); 439(Q100)	compatible with Bell 103, 212A CCITT V.22, V.22 bis; board-level modem plugs into IBM PC; ARQ error correction
Ark 24K Plus	300, 600, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	795(Q1); 540(Q100)	compatible with Bell 103, 212A CCITT V.22, V.22 bis; board-level modem plugs into IBM PC; ARQ error correction
DATEC INC. P.O. Box 13568, Research Triangle Park, NC 27709-3568 (919) 544-6433								**CIRCLE 222**
212SA	1200	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local analog loopback, self-test	495(Q1)	Bell 103, 113, 212A compatible
212SC	1200	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, self-test	550(Q1)	Bell 103, 113, 212A compatible; battery back-up
224KT	2400	DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	895(Q1)	Bell 103, 113, 212A, CCITT V.22, V.22 bis compatible
DECATEK INC. P.O. Box 569, Stone Mountain, GA 30086-0569, (404) 493-7273								**CIRCLE 223**
ZIPmodem	9600	QAM	half duplex	synch	auto dial/ auto answer	self-test	2,995 (Q1); 1,995 (Q100)	board-level modem plugs into IBM PC/AT and features a SNA/SDLC protocol converter; CCITT V.27, V.29 compatible; includes communications software
DIGITAL COMMUNICATIONS ASSOCIATES INC. (DCA) 1000 Alderman Dr., Alpharetta, GA 30201, (404) 442-4000								**CIRCLE 224**
DCA 911	2400	PSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	795(Q1)	compatible with Bell 212A, CCITT V.22, V.22 bis; error correction
DCA 920	4800	PSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,495(Q1)	CCITT V.27 bis/ter compatible, LCD display, eye pattern generator
Irma's Fastlink	10K	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	self-test	2,395(Q1)	Bell 103, 212A, compatible; includes CROSSTALK software; board-level modem plugs into IBM PC

Modems

MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
DIGITAL EQUIPMENT CORP. 200 Baker Ave., Concord, MA 01742, (617) 264-1420								**CIRCLE 225**
DF12	300, 1200	FSK, QDPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	665(Q1)	Bell 103J, 212A compatible
DF224	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local analog loopback, remote digital loopback, self-test	795(Q1)	compatible with Bell 103J, 212A, CCITT V.22, V.22 bis
ELECTRONIC VAULTS INC. 12347-E Sunrise Valley Dr., Reston, VA 22091, (703) 620-3900								**CIRCLE 226**
Fastcomm 1296/I	300, 1200, 4800, 7200, 9600	QAM	half, full duplex	asynch	auto dial/ auto answer		995(Q1)	compatible with Bell 103, 212A, CCITT V.29; board-level modem plugs into IBM PC and compatibles
Fastcomm 2496/I	300, 1200, 2400, 4800, 7200, 9600	QAM	half, full duplex	asynch	auto dial/ auto answer		1,095(Q1)	compatible with Bell 103, 212A, CCITT V.22 bis, V.29; board-level modem plugs into IBM PC and compatibles; error detection
Upta 96/I	4800, 7200, 9600	QAM	half duplex	asynch	auto dial/ auto answer		895(Q1)	CCITT V.29 compatible; board-level modem plugs into IBM PC and compatibles; error detection
FUJITSU AMERICA INC.(DATA PRODUCTS DIV.) 3055 Orchard Dr., San Jose, CA 95134, (408) 946-8777								**CIRCLE 227**
M1915L	2400, 4800	PSK	full duplex	synch				CCITT V.27 compatible
M1921L	4800, 7200, 9600	QAM	full duplex	synch				CCITT V.29 compatible; opt. 4 channel (TDM) multiplexer
M1935D	1200, 2400	PSK, QAM	full duplex	asynch/synch	auto dial auto answer	local digital and analog loopback, remote digital loopback, self-test		Bell 212A, CCITT V.22, V.22 bis compatible
GAMMALINK 2452 Embarcadero Way, Palo Alto, CA 94303, (415) 856-7421								**CIRCLE 228**
GammaComm/ GammaModem	4800, 7200 9600	QAM	half duplex	synch	auto dial/ auto answer	local and remote digital loopback, self-test	1,995(Q1); 1,495(Q100)	CCITT V.27, V.29 compatible; board-level modem plugs into IBM PC/AT; includes communications software; GammaModem is standalone model
GANDALF DATA INC. 1020 S. Noel, Wheeling, IL 60090, (312) 541-6060								**CIRCLE 229**
Access Series 24S	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	650(Q1)	compatible with Bell 103, 212A, CCITT V.22, V.22 bis
Access Series 208	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,300-1,450(Q1)	Bell 208 A/B compatible; point-to-point; rackmount

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
Access Series 212	300, 1200	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	545(Q1)	Bell 103, 113, 212 compatible

GENERAL DATACOMM INDUSTRIES INC. **CIRCLE 230**
Rt. 63, Middlebury, CT 06762, (203) 574-1118

DC 201C-K/ DC 201-7	1200, 1800, 2400/ 1200, 2400	DPSK	half duplex/ half, full duplex	asynch, synch/ synch	auto dial, auto answer/ manual orig., auto answer	local digital and analog loopback, remote analog loopback, self-test/local and remote, digital and analog loopback, self-test	795/745(Q1)	Bell compatible/Bell, CCITT V.26 compatible
DC 2400ASM/ DC 201C	1200, 1800, 2400/ 1200, 2000, 2400	DPSK	full duplex/ half, full duplex	asynch, synch/ synch	manual orig., auto answer	local digital and analog loopback, remote analog loopback, self-test/local and remote, digital and analog loopback, self-test	825/995(Q1)	Bell, CCITT V.26 compatible
DC 9600 QPS/ DC 14400	4800, 7200, 9600/1200, 9600, 14.4K	QAM	full duplex/ half, full duplex	synch	manual orig., auto answer	local digital and analog loopback, self-test/local and remote, digital and analog loopback, self-test	1,675/ 5,995(Q1)	CCITT V.29 compatible

HALCYON COMMUNICATIONS INC. **CIRCLE 231**
2121 Zanker Rd., San Jose, CA 95131, (408) 293-9970

H424	1200, 2400	PSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	530(Q1)	Bell 212A, CCITT V.22 bis, Hayes compatible
H448	4800	PSK	half, full duplex	synch		local and remote, digital and analog loopback, self-test	1,295(Q1)	CCITT V.27 bis/ter compatible
H496	9600	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test	1,495(Q1)	CCITT V.29 compatible; board-level modem plugs into four channel, synch TDM

HAYES MICROCOMPUTER PRODUCTS INC. **CIRCLE 232**
P.O. Box 105203, Atlanta, GA 30848, (404) 449-8791

Smartmodem 1200	0-300, 1200	DPSK, FSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	599(Q1)	Bell 103, 212A, CCITT V.22 compatible
Smartmodem 1200B	0-300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	499(Q1)	Bell 103, 212A, CCITT V.22 compatible; board-level modem plugs into IBM PC; includes Smartcom II communications software
Smartmodem 2400	0-300, 1200, 2400	FSK, DPSK	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	899(Q1)	Bell 103, 212A, CCITT V.22 compatible

INCOMM DATA SYSTEMS INC. **CIRCLE 233**
115 N. Wolf Rd., Wheeling, IL 60090, (312) 459-8881

2400 FDX	1200, 2400	PSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	699(Q1)	Bell 212, CCITT V.22 bis compatible

Modems

MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
PC1200	0-300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local analog loopback	399(Q1)	Bell 103, 212A compatible; board-level modem plugs into IBM PC/XT
Turbo 2400S	300, 600, 1200, 2400	FSK, PSK	half, full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	699(Q1)	Bell 103, 212, CCITT V.22, V.22 bis, V.23 compatible

INFOTRON SYSTEMS CORP. **CIRCLE 234**
9 N. Olney Ave., Cherry Hill, NJ 08003, (609) 424-9400

DL 96/V.29	4800, 7200, 9600	QAM	full duplex	synch		local and remote, digital and analog loopback, self-test		
DL 201C	2400	PSK	full duplex	synch		local digital and analog loopback, self-test		Bell 201C compatible
DL 212B	1200	FSK, PSK	full duplex	asynch/synch	auto answer	local and remote, digital and analog loopback, self-test		Bell 103, 113, 212 compatible

LEXICON CORP. **CIRCLE 235**
1541 N.W. 65th Ave., Ft. Lauderdale, FL 33313, (305) 792-4400

LEX-15	1200	FSK	half duplex	asynch	manual orig.		325(Q1)	Bell 202S compatible
LEX-15B	1200	FSK	half duplex	asynch	manual orig.		395(Q1)	Bell 202S compatible

MICOM SYSTEMS INC. **CIRCLE 236**
4100 Los Angeles Ave., P.O. Box 8100, Simi Valley, CA 93063, (805) 583-8600

M3024	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	685(Q1)	Bell 212, CCITT V.22 bis compatible; alternate voice/data operation
M3212	300, 1200	FSK, DPSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, self-test	445(Q1)	Bell 103, 212 compatible; rackmount available
M3224	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	660(Q1)	Bell 212, CCITT V.22 compatible; rackmount available

MICROCOM **CIRCLE 237**
1400A Providence Hwy., Norwood, MA 02062, (617) 762-9310

SX/2400		FSK, DPSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	999(Q1)	Bell 212, CCITT V.22 compatible; MNP error correction; standalone or rackmount
ZX/2400		FSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	local analog loopback, remote digital and analog loopback, self-test	999(Q1)	Bell 212, CCITT V.22, Hayes compatible; MNP error correction; standalone or rackmount

MULTI-TECH SYSTEMS INC. **CIRCLE 238**
82 Second Ave. S.E., New Brighton, MN 55112, (612) 631-3550

MultiModem 224E	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback	895(Q1)	compatible with Bell 103, 212A, CCITT V.22 bis, Hayes Smartmodem 1200; MNP error correction

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
MultiModem 224 PC	300, 1200, 2400	FSK, PSK, QAM	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795(Q1)	compatible with Bell 103, 113, 212A, CCITT V. 22 bis; includes MultiCom PC s oftware
MT224AD	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback	895(Q1)	compatible with Bell 103, 113, 212A, CCITT V.22 bis, Hayes Smartmodem 1200; rackmount available
NCR COMTEN INC. 2700 Snelling Ave. North, St. Paul, MN 55113, (612) 638-7777								**CIRCLE 239**
7164-100C	4800	DPSK	full duplex	synch		local analog loopback and remote digital loopback, self-test	2,995(Q1); 2,067(Q100)	IBM 3834-1, 3864-1, 3868-2 compatible; point-to-point; rackmount available
7164-200C	4800	DPSK	half duplex	synch	auto answer	local analog loopback and remote digital loopback, self-test	3,195(Q1); 2,205(Q100)	IBM 3864-2 compatible; rackmount available
7165-C	9600	QAM	full duplex	synch		local analog loopback and remote digital loopback, self-test	3,995(Q1); 2,757(Q100)	IBM 3865-1, 3865-2, 3868-3, 3868-4 compatible; rackmount available
NEC AMERICA INC. 110 Rio Robles, San Jose, CA 95134, (408) 433-1250								**CIRCLE 240**
DSP 2430 II	300, 1200, 2400	FSK, PSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795(Q1)	Bell 212AR, CCITT V.22 bis compatible
N201CR	2400	DPSK	half duplex	synch	manual orig./ auto answer	local digital and analog loopback, self-test	845(Q1)	Bell 201C, 201CR compatible
N212BR	300, 1200	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795(Q1)	Bell 212AR compatible
NOKIA-KINEX CO. 6950 Bryan Dairy Rd., Largo, FL 33543, (813) 541-6406								**CIRCLE 241**
24/201C	1200, 2400	DPSK	half, full duplex	synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	695(Q1)	Bell 201C, CCITT V.26 bis compatible
48/27	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,650(Q1)	CCITT V.27 compatible
48/208AB	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	1,365-1,875(Q1)	Bell 208A/B compatible
NOVATION INC. 20409 Prairie St., Chatsworth, CA 91311, (818) 996-5060								**CIRCLE 242**
2400 Professional		FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test		Bell 103, 212A, CCITT V.22 bis compatible; LCD display
Apple Cat II System		FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback		Bell 103, 212A compatible; board-level modem plugs into Apple, S-100

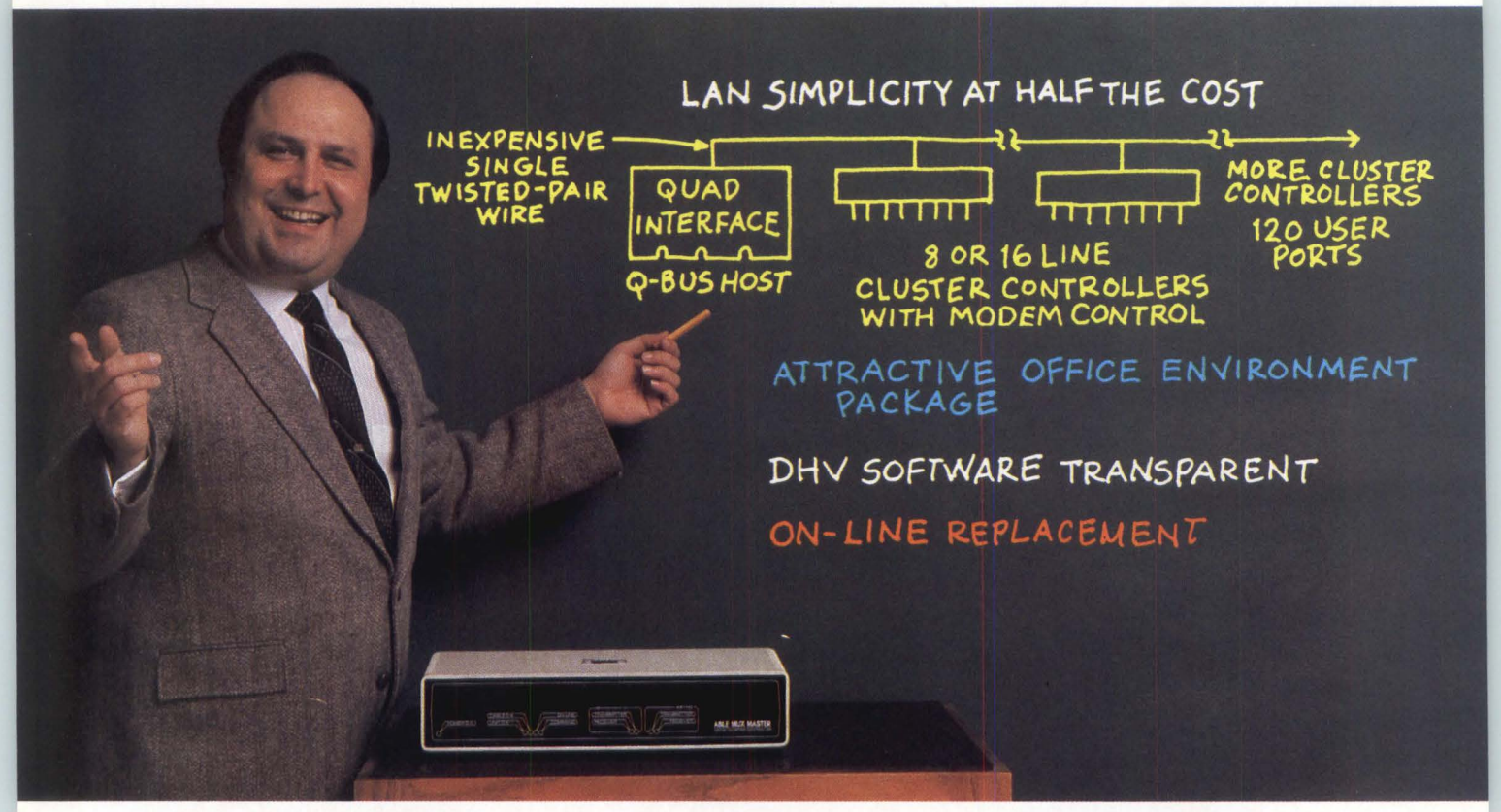
Unleash the Power of Your MICROVAX II

with three new products from ABLE

MUX MASTER™ — The most advanced user connection system on the market.

QNIVERTER II — Economical high performance Q-BUS—UNIBUS converter.

MICROVERTER — Only bus converter on the market with memory mapping.



Compliment the appearance and performance of the MicroVAX II with the flexibility and connectability of the MUX MASTER.

Make use of the incredible array of UNIBUS products by linking them to your computer with QNIVERTER or MICROVERTER.

ABLE COMPUTER **THE CONNECTIVITY SPECIALIST**

UNITED STATES, 3080 Airway Avenue, Costa Mesa, California 92626. (714) 979-7030, TWX 910-595-1729, TLX 668307. CANADA, Suite 101, 101 The Queensway West, Mississauga, ON L5B 2P7, Canada. (416) 270-8086. EUROPE, 287 London Road, Newbury, Berkshire RG13 2QJ, England. (0635) 32125, TLX 848715.

MICROVAX II, Q-BUS AND UNIBUS ARE TRADEMARKS OF DIGITAL EQUIPMENT CORPORATION.

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
CAT Communication System		FSK, PSK	full duplex	asynch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test		Bell 103, 212A, Hayes compatible; board-level modem plugs into IBM; standalone available
OMNITEL INC. 5415 Randall Place, Fremont, CA 94538, (415) 490-2202								**CIRCLE 381**
T1200-PC2R	1200	DPSK	half, full duplex	asynch	auto dial/ auto answer	local analog loopback	349(Q1)	Bell 103A, 212A compatible; CROSSTALK software; half-size board-level modem plugs into IBM PCs
T1200-SD1	1200	DPSK	half, full duplex	asynch/ synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback	349(Q1)	internal power supply; Bell 103A, 212A compatible
T2400-PC1R	2400	DPSK	half, full duplex	asynch	auto dial/ auto answer	local analog loopback	449(Q1)	half-size board-level modem plugs into IBM PCs; Bell 103A, 212A, CCITT V.22 bis compatible
PARADYNE CORP. 8550 Ulmerton Rd., Largo, FL 33540, (813) 530-2000								**CIRCLE 243**
Challenger 24	300, 600, 1200, 2400	DPSK	half, full duplex	asynch/ synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	700(Q1); 620(Q100)	Bell 103, 212, CCITT V.22, V.22 bis compatible
FDX 1200	300, 600, 1200	QAM	half, full duplex	asynch/ synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	395(Q1); 375(Q50)	Bell 103, 113, 212A, CCITT V.22 compatible
HDX 9600	4800, 9600	QAM	half duplex	synch	auto dial/ auto answer	local and remote, digital and analog loopback, selt-test	2,190(Q1); 1,860(Q50)	Bell 208B compatible
PEACHTREE TECHNOLOGY INC. 3120 Crossing Park, Norcross, GA 30071, (404) 662-5556								**CIRCLE 244**
P-1200	300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback	495(Q1); 395(Q100)	Bell 103, 212A compatible; includes CROSSTALK Version 3.6 software
P-1200S	300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	local digital and analog loopback	595(Q1); 495(Q100)	Bell 103, 212A compatible; includes CROSSTALK Version 3.6 software
PRENTICE CORP. 260 Caspian Dr., P.O. Box 3544, Sunnyvale, CA 94088-3544, (408) 734-9810								**CIRCLE 245**
9629	9600	QAM	half, full duplex	synch	manual orig./ manual answer	local digital and analog loopback, self-test	1,595-1,695(Q1)	CCITT V.29 compatible; rackmount or standalone
P-201C	2400	DPSK	half, full duplex	synch	manual orig./ manual answer	local digital and analog loopback, self-test	595-695(Q1)	Bell 201B/C compatible; standalone or rackmount
P-208A/B	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	local digital loopback, self-test	1,295-1,395(Q1)	Bell 201 B/C compatible; standalone or rackmount

Modems

MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
PROMETHEUS PRODUCTS INC. 4545 Cushing Pkwy., Fremont, CA 94538, (415) 490-2370								**CIRCLE 246**
Promodem 1200/ Promodem 1200A	1200	PSK	half, full duplex	asynch, synch	auto dial, auto answer	local digital and analog loopback, self-test	495/ 449(Q1)	Bell 212 compatible/board-level modem plugs into Apple II, IIe, II+; includes word processing software
Promodem 1200B	1200	FSK, PSK, DPSK, QAM	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, self-test	399 (Q1)	Bell 212 compatible; board-level modem plugs into IBM PC and compatibles
Promodem 1200M		PSK	half, full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, self-test	549(Q1)	Bell 212 compatible; includes Procom-M communications software
RACAL-MILGO P.O. Box 407044, Ft. Lauderdale, FL 33340-7044, (305) 475-1601								**CIRCLE 247**
CMS 12	1200	FSK	half, full duplex	asynch/synch		local and remote, digital and analog loopback, self-test	1,300(Q1); 1,249 (Q100)	standalone and central site card versions
Mark 48	2400, 4800	DPSK	half, full duplex	synch		local digital and analog loopback	1,150(Q1); 956(Q100)	
Omnimode 48	2400, 4800	QAM	half duplex	asynch/synch	auto dial/ auto answer	local and remote digital and analog loopback, self-test	2,050(Q1); 1,759 (Q100)	
RACAL-VADIC 1525 McCarthy Blvd., Milpitas, CA 95035, (408) 946-2227								**CIRCLE 248**
1200PA	300, 1200	FSK, PSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	495(Q1)	Bell 103, 212A compatible; LCD display; MNP error correction
VA212 PAR	1200	FSK, DPSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	595(Q1); 445(Q100)	Bell 103, 212 compatible; rackmount
VA4224E	2400	FSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	695(Q1); 560(Q100)	Bell 103, 212, CCITT V.22 bis compatible; MNP error correction; rackmount
TANDY CORP. 1800 One Tandy Center, Ft. Worth, TX 76102, (817) 390-3100								**CIRCLE 249**
DC2212	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local analog loopback	399(Q1)	Bell 212A compatible
TECMAR INC. 6225 Cochran Rd., Solon, OH 44139, (216) 349-0600								**CIRCLE 250**
Phonegate 2400	110, 300, 600, 1200, 2400		half, full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	789(Q1)	Bell 103, 212A, CCITT V.22, V.22 bis, Hayes compatibles; board-level modem plugs into IBM PC and compatibles
TEK-COM CORP. 120 Charcot Ave., San Jose, CA 95131, (800) 621-0854								**CIRCLE 251**
P212A SA	300, 1200	FSK, PSK	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, remote digital loopback, self-test	550(Q1); 358(Q100)	Bell 212A compatible

Modems

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
TC212AD	300, 1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	local analog loopback	359(Q1); 197(Q100)	Bell 212A, Hayes Smartmodem compatible
TIMEPLEX INC. 400 Chestnut Ridge Rd., Woodcliff Lake, NJ 07675, (201) 930-4600								**CIRCLE 252**
AIM 2400	2400	DPSK	full duplex	synch		local and remote, digital and analog loopback, self-test	900-1,050(Q1)	Bell 3002 compatible
AIM 4800	4800	DPSK	full duplex	synch		local and remote, digital and analog loopback, self-test	1,600-1,850(Q1)	Bell 3002 compatible
V.29 Plus	9600		full duplex	synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	3,175-3,675(Q1)	CCITT V.29 compatible
TRANSEND CORP. 1887 O'Toole Ave., C209, San Jose, CA 95131, (408) 435-0701								**CIRCLE 253**
PCM1200	1200		half, full duplex	asynch	auto dial/ auto answer	self-test	241(Q1); 159(Q100)	Bell 212A compatible; board-level modem plugs into IBM PC/XT/AT; file transfer software available
TRI-DATA 505 E. Middlefield Rd., Mountain View, CA 94043-4082 (415) 969-3700								**CIRCLE 254**
OZ Guardian 533	110, 300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	750(Q1)	Bell 212A compatible
TYMNET (MCDONNELL DOUGLAS NETWORK SYSTEMS CO.) 2710 Orchard Pkwy., San Jose, CA 95134, (408) 946-4900								**CIRCLE 255**
931	1200, 2400	DPSK, QAM	full duplex	asynch/synch	manual orig./ auto answer	local digital and analog loopback, self-test	450(Q1); 414(Q100)	Bell 212A, CCITT V.22 bis compatible
932	1200, 2400	DPSK, QAM	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, self-test	495(Q1); 455(Q100)	Bell 212A, CCITT V.22 bis compatible
UNIVERSAL DATA SYSTEMS 5000 Bradford Dr., Huntsville, AL 35805-1953, (205) 837-8100								**CIRCLE 256**
202T	0-1200, 1800	FSK	half, full duplex	asynch	manual orig./ manual answer	local digital and analog loopback, self-test	425(Q1)	Bell 202 compatible, anti-streaming
212A/D	0-300, 1200	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote analog loopback, self-test	545(Q1)	Bell 103, 212A compatible
224A/D	0-300, 1200, 2400	FSK, PSK	full duplex	asynch/synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	645(Q1)	Bell 103, 212A, CCITT V.22, V.22 bis compatible
FasTalk 2400	0-300, 1200, 2400	FSK, PSK, QAM	full duplex	synch	auto dial/ auto answer	local and remote, digital and analog loopback, self-test	625(Q1)	Bell 103, 212A, CCITT V.22, V.22 bis compatible

Modems

MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Diagnostics	Price $	Notes, features, options
US ROBOTICS INC. 8100 N. McCormick Blvd., Skokie, IL 60076, (312) 982-5010								**CIRCLE 257**
Courier 2400	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch	auto dial/ auto answer	local and remote analog loopback, self-test	699(Q1)	Bell 103, 212A, CCITT V.22 bis compatible; standalone
Microlink 2400	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch	auto dial/ auto answer	local and remote analog loopback, self-test	699(Q1)	Bell 103, 212A, CCITT V.22 bis compatible; board-level modem plugs into IBM PC/XT/AT and compatibles
VISIONARY ELECTRONICS INC. 141 Parker Ave., San Francisco, CA 94118, (415) 751-8811								**CIRCLE 258**
Visionary 1200 XT		FSK, PSK	half, full duplex	asynch	auto dial/ auto answer		495(Q1); 395(Q100)	Bell 212A, Hayes compatible
WESTERN DATACOM 5083 Market St. Youngstown, OH 44512, (216) 788-6583								**CIRCLE 259**
424 Autodial	300, 1200, 2400		full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	695(Q1)	
424 Error Free	300, 1200, 2400		full duplex	asynch/synch	auto dial/ auto answer	local digital and analog loopback, remote digital loopback, self-test	795(Q1)	Bell 102, 212A, CCITT V.22 bis compatible; MNP error correction
WC200		FSK	half, full duplex	asynch	auto dial/ auto answer	local analog loopback, self-test	495(Q1)	Bell 103, 113, 202, CCITT V.21, V.23 compatible; standalone

Information was solicited but not received from the following manufacturers:

Bizcomp Corp.
532 Mercury Dr.
Sunnyvale, CA 94086
(408) 733-7800

Coherent Communications Systems Corp.
60 Commerce Dr.
Hauppauge, NY 11788
(516) 231-1550

Databit Inc.
110 Ricefield Lane
Hauppauge, NY 11788
(516) 435-4000

Develcon Electronics Inc.
856 51st St., East
South Saskatoon
Saskatchewan, S7 KC7, Canada
(306) 933-3300

IBM Corp.
900 King St.
Rye Brook, NY 10573
(914) 934-4839

Northern Telecom Inc.
9705 Data Park
Minneapolis, MN 55343
(612) 932-8000

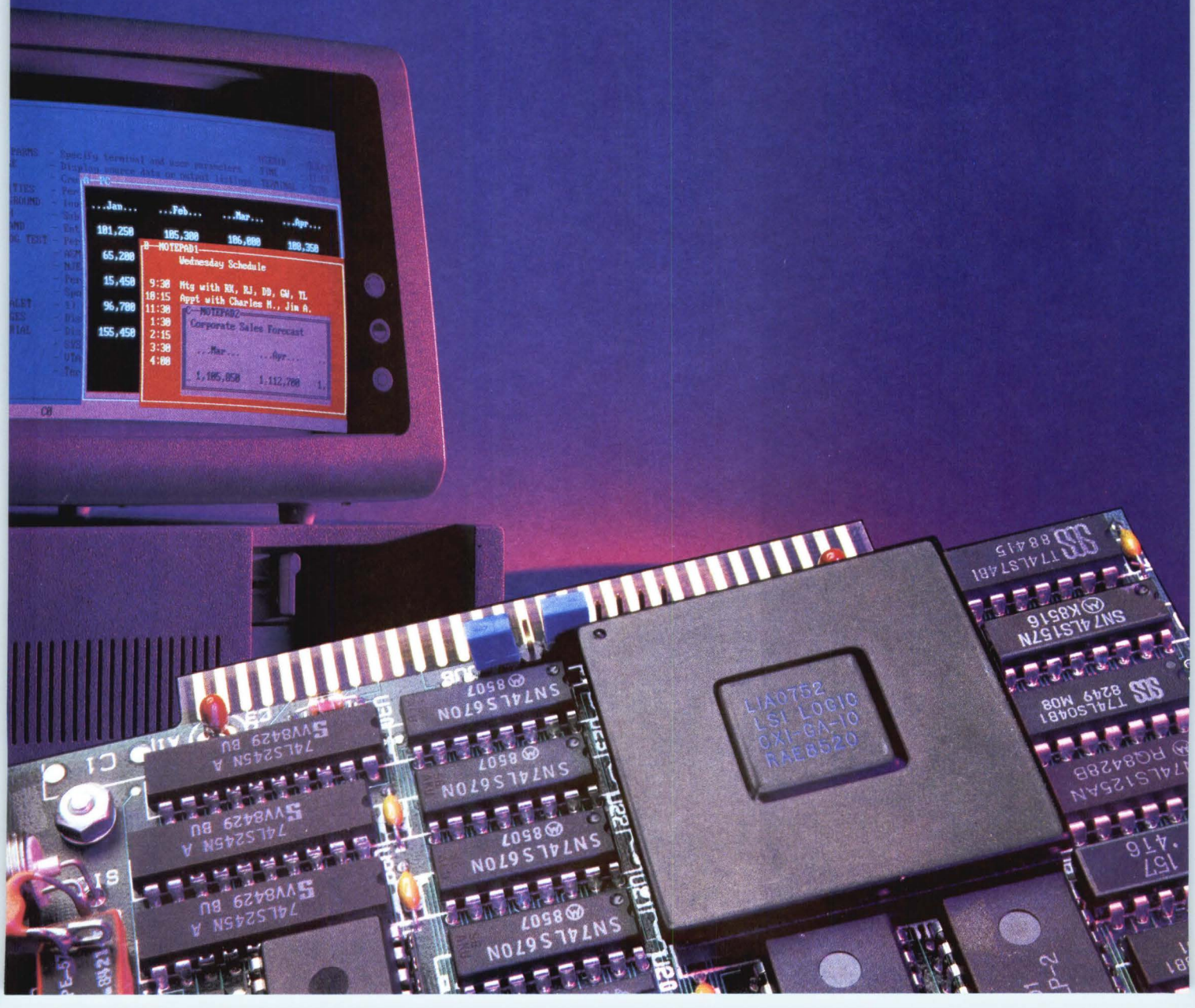
Penril Data Comm
207 Perry Parkway
Gaithersburg, MD 20877
(301) 921-8600

Ven-Tel Inc.
2342 Walsh Ave.
Santa Clara, CA 95051
(408) 727-5721

Wolfdata Inc.
187 Billerica Rd.
Chelmsford, MA 01824
(617) 250-1500

More micro-to-mainframe answers

CXI



A message from CXI regarding micro-to-mainframe communications

How do you effectively integrate PCs into your corporate information network? That's the question facing most MIS departments today.

PC users want to communicate and share data with the mainframe. They want to be assured they can expand their computing capability as their needs grow.

To answer these demands, MIS staffs must develop a plan. A micro-to-mainframe strategy, if you will. In developing your strategy, you'll want to look for better ways to move information without disrupting the system you already have in place.

That's why at CXI, we believe the best micro-to-mainframe products are the ones that can fit your strategy. Rather than your strategy having to fit the products.

So we design and manufacture our connections to be easily adaptable and expandable. They're also the only products to provide a consistent application program interface across the entire product line.

These solutions are based on many industry firsts from CXI:

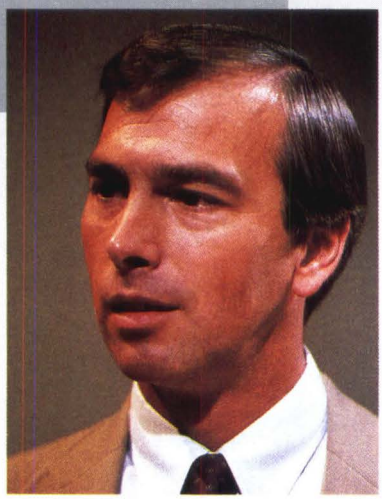
- *The first gate-array chip developed for 3270 terminal emulation.*
- *The first interface board to offer multiple host sessions.*
- *The first IRMA-compatible products.*
- *The first support of IBM's 3270 PC Application Program Interface*
- *The first support of all major micro-to-mainframe software.*

On the following pages, we will discuss our products in detail. And although you may not need every product we make, you'll get a good idea of what we can provide.

In a word — answers. Intelligent answers to the problems facing your network now. And ways to be prepared for changes in the future.

Charles P. Morel
Chairman

Louis C. Cole
President



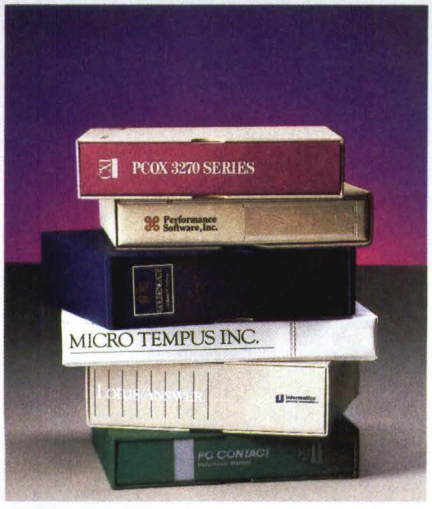
CXI, Inc. • 3606 West Bayshore Road • Palo Alto, CA 94303-4229 • 800-225-PCOX • In California 415-424-0700 • Telex: 821945

CXI

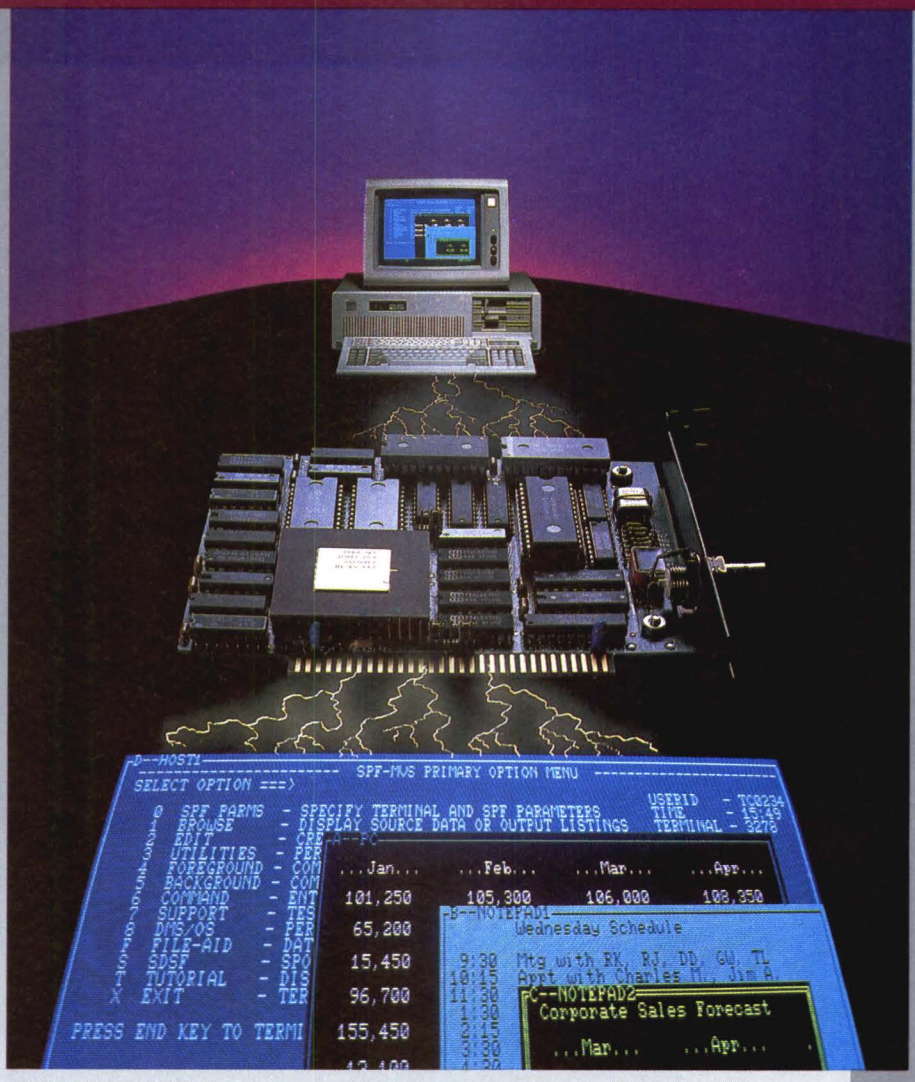
Micro-to-mainframe answers

CXI offers many excellent micro-to-mainframe answers to meet your networking needs. You can expand your network capability easily and efficiently.

- PCOX products emulate IBM® 3278/79 terminals, 3279-S3G terminals, 3270 PCs, 3287 printers, 3274 controllers, and 5251 terminals.
- Our products connect your PC to the mainframe via coaxial cable, twinaxial cable or synchronous modem.
- PCOX products work with all major micro-to-mainframe application software.
- PCOX products work with all IBM PCs, XTs, ATs and compatibles.
- PCOX products have the same user presentation and application interface.
- Product upgrades are provided on diskette.



With three Application Program Interfaces to choose from — IBM, IRMA and PCOX — CXI products work with all major micro-to-mainframe software.



CXI's PCOX/PLUS connections allow users to simultaneously view one host session, one PC session and two notepads.

Connect your PC to your host with PCOX coaxial connections

With CXI's PCOX/STANDARD™ and PCOX/PLUS™, you can get immediate access to mainframe data. These coaxial connections offer users exceptional value.

- Exact IBM 3278/79 terminal emulation for use of mainframe applications and operating systems.
- File transfer software to upload and download data.
- Windowing software to simultaneously view one host session, one PC session and two notepads.
- A software migration path to full 3270 PC functionality.
- IRMA™ compatibility to allow you to use existing micro-to-mainframe software from companies such as Cullinet, Informatics, and McCormack & Dodge.

CIRCLE NO. 51

Multiple host sessions provide printer support & file transfer

The PCOX/3270 PC™ coaxial connection provides full IBM 3270 PC emulation on the IBM PC you already have. It also provides additional features unique to CXI.

Now you can:

- Access up to five host sessions concurrently for such on-line applications as electronic mail, file transfer and host databases.
- Attach local printers by using any number of the five host sessions for 3287 printer emulation.
- View a PC session and mainframe data simultaneously while using two notepads to record and manipulate information.
- Use the IBM 3270 PC Application Program Interface for your micro-to-mainframe software.

And, the PCOX/3270 PC requires even less memory than a comparable IBM 3270 PC.

PCOX/3270 PC functionality allows users to access multiple host databases concurrently and, with KEYBOARD MATE, reduces the number of keystrokes.

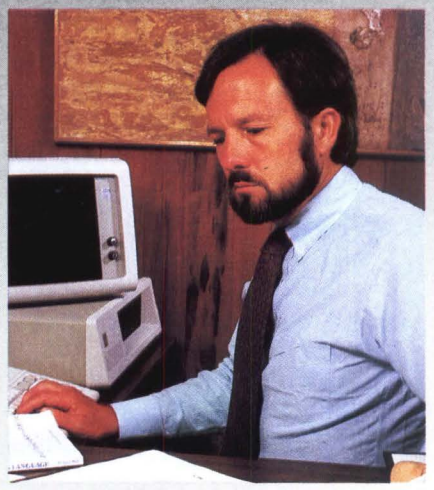
Migrate from 3278 to 3270 PC emulation

The PCOX/3270 PC Upgrade provides an easy migration path from single to multiple host capability:

- For PCOX/STANDARD and PCOX/PLUS products
- For IRMA boards.

Now you can easily upgrade your current coaxial connection to multihost functionality: Five host sessions, one PC session, two notepads, printer support and IBM 3270 PC Application Program Interface.

CIRCLE NO. 52



CXI product upgrades designed by developers like Jeff Bowers are provided to users on diskettes.

CXI, Inc. • 3606 West Bayshore Road • Palo Alto, CA 94303-4229 • 800-225-PCOX • In California 415-424-0700 • Telex: 821945

CXI

Cost effective remote access to your host

CXI offers users three solutions to improve remote micro-to-mainframe communications:

- PCOX/STANDARD REMOTE™
- PCOX/PLUS REMOTE™
- PCOX/3270 PC REMOTE™

Each PCOX remote product connects directly to a synchronous modem. By emulating an IBM 3274 cluster controller, PCOX eliminates the requirement for such costly equipment. And, you can cost-effectively link several PC s to the same modem with CXI's DAISY CHAIN KIT.™

Users can choose among a variety of features.

- Single host access through the emulation of an IBM 3278/79 terminal with hot key to PC session.
- Windowed access to a host session, a PC session and two notepads.
- File transfer software to up-load and download host data.
- PC printer support through emulation of a host-addressable 3287 printer.
- Remote 3270 PC emulation with up to five host sessions, a PC session and two notepads viewed at one time.
- Use of IBM's 3270 PC Application Program Interface.

CIRCLE NO. 53

Expand your LAN capability with PCOX/GATEWAY micro-to-mainframe connections

PCOX/GATEWAY™ products provide you a wide range of alternatives to cost effectively incorporate your LAN into your micro-to-mainframe strategy.

These products provide each LAN user with:

- Multiple host sessions with 3270 PC emulation.
- 3278/79 terminal emulation.
- Local printer support with 3287 printer emulation.
- Connection to the mainframe through existing IBM 3274 controllers via a Category A coaxial cable.
- Connection to the mainframe remotely through a leased or dial-up telephone line.

PCOX/GATEWAY™ products operate on an IBM PC Network, Token Ring, or NETBIOS-compatible resource sharing LAN.

CIRCLE NO. 54

PCOX remote products connect PC users in branch offices via synchronous modem to host databases.

Host graphics on your PC

CXI's PCOX/GRAPHICS™ is a coaxial connection offering users a single slot solution to access both mainframe graphics and mainframe data.

PCOX/GRAPHICS provides:

- True IBM 3279 Model S3G terminal emulation on an IBM PC, XT, AT or compatible using a color monitor.
- Support of the IBM 5154 Enhanced Color Display in high-resolution mode.
- Use of mainframe graphics software such as SAS-Graph,™ GDDM™, and DISSPLA™.
- Fast access to host graphics information.
- File transfer capability to upload and download information.
- IRMA compatibility.

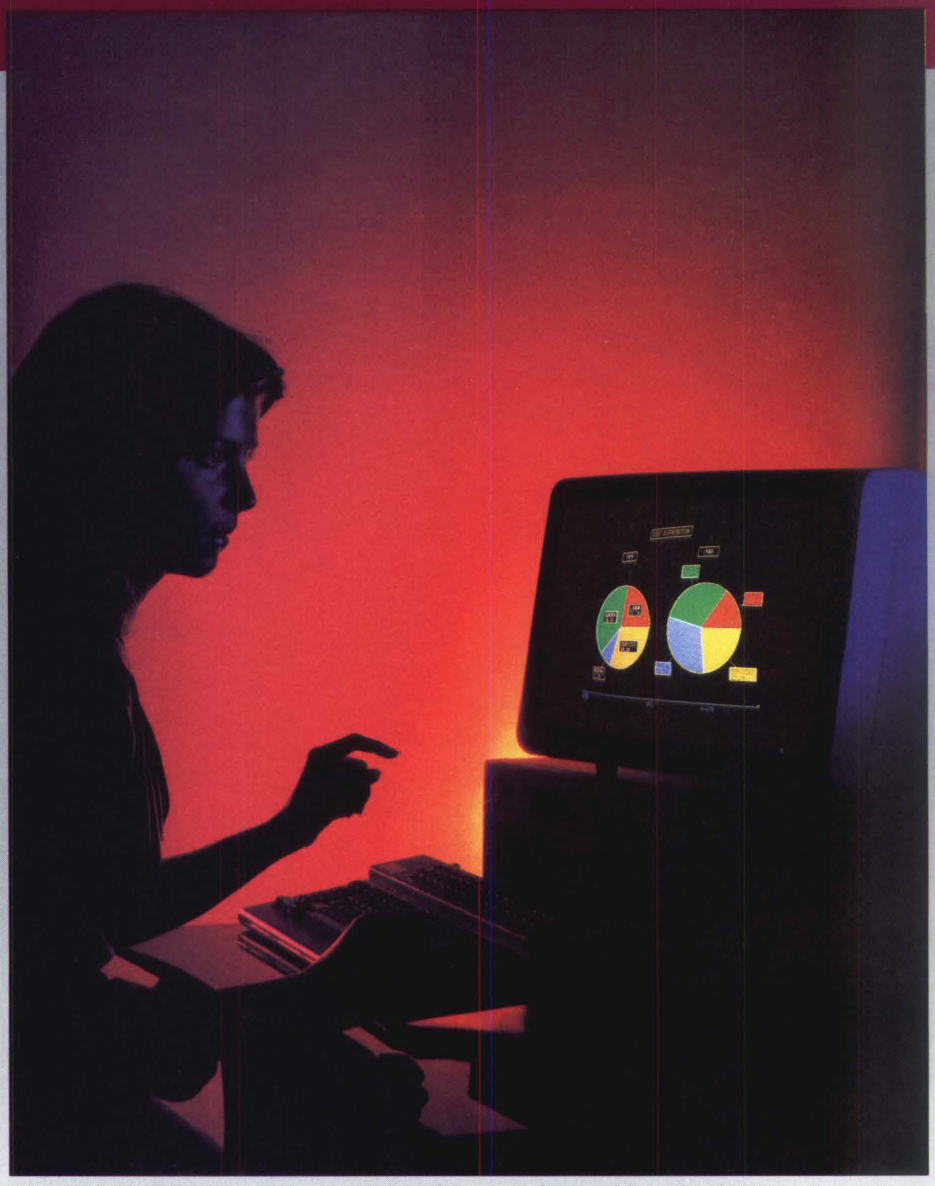
CIRCLE NO. 55

Connect your PC to a System 34/36/38

With PCOX/5251 TWINAX you can access data from your system 34/36/38 on your PC via twinaxial cable.

- Emulate a 5251 model 11, a 5291 models 1 or 2, or 5292 terminals.
- Upload and download data with file transfer software.
- Use PC attached printers to emulate 5250 series printers.
- Access a PC session and up to seven host sessions concurrently.
- Use one host session for local printer support.

CIRCLE NO. 56



PCOX/GRAPHICS users can access mainframe graphics and host databases on their PC.

KEYBOARD MATE enhances PCs

CXI's KEYBOARD MATE™ is a compact keyboard attachment which allows PCOX users 3270 PC functions on your present keyboard eliminating multiple keystrokes for many host and windowing operations.

CIRCLE NO. 57

COAX MATE eliminates cable

CXI's COAX MATE™ multiplexes two Category A coaxial devices over one coaxial cable, doubling the capacity of already-installed cables.

CIRCLE NO. 58

CXI, Inc. • 3606 West Bayshore Road • Palo Alto, CA 94303-4229 • 800-225-PCOX • In California 415-424-0700 • Telex: 821945

Committment to customer support

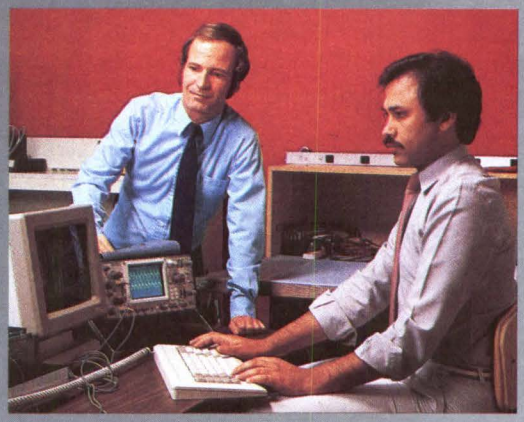
At CXI, we provide extensive customer support through a worldwide distribution network and a staff of sales support specialists. CXI offers both hotline telephone support and training for users and potential customers alike.

Our products are easy to install. They are sold with clear, concise user documentation to facilitate both installation and operation. Customer-support specialists are available to help quickly integrate PCOX products into your network.

Customer service is top priority for CXI's Pam Grange and other members of our technical support staff.

PCOX products are supported by software from companies such as:

- Applied Data Research
- Cincom Systems
- Computer Associates
- Cullinet
- Duns Plus
- Informatics
- McCormack & Dodge
- Micro Tempus
- Performance Software
- SAS



CXI's VP of Engineering Taylor Gahr works with design engineers like Shashi Rattan to develop PCOX hardware.

Product development tracks IBM

CXI has effectively tracked IBM's technology, offering 3278/79 emulation, 3270 PC capability, 3279-S3G graphics functionality, and gateways to IBM's PC Network. We will continue to track IBM's micro-to-mainframe strategies, and incorporate the essential elements into our product line.

CXI supports all major micro-to-mainframe software

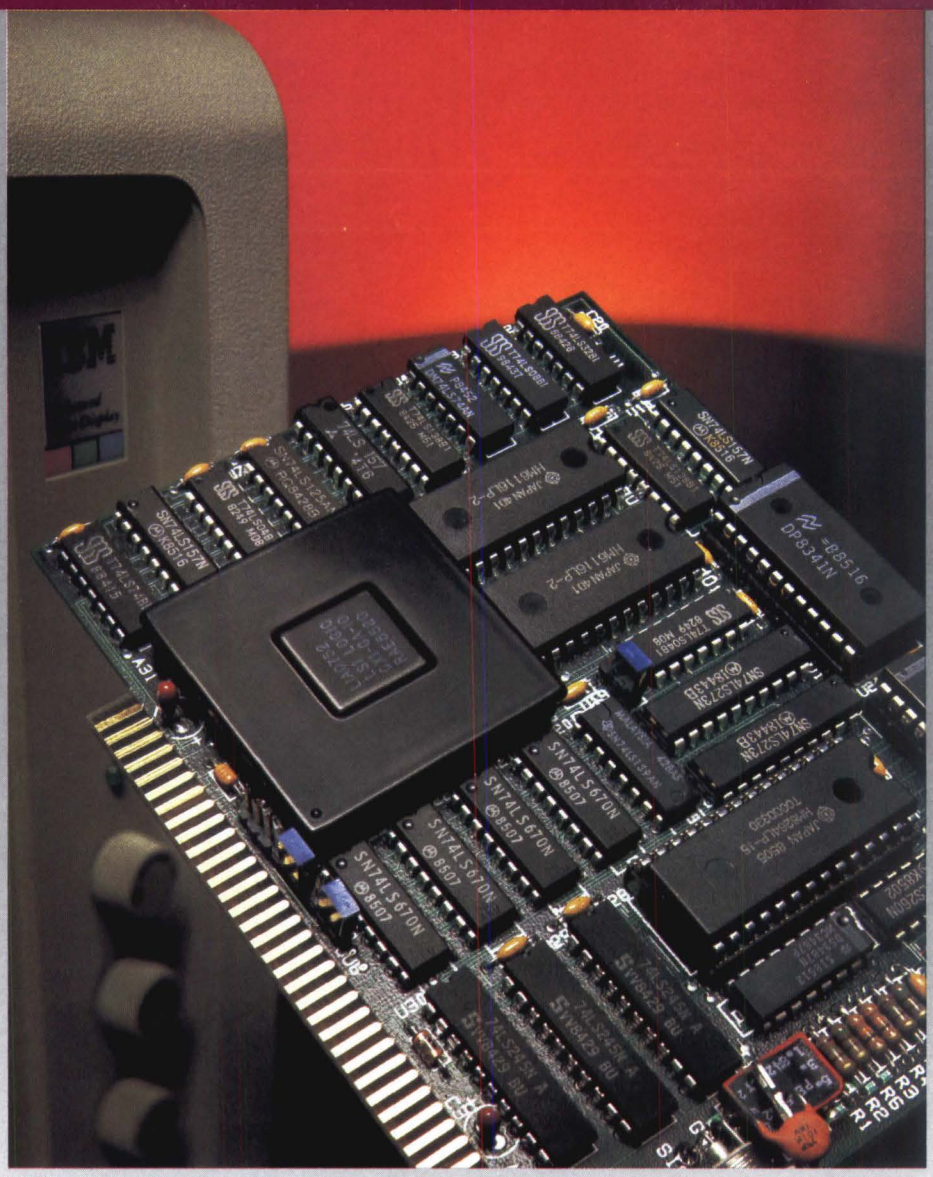
As the only company offering three distinct application program interfaces — the PCOX, IBM and IRMA interfaces — CXI provides the broadest capability available to incorporate any micro-to-mainframe software into your network strategy.

CXI

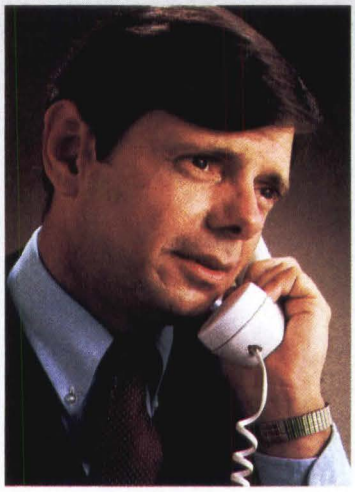
CXI's leadership is based on quality, service and value. Our expertise has been recognized by customers such as
• General Motors • EDS •TWA • Citicorp • IBM • Avon Products • Del Monte Foods • JC Penney • Exxon • General Electric • Coca Cola • Bank of America • Nordstrom • Bank of Montreal • British Petroleum • Pacific Mutual Insurance • Polaroid • United Airlines • Time, Inc. • Travenol Labs • Motorola • Pacific Bell • New England Life • Pratt & Whitney • Utah Power & Light • General Dynamics • Carter Hawley, Hale.

CXI also sells PCOX products on an OEM or private label basis to • ITT Information Systems • Fujitsu • Ericsson • Information Systems AB • Philips International BV • AST Research Inc. • Tecmar • Intelligent Technologies • Asher Technologies.

Founded in 1982, CXI has become a leader in the development of micro-to-mainframe technology. We design, manufacture and market the most advanced products for corporate communication networks. And we are backed by a significant financial investment from ITT Corporation.



CXI's advanced micro-to-mainframe technology provides our customers with cost-effective add-in communication products.



VP of Worldwide Distribution Grant Wieler answers questions about CXI's micro-to-mainframe products.

The PCOX product line is available from an international network of distributors specializing in data communications products.

For the name of your nearest CXI distributor call **(800) 225-PCOX**. In California call (415) 424-0700.

FOR COMPLETE PRODUCT INFORMATION, CIRCLE NO. 59

CXI, Inc. • 3606 West Bayshore Road • Palo Alto, CA 94303-4229 • 800-225-PCOX • In California 415-424-0700 • Telex: 821945

Local Area Networks

Company / Network name	Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
Local area network					**Network interface hardware**				
3M 3920 Varsity Dr., Ann Arbor, MI 48104, (313) 973-1500									**CIRCLE 305**
LAN/I	broadband; token-passing	2.5M	10,000; 14 miles		7014 box		all computers with asynch RS232C port	included	2,100
					7102 box		all computers with asynch RS232C port	included	1,400
					7108 box		all computers with asynch RS232C port	included	3,200
LAN/II	broadband; token-passing, IEEE 802.4	10M	16,000; 40 miles	X.25 level 2, HDLC, IEEE 802.3 and Ethernet baseband	7202 Remodulator			included	9,950
					7204, 7208, 7212, 7216 box	16 asynch	all computers with asynch RS232C port	included	5,850-8,150
					7241, 7242, 7243 box	3 asynch, 3 synch, RS422	all HDLC, X.25 LAPB, synch computers	included	5,950-9,590
ABLE COMPUTER 3080 Airway Ave., Costa Mesa, CA 92626, (714) 979-7030									**CIRCLE 306**
ATTACH	twisted-pair, fiberoptic; proprietary	1M	1-5 km		Host Interface (DH, DMF, D2) board	128 asynch	DEC PDP, VAX	opt. Lanswitch	11,250-500,000 plus
APPLE COMPUTER INC. 20525 Mariani Ave., Cupertino, CA 95014, (408) 996-1010									**CIRCLE 307**
AppleTalk	twisted-pair; CSMA/CA	230.4K	32; 1,000 feet	SDLC	LaserWriter required		Macintosh		
					Macintosh required	2 RS422	Macintosh	included	
APPLITEK CORP. 107 Audubon Rd., Wakefield, MA 01880, (617) 246-4500									**CIRCLE 308**
UniLAN	baseband, broadband, fiberoptic; proprietary, Unilink	10M	64,000; 20 miles	Burroughs, SNA, Sperry Univac, X.25	NI10 box	2 asynch	any IEEE 802.3		11,250-13,500

Finally, a network th

Thanks to 3+.

The multi-user PC network operating system that does everything you need it to do.

Like conform to all the standards. And play all the greats. Ethernet. STARLAN. Token Ring. AppleTalk. Peripherals like the HP Laserjet and Apple LaserWriter. Plus all the latest multi-user software such as dBASE III Plus, RM/Cobol and R:base 5000 Multi-User.

Because 3+ doesn't "emulate" the standards like other networking schemes. It implements them. Exactly. Including the Microcom MNP protocol. The XNS protocols. The Microsoft Redirector. And, of course, PC/MS-DOS 3.1.

In fact, 3+ gives you everything PC/MS-DOS does. "Plus" a whole lot more. Such as internetworking. To link multiple local area networks over ordinary phone lines. And remote PC access. For networking at home or on the road.

Electronic mail, too. To send information to any user on any of your networks. Whether they're across the building—or the country.

And if you're designing for the IBM mainframe environment, get our 3+3270. And you're into the corporate data bank.

at plays all the greats.

We could go on. But you get the idea. The 3+ family is the most complete and compatible network operating software you can buy.

In fact, there's only one other thing you'll want. A way to manage network communications, files, printers and backup.

We have that, too. In our 3Server family of dedicated network servers. Each delivers maximum network performance for 5 to 50 users. Or, thanks to 3+ versatility, you can use ordinary PC ATs or compatibles.

And remember, with us, you're not just a customer. You're a partner. Fully supported with competitive reseller margins. Regional sales and service training. An engineering "hot line." And much more. All backed by 3Com, the most experienced supplier of PC networking products.

So why settle for half a networking solution? Or a proprietary approach that locks you into a dead end? Call now at 415/960-9415.

Because in networking, there's only one way you can have it all.

3Com®

CIRCLE NO. 18 ON INQUIRY CARD

Local Area Networks

Company Network name	Networking media/access	Data rate (bps)	Max. no stations Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
					NI10G box	24 synch	Burroughs, Honeywell, IBM, NCR, Sperry		
					NI10T box	32 asynch, 32 synch	any computer with asynch RS232C port	Network control Mode($250 per port)	6,000-15,000(box)
ASHER TECHNOLOGIES 1009 Mansell Rd., Roswell, GA 30076, (404) 993-4590									**CIRCLE 309**
Quadnet VI	baseband, coaxial; CSMA/CD, CSMA/CA	1.43M	235; 4,000 feet	Quad3270, SNA	QN6100 board	1 asynch, 2 parallel	IBM PC/XT/AT and compatibles		2,085-97,275
QNet IX	baseband, twisted-pair, fiberoptic; token-passing	10M	255; unlimited		QN9100 board	1 asynch, 2 parallel	IBM PC/XT/AT and compatibles		2,485-147,403
AST RESEARCH INC. 2121 Alton Ave., Irvine, CA 92714, (714) 863-1333									**CIRCLE 310**
PCnet	baseband; CSMA/CD	800K	224; 7,000 feet		PCnet board			included; opt. NETBOIS software	495
PCnet II	baseband, twisted-pair; CSMA/CA	800K	160; 2,500 feet	BSC, SNA	PCnet II board			included; opt. NETBOIS software	495
Resource Sharing Network	baseband; CSMA/CD	5M	64; 1,500 feet		Resource Sharing Network board			NETBIOS software	495
CODEX CORP. 20 Cabot Blvd., Mansfield, MA 02067, (617) 364-2000									**CIRCLE 311**
4000 Series LAN	baseband, broadband; CSMA/CD, IEEE 802.3	10M	unlimited	SNA, X.25	4020 Nest	96 asynch	all computers with asynch port	CORT/XNS software	
					4020 Unit box	4 asynch	all computers with asynch port	CORT/XNS software	996
COMMUNICATION MACHINERY CORP. 1421 State St., Santa Barbara, CA 93101, (805) 963-9471									**CIRCLE 312**
Ethernet	baseband; CSMA/CD, IEEE 802.3	10M	1,024; 2.5 km		DRN-1100 box	16 asynch, console		Internet TCP software	9,900
					ENP-20 board	2 asynch	computers with Berkeley UNIX Version 4.2, System V	opt. Internet TCP/IP, Fusion XNS software	3,000
					ENP-50 board	2 asynch	DEC MicroVAX	opt. Internet TCP/IP software	2,700

Local Area Networks

Company / Network name	Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
Local area network					**Network interface hardware**				
COMPLEXX SYSTEMS INC. 4930 Research Dr., Huntsville, AL 35805, (205) 830-4310									**CIRCLE 313**
XLAN	baseband, twisted-pair; CSMA/CA	1M	192; 8,000 feet		IP-3 box	192 asynch, 64 parallel	any computer with asynch ASCII port	opt. Traverse software	298-198(port)
CONCORD DATA SYSTEMS INC. 397 Williams St., Marlborough, MA 01752, (617) 890-1394									**CIRCLE 314**
Token/Net	broadband; token-passing, IEEE 802.4	5M, 10M	25 miles		TIM 200 box	2 asynch or 2 synch, 2 RS449/422	any computer with RS232C, RS449, RS422 ports		4,135
					TIM 200 box	3 asynch or 3 synch, 1 RS449/422	any computer with RS232C, RS449, RS422 ports		5,135
					TIM 220 box	12 asynch or 12 synch	any computer with RS232C, RS449, RS422 ports		5,940
CORVUS SYSTEMS INC. 2100 Corvus Dr., San Jose, CA 95124, (408) 559-7000									**CIRCLE 315**
OMNINET	baseband, twisted-pair; CSMA/CD	1M	64; 4,000 feet		Apple board		Apple II, IIe, Macintosh	opt. Constellation III software	2,490
					IBM PC board		IBM PC/XT/AT and compatibles	opt. Constellation II, Novell Netwave/O, OMNISHARE software	2,490
					MultiBrand box	2 asynch, 1 parallel	Apple II, Macintosh; DEC Rainbow; IBM and compatibles	opt. Print Server II, Dialout software	990-2,100
CYB SYSTEMS INC. 2215 West Braker Lane, Austin, TX 78758, (512) 835-2266									**CIRCLE 316**
Unite	baseband, twisted-pair; CSMA/CD, IEEE 802.3	10M	255; 1,500m		DataManager box	18 asynch, 18 synch, 1 parallel	IBM PC/XT/AT, PC compatibles	included	17,619-21,064
					DataMate box	10 asynch, 10 synch, 1 parallel	IBM PC/XT/AT, PC compatibles	included	12,537-15,982
					DataMaster box	34 asynch, 34 synch, 1 parallel	IBM PC/XT/AT, PC compatibles	included	31,795-35,290
DATA GENERAL CORP. 4400 Computer Dr., Westboro, MA 01580, (617) 366-8911									**CIRCLE 384**
Ethernet/IEEE 802.3	baseband; CSMA/CD, IEEE 802.3	10M	1,024; 2,500m		Intelligent LAN Controller		ECLISPE MV/2000, MV/4000, MV/8000-II, MV/10000	opt. XODIAC, TCP/IP software	4,500

COST SAVING
CONNECTIONS

RS232 INTERFACE PROBLEM SOLVERS...FROM WESTERN TELEMATIC INC.

END DATA SWITCHING PROBLEMS

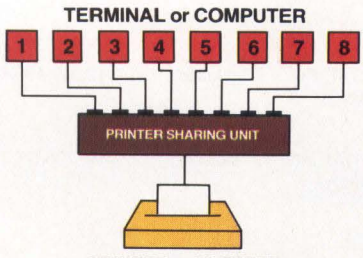
Is switching data cables becoming a pain in the ASCII? Automatically switch between computers, printers, instruments—just about any RS232 device.

Economically expand computer ports, access multiple computers or remote peripherals.

From simple AB switches to intelligent 196 port code activated switching systems, our reliable, easy to use, interface switches will help end your interconnect problems.

EFFICIENT PRINTER SHARING

It's time to make more efficient use of your expensive printers. Share a single plotter, daisy wheel, dot matrix or laser printer with up to 8 computers, word processors or CAD systems. Ideal for the automated office, school or engineering lab.

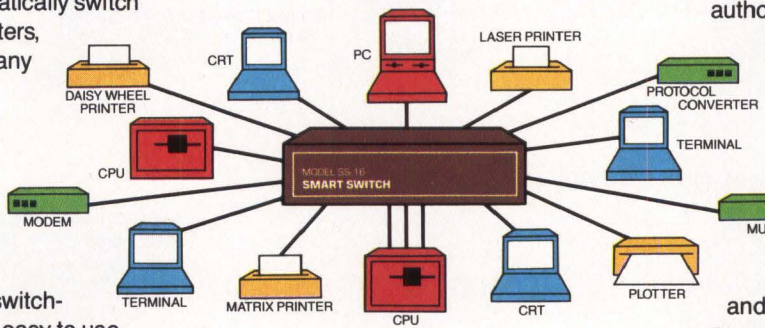


Our 4 or 8 port Printer Sharing Units work automatically. No cable switching or knobs to turn. Software changes are usually unnecessary since they use standard Ready/Busy or XON/XOFF handshaking.

AFFORDABLE RS232 NETWORKING

Create your own local network with our Any-port to Any-port Smart Switches. Available in either 8 or 16 port versions, the Smart Switch is ideal for computer port expansion, computer sharing, engineering work clusters and much more.

Each port has its own spooling buffer. So any baud rate can communicate with any other baud rate and parity anywhere in the system.



A special supervisory port lets you monitor activity on any other port, connect ports together, broadcast messages or designate the supervisory power to other ports.

The Smart Switch is easy to use. User friendly commands allow you to select ports, disconnect and display port activity. A push button defines each port for either DCE or DTE. So if you need an intelligent, affordable way to link your RS232 system, you're ready for the Smart Switch.

CONCERNED ABOUT DATA SECURITY?

Prevent unauthorized access to your computer system. Our Dial-back Security Unit prevents outsiders from peeking at, destroying or tampering with your data. Only users entering authorized passwords and dial-back numbers stored in the 200 number battery backed directory will be allowed access.

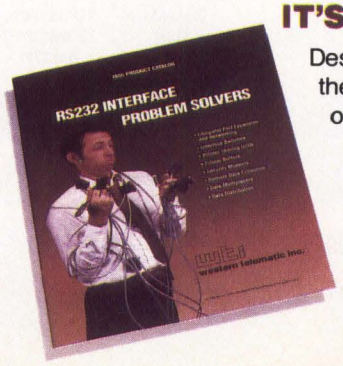
An auxiliary command port is used to set-up the directory and security levels as well as log each password attempt and duration of each call.

Simply connect the DSU between your computer and modem and feel secure about who's using your data.

QUALITY PRODUCTS

Every WTI product is designed and manufactured with quality and reliability as a major requirement. We're so confident you'll like our products that we offer a 30 day return policy. Compare our features, quality, customer support and prices with any other manufacturer and you'll know why WTI is a recognized leader in the Data Communications industry.

IT'S ALL IN THE BOOK...IT'S FREE



Descriptions, diagrams, specifications and prices for the above products, plus many more, are in our colorful new catalog. It's your cost saving connection ...just ask for it!

Call toll free: **1-800-854-7226**
(in California 714/979-0363)

western telematic inc.

2435 S. Anne St., Santa Ana, CA 92704 • Telex 467741

CIRCLE NO. 19 ON INQUIRY CARD

Local Area Networks

Company / Network name	Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
					L/LC		ECLIPSE MV/2000DC, DS/7500	opt. XODIAC, TCP/IP software	1,750
DATAPOINT CORP. 9725 Datapoint Dr., San Antonio, TX 78284, (512) 699-7000									**CIRCLE 317**
ARC	baseband, fiberoptic; token-passing	2.5M	255; 4 miles	Datapoll, SNA, X.25	COM 9026 board		Compaq; Datapoint 1200, 1560, 6600, 8400, 8600, 8650, 8850; IBM PC	included	695(IBM PC)
DAVID SYSTEMS 701 E. Evelyn Ave., Sunnyvale, CA 94086, (408) 720-8000									**CIRCLE 318**
David Information Manager	twisted-pair; CSMA/CD, IEEE 802.3	2M	384; 4,000 feet	SNA/SDLC, X.25	David Manager box	384	IBM 3270, IEEE 802.3 compatible		390
DIGITAL EQUIPMENT CORP. 200 Baker Ave., Concord, MA 01742, (617) 264-1420									**CIRCLE 319**
Ethernet	baseband, broadband; CSMA/CD, CSMA/CA	10M	1,023; 3.8 km	DECnet, SNA TCP/IP, X.25	DECNA board		DEC Pro 350, Pro 380	opt. Pro-DECnet ($95)	895
					DEQNA board		DEC MicroVAX I, II	opt. DECnet ($495-$1,450)	1,150
					DECserver 100 box	8 asynch		included	2,600-2,750
DIGITAL MICROSYSTEMS INC. 1840 Embarcadero, Oakland, CA 94609, (415) 261-1034									**CIRCLE 320**
HiNet	baseband, dual twisted-pair, fiberoptic; master/slave polling	500K	63; 5,000 feet	IBM 3270, X.25	HiNet PC Adapter Card board	1 asynch, RS422	Columbia; Corona; Compaq; IBM PC/XT/AT; NCR; Olivetti M24; TeleVideo	included	
DIGITAL PRODUCTS INC. 600 Pleasant St., Watertown, MA 02172 (617) 924-1680									**CIRCLE 321**
NetCommander	twisted-pair; serial RS232C	110-19.2K	30; 800 feet		NC4 box	4 asynch	all computers	opt. BLAST software	1,095
					NC8 box	8 asynch	all computers	opt. BLAST software	1,695
					NC16 box	16 asynch	all computers	opt. BLAST software	$2,950
EQUINOX SYSTEMS 12041 S.W. 144 St., Miami, FL 33186-6108, (305) 255-3500									**CIRCLE 322**
Data PBX	twisted-pair; TDM	up to 9600	1,320; 1 mile		LM-48 box	48 asynch	all asynch computers		7,200-14,400

Local Area Networks

Company / Network name	Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
	Local area network				**Network interface hardware**				
EXCELAN INC. 2180 Fortune Dr., San Jose, CA 95131, (408) 434-2237									**CIRCLE 323**
EXOS	baseband; CSMA/CD, IEEE 802.3	10M	1,024; 3 km		EXOS 201 board	Ethernet, SBX	Multibus computers	NX200; opt. EXOS 8010 TCP/IP protocol package	1,995-2,045
					EXOS 202 board	Ethernet, SBX	VMEbus computers	NX200; opt. EXOS 8010 TCP/IP protocol package	2,280-2,330
					EXOS 203 board	Ethernet, SBX	Q-bus computers	NX200; opt. EXOS 8010, 8030, TCP/IP protocol packages	2,280-2,330
					EXOS 205 board	Ethernet SBX	IBM PC/XT/AT and compatibles	NX200; opt. EXOS 8011, 8050 TCP/IP protocol packages	995
FIBERCOM INC. P.O. Box 11966, Roanoke, VA 24022-1906, (703) 342-6700									**CIRCLE 324**
Whispernet	fiberoptic; CSMA/CD, IEEE 802.3	10M	1,024; 4 km	X.25	WS/1-A box	32 asynch	all computers with RS232C, RS422 ports	included	10,000-15,000
					WS/1-SDLC box	32 synch	all IBM	included	10,000-15,000
					WS/1-HSM box		DEC VAX, PDP	included	15,000
FOX RESEARCH INC 7005 Corporate Way, Dayton, OH 45459, (513) 433-2238									**CIRCLE 325**
10-NET	twin-ax, twisted-pair; CSMA/CA	1M	10,000 feet	RS232C, SNA	10-NET Circuit Board		Compaq; Corona; IBM PC/XT/AT; Olivetti M24; TeleVideo; Zenith 100	included	695(node)
GANDALF DATA INC. 1020 S. Noel Ave., Wheeling, IL 60090, (312) 541-6060									**CIRCLE 326**
PACXNET	baseband, twisted-pair, fiberoptic; dynamic time slot allocation	19.2K-64K	25,000; 3.1 miles	IBM 3270, T-1, X.25	PACX 2000 box	1,920 asynch, 1,920 synch	any asynch computer	opt. LINK 2000 and PACX 2000 software	9,600-269,500
					SWITCHMUX box	16 asynch, 4 synch	any asynch or synch computer	included; opt. LINK 2000 software	2,050-4,350
GENERAL DATACOMM INC. Route 63, Middlebury, CT 06762, (203) 758-1118									**CIRCLE 327**
DATX	baseband, twisted-pair; proprietary	75-19.2K	1,320; 15,000 feet		DATX 2000 box	1,320 asynch, 1,320 synch			60,000

We're giving you the standard line.

Our local and remote communications solutions let your PCs take advantage of all the major networking standards. NetWare. NETBIOS. SNA. X.25. You name it.

G/NET™ is our Local Area Network for IBM PCs and compatibles. Incorporating the Novell NetWare/G family of network operating systems, G/NET offers electronic mail, print spooling, multiple file and communications servers, and access to over 3,000 LAN applications. And with our G/NETBIOS™ option, you can even run programs developed for IBM's PC Network or Token Ring LAN.

To reach beyond the LAN, our G/SNA™ series provides PC-to-host and LAN-to-host SNA communications. Your PCs can switch between 3270 emulation, 3770/RJE emulation, and local PC-DOS or LAN applications at the push of a button. Our G/X25™ series offers PC links and LAN gateways to X.25 public data networks. And we provide flexible solutions for async and bisync communications as well.

Think of us as your PC SafetyNet.™ Because in addition to our cost-effective products, we offer you the security of a total solution supplier. With complete service and support. And continued innovation so you won't be left behind with obsolete technology.

SafetyNet also means assured performance. We've proven our superiority time and time again in benchmark tests against more expensive LANs. And in real life installations. Just ask any one of our more than 25,000 users.

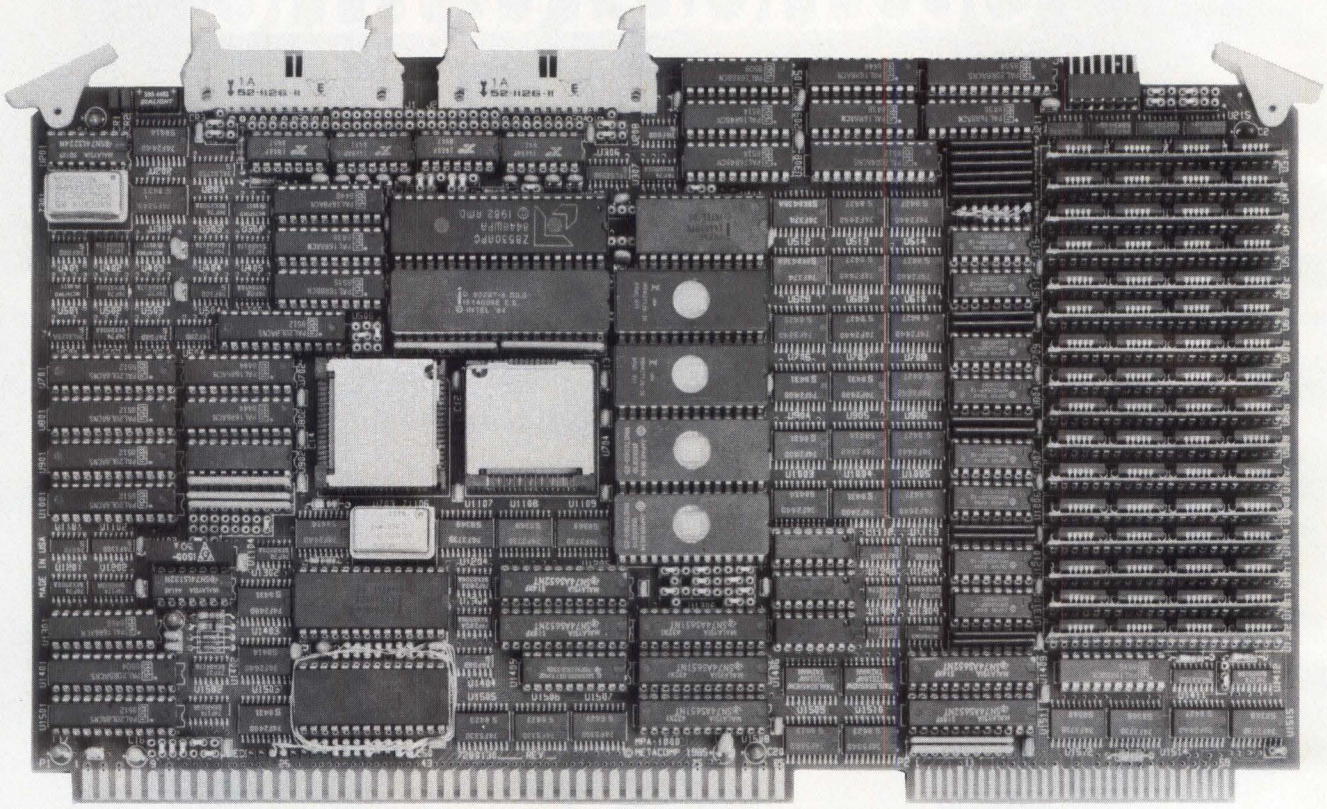
So call the innovative communications experts at Gateway for your local distributor or dealer. And see for yourself how our standard line will meet your highest standards.

Gateway communications, inc.

Your PC SafetyNet.™

16782 Red Hill Ave., Irvine, CA 92714. (714) 261-0762.

HONEST ENGINE



An 80286 CPU Board Without Compromise.

The MPA-1000 is the only Multibus-compatible CPU that taps the full capabilities of the 80286 microprocessor. An honest engine, built to unleash the full potential of the 80286 in multi-user, multi-tasking or real-time applications. And it delivers the power and memory for these demanding applications all in a single card slot.

Up to 2 Mbytes of dual-ported zero wait state dynamic RAM. iLBX high speed memory bus interface. Two serial I/O ports, and programmable registers which allow flexible memory mapping and minimize option jumpers and possible configuration errors.

And for even greater performance, simply plug in the optional 80287 numeric coprocessor and the 82258 Advanced DMA Controller.

Don't compromise. Call or write METACOMP today. Discover what makes the MPA-1000 the honest 80286 engine.

METACOMP

THE MULTIBUS BREAKTHROUGH PEOPLE

METACOMP, Inc
9466 Black Mountain Road
San Diego, CA 92126
(619) 578-9840
TWX 910-335-1736 METACOMP SDG

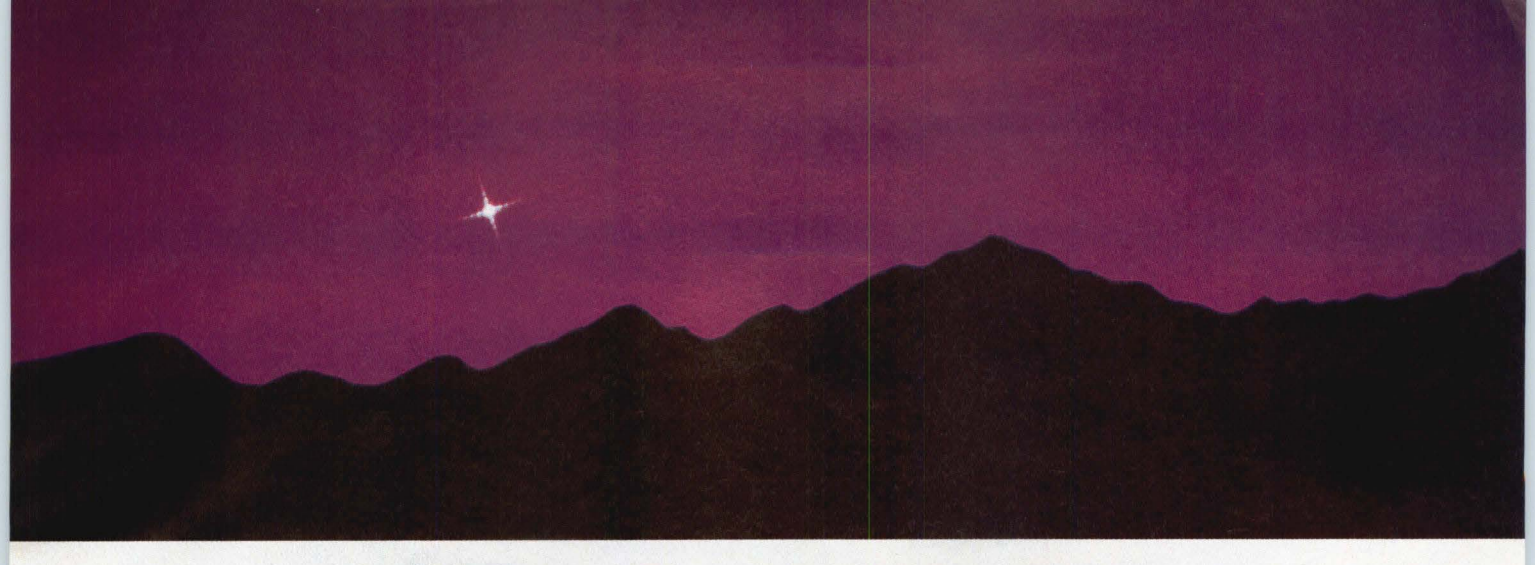
Local Area Networks

Company / Network name	Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
	Local area network				Network interface hardware				
HONEYWELL INFORMATION SYSTEMS INC. 200 Smith St., Waltham, MA 02154, (617) 895-6000									**CIRCLE 328**
Ethernet Product Line	baseband; CSMA/CD, IEEE 802.3	10M	1,000 and up; 2,800m	SNA/SDLC, X.25	CS/1 Series box	32 asynch, 32 synch	all computers	included	10,080-16,380
					CS/100 Series box	14 asynch, 10 synch	all computers	included	3,780-5,670
IDE ASSOCIATES INC. 35 Dunham Rd., Billerica, MA 01821, (800) 257-5027									**CIRCLE 329**
IDEAnet	baseband; CSMA/CD	800K	20; 2,000 feet		IDEAnet board		IBM PC/XT/AT	included	1,195(starter kit)
INFOTRON SYSTEMS CORP. 9 North Olney Ave., Cherry Hill, NJ 08003, (609) 424-9400									**CIRCLE 330**
INX4400	twisted-pair; proprietary	35M	4,000; 64 km	SNA, X.25	RSEU box	64 asynch, 64 synch, RS422	transparent		
					RSEU-128	128 asynch	transparent		
INTERCONTINENTAL MICRO SYSTEMS CORP. 4015 Leaverton Court, Anaheim, CA 92807, (714) 630-0964									**CIRCLE 331**
TurboLAN	baseband, twisted-pair, coaxial; token-passing	2.5M	4,000; 40 miles		LAN-PC board		IBM PC/XT/AT; Tandy 1000, 1200	opt. Server AT/XT	495-1,595
					LANS-100 board		any computer with S-100 bus		495
					WS80-X board	2 asynch, 2 synch, 2 parallel	compatible with any multiuser using TurboDOS	opt. Server-WS	995-2,995
KEE INC. 10739 Tucker St., Beltsville, MD 20705, (301) 937-4740									**CIRCLE 332**
KEE LAN	broadband; CSMA/CD	2M	16,000; 20 miles	X.25	6002-2-8 box	2 synch, 2 parallel	all computers with synch port		2,340
					8002-8-32 box	8 asynch, 2 parallel	all computers with asynch port		3,990
					8002-32R box	32 asynch, 2 parallel	all computers with asynch port		11,100
MAGNOLIA MICROSYSTEMS INC. 4039 21st Ave. West, Seattle, WA 98199, (206) 285-7266									**CIRCLE 333**
MAGnet	baseband, twisted-pair; token-passing	500K	64; 200 feet		XM-422-PC board	1 synch	IBM PC compatibles	opt. Concurrent CP/M with DR/NET software	595
					XM-422-89 board	1 synch	Zenith Z89, Z90	opt. DR/NET software	595

Local Area Networks

Company / Network name	Local area network: Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface hardware: Network interface model name/type	Ports	Computers supported	Networking software	Price $
					XM-422-696 board	1 synch	Zenith	opt. DR/NET software	595
MICOM-INTERLAN INC. 155 Swanson Rd., Boxborough, MA 01719, (617) 263-9929									**CIRCLE 334**
NET/PLUS	baseband; CSMA/CD, IEEE 802.3	10M	1,024; 500m		NP100 board		DEC VAX 11/730, 11/750, 11/780, 11/785; PDP-11		3,600-4,700
					NP200 board		DEC MicroVAX II, LSI-II		2,100-2,800
					NP300 board		Multibus-based computers		2,100-4,000
					NP600 board		IBM PC/AT and compatibles		1,200-1,600
MOLECULAR COMPUTER 1983 Concourse Dr., San Jose, CA 95131, (408) 434-9500									**CIRCLE 335**
System 16/300	twisted-pair; CSMA/CD, CSMA/CA, proprietary	800K	768; 32,000 feet	IBM 2780, 3270, SNA, X.25	System 16/300 box	7 asynch (server), 2 synch (server)	IBM PC/AT and compatibles	Novell Advanced NetWare software	6,995-99,995
					16370 PC Interface board	RS422	IBM PC/AT and compatibles	Novell Advanced NetWare software	195
MOTOROLA SEMICONDUCTOR PRODUCTS (MICROSYSTEMS) 2900 S. Diablo Way, Tempe, AZ 85282, (602) 438-3501									**CIRCLE 336**
Ethernet	baseband; CSMA/CD	10M	60; 500m		MVME330UX board		VME-based systems using UNIX System V	Fusion XNS protocol software	
					MVME330VX board		VME-based systems using VERSAdos	Fusion XNS protocol software	
MAP	broadband; token-passing, IEEE 802.4	10M			MVME370SET-1 board		any VME-based system		3,995
NCR CORP. 1700 S. Patterson Blvd., Dayton, OH 45479, (513) 445-5000									**CIRCLE 337**
NCR PC2PC	baseband, twisted-pair; CSMA/CA	1M	64; 4,000 feet		board		NCR DMV, PC4, PC6, PC8 and compatibles	NCR PC2PC Version; opt. NCR PC2PC Mail	495(node)
NESTAR SYSTEMS INC. 2585 East Bayshore Rd., Palo Alto, CA 94303, (415) 493-2223									**CIRCLE 385**
PLAN Service Arcnet	baseband, coaxial; token-passing	2.5M	255; 4 miles	SNA	Network Interface Card		IBM PC/XT/AT, Portable PC and compatibles	PlanPak software	17,000(10 workstations)

LOCAL AREA NETWORKS



THE DAWN OF COMPATIBLE COMMUNICATIONS

FutureCom™ is Here! Introducing the FutureCom 2000 Integrated Area Network™ and the end of compatibility and connectivity problems in networking.

Now you can combine local and wide area networks into a single unified system. FutureCom is the innovation you've been waiting for—the best features of both local and wide area networking in one powerful package.

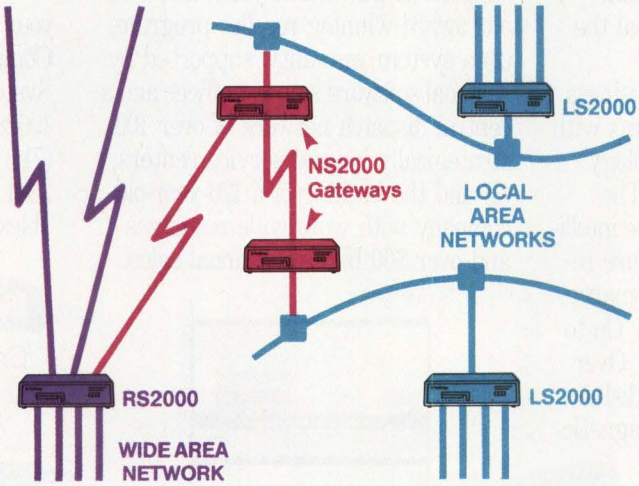
FutureCom Local and Wide Area Networks FutureCom lets you design custom local and wide area networks. These networks may stand alone, or they may be easily combined to form your own Integrated Area Network. Different networks may be added later on, or the nature of the network may change, without sacrificing connectivity and compatibility.

The FutureCom LS2000 Local Server provides access for computer or terminal devices to an Ethernet LAN for efficient local resource sharing. The RS2000 Remote Server provides wide area connectivity via multiple RS-232 composite links (up to 4 per node).* Both servers support up to 32 channels and provide local and remote switching, port contention and advanced security features.

FutureCom Integration The key to the Integrated Area Network is the NS2000 Network Server, a bridge between Ethernet and RS-232. The NS2000 consists of one Ethernet link and up to four RS-232 links. Use it to connect multiple LANs across standard leased telco lines, and/or integrate FutureCom LANs and WANs into a single network.

Suddenly, the possibilities of networking are endless. Welcome to the new era of compatible communications.

The Future is Bright A FutureCom network is easy to install, maintain and best of all—to expand. ComDesign understands the implications of a network that cannot be changed and improved upon. FutureCom is designed for continuous growth and diversification, and will grow with you to keep your network in tune with your needs. Modular hardware and software design assures flexibility and adaptability, and additional channel capacity can be added in the field.

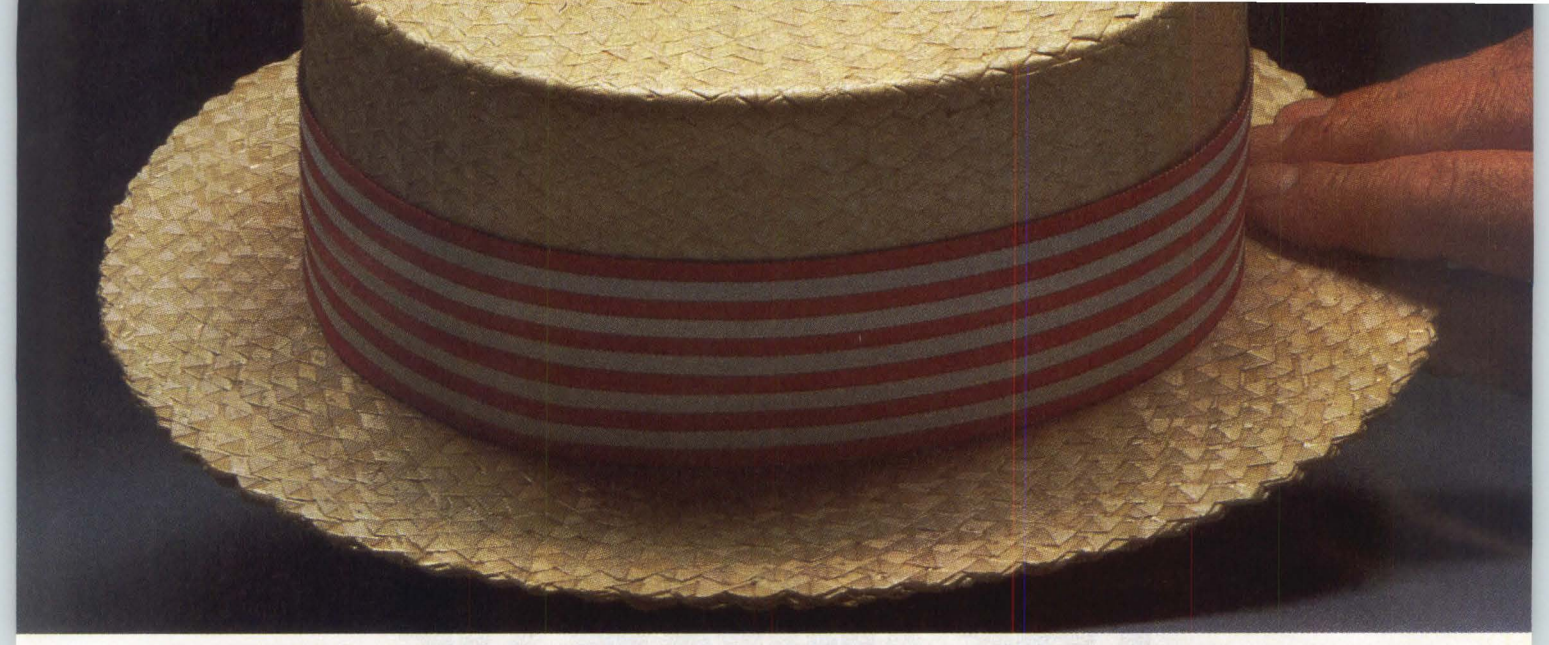


Find Out More The Integrated Area Network is the solution to your networking problems. Let us show you how easy it can be to design a FutureCom Network. Call us toll-free (800) 235-6935 in the Continental U.S., or in California (800) 368-8092 and ask for a free FutureCom brochure. ComDesign, Inc. 751 South Kellogg Avenue, Goleta, California 93117. (805) 964-9852. TWX 910-334-1189.

ComDesign

Leaders in Data Communications

*X.25 and other networking capabilities are currently under development.



IT TAKES MORE THAN A LITTLE SONG AND DANCE TO DELIVER A HIGH-QUALITY, LOW-PRICED SYSTEM

What can make you die out there is the sad performance delivered by most multiuser systems.

Many offer little more than a low price to sing their praises, so you have to dance around their performance.

A few combine low price with good performance. Not a bad show.

But the one that combines low price/high performance with high quality and the capacity of a super mini — now, that's what it takes to steal the show from your competition.

IT TAKES the C.Itoh 680 Business Computer Systems. The systems with high performance 68020 technology at clock rates up to 16.7MHz. The systems that employ distributive intelligence throughout the architecture resulting in zero-wait-state performance.

IT TAKES C.Itoh capacities. Up to 64 users. Up to 8MB of RAM. Over 1300 MB of disk. With floppy disk, streamer tape and half-inch magnetic tape for backup.

IT TAKES a company that provides industry standard operating systems like UNIX, PICK and RM/COS plus hundreds of vertical applications through CAPS, the CIES Applications Programs Service.

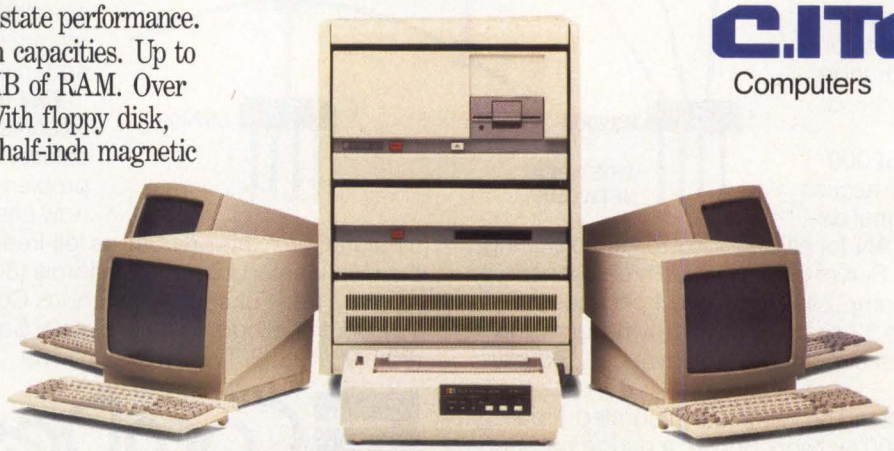
IT TAKES C.Itoh pricing and support. The multiuser 680 systems begin at under $6,000, but still allow potential profit margins exceeding 50%. The 680 support we put behind you includes (1) our award-winning reseller program, (2) a system warranty, supported by regional software support offices and a central dispatch network of over 100 strategically located service centers, (3) and the backing of a 126-year-old company with worldwide resources and over $60 billion in annual sales.

IT TAKES demonstrated success of producing only the highest quality products, as witnessed by the C.Itoh video terminals used in over 150,000 workstations and over 2 million C.Itoh printers installed worldwide.

IT TAKES C.Itoh's ability to give you a single source for a full complement of compatible systems, terminals, printers and software applications.

If you want to steal the show from your competitors, write C.Itoh's Computer Systems Division, CIE Systems, 2515 McCabe Way, P.O. Box 19628, Irvine, CA 92713-9628. Or call (714) 660-1800. Call toll free 1-800-437-2341. In California, call 1-800-458-6279. Telex: 655-438. TWX: 910-595-2605.

C.ITOH
Computers

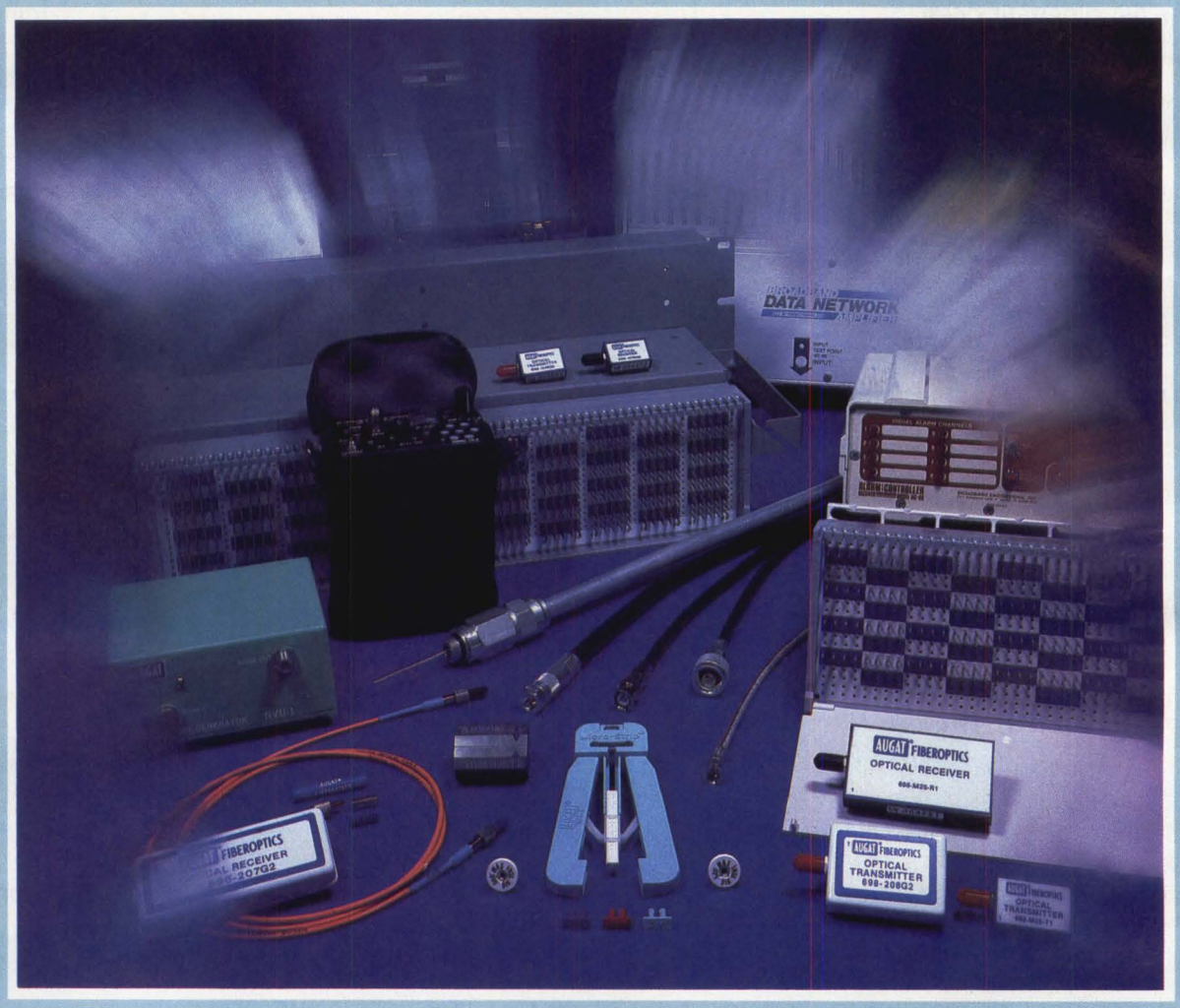


BUSINESS COMPUTER SYSTEMS

Local Area Networks

Company / Network name	Local area network: Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface hardware: Network interface model name/type	Ports	Computers supported	Networking software	Price $
PLAN Series Token Ring	baseband, twisted-pair; token-passing	4M	260; 1,000 feet	SNA	IBM Token Ring Adapter Card		IBM PC/XT/AT, Portable PC and compatibles	PlanPak software	17,500(10 workstations)
NETWORK DEVELOPMENT CORP. 81 Great Valley Parkway, Malvern, PA 19355, (215) 296-7420									**CIRCLE 338**
Device Network Architecture (DNA)	baseband, twisted-pair	800K	64; 5,000 feet	DNA	DNA board	4 asynch, 2 synch, 3 parallel	Compaq; Fujitsu; IBM PC/XT/AT; Leading Edge; Sperry; Zenith	DNA Network software	695
NOVELL INC. 1170 North Industrial Park Dr., Orem, UT 84057, (801) 226-8202									**CIRCLE 339**
NetWare/ ARCNET	baseband; token-passing	2.5M	50(server)		ARCNET board	2 asynch, 1 parallel	IBM PC/XT/AT and compatibles	Advanced NetWare, SFT NetWare 286 software	2,595
NetWare/G-Net	baseband; CSMA/CD	1.43M	50(server); up to 7,000 feet		G-Net board	2 parallel	IBM PC/XT/AT and compatibles	Advanced NetWare, SFT NetWare 286 software	2,395
NetWare/ ProNET	baseband, twin-ax, twisted-pair, fiberoptic; token-passing	9.94M	50(server); 100m-2.5 km		P-1300 board	1 parallel	IBM PC/XT/AT and compatibles	Advanced NetWare, SFT NetWare 286 software	3,095
PC LAN TECHNOLOGIES INC. 5780 Lincoln Dr., Suite 106, Minneapolis, MN 55436, (612) 935-7509									**CIRCLE 340**
LT LAN	baseband, twisted-pair; CSMA/CD, proprietary, IEEE 802.3	1M, 2M	1,220 feet		LT LAN Adapter board		IBM PC/XT/AT and compatibles		750(starter kit)
PERKIN-ELMER CORP. (DATA SYSTEMS GROUP) 2 Crescent Place, Oceanport, NJ 07757, (201) 870-4500									**CIRCLE 341**
Pennet	baseband; CSMA/CD, IEEE 802.3	10M	100; 1.5 miles	X.25	EDLC board		Perkin-Elmer 3200, XF series	opt. Pennet software	3,700
					Ethernet Terminal Server box	8 asynch	Perkin-Elmer 3200, XF series	included	4,000-5,500
PHOENIX DIGITAL CORP. 2315 N. 35th Ave., Phoenix, AZ 85009, (602) 278-3591									**CIRCLE 342**
OPTOnet	baseband, fiberoptic; token-passing, IEEE 802.4	1M	253; 1-4 miles	Dpac	Dpac box	48 asynch, 48 synch, 48 IEEE 488	DEC, Honeywell, IBM PC	proprietary	10,000-30,000
PRIME COMPUTER INC. Prime Park, Natick, MA 01760, (617) 655-8000									**CIRCLE 343**
Primenet/ Ringnet	twin-ax, fiberoptic; token-passing	10M	128; 3,280 feet		Primenet Node Controller board		Prime 50 Series	opt. Primenet software	$5,000

Networking... see your way clear



You're not alone. It's easy to get confused by the enormous spectrum of networking requirements, products and technologies that blur the way.

Let Augat bring your picture into focus.

Augat is one of the world's most respected names in electronic interconnection technology. We possess a unique capability for network solutions, because of unequaled product breadth coupled with vast experience in the OEM and CATV marketplaces.

Augat offers an unusual combination; the resources of a large ($250,000,000.00), vigorous growth company plus a willingness and ability to go beyond merely selling products.

Our commitment to total solutions comes from years of experience in the CATV market, where total support is an integral service.

Let us help you enjoy a better view. Call or write "NETWORKING", Augat/Broadband Communications Group, 710 Narragansett Park Drive, Pawtucket, Rhode Island 02861, (401) 724-4400.

Broadband Network Electronics • Coaxial Connectors • Fiberoptics • Test Equipment • System Compatible Cross Connections

AUGAT® BROADBAND COMMUNICATIONS GROUP

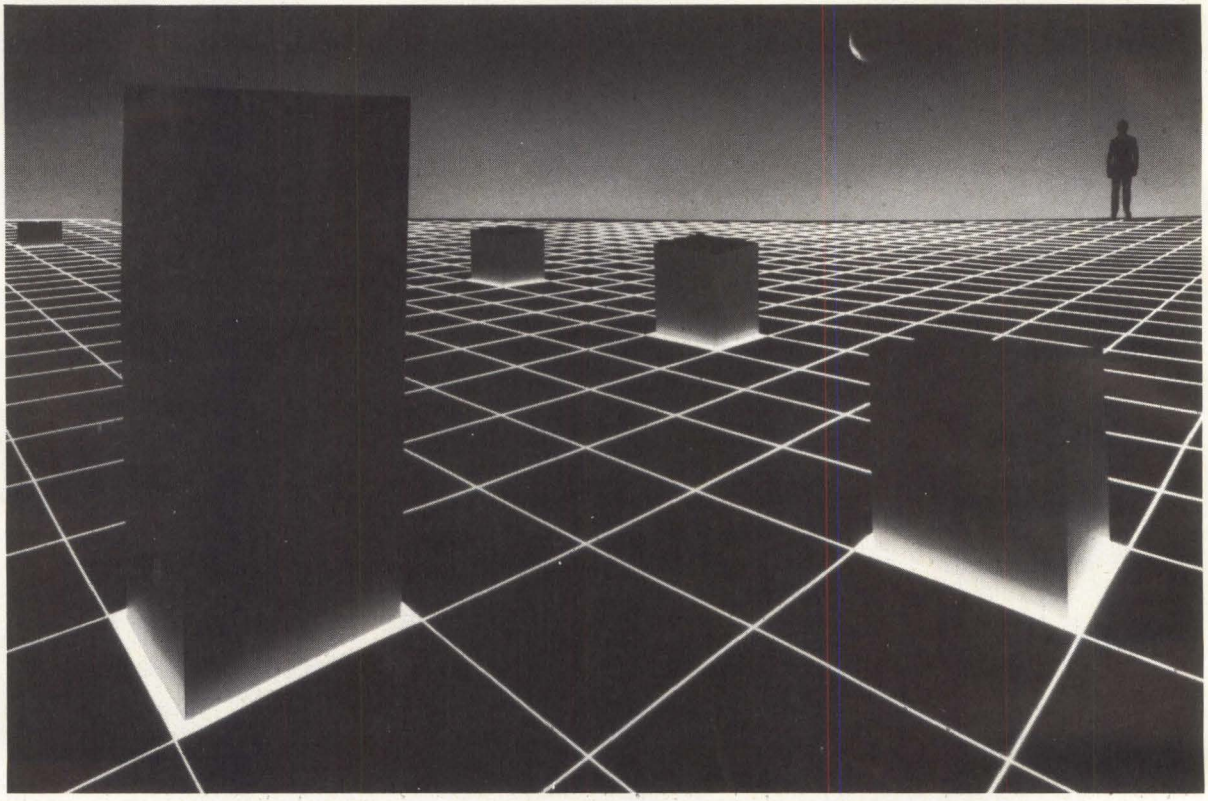
Quality and Innovation

CIRCLE NO. 24 ON INQUIRY CARD

Local Area Networks

Company / Network name	Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface model name/type	Ports	Computers supported	Networking software	Price $
Local area network					**Network interface hardware**				
PROTEON INC. 4 Tech Circle, Natick, MA 01760, (617) 655-3340									**CIRCLE 344**
ProNET-10	baseband, twin-ax, twisted-pair, fiberoptic; token-passing, IEEE 802.5	10M	255; 50 km		P1000 board		DEC PDP-11, VAX	opt. TCP/IP, Ringway software	3,150-1.5 million
					P1200 board		all Multibus computers	opt. TCP/IP software	3,150-1.5 million
					P1300 board		AT&T 6300; Columbia; Compaq; Eagle; IBM PC/XT/AT	opt. Netware/P, TCP/IP software	799-200,000 plus
ProNET-80	baseband, twin-ax, twisted-pair, fiberoptic; token-passing, IEEE 802.5	80M	240; 50 km	DECnet	P1080 board		DEC PDP-11, VAX	opt. TCP/IP, Ringway software	8,000
QUANTUM SOFTWARE SYSTEMS LTD. 215 Stafford Rd. W., #104, Nepean, Ontario, K2H 9C1, Canada, (613) 726-1893									**CIRCLE 345**
QNX Operating System	twin-ax; token-passing	2.5M	255; 6,000 feet		QNET board	10 asynch, 2 parallel	IBM PC/AT and compatibles	included	950
SIECOR CORP. P.O. Box 13625, Research Triangle Park, NC 27709, (919) 549-6571									**CIRCLE 346**
Fiber Optic Ethernet	baseband, fiberoptic; CSMA/CD, IEEE 802.3	10M	1,024; 2.5 km		Ethernet LAN vendors		all major computers		
STEARNS COMPUTER SYSTEMS P. O. Box 9384, Minneapolis, MN 55440, (612) 829-0361									**CIRCLE 347**
ViaNet	baseband; token-passing, IEEE 802.3, IEEE 802.4, IEEE 802.5	2.5M	255; 3 miles	SNA	ViaNet board		IBM PC/XT/AT and compatibles	included	499
TELTONE CORP. 10801 120th Ave. N.E., Kirkland, WA 98033, (206) 827-9626									**CIRCLE 348**
Data Carrier System	twisted-pair	9600	5,000 feet		DCS-2B box	1 asynch	DEC, Data General, Hewlett-Packard, Honeywell, Prime		435-673
					DCS-2SE box	1 asynch or 1 synch	DEC, Data General Hewlett-Packard, Honeywell, IBM, Prime		592-875
TIENET INC. 2300 Central Ave., Suite F, Boulder, CO 80301, (303) 444-2600									**CIRCLE 349**
Tienet	baseband, twisted-pair, coaxial; CSMA/CD, proprietary	1M	24,000; 2 miles		Tienet box	16 asynch, 16 synch	Apple, Data General, DEC, Hewlett-Packard, Honeywell, Perkin-Elmer		460-551

Before we can share ideas, we have to share information.



Introducing poly-SHARE®. It lets PC and VAX users create an organized, central lending library.

What a novel idea!

Programs, files, worksheets, WP documents, created either on a PC or a VAX system, are organized and securely stored on the VAX computer by the poly-SHARE program. So they're instantly accessed and transferred by any authorized PC or VAX user.

Poly-SHARE software is perfect for any company or department that includes a population of PCs and one or more VAX systems. And security features insure that even sensitive and confidential information can be stored in the library.

Engineers and scientists store test data and frequently used programs. Accountants deposit budgets, forecasts, and commonly-used worksheets. Managers file reports, production information, and sales results. Administrators and secretaries instantly recall standardized sections of contracts, proposals, and business letters. And software developers organize original and updated code modules.

The poly-SHARE program's breadth of appeal is matched by its ease of use. It provides a menu interface, on-line help and fully automatic transfers of library entries to and from PCs. And it's available for both ALL-IN-1 and standard VMS configurations.

FREE EVALUATION KIT.

Call us today and ask for our fully functional evaluation kit. This no-risk offer will let you put poly-SHARE to the most important test: how will it work for you?

800/545-5405 (Ext. 6)

polygon®

The difference is experience.

CIRCLE NO. 25 ON INQUIRY CARD

Local Area Networks

Company / Network name	Local area network: Networking media/access	Data rate (bps)	Max. no stations / Max. distance (end-to-end)	Gateways available	Network interface hardware: Network interface model name/type	Ports	Computers supported	Networking software	Price $
WANG LABORATORIES INC. One Industrial Ave., Lowell, MA 01851, (617) 459-5000									**CIRCLE 350**
WangNet/ FastLAN	broadband; CSMA/CD, token-passing, proprietary, IEEE 802.3	up to 10M	up to 10,000; 4 miles		Cable Interface Unit box		Wang VS, OIS, Alliance		3,800
					CMUX box		IBM 3270		3,375
					Fixed Frequency Modem box		any computer with RS232C, RS449 ports		850-1,200
					IBM PC-Net Adapter box		IBM PC/XT/AT		400
WESTERN TELEMATIC INC. 2435 S. Anne St., Santa Ana, CA 92704, (714) 979-0363									**CIRCLE 351**
Smart Switch	twisted-pair	19.2K	16; up to 2,000 feet	ASCII, RS232C port	SS-8 box	8 asynch	all computers with RS232C serial port		695
					SS-8B box	8 asynch	all computers with RS232C serial port		995
					SS-16 box	16 asynch	all computers with RS232C serial port		1,895
WESTWIND COMPUTER 1690 65th St., Emeryville, CT 94608, (415) 652-3222									**CIRCLE 352**
WEB	flat cable; proprietary	350K	7; 500 feet		WEB box	2 asynch, 1 parallel	most computers using CP/M	WEBstat, WEBmail software	1,295-1,995
XEROX CORP. Xerox Square, Rochester, NY 14644, (716) 423-5078									**CIRCLE 386**
XC 22	baseband; CSMA/CD, IEEE 802.3	10M	30; 5600 feet		XC 22 board		IBM PC/XT/AT; Xerox 6060 family	XC 20 software	600-850 (per node)
XC 24	baseband, CSMA/CD, IEEE 802.3	1M	200		XC 24 board		IBM PC/XT/AT; Xerox 6060 family	XC 20 software	600-850 (per node)
XYPLEX INC. 100 Domino Dr., Concord, MA 01720, (617) 371-1400									**CIRCLE 353**
Xyplex System	baseband, broadband, fiberoptic; CSMA/CD, CSMA/CA, IEEE 802.3	10M	32,000 feet	BSC, SNA	XP-4N64 board	64 asynch			8,100
					XP-CC8 box	8 asynch			

Information was solicited but not received from the following manufacturers:

3Com Corp.
1365 Shorebird Way
Mountain View, CA 94043
(415) 961-9602

Bridge Communications
1345 Shorebird Way
Mountain View, CA 94043
(415) 969-4400

Coherent Communications Systems Corp.
60 Commerce Dr.
Hauppauge, NY 11788
(516) 231-1550

Gateway Communications Inc.
16782 Redhill Ave.
Irvine, CA 92714
(714) 261-0762

IBM Corp.
900 King St.
Rye Brook, NY 10573
(914) 934-4839

Metapath
222 Lincoln Center Dr.
Foster City, CA 94404
(415) 345-7700

National Instruments Inc.
12109 Technology Blvd.
Austin, TX 78727
(512) 250-9119

NEC Information Systems Inc.
1414 Massachusetts Ave.
Boxborough, MA 01719
(617) 264-8000

Network System Corp.
7600 Boone Ave., North
Minneapolis, MN 55428
(612) 425-2202

Northern Telecom Inc.
9705 Data Park
Minneapolis, MN 55343
(612) 932-8000

Orchid Technology
47790 Westinghouse Rd.
Fremont, CA 94539
(415) 490-8586

Santa Clara Systems
1610 Barryessa Rd.
San Jose, CA 95133
(408) 729-6700

Sytek Inc.
1225 Charleston Rd.
Mountain View, CA 94043
(415) 966-7300

Ungermann-Bass Inc.
2560 Mission College Blvd.
Santa Clara, CA 95050
(408) 496-0111

Ztel Inc.
181 Ballardvale St.
Wilmington, MA 01887
(617) 657-8730

Networking Software

Company	Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price $	Function
APPLIED INFORMATION SYSTEMS INC. 500 Eastowne Dr., Chapel Hill, NC 27514, (919) 942-7801							**CIRCLE 354**
	BURCOM	proprietary	DEC PDP-11, VAX	DEC VAX/VMS, PRO/POS, MICRO/RSX, PDP-11/RSX		700-5,000	allows communications between DEC and Burroughs computers, supports the Burroughs point-to-point conversational and poll-select protocols, emulates MT983 terminal
APPLIED INTELLIGENCE INC. 1043 Stierlin Rd., Mountain View, CA 94043, (415) 967-3512							**CIRCLE 355**
	PC/NOS	network independent		MS-DOS, PC-DOS		125(per node)	provides concurrent user/server capabilities on LAN, allows sharing of most devices which are part of the MS-DOS device chain, compatible with IBM PC Net applications
AST RESEARCH INC. 2121 Alton Ave., Irvine, CA 92714, (714) 863-1333							**CIRCLE 356**
	AST-NETBIOS Option	AST LANs	AST PCnet, PCnet II, Resource Sharing Network	IBM PC/XT/AT with DOS 3.1	AST or IBM Network Program or equivalent	195(per network)	ensures compatibility with application and utility software designed for the IBM PC network, fully emulates IBM NETBIOS, provides node-naming facilities
	AST-Network Program	NETBIOS-compatible LAN	NETBIOS compatible	IBM PC/XT/AT with DOS 3.1	none	75	allows sharing of disk and printers over LAN
	AST SNA/BSC Gateway	NETBIOS-compatible LAN (AST, IBM)	AST PCnet, PCnet II, Resource Sharing Network or equivalent	IBM PC/XT/AT with DOS 3.1	none		allows LAN users to access a mainframe via SNA or BSC protocols
AUSCOM (A KMW SYSTEMS CO.) 2007 Kramer Lane, Austin, TX 78758, (512) 836-8080							**CIRCLE 357**
	Fusion TCP/IP	ARPANET	Auscom Model 8911A	IBM VM/CMS, MVS		5,000-15,000	allows an IBM mainframe (or plug-compatible mainframe) to communicate via an Auscom Model 8911A to an Ethernet LAN
	XNS	networks supporting XNS	Proteon ProNET interface	IBM VM, MVS		5,000-10,000	allows an IBM mainframe (or plug-compatible mainframes) to communicate via an Auscom Model 8911A to Proteon's token-passing ring LAN
COMMUNICATION MACHINERY CORP. 1421 State St., Santa Barbara, CA 93101, (805) 963-9471							**CIRCLE 358**
	Internet TCP-IP	Ethernet (TCP-IP)	Communication Machinery ENP	UNIX System V, Berkeley UNIX Version 4.X, DEC VMS, MS-DOS, XENIX		500	allows TCP-IP communication over an Ethernet, includes Mil Spec versions of TCP-IP, ARP, ICMP, UPD; Dept. of Defense-defined FTP, TELNET and SMTP utilities
	QM100	ARAPNET, any TCP-IP network	intelligent processor			20,000 (source)	allows a host to communicate on a TCP-IP LAN, includes the Dept. of Defense-defined FTP, TELNET and SMTP utilities

ADVERTISERS' INDEX

See P. 76 for Career Opportunity Advertisers

See P. 76 for Mini-Micro Marketplace

Networking Software

Company / Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price $	Function
COMMUNICATIONS SOLUTIONS INC. 992 S. Saratoga-Sunnyvale Rd., San Jose, CA 95129, (408) 725-1568						**CIRCLE 359**
Access/BSC 3270	BSC	synch modem	IBM PC and compatibles, MS-DOS, UNIX systems, proprietary multi-user and multi-tasking systems		200	allows IBM PC or compatibles, UNIX systems, or proprietary multi-user, multi-tasking systems to communicate to IBM hosts
Access/SNA 3270 Access/SNA 3770	SNA	synch modem	IBM PC or compatibles, MS-DOS, UNIX systems, proprietary multi-user, multi-tasking systems		200	allows IBM PC or compatibles UNIX systems, proprietary multi-user, multi-tasking systems to communicate to IBM hosts
Access/SNA APPC Access/DIA	SNA	synch modem	IBM PC and compatibles, MS-DOS, UNIX systems, proprietary multi-user and multi-tasking systems		200	allows application programs to communicate with each other using IBM Advanced Program-to Program Communications (APPC/LU6.2) protocols
CORVUS SYSTEMS INC. 2100 Corvus Dr., San Jose, CA 95124, (408) 559-7000						**CIRCLE 360**
Constellation II	OMNINET	OMNINET transporter	IBM PC and compatibles, MS-DOS, Corvus Concept, Macintosh, Apple II	none	495(per network interface, includes Constellation software)	provides disk and printer sharing in LAN environment, supports network booting and file transfer via multiple operating systems on the same network
SNA Gateway	OMNINET	OMNINET transporter	IBM PC and compatibles, MS-DOS, Corvus Concept	Constellation II	5,000	allows personal computer on OMNINET to access a mainframe SNA network, providing 3278 emulation, file transfer and program-to-program communication; implements all of the SNA layers and allows multiple active sessions
COSI 313 N. First St., Ann Arbor, MI 48103, (313) 665-8778						**CIRCLE 361**
Tango	Ethernet	RS232C	IBM PC and compatibles, computers with UNIX	none	195(PC package); 295(UNIX package)	connects IBM PC running DOS with UNIX-based micro- and minicomputers; emulates DEC, IBM, Tektronix graphics terminal
DATA GENERAL CORP. 4400 Computer Dr., Westboro, MA 01580, (617) 366-8911						**CIRCLE 382**
Data General SNA	SNA	intelligent synch controller, synch modem	Data General AOS, AOS/VS	APILU 2; SNA 3270, 3278 APL, RJE 80; Data General SNA, SDLC, XDLC		implements SNA specifications
TCP-IP	TCP-IP	intelligent LAN controller	Data General AOS/VS, Data General UX (native mode UNIX)			implements TCP-IP, Berkeley UNIX Version 4.2, Dept. of Defense specifications
XNS	XNS		Data General AOS, AOS/VS			implements XNS/ITP specifications
DATAPOINT CORP. 9725 Datapoint Dr., San Antonio, TX 78284, (512) 699-7000						**CIRCLE 362**
RMS	ARCNET	resource interface modules, hubs	IBM PC, MS-DOS, UNOS, CTOS, Datapoint DOS			provides full resource sharing and multi-tasking capabilities

Networking Software

Company / Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price $	Function
DIGITAL EQUIPMENT CORP. 200 Baker Ave., Concord, MA 01742, (617) 264-1420						**CIRCLE 363**
DECnet	DECnet	DEUNA, DEQNA, DMR-11, DZ-11	DEC VAX-11, MicroVAX, MS-DOS		95-4,425	provides all ISO/OSI layers for communication between systems running DECnet
LAT	LAT	DEUNA, DEQNA, DECserver 100, LAT-11	DEC VAX-11, MicroVAX		150	provides terminal to host connection and multiple sessions to any system on the LAN
EXCELAN INC. 2180 Fortune Dr., San Jose, CA 95131, (408) 434-2300						**CIRCLE 364**
EXOS 8011	Ethernet	EXOS 205	IBM PC/AT, XENIX	none	595	allows an IBM PC/AT to communicate over an Ethernet, implements TCP-IP, TELNET, FTP and R utilities
EXOS 8012	Ethernet	EXOS 201, 202, 203	Berkeley UNIX Version 4.2, UNIX System V, Intel 286/310, NCR Tower, Integrated Solutions, Mostek	none	1,645	allows UNIX-based, Multibus, VMEbus and Q-bus computers to communicate over an Ethernet, implements TCP-IP, FTP, TELNET and R utilities
EXOS 8040	Ethernet	EXOS 203, 204	DEC VAX/VMS, MicroVAX/MicroVMS	none	2,150 (MicroVAX); 5,000(VAX)	allows DEC VAX and MicroVAX to communicate over an Ethernet, implements TCP-IP, FTP and TELNET utilities
INTEL CORP. 3065 Bowers Ave., Santa Clara, CA 95051, (408) 987-8080						**CIRCLE 365**
iRMX Networking Software (iRMX-NET)	OpenNET (IEEE 802.3)	iSBC 186/51, iSBC 552, iSBX 586, iSMX 552	iRMX 86	Intel iNA 960, iRMX 86	2,000 (single-user license)	provides transparent remote file access and additional networking services among multiple Intel 286/300 series supermicrocomputers and IBM PC/XT/ATs and compatibles when combined with other Intel OpenNET LAN product modules designed for Ethernet LANs
MAP-NET	OpenNET/MAP 2.1	iSMX 554	iRMX 86	iNA 960, iRMX 86	2,000(8-user development license)	implements ISO's OSI layers 5 through 7 as specified by MAP 2.1, provides MAP 2.1 ISO FTAM, Session CASE, and Network Management Directory Services; preconfigured to run on Intel's iSMX 554 MAP board
XENIX Networking (XENIX-NET)	OpenNET (IEEE 802.3)	iSXM 552 COMMengine (Multibus board)	IBM PC/MS-DOS 3.1, iNDX, iRMX 86, MS-NET 1.0, XENIX 3.0	Intel iNA 960 transport software XENIX 3.0	2,000-2,800 (single-user license)	provides transparent remote file access and additional networking services among multiple Intel 286/300 series supermicrocomputers and IBM PC/XT/ATs and compatibles when combined with other Intel OpenNET LAN product modules designed for Ethernet LANs
LINKWARE CORP. 77 Rumford Ave., Waltham, MA 02154, (617) 894-9330						**CIRCLE 366**
Linkware: Information Server	DECnet, Ungermann-Bass and compatible LANs	asynch modem, Ungermann-Bass NIU150	IBM VM/CMS, MVS/TSD, System 38; DEC VAX/VMS; UNIX System III, System IV, Berkeley UNIX Version 4.1 and 4.2	none	12,000-35,000 (site license)	host resident file server application with corresponding PC software facilitates transfer and information sharing between dissimilar hosts, PCs and terminal users; includes bundled terminal emulation software

Networking Software

Company / Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price $	Function
Linkware: PC Connection	DECnet, Ungermann-Bass and compatible LANs	asynch modem, Ungermann-Bass NIU150	IBM PCs and compatibles, DEC Rainbow, DECMate II, Apple Macintosh, DG/One, Lee Data 400	none	20,000 (unlimited site license)	microcomputer-resident application communicates with Linkware's Information Server on the host, enables PC users to upload or download binary and text data, makes files available to a terminal user (and vice versa) or exchanges files with an incompatible application, provides terminal emulation

MOTOROLA SEMICONDUCTOR PRODUCTS (MICROSYSTEMS) **CIRCLE 367**
2900 S. Diablo Way, Tempe, AZ 85282, (602) 438-3501

MicroMap	MAP 2.1	Motorola MVME371, MVME372	any VMEbus-based system			allows any VMEbus-based system to communicate with MAP token bus protocol

NESTAR SYSTEMS INC. **CIRCLE 383**
2585 E. Bayshore Rd., Palo Alto, CA 94303, (415) 493-2223

Plan Series Utilities Program	Nestar Plan Series	Nestar Network Interface Card or Token-ring Adapter Card	IBM PC-DOS	Nestar PC-DOS support package	1,000 (one-time license fee)	

NETWORK SYSTEMS CORP. **CIRCLE 368**
7600 Boone Ave. North, Minneapolis, MN 55428, (612) 425-2202

Netex	HYPERchannel, HYPERbus	HYPERchannel adapter, HYPERbus BIU	IBM MVS/SP3, MVS/X3, VM/SP; DEC RSX-11	none	10,000-23,000 (license)	facilitates communication between different computers without requiring modification to the computer operating system

NOVELL INC. **CIRCLE 369**
748 N. 1340 West, Orem, UT 84057, (801) 226-8202

Advanced NetWare	NetWare/G-net, NetWare/S-net, NetWare/ProNET, NetWare/ARCNET	none	MS-DOS	none	1,595	LAN operating system software supports multiple file servers, bridges, gateways, remote workstations and DOS 3.1
SFT NetWare 286	NetWare/G-net, NetWare/S-net, NetWare/ ProNET, NetWare/ARCNET	none	MS-DOS	none	2,495	LAN operating system software supports multiple file servers, bridges, gateways, remote workstations and DOS 3.1; features disk mirroring, media correction and transaction back out

PACER SOFTWARE INC. **CIRCLE 370**
1227 Pearl St., La Jolla, CA 92037, (619) 454-0565

pcLINK	proprietary		Apple Macintosh, DEC VAX, IBM PC/XT/AT, Prime PRIMOS	none	2,000(server software and up to five PCs)	microcomputer interconnect package for the Prime 50 Series and the DEC VAX; Apple Macintosh, IBM PC/XT/AT and compatibles are the target PCs

PATHWAY DESIGN INC. **CIRCLE 371**
One Apple Hill, P.O. Box 8179, Natick, MA 01760, (617) 237-7722

netPATH	SNA, NetWare, Etherlink, OMNINET, ProNET, PCnet, Quadnet	communications adapter	IBM PC, MS-DOS, Novell NetWare		3,995(32 sessions); 2,995(16 sessions); 1,995(8 sessions)	allows LAN PCs to operate on IBM SNA network, supports 32 concurrent sessions

PERKIN-ELMER CORP. (DATA SYSTEMS GROUP) **CIRCLE 372**
2 Crescent Place, Oceanport, NJ 07757, (201) 870-4500

PENnet Plus	X.25 ISO/OSI	synch adapter	Perkin-Elmer OS/32	none	2,300-7,000	allows a Perkin-Elmer 3200 system to communicate over an X.25 or Ethernet IEEE 802.3 link, provides transport ISO 8072/8073 Class 3 service with program interface and routing functions

Networking Software

Company / Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price $	Function
PENnet Plus S3200X	X.25 ISO/OSI	synch adapter	XELOS (UNIX System V)	none	5,000	allows a Perkin-Elmer 3200 system to communicate over an X.25 or Ethernet IEEE 802.3 link, provides transport ISO 8072/8073 Class 3 service with program interface and routing functions

PROTEON INC. **CIRCLE 373**
4 Tech Circle, Natick, MA 01700, (617) 655-3340

MS-DOS TCP/IP	ProNET	ProNET p1300	MS-DOS 2.0, PC-DOS 2.0		250	provides terminal emulation to a ProNET MIU over the network, file transfers between PCs on other TCP-IP hosts
VM/CMS TCP/IP	ProNET	ProNET p1000, IBM DACU	VM/CMS	IBM VMCF	15,000-17,000	provides TCP-IP for the VM/CMS environment, allows remote login and file transfer to occur with other TCP-IP speaking hosts on the ProNET ring
VAX/VMS TCP/IP	ProNET	ProNET p1000	DEC VAX/VMS	none	6,000	provides Berkeley UNIX Version 4.2 networking facilities on a DEC VAX/VMS system, compatible with all TCP-IP implementations

SPARTACUS INC. **CIRCLE 374**
One Lowell Research Center, 847 Rogers St., Lowell, MA 01852, (617) 275-4220

KNET	Ethernet	K-200	IBM VM, MVS; DEC VAX/VMS, PDP-11	none	12,000(one time license); 9,500(protocol conversion); 8,500(XNS)	allows an IBM mainframe to communicate over an Ethernet with IBM and non-IBM workstations and computers; implements both TCP-IP and XNS protocols; supports FTP, TFPT, SMTP and TELNET
KNET/PC	Ethernet	3Com 500B	IBM PC, MS-DOS, XENIX	none	700	allows IBM PC/ XT/ AT and compatibles to participate on Ethernet as a peer with other hosts on the network, provides remote logon and file transfer services

THE SOFTWARE LINK INC. **CIRCLE 375**
8601 Dunwoody Place, Suite 632, Atlanta, GA 30388, (404) 998-0700

LANLink		none	IBM PC-DOS, PC-DOS 3.1		495(starter kit)	allows users to set up a star central file micro or daisy-chain micros together

THE SYSTEMS CENTER INC. **CIRCLE 376**
1320 Greenway Plaza, Irving, TX 75038-2510, (214) 659-9318

SNA Gateway	SNA, Corvus OMNINET	dial or leased line modem (4800 or 9600 bps)	IBM PC, MS-DOS, Corvus CCOS	Network Datamover (PC and MVS), mainframe-to-micro link software	18,500(MVS); 9,500(SNA Gateway)	provides gateway from OMNINET to IBM mainframes, allows IBM PCs and Corvus Concepts to emulate IBM 327X terminals and mainframe- to-micro data transfer from host MVS mainframe to IBM PC on OMNINET

TECHNOLOGY CONCEPTS INC. **CIRCLE 377**
Old County Rd., Sudbury, MA 01776, (617) 443-7311

CommUnity	DECnet Phase IV		Berkeley UNIX Version 4.2, System V; MS-DOS		50,000 (end node); 75,000(full routing node)	packet orientated network structure with gateways to foreign networks, adaptive routing, file access and transfer, virtual terminal interface

TORUS SYSTEMS INC. **CIRCLE 378**
495 Seaport Ct., Suite 105, Redwood City, CA 94063, (415) 363-2418

TAPESTRY	any IBM NETBIOS-compatible network	IBM NETBIOS, XNS	MS-DOS 3.1	none	495(network manager package); 295(per workstation)	icon-based interface features gateways to mainframes; file, printer and modem sharing, file management

Networking Software

Company	Package name	Network	Network hardware interface	Computer/operating system compatibility	Required additional software	Price $	Function
TRANSACTION DATA SYSTEMS INC. 7061 Grand National Dr., Orlando, FL 32819, (305) 351-1210							**CIRCLE 379**
Freedom Network System	PNF (Packet Network Facility)	asynch, bisynch protocols; SNA	Perkin-Elmer 3200 Series				backbone packet network supports multiple priority levels, transaction switching
UNIPRESS SOFTWARE INC. 2025 Lincoln Highway, Edison, NJ 08817 (201) 985-8000							**CIRCLE 380**
PCworks	proprietary	IBM PC, Apple Macintosh, Hayes Smartmodem	IBM PC, MS-DOS		195		allows sharing of data between IBM PC, Apple Macintosh or UNIX hosts, emulates standard ANSI, TTY or DEC VT52, VT100 terminals
UniHost	proprietary	Bell 103, 212A, Hayes Smartmodem	DEC VAX, UNIX, MC680001		395(workstations); 595(MC68K); 795(VAX)		allows sharing of data, supports ASCII and binary file transfer

Information was solicited but not received from the following manufacturers:

Bridge Communications 1365 Shorebird Way Mountain View, Ca 94043 (415) 969-4400	Honeywell Information Systems Inc. 200 Smith St. Waltham, MA 02154 (617) 895-3247	Innovatek Microsystems Inc. Smithfield Rd. Millerton, NY 12546 (914) 373-9003	Network Research Corp. 2380 N. Rose Ave. Oxnard, CA 93030 (805) 485-2700	Orchid Technology 47790 Westinghouse Dr. Fremont, CA 94539 (415) 490-8586
Gateway Communications Inc. 16782 Redhill Ave. Irvine, CA 92714 (714) 261-0762	IBM Corp. 900 King St. Rye Brook, NY 10573 (516) 934-4839	Metapath Inc. 222 Lincoln Center Dr. Foster City, CA 94404 (415) 345-7700	Northern Telecom Inc. 9705 Data Park Minneapolis, MN 55343 (612) 932-8153	Unisoft Systems Corp. 739 Allston Way Berkeley, CA 94710 (415) 644-1230

REGIONAL SALES OFFICES

BOSTON
Robert K. Singer
National Sales Manager
John J. Fahey
Regional Manager
Katie Kress
Sales Coordinator
275 Washington St.
Newton, MA 02158
(617) 964-3030

PHILADELPHIA
Stephen B. Donohue
Regional Manager
1873 Route 70, Suite 302
Cherry Hill, NJ 08003
(609) 751-0170
in N.Y.: (212) 972-0058

ATLANTA
Larry Pullman
Regional Manager
6540 Powers Ferry Rd.,
Suite 170
Atlanta, GA 30339
(404) 955-6500

CHICAGO
Robert D. Wentz
Regional Manager
Marianne Majerus
Sales Coordinator
Cahners Plaza
1350 E. Touhy Ave.
P.O. Box 5080
Des Plaines, IL 60018
(312) 635-8800

DALLAS
Don Ward, Regional Manager
13740 Midway Suite 515
Dallas, TX 75234
(214) 980-0318

DENVER
John Huff
Regional Manager
270 St. Paul St.
Denver, CO 80206
(303) 388-4511

LOS ANGELES
Len Ganz
Regional Manager
12233 West Olympic Blvd.
Suite 236
Los Angeles, CA 90064
(213) 826-5818

ORANGE COUNTY
Debra Huisken
Regional Manager
2041 Business Center Dr.
Suite 109
Irvine, CA 92715
(714) 851-9422

SAN FRANCISCO
Frank Barbagallo
Northwestern Region Sales Manager
Rick Jamison
Regional Manager
Kathleen Maxwell
Sales Coordinator
Sherman Building, Suite 100
3031 Tisch Way
San Jose, CA 95128
(408) 243-8838

AUSTRIA/WEST GERMANY
Elan Marketing Group
Neutor g. 2
P.O. Box 84
1013 Vienna, Austria
Tel: 43-222-663012

BENELUX
Elan Marketing Group
BOSCHDIJK 199B
5612 HB Eindhoven
The Netherlands
Tel: 31-40-455724

ISRAEL
Elan Marketing Group
13 Haifa St., P.O. Box 33439
Tel Aviv, Israel
Tel: 972-3-252967
Telex: 341667

JAPAN
Kaoru Hara
General Manager
Trade Media Japan Inc.
Suite 412 Azabu Heights
1-5-10 Roppongi Minato-ku,
Tokyo, 106, Japan
Tel: (03) 587-0581

TAIWAN
Donald H. Shapiro
Trade Winds, 2nd Floor
132 Hsin Yi Road, Sec. 2
Taipei, Taiwan
Tel: 3932718
Telex: 24177

UNITED KINGDOM
Elan Marketing Group
5th Floor, Suite 10
Chesham House
136 Regent St.
London W1R 5FA
Tel: 437-6900
Telex: 267653

SWEDEN
Elan Marketing Group
Humlegardsgatan Nr. 5
11446 Stockholm, Sweden
Tel: 46-8-677243

Mini-Micro Marketplace
Carol Flanagen
275 Washington St.
Newton, MA 02158
(617) 964-3030

Direct-Response Postcards
Carol Flanagen
275 Washington St.
Newton, MA 02158
(617) 964-3030

Career Opportunities
Carol Flanagen
Recruitment Advertising Manager
275 Washington St.
Newton, MA 02158
(617) 964-3030

Cahners Magazine Division
William Platt, President
T.M. McDermott, Vice President
Electronics/Computer Group
Tom Dellamaria, VP/Production
Ira Siegel, VP/Research

Promotion Staff
Susan Rapaport
Marketing Communications Director
Mary Gregory
Promotion Manager
Elizabeth Phillips
Marketing Assistant

Circulation
Denver, CO.
(303) 388-4511
Sherri Gronli
Group Manager

MINI-MICRO MARKETPLACE

A special section for advertisers of hardware, software and services.

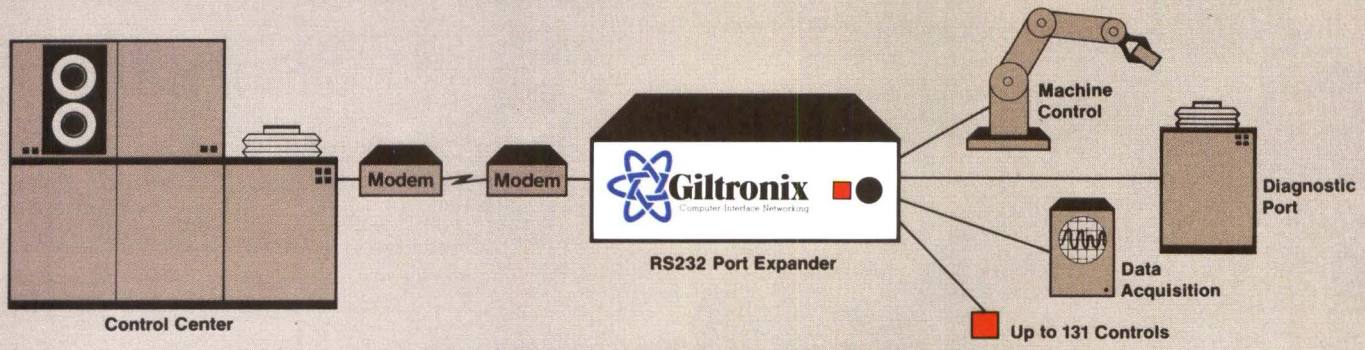
READERS: Please circle reader service numbers on Reader Inquiry Card for additonal information.

Giltronix for multi-port expansion...

15 Port-RS232 Port Expander

The Giltronix RS232 Port Expander enables cost-effective automated local and remote testing, data acquisition, remote diagnostic execution and remote peripheral control.

- Local or Remote Port Expansion
- Optional Audible Warning Device for Remote Applications
- Comprehensive Password Security Options
- 8 Data Lines Controlled: 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DCR), 8(DCD), 20(DTR) and 24(TC)
- RS232, RS422, or RS423 Interface Capabilities

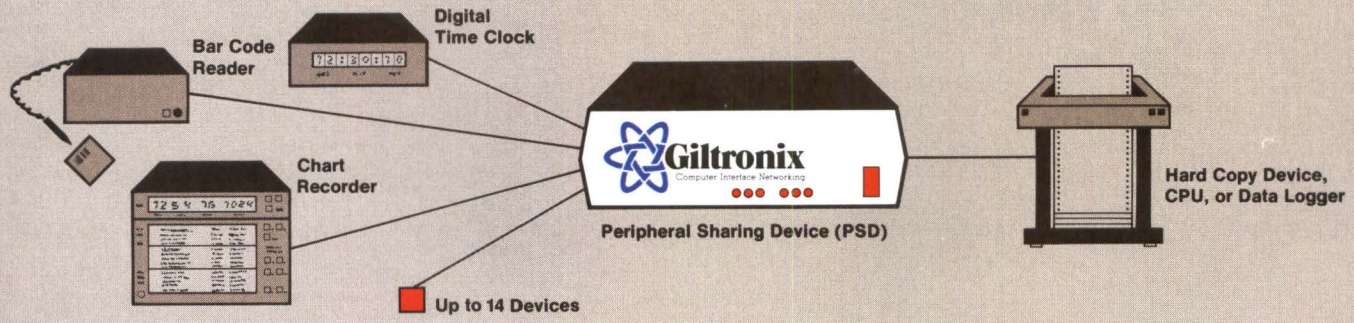


Giltronix for multi-port contention...

Peripheral Sharing Device (PSD)

The Giltronix (PSD) is the low-cost solution for numerous port-contention/device sharing applications such as printer sharing, industrial plant monitoring and data logging for multiple systems under test.

- 3, 5, 7 and 14 port models available
- 8 Data Lines Controlled: 2(TD), 3(RD), 4(RTS), 5(CTS), 6(DCR), 8(DCD), 20(DTR) and 24(TC)
- Asynchronous communications
- No special cables or software required



Giltronix for cost-effective switching solutions...

Direct Sales/Distributors world wide, call or write today for complete information.

Giltronix
Computer Interface Networking

CIRCLE NO. 30 ON INQUIRY CARD

Headquarters
3780 Fabian Way
Palo Alto, CA 94303
(415) 493-1300
Telex 345542

Information Hot-Line: 1-800-531-1300 (Outside California)

THINK SYNC!

For micro-to-mainframe or micro-to-micro bisync communications

New **Sync-Up**™ modems from UDS now bring synchronous communication capability to your IBM or IBM-compatible microcomputers. These units are ideal for bisync applications requiring automatic dialing.

Other features include auto-answer, automatic pulse/tone dialing selection, blind dialing, call progress detection and built-in diagnostic tests.

After initial set-up, options are keyboard selectable.

CHOICE OF SPEED

Sync-Up modems are available in two models: 201C for half-duplex 2400 bps and 208B for 4800 bps half-duplex communication via the dial-up telephone network. 4800 bps version is strappable to the 208A configuration, which delivers full-duplex capability on four-wire dedicated lines.

CHOICE OF SOFTWARE

To enhance the performance of **Sync-Up** modems, UDS offers two custom software packages — **Sync-Up** "Dial" and **Sync-Up** "BSC." "Dial" exercises complete control of the device until connection with the remote modem is achieved; control is then shifted to the RS-232C interface. "BSC" is the ideal package for micro-to-mainframe or micro-to-micro communication, since it fully emulates either a 2780/3780 or a 3270 terminal.

For full details and quantity prices on the **Sync-Up** hardware/software packages, contact UDS today. Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 205/837-8100; Telex 752602 UDS HTV.

QUANTITY ONE PRICES	201C	208A/B
With "Dial" Software	$685	$1200
With "BSC" Software	$895	$1410
Without Software	$625	$1140

Universal Data Systems

MOTOROLA INC.
Information Systems Group

UDS modems are offered nationally by leading distributors. Call the nearest UDS office for distributor listings in your area.

DISTRICT OFFICES: **Atlanta,** GA, 404/998-2715 • **Aurora,** CO, 303/368-9000 • **Blue Bell,** PA, 215/643-2336 • **Boston,** MA, 617/875-8868 • **Columbus,** OH, 614/895-3025 • **East Brunswick,** NJ, 201/238-1515 • **Glenview,** IL, 312/998-8180 • **Houston,** TX, 713/988-5506 • **Huntsville,** AL, 205/837-8100 • **Issaquah,** WA, 206/392-9600 • **Mesa,** AZ, 602/820-6611 • **Milwaukee,** WI, 414/273-8743 **Minnetonka,** MN, 612/938-9230 • **Mountain View,** CA, 415/969-3323 • **Richardson,** TX, 214/680-0002 • **St. Louis,** MO, 314/434-4919 • **Silver Spring,** MD, 301/942-8558 • **Tampa,** FL, 813/684-0615 **Thousand Oaks,** CA, 805/496-3777 • **Tustin,** CA, 714/669-8001 • **Uniondale,** NY, 516/222-0918 • **Willowdale,** Ont, Can, 416/495-0008 • **Ypsilanti,** MI, 313/483-2682

CIRCLE NO. 31 ON INQUIRY CARD

Created by Dayner/Hall, Inc., Winter Park, FL