MARCH 1987

Mini-Micro Systems

THE MAGAZINE FOR COMPUTER SYSTEMS INTEGRATION

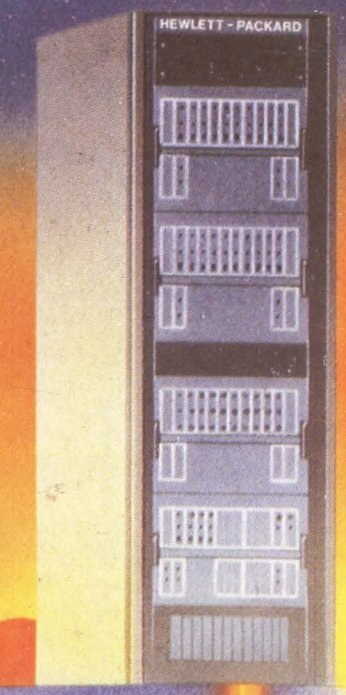
A CAHNERS PUBLICATION

SPECIAL REPORTS:

- **PCs and compatibles**
- **Coprocessor boards**
- **Project management software**

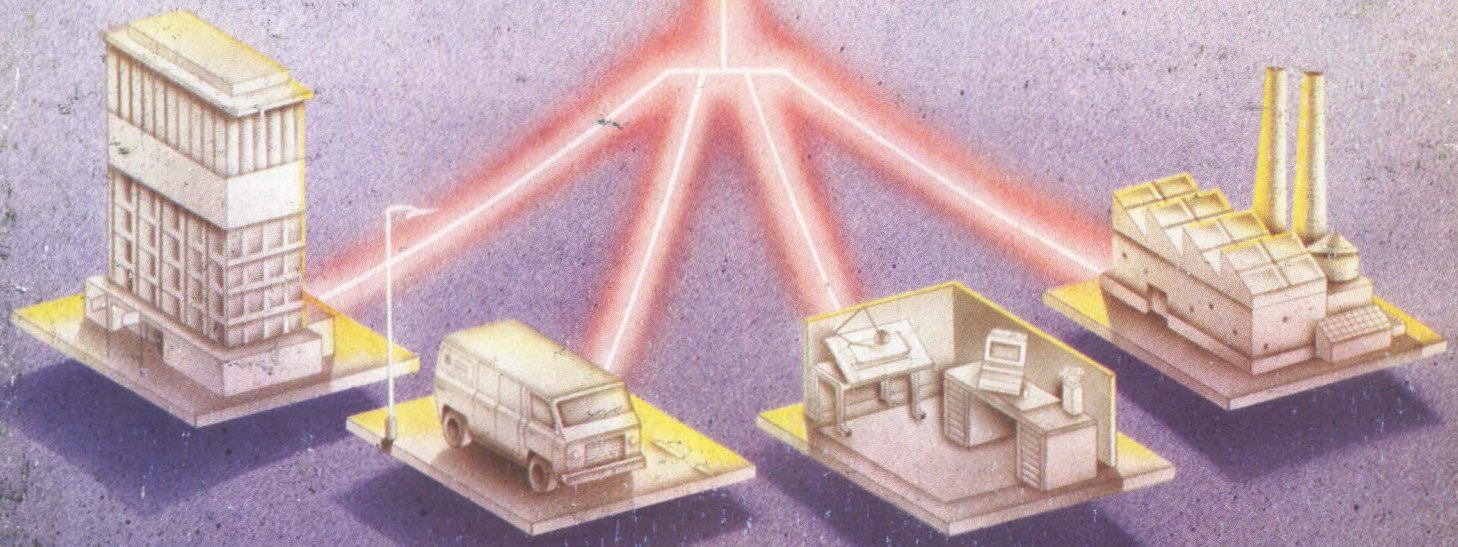
PRODUCT TABLE:

Single-board computers



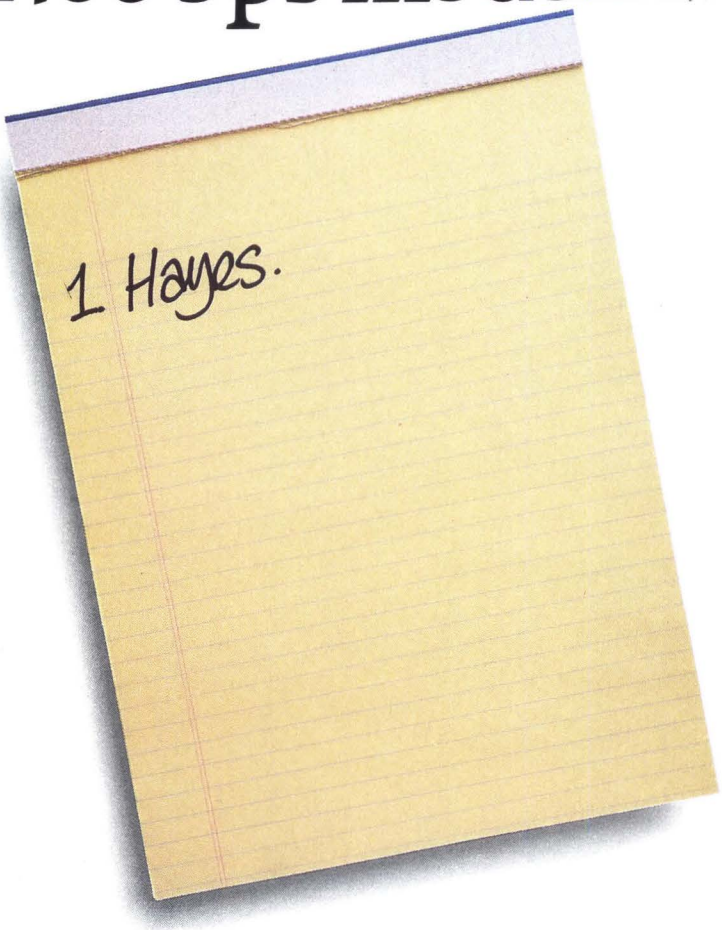
X.25

HP's private packet networks



PLUS: Annual Communications Handbook

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



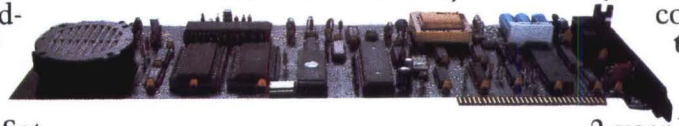
Now that you've memorized that, here's a partial list of why a Hayes® Smartmodem 2400™ is best for you.

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!

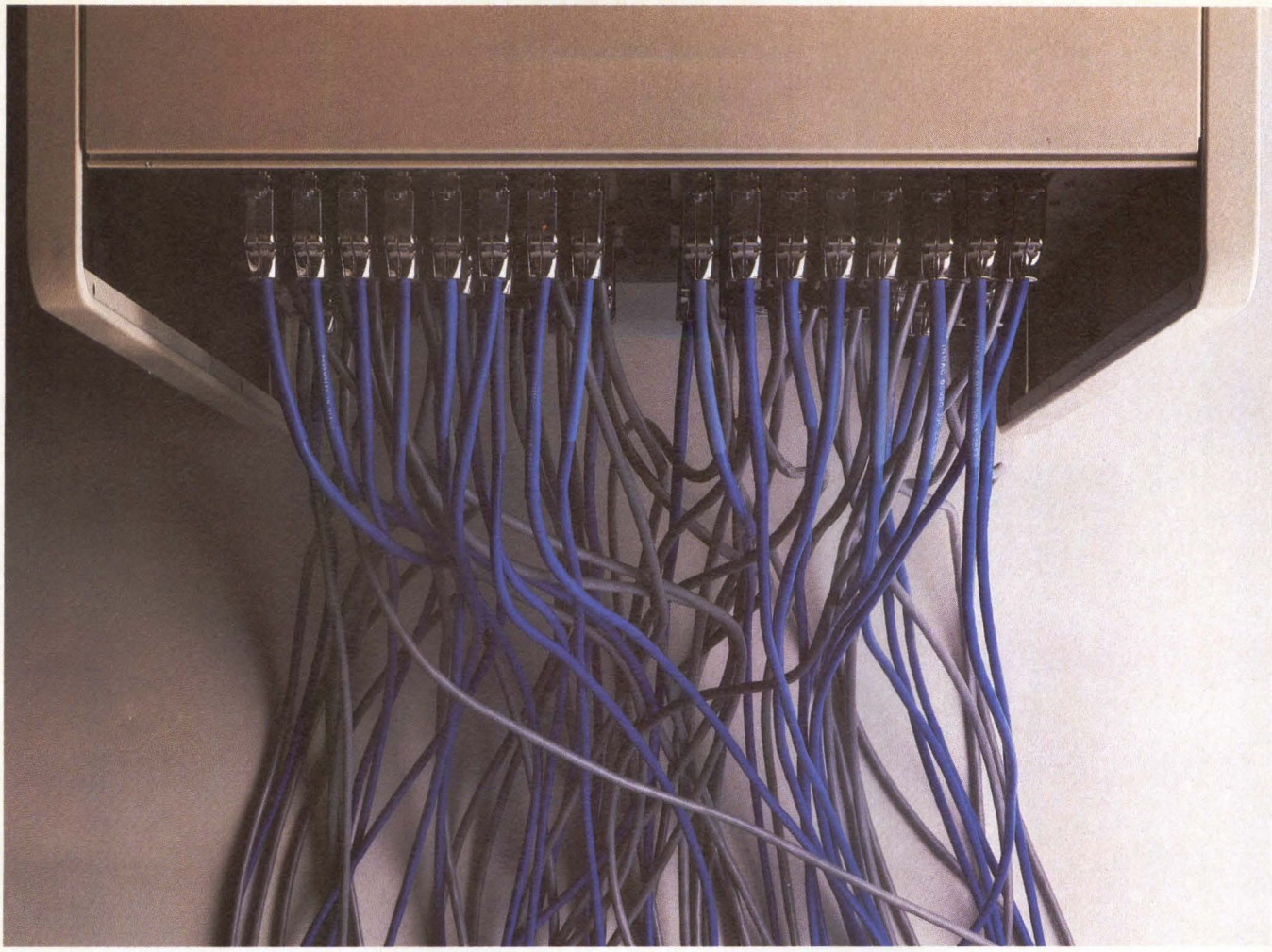
For more information or technical specs, contact your authorized Hayes dealer. Or Hayes directly at (404) 441-1617.

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

Hayes®

Say yes to the future with Hayes.

CIRCLE NO. 1 ON INQUIRY CARD



How many more reasons do you need to Unplug your computer?

Until now, connecting 128 terminals to your computer meant one thing. A myriad of cards taking up precious space on the backplane. And accomplishing nothing but communications. All of which could frustrate almost any self-respecting system designer into hanging up his calculator.

Well, at Systech, we understand the serial communications problems of a multi-user system. So we developed The Unplug™ asynchronous distributed multiplexer that can be used with any Multibus,® VMEbus or Multibus® II system.

The Unplug can take those 128 connections off the back of the computer and turn them into just one. And presto, you've got all the expansion slots you need for more important things. Like disks. Streaming tapes. More CPU power. A synchronous communications processor. And your imagination.

You see, what we did was move part of the computer's operating system—the part devoted to managing traffic to and from the terminals—out of the computer and into The Unplug. Giving the host computer the freedom to concentrate on more important tasks.

We know it sounds simple. And the truth is, it is. In fact, you might wonder why no one thought of it before. Then again, no one else has our commitment to make your job easier. And a lot more gratifying.

Just give us a call at Systech to hook up with The Unplug. Then you can start figuring out what you want to add on next.

Instead of trying to figure out how to untangle all those wires.

Systech Corporation, 6465 Nancy Ridge Drive, San Diego, CA 92121, (619) 453-8970.

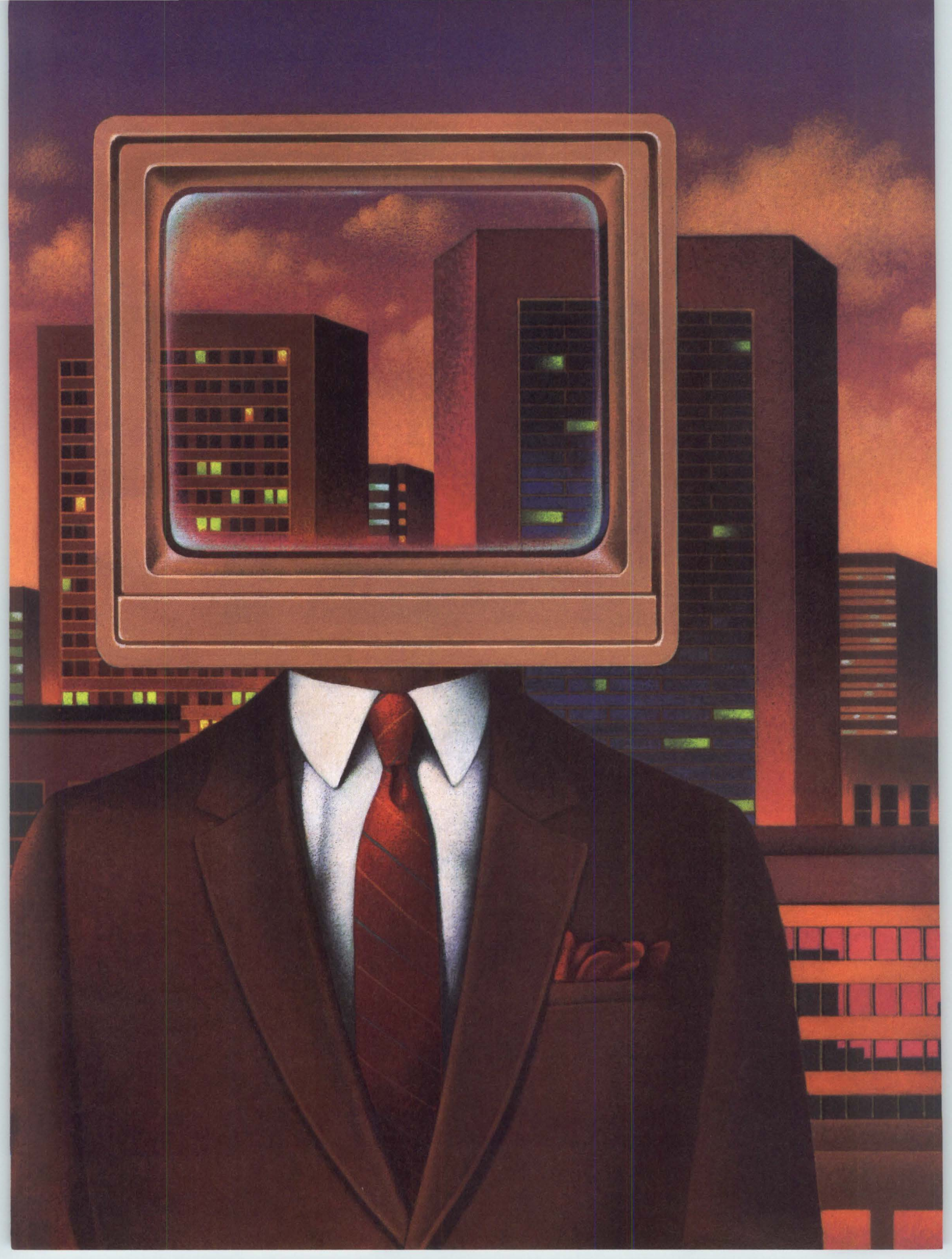
CIRCLE NO. 2 ON INQUIRY CARD

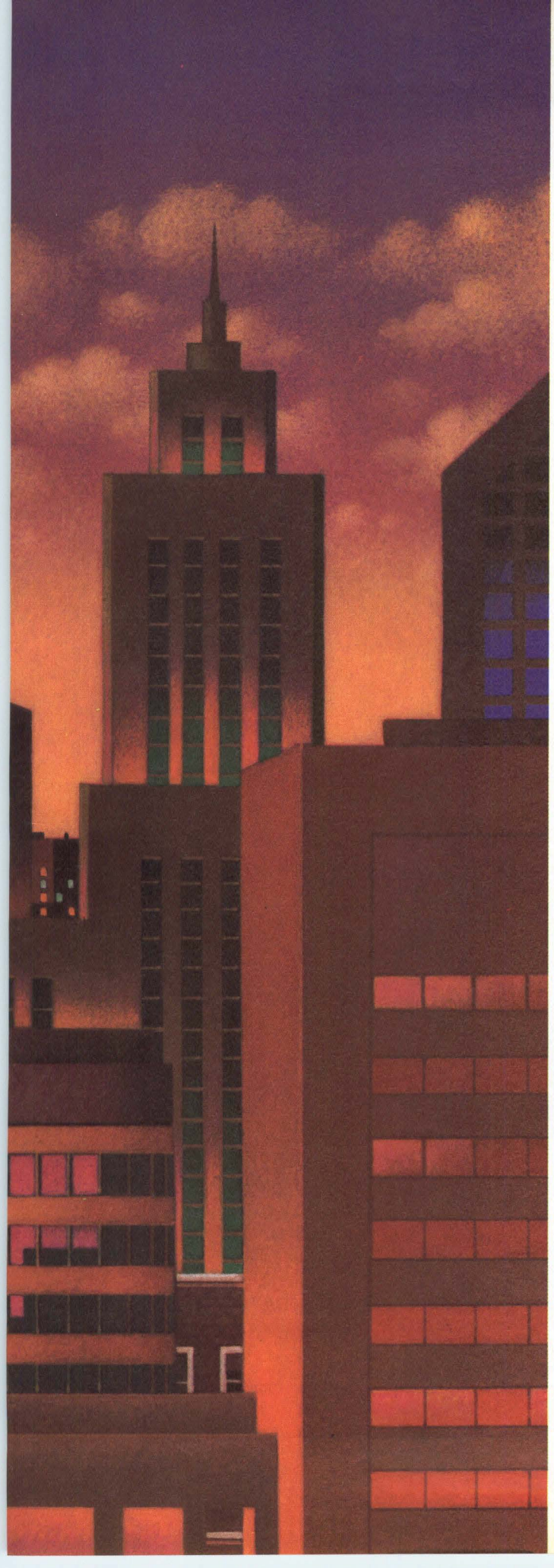
The Unplug.

An outlet for your frustrations.

When you're ready to expand, you simply run one cable from the last Unplug to the next. And you've hooked up 8 new users, without ever opening the computer cabinet.

SYSTECH





Introducing A Graphics Terminal That Turns Imagination Into Reality.

Your imagination sees a great idea long before your eyes do. In seconds, you can visualize every detail in clear, sharp images—something no graphics terminal has ever been able to do. Until now. Introducing the ForeSight Edition™ 4560 Tektronix 4010/4014 monochrome graphics terminal from Micro-Term. Finally, a graphics terminal to match your imagination step for step.

Think of the ideas you've had that just couldn't be drawn fast enough. Details were lost because your terminal couldn't keep up. The ForeSight 4560 can. No Tektronix or DEC-compatible terminal draws this fast. Its non-stop, high speed drawing rate of 2 million pixels per second assures you that a quick idea won't suffer because of a slow terminal.

Or a dull image. Your imagination doesn't create them and neither does the ForeSight 4560. Every image is extraordinarily clear and sharp on the overscanned, soft-white background, and the unique 20 x 20 dot character cell brings an unequaled level of resolution to your designs. And should you ever have a problem with the ForeSight 4560, consider it solved. The 2 year/ 90 day on-site warranty is the finest available and you may extend coverage to five years.

It takes more than superior technology to meet your needs. It takes imagination and the ability to solve the problems you face every day. It takes ForeSight.

Call Micro-Term to find out more about our entire ForeSight Edition series of DEC VT 220 and Tektronix 4010/4014 alphanumeric and graphics terminals. Toll Free: 1-800-325-9056.

MICRO-TERM

Solutions You Can See.
From The Company To Watch™

Micro-Term, 512 Rudder Road, St. Louis, MO 63026.
314-343-6515 TWX: 910 760 1662 FAX: 314-326-0052
Nationwide service available through TRW, Inc.

Regional Offices
San Francisco • Chicago • Boston

CIRCLE NO. 3 ON INQUIRY CARD

Hard Copy vs.

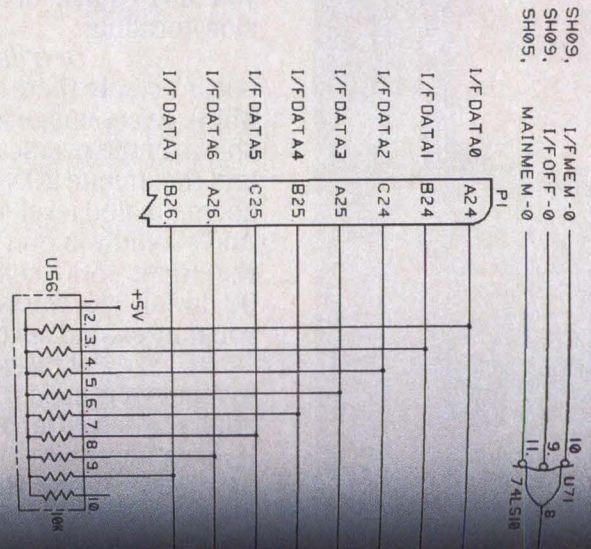
Easy Copy

Easy Copy

Easy Copy

Easy Copy

Easy Copy



The Honeywell Visigraph printer/plotter offers easy interface setup and page formatting, as well as:

• Programmable video interface (up to 1280 x 1024, 60 Hz noninterlaced) • 8-bit parallel interface (V-80) • A,B,A3 and A4 size drawings • 300 dpi monochrome thermal transfer printing • Fast plots (8.5 second A size) • Lightweight compact construction • Built-in self-test • Simple, clean loading • Prices starting from $7,950 • Attractive OEM terms

Contact Dan Winter for more information.
Honeywell Test Instruments Division
Box 5227, Denver, CO 80217-5227
(303) 773-4745

Special Offer Extended

Trade in your Versatec* V-80 and receive $1000 off a Honeywell Visigraph.

VISIGRAPH

Honeywell

Together, we can find the answers.

Honeywell

*Versatec is a trademark of Versatec, Inc.

CIRCLE NO. 4 ON INQUIRY CARD

Mini-Micro Systems

A CAHNERS PUBLICATION

VOL. XX NO. 3
MARCH 1987

PRODUCTS SPOTLIGHT

INTERPRETER

FEATURES

*DEC DIRECTIONS

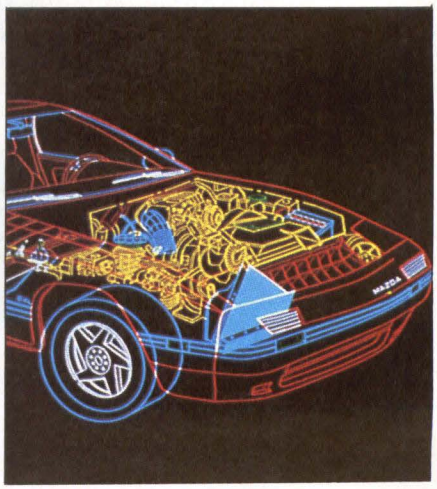
*Appearing in issues of subscribers who have DEC computers

DEPARTMENTS

Cahners Publishing Company • A Division of Reed Publishing USA • Specialized Business Magazines for Building and Construction • Computer/Technology • Electronics • Food/Packaging • Manufacturing Industries • Medical, Design & Publishing
MINI-MICRO SYSTEMS (ISSN 0364-9342) is published monthly with additional issues in May and November by Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington St., Newton, MA 02158. William M. Platt, President; Terrence M. McDermott, Executive Vice President; Jerry D. Neth, Vice President of Publishing Operations; J.J. Walsh, Financial Vice President/Magazine Division; Thomas J. Dellamaria, Vice President Production and Manufacturing; Edwin V. Burkholder, Group Vice President. Copyright 1987 by Reed Publishing USA, a division of Reed Holdings Inc., Saul Goldweitz, Chairman; Ronald G. Segel, President and Chief Executive Officer, 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; $80 in Canada and Mexico; $105 surface mail in all other countries; air mail surcharge, $45 (14 issues). Special HANDBOOK issues, $15. Single issues, $6 in the United States; $8 in Canada and Mexico; $10 in all other countries.

p. 27 . . . Hewlett Packard introduces customer-owned X.25 networks. Art design by Franson and Associates. Courtesy of Hewlett-Packard Co.

p. 55 . . . . . Clones target IBM



p. 79 . . . . Cards boost performance

STAFF

Vice President/Publisher
Donald Fagan

Chief Editor
George V. Kotelly

Executive Editor
Tim Mead

Managing Editor
James F. Donohue

Senior Editor: **David Simpson**
Senior Editor: **Doug Pryor**
Senior Editor: **Tim Scannell**

Senior Editor: **Carl Warren**
Irvine, (714) 851-9422
Senior Editor: **Mike Seither**
San Jose, (408) 296-0868

Associate Editor: **Jesse Victor**

Associate Editor/Research: **Frances Michalski**
Staff Editor/New Products: **Megan Nields**
Editorial Assistant: **Lisa Kramer**

Contributing Editors

Andrew Allison
Mini/Micro Computer
Product and Market Consultant
Raymond C. Freeman Jr.
Freeman Associates
Special Features Editor: **Wendy Rauch-Hindin**
Dix Hills, N.Y.
(516) 667-7278
Gene R. Talsky
Professional Marketing Management Inc.
Robert E. Peterson, Jr., Edward Teja
Freehold Corp.
Rick Dalrymple
CAP International Inc.

Editorial Production

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

Editorial Services

Terri Gellegos

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

Art Staff

Senior Art Director: **Mary Anne Ganley**
Art Director: **Cynthia Norton**

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

Production Staff

VP Production: **Wayne Hulitzky**
Director/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:** 18818 Teller Ave., Suite 170, Irvine, CA 92715. **Los Angeles:** 12233 W. Olympic Blvd., Los Angeles, CA 90064. **San Jose:** 3031 Tisch Way, San Jose, CA 95128.

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 Katie Pyziak, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., Box 5080, Des Plaines, IL 60018. Phone (312)635-8800.

THINK GIG.

No, Maxtor isn't announcing a gigabyte drive.

Not yet.

But consider this. In just four years, we've increased capacities in our 5¼-inch disk drive families from 140 MB to 800 MB.

So can gigabytes be far behind?

That's why now's the time to start thinking about what you could do with a gigabyte drive from Maxtor. Like open up new applications. New markets. And a devastating competitive edge.

But then, you can get those advantages from every Maxtor drive. Because each one offers the highest performance, highest capacity and lowest cost-per-megabyte in its class.

So don't just think gig.

Think Maxtor.

Maxtor Corporation, 150 River Oaks Parkway, San Jose, CA 95134, (408) 942-1700, TELEX 171074.

Sales offices: Austin (512) 345-2742, Boston (617) 872-8556, Orange County (714) 472-2344, New Jersey (201) 747-7337, San Jose (408) 435-7884.

Maxtor

Distributed by: Anthem Electronics, Inc., Lionex Corporation, Pioneer-Standard Electronics, Inc., Quality Components, Inc., Storex Corporation.

CIRCLE NO. 6 ON INQUIRY CARD

All these benefits make a lasting impression

Instant paper switching
The park function enables you to print cut-sheets while a continuous form remains loaded.

Makes friends with your computer
Epson FX/JX or IBM PC emulations plus parallel and serial interfaces ensure that the printers make friends with a range of computers and softwares.

Color graphics
The color capability, which is standard, highlights your text and business graphics.

View your lines
The view function permits you to inspect the last printed line without losing top-of-form.

Four paper paths
The different paper paths facilitate tear-off and bottom feed for special applications. A sheetfeeder is optional.

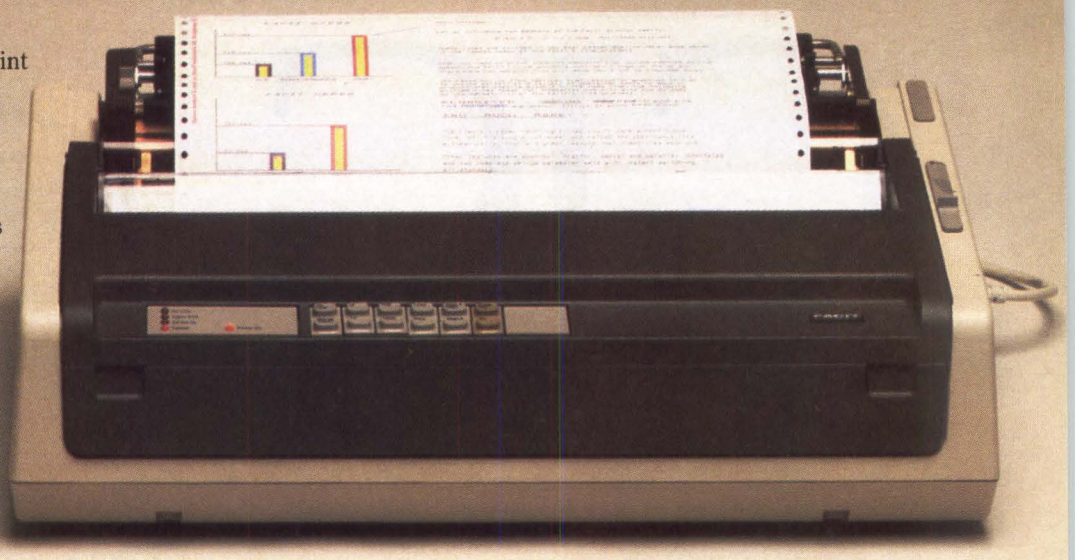
High Capacity
The C-line printers, with print speeds up to 400 cps, are built to take heavy workloads – 500 to 700 pages per day.

Automatic paper loading
The printer itself loads the paper for cut sheets and continuous forms.

Alternate between different set-ups
You can switch application – or even host – at the touch of a key.

Easy installation
Just answer the printed questions with the "yes" and "no" keys on the control panel.

IBM and Epson are registered trademarks

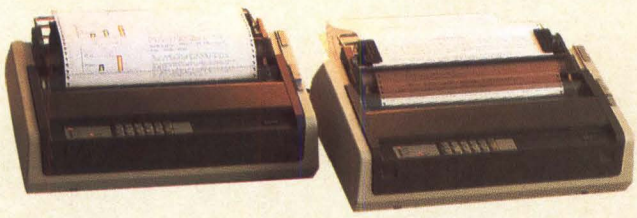


Your initial impressions may lead you to think that the main benefits of the Facit C-line matrix printers are their user-friendliness and printout functions

You're right – but there's more to it.

Quality and reliability are the essential features that permit the C-line printers to perform perfectly day after day, year after year. These are the really decisive benefits.

We think you'll agree.
In the long run.



Contact your nearest Facit representative for a C-line demonstration.

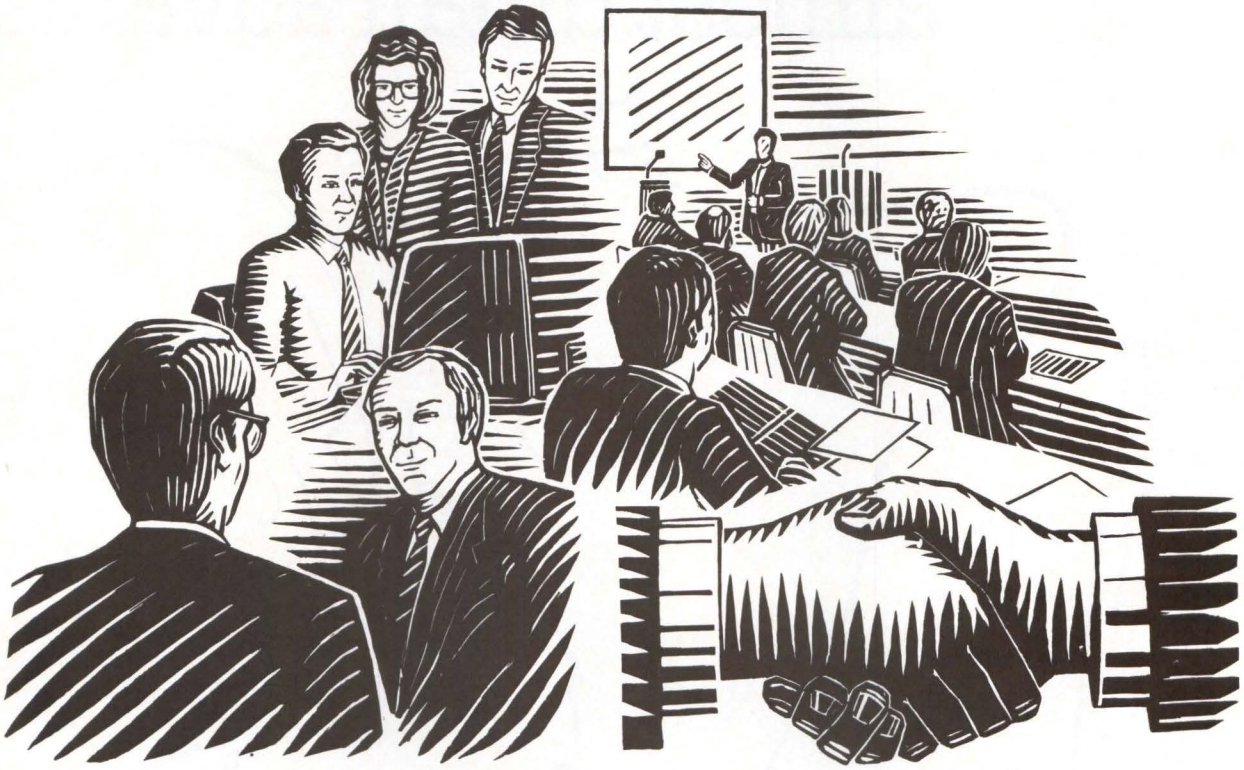
FACIT

Head Office: *Facit AB, S-172 91 Sundbyberg. Sweden. Phone: 46 8 764 30 00.* USA: *Facit Inc. P.O. Box 334, Merrimack. NH 03054. Phone: (603) 424-8000*

AUSTRALIA: EAI Electronics Associates Pty Ltd., 427-3322. *AUSTRIA:* Ericsson Information Systems GmbH, 0222-613 641. *BELGIUM:* Ericsson S.A., 02-243 82 11. *CANADA:* Facit Canada Inc., 416-825-8712. *CYPRUS:* LBM (Lillytos) Ltd 516 46 34. *DENMARK:* Facit A/S, 02-63 33 11. *FINLAND:* OY Facit, 90-420 21. *FRANCE:* Facit S.A., 1-4780 7117. *GREAT BRITAIN:* Facit 0634-40 20 80. *GREECE:* Computer Application Co. Ltd., 01-671 97 22. *HONGKONG:* Gilman & Co. Ltd., 5-893 00 22. *ICELAND:* Gisli J. Johnsen HF, 354-64 12 22. *INDIA:* Forbes Forbes Campbell & Co. Ltd., 22-20 48 081. *IRELAND:* Ericsson Information Systems Ltd., 75 30 93. *ITALY:* Facit Data Products S.p.A., 039-63 63 31. *JAPAN:* Electrolux (Japan) Ltd., 03-479-7570. *KOREA:* True Trading Co. Ltd., 2-783-3855-7. *THE NETHERLANDS:* Facit B.V., 3480-21784. *NEW ZEELAND:* Northrop Instruments and Systems, 501-801, 501-219. *NORWAY:* Ericsson Information Systems A/S, 02-35 58 20. *PORTUGAL:* Regisconta Sarl, 1-56 00 91. *SINGAPORE:* Far East Office Eqpts Pte Ltd., 745 82 88. *SPAIN:* Perifericos S.A., 4-57 90 81. *SWEDEN:* Ericsson Information Systems Sverige AB, 08-28 28 60. *SWITZERLAND:* Ericsson Information Systems AG, 01-821 59 21. *USA:* Facit Inc., (603) 424-8000. *WEST GERMANY:* Facit GmbH, 0211-61 090.

CIRCLE NO. 251 ON INQUIRY CARD

COMDEX/Spring '87 GETS YOU GROWING.



Go to COMDEX/Spring '87 and gear your business up for extra profits and growth. Because there you'll gather all the resources you need to make the most of the busiest selling season of the year.

Exhibits to grow on

COMDEX/Spring '87 unites you with the hottest selling products and services including hardware and software to automate and integrate offices. New tools and techniques for communications and networking. Advances in micro-to-mainframe links. Mass storage devices such as CD ROM. CAD/CAM and desktop publishing products. All the products and services to grow on.

Insight to grow on

With a Conference that includes the acclaimed Desktop Publishing and CAD/CAM Seminars, and special sessions on microcommunications and software challenges, COMDEX/Spring '87 shows you the workings of today's money machines.

Thousands of resellers from all over the country are gearing up for growth at COMDEX/Spring '87. Get your business growing by completing and sending in the coupon for attendee information.

Produced by The Interface Group, Inc., 300 First Avenue, Needham, MA 02194.

COMDEX®/Spring '87

June 1–4, 1987
Georgia World Congress Center
Atlanta, Georgia
It's time to get up and grow.

I want to get up and grow at COMDEX/Spring '87!

☐ Send me complete attendee information
☐ Send me exhibitor information.

Name_____

Title_____

Company_____

Address_____

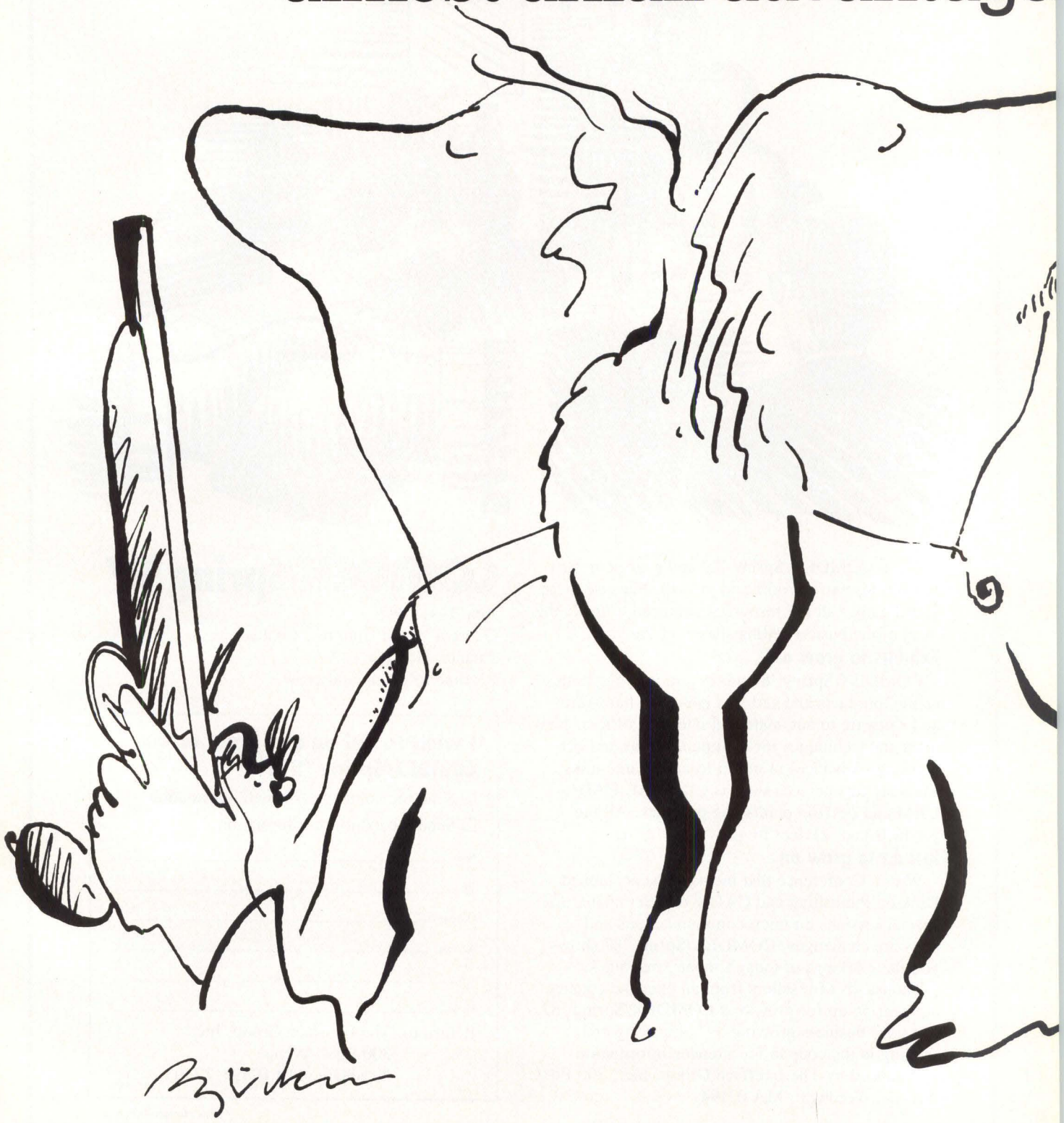
City_____ State_____ Zip_____

Phone ( )_____

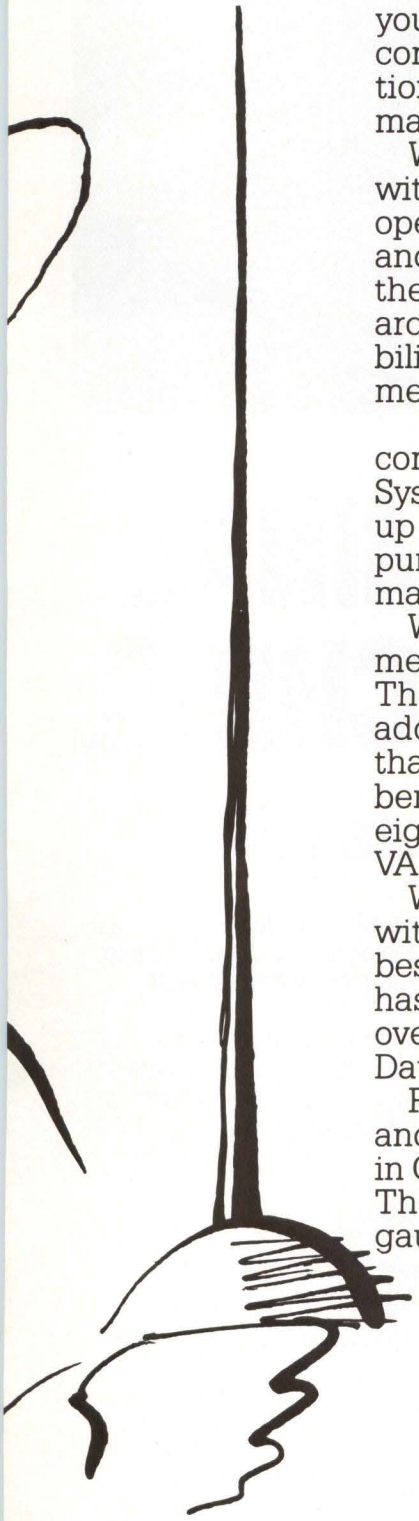
Return to: The Interface Group, Inc.
300 First Avenue
Needham, MA 02194–2720

MS- M/87

HP Precision Architecture gives almost unfair advantage.



you an



It's simpler, faster, more reliable and efficient than conventional computer architecture. And it delivers superior performance for less money. Which makes it a lot easier to meet the challenge from your competitors.

HP Precision Architecture can give you the edge right up the line, with complete software and communications compatibility from micros to mainframes.

We also designed in compliance with industry standards for networking, operating system, languages, graphics and data bases. Combine this with the advantages of an open system architecture. And you have the flexibility you need to keep your investment growing into the 21st century.

HP is the first major vendor to combine real-time and the UNIX* System V operating system. That opens up all kinds of possibilities in general purpose, scientific, engineering and manufacturing applications.

We're already shipping the first member of our new computer family. The HP 9000 Model 840 has a memory address space 128,000 times larger than the VAX architecture. And HP's benchmarks show that it delivers up to eight times the performance of the VAX 11/780. All for just $81,500.**

When you take on the competition with the Model 840, you'll have the best people in your corner. HP's support has again been rated Number One overall, according to the 1986 U.S. Datapro Survey.

For further proof, pick up the phone and call us at 1-800-556-1234, Ext. 160; in California 1-800-441-2345, Ext. 160. Then you'll be ready to pick up the gauntlet.

we never stop asking "What if..."

HEWLETT PACKARD

CIRCLE NO. 9 ON INQUIRY CARD

*UNIX is a registered trademark of AT&T in the U.S.A. and other countries. SVID Issue 1. **U.S. List Price. MS02701

SWITCHING TERMINALS. TERMINAL SWITCHING.

Get Connected With An Equinox Data PBX.

An Equinox Terminal Network lets you connect your terminal to any async RS-232 computer, modem or printer with a few keystrokes. No more cable swapping, A-B switches or moving between terminals.

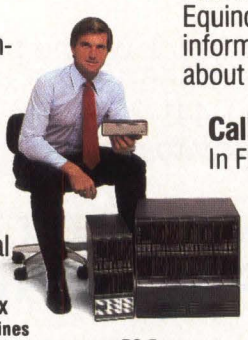
Low-Cost, Easy Installation.
Equinox terminal networks cost under $100 per connection and are protocol transparent. "Plug and play" wiring accessories, menu-driven configuration and on-line "HELP" make installation a snap.

Network Growth With Compatible Products.
Whether you have a few terminals or thousands, we have a Data PBX to create the right size Terminal Network for your needs. And all of our Data PBXs are fully compatible, so they can be expanded and networked to accommodate growth and protect your investment.

Find out why thousands of terminal users rely on an Equinox Data PBX for terminal networking. For more information, an on-site demonstration or to find out about our 30-day no-risk free trial program,

Call 1-800-DATA-PBX.
In Florida call (305)255-3500.
Equinox Systems Inc.
12041 S.W. 144th Street
Miami, FL 33186-6108.

Equinox is a registered trademark of Equinox Systems Inc.



MDX
8-16 Lines

DS-5
24-960 Lines

DS-15
24-1320 Lines

EQUINOX

Smart Connections For Dumb Terminals.

CIRCLE NO. 10 ON INQUIRY CARD

EDITORIAL

A STRONG MANAGEMENT TEAM

I am pleased to announce two important additions to *Mini-Micro Systems* management personnel. First, Don Fagan assumes leadership of the sales force as vice president/publisher, replacing S. Henry Sacks, who has resigned. A well-known and respected name in the computer industry, Don served nearly 20 years with *ComputerWorld* in increasingly responsible positions. Starting as a salesman, he demonstrated proficient sales skills that quickly advanced him to vice president of sales, and then to publisher. Under his direction, *ComputerWorld* ranked first in the U.S. trade press industry in total sales and in ad pages for more than a decade.

Second, Tim Mead joins the editorial staff as executive editor. He has admirably served Cahners Publishing Co. for the past seven years in senior editorial positions. Starting at *Electronic Business* as communications editor, Tim moved rapidly to managing editor, features. His next promotion placed him as editor-in-chief of *Business Computer Systems.*

Prior to his career at Cahners, Tim worked as a field editor for Fairchild Publications and as a general assignment reporter for a New Jersey daily newspaper. He holds a B.A. degree from the University of North Carolina.

Our best wishes for future personal and professional success go to S. Henry Sacks, founder and for the past 19 years, publisher of *Mini-Micro Systems*—originally titled *Modern Data.* Under his tutelage, *Mini-Micro Systems* grew quickly to become the leading monthly computer magazine in its niche.

By integrating the achieved knowledge and experience of the past with the newly gained sales and editorial expertise, *Mini-Micro Systems* now stands positioned to meet the future challenges of the ever-changing, fast-moving, computer system marketplace.

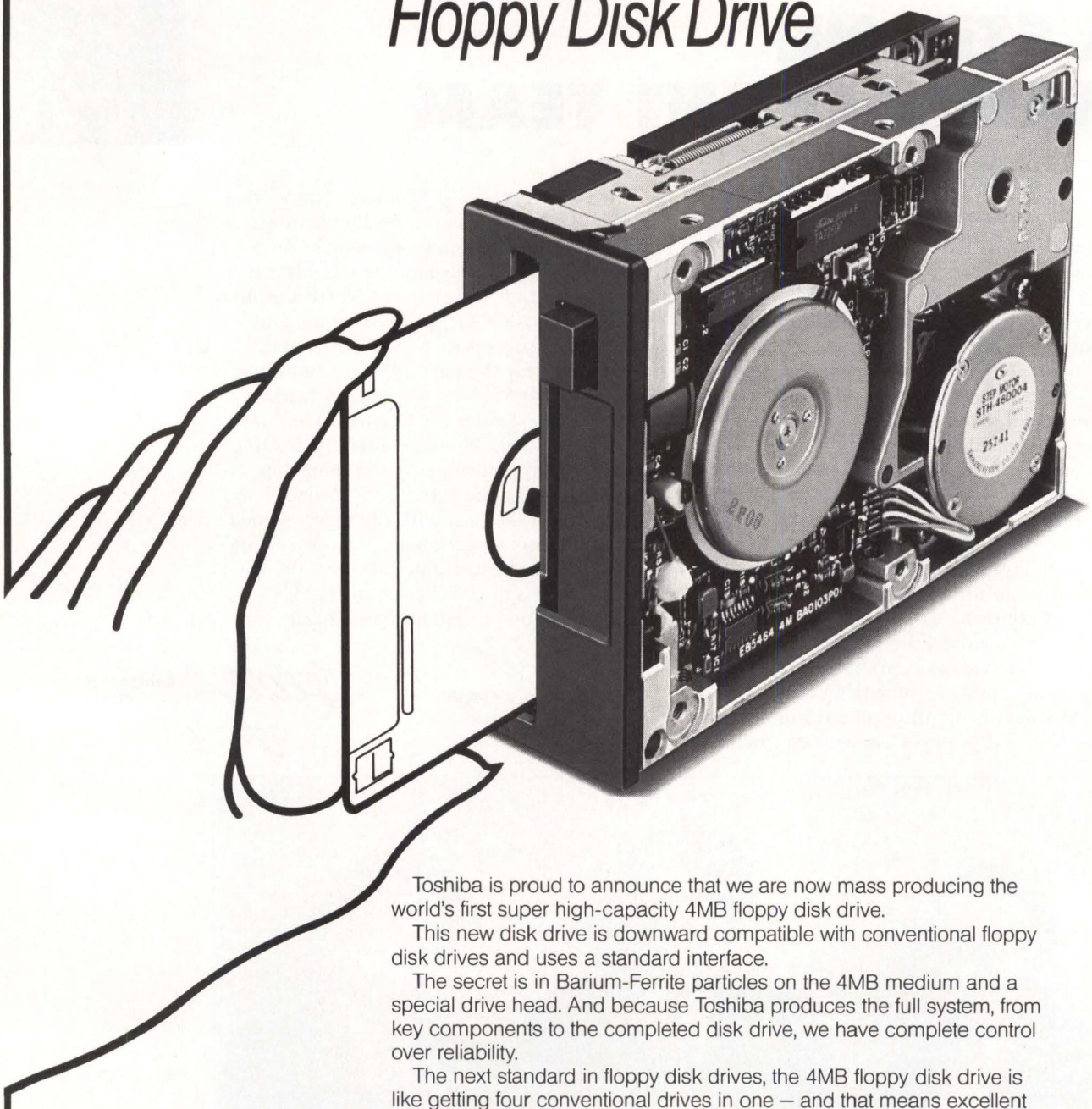
George V. Kotelly
Chief Editor

Introducing the new team: *George V. Kotelly, Chief Editor; Donald E. Fagan, Publisher; and Timothy G. Mead, Executive Editor.*

Introducing the World's First

4MB 3.5-Inch

Floppy Disk Drive



Toshiba is proud to announce that we are now mass producing the world's first super high-capacity 4MB floppy disk drive.

This new disk drive is downward compatible with conventional floppy disk drives and uses a standard interface.

The secret is in Barium-Ferrite particles on the 4MB medium and a special drive head. And because Toshiba produces the full system, from key components to the completed disk drive, we have complete control over reliability.

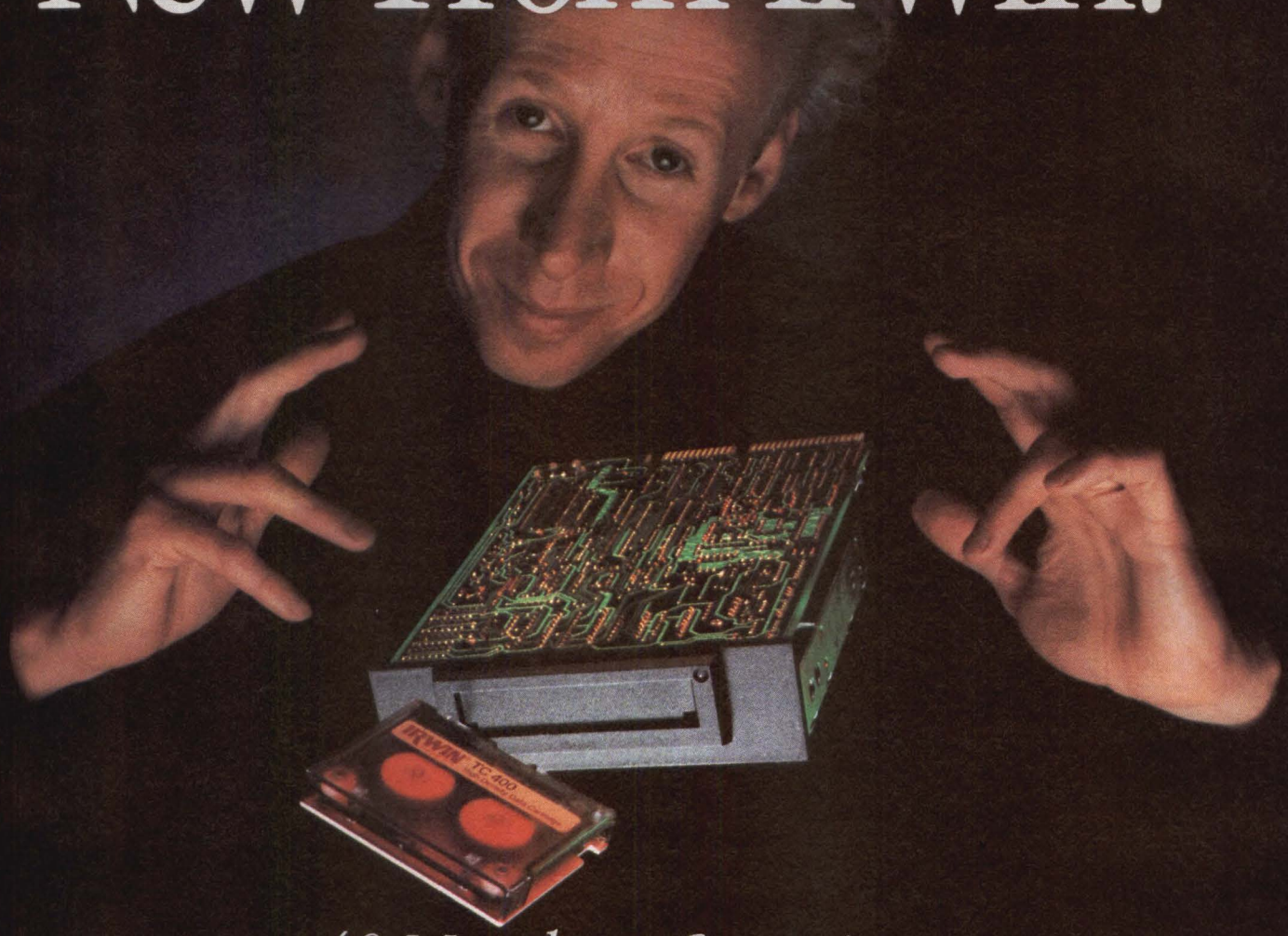
The next standard in floppy disk drives, the 4MB floppy disk drive is like getting four conventional drives in one – and that means excellent cost performance.

TOSHIBA

TOSHIBA AMERICA, INC. OEM Division, 9740 Irvine Blvd., Irvine, CA 92718 Tel: (714) 380-3000

CIRCLE NO. 11 ON INQUIRY CARD

New From Irwin!



40 Megabyte Capacity

Now . . . the new 40 megabyte, Model 145 Tape BACKUP™ System, plus five other new Irwin models, provide PC designers and system integrators unparalleled flexibility with the widest selection of tape backup peripherals available today.

Irwin offers these unique advantages.

- RELIABILITY — More than 150,000 sold.
- INTERCHANGEABILITY — The new Irwin Model 145 can read data cartridges created on any of Irwin's seven other Models.
- FLEXIBILITY — Both 5¼" and 3½" form factors, at 500 and 250 Kbits with capacities from 10 to 40 megabytes.
- MARKET ACCEPTANCE — The most frequently integrated tape backup peripheral available today.

Irwin BACKUP™ Systems

5½" FORM FACTOR	3½" FORM FACTOR	CAPACITY	DATA TRANSFER RATE	DATA CARTRIDGE
Model 145 **NEW**	Model 245 **NEW**	40 mb	500 Kbits	DC2000
Model 125 **ALREADY BEST SELLER**	Model 225 **NEW**	20 mb	500 Kbits	DC1000
Model 120 **NEW**	Model 220 **NEW**	20 mb	250 Kbits	DC2000
Model 110 **ALREADY BEST SELLER**	Model 210 **NEW**	10 mb	250 Kbits	DC1000

All Irwin models are available *NOW!*

When you choose a tape system manufacturer as your partner, consider Irwin Magnetics and the features that have made Irwin BACKUP™ Tape Systems the best sellers of the microcomputer industry.

Call us! We want to work with you.

1-800-BACKUP 1

IRWIN MAGNETICS

Irwin Magnetics
Box 7639
Mt. Prospect, IL 60068
1-800-BACKUP 1

CIRCLE NO. 28 ON INQUIRY CARD

2507112

LETTERS

SCANNERS REVISITED

To the editor:

Regarding your October 1986 article, "Datacopy builds scanning system for desktop publishing vendors:"

- Microtek Lab Inc. is located in Gardena, Calif., near Los Angeles, not in San Diego.
- Our MS-300A and the earlier MS-300 scan text and line art as well as complicated graphics and photographs. In fact, for a long time, we were the only ones to offer mixed mode scanning (line out/halftone text).
- We provide up to 52 levels of gray in our halftone images.
- We have offered a PC DMA interface (as well as serial and parallel mailbox interfaces) free for a year now.

Robert Hsieh, Ph.D.
Vice President, General Manager
Microtek Lab Inc.
Gardena, Calif. 90247

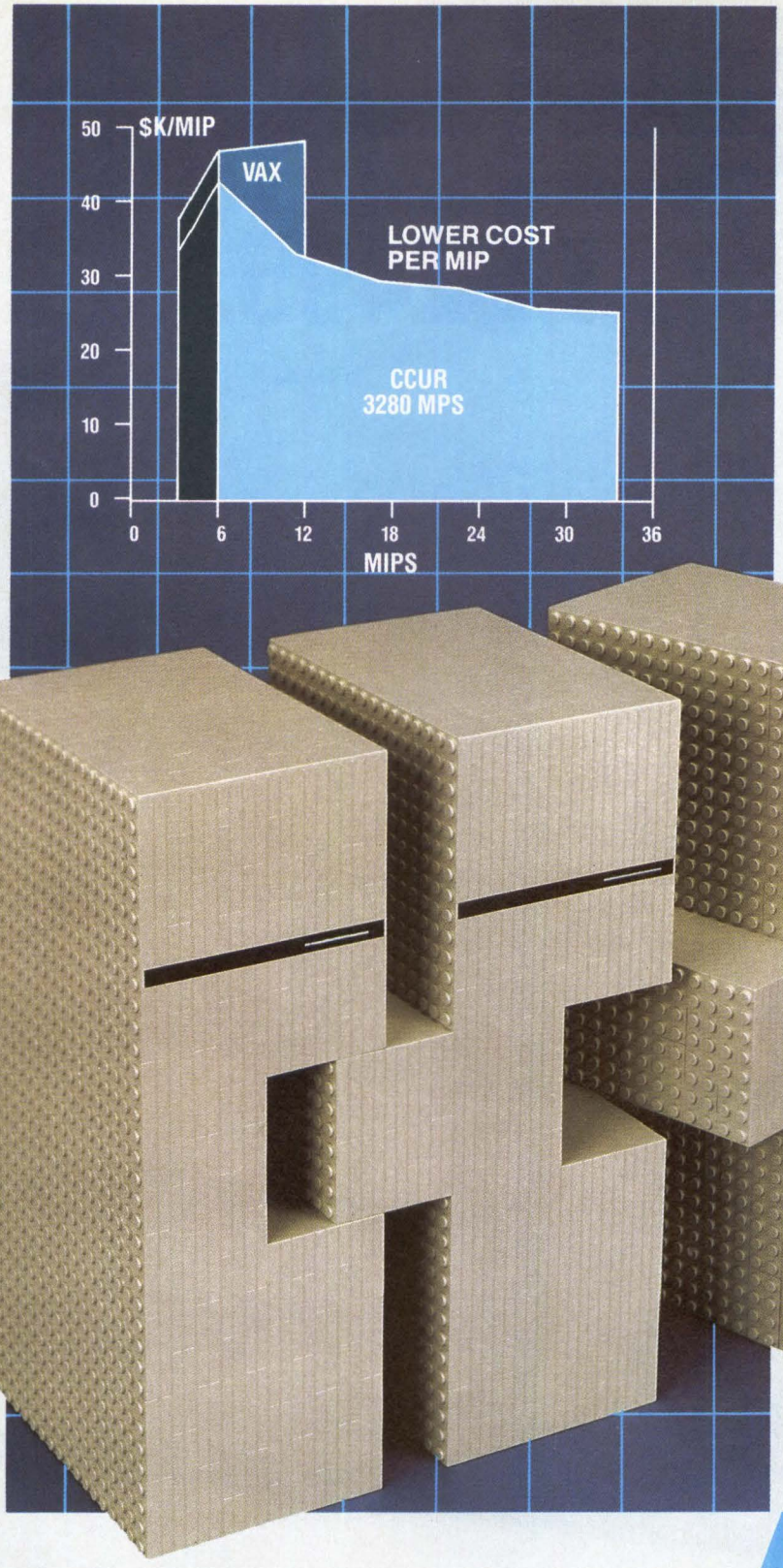
MISSING LISTING

To the editor:

Manzana MicroSystems Inc. introduced the first 3½-inch flexible disk drive for 5¼-based MS-DOS computers in early 1985, more than a year before IBM Corp. announced its 3½-inch drives. Manzana is currently the largest manufacturer of 3½-inch disk drive subsystems for IBM and compatible computers. I was, therefore, surprised to not see Manzana included in your listing of 3½-inch disk drives (MMS Fall Peripherals Handbook, November 14, 1986, Page 33).

Demand for our subsystems has grown steadily. Not only have we had a number of sizeable orders from large institutions—the U.S. Postal Service and Westinghouse Electric Co.—but our dealers have reported increased demand for our 3½-inch upgrades. Manzana offers a comprehensive line of 3½-inch external and internal drive systems.

David L. Gluck
President
Manzana MicroSystems Inc.
Goleta, Calif. 93117



Plug-In Parallel Processing

HOW TO BUILD A REAL REAL-TIME PROCESSING SYSTEM

The best place to start is with Parallel Processing from Concurrent Computer Corporation. You get outstanding price/performance from a unique system architecture with an event-driven, real-time operating system that maximizes throughput, response and sheer computational power.

Power and Growth

Concurrent Computer Corporation gives you all the power you need today and the ability to plug-in more when you need it. Without the high cost of replacing hardware or software.

Our flagship Model 3280 MPS lets you start at 6 MIPS and grow up to 33 MIPS just by plugging in additional processors. There's no need to reprogram; no obsolescence of your existing hardware.

Computers With A Future

There are a lot more reasons why Parallel Processing makes sense. Like its built-in reliability. Like the way it accommodates I/O. The low life-cycle cost. They're the systems with a built-in future.

Want more?

1-800-631-2154

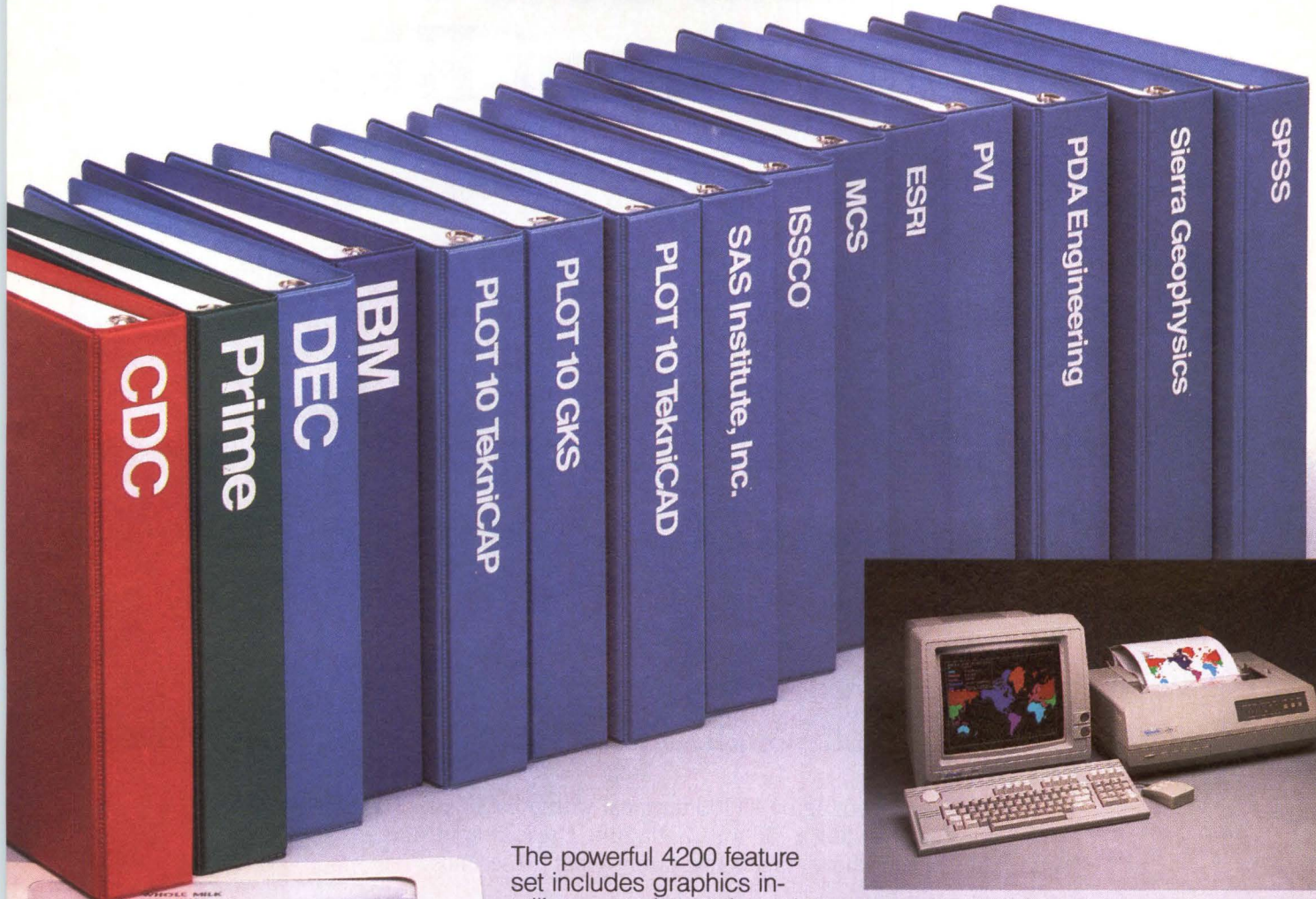
or write us at

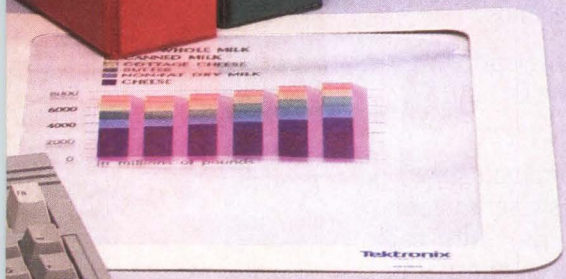
Concurrent Computer Corporation
2 Crescent Place
Oceanport, NJ 07757

Concurrent Computer Corporation

CIRCLE NO. 14 ON INQUIRY CARD

YOU'VE SEEN TEK GRAPHICS PERFORMANCE LIKE THIS. BUT NOT AT $2495.





The industry graphics standard offers a dramatic price/performance breakthrough with the Tektronix 4200 Family of Intelligent Color Graphics Terminals.

Equally dramatic are the capabilities you gain for your Data Analysis, CAD and Shop Floor/Manufacturing applications.

The powerful 4200 feature set includes graphics intelligence to boost throughput of those graphics applications. And with local segments, you can use such popular features as true zoom and pan to view data well beyond display resolution.

To take full advantage of those features, you'll find 4200 compatibility with the world's leading software and hardware vendors. And because the 4200 Series are members of the broad Tek product family, your investment in that software, hardware and training time stays protected now and in the future.

You can bring your 4200-applications to life by adding a Tek Color Ink-jet Printer. That enables high-resolution color hardcopy output on paper or transparencies. To further enhance productivity, there's 4200 background copy that allows system use even while you're printing.

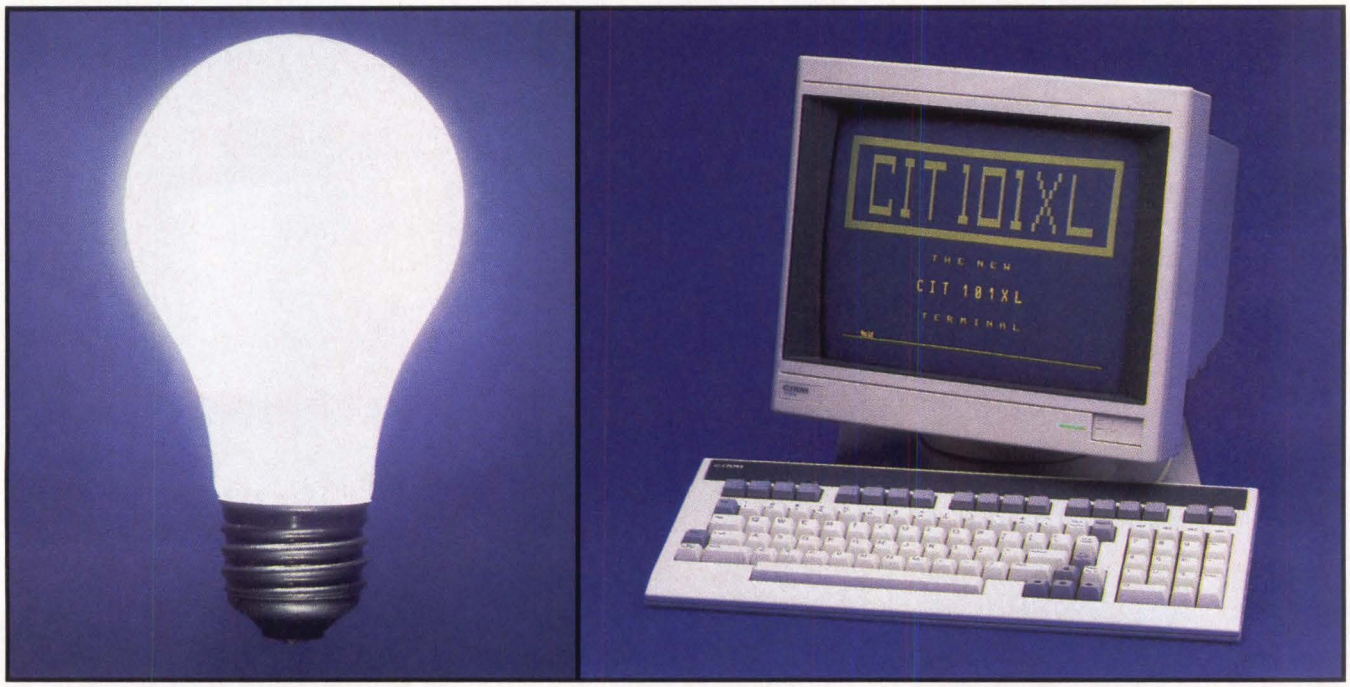
To learn more about the 4200 Family of Intelligent Color Graphics Terminals, contact your Tek representative. Or call, 1-800-225-5434. In Oregon, 235-7202.

TEK GRAPHICS PROCESSING SYSTEMS.

Tektronix®
COMMITTED TO EXCELLENCE

CIRCLE NO. 15 ON INQUIRY CARD

Two Great 60-Second Replacement Kits.



Replacing your aging VT100 terminal with our CIT 101XL is as easy as changing a 100 watt light bulb. Because from start to finish, the whole process takes only about 60 seconds.

The CIT 101XL is not only 100% compatible with your old VT100, it's compatible-plus. And that's where the CIT 101XL really starts to shine.

With some pretty bright features that C. Itoh terminals have become famous for. Like a big 14-inch tilt-and-swivel screen, large easy-to-read characters in a 7 x 11 dot matrix, multi-page memory and a choice of soft white, amber or green phosphors.

But don't think we re-invented the light bulb completely. While the CIT 101XL keyboard retains that comfortable VT100 layout and functionality, we improved it by arranging the cursor keys into an inverted "T" and adding 16 function keys.

The CIT 101XL. It's time to shed some new light on the old.

For more information on the CIT 101XL terminal, contact CIE Terminals, a C. Itoh company, 2505 McCabe Way, Irvine, CA 92714; or call (714) 660-1421 or our toll-free number (800) 624-2516.

VT100 is a trademark of Digital Equipment Corporation.

C.ITOH
CIE Terminals

CIE Terminals, Inc., 2505 McCabe Way, Irvine, CA 92714 • (714) 660-1421 (800) 624-2516

CIRCLE NO. 16 ON INQUIRY CARD

BREAKPOINTS

GRAPHON UNVEILS DEC/TEK COLOR TERMINALS AT NCGA

GraphOn Corp., Campbell, Calif., invades the color market with its new GO-400 line of graphics and alphanumeric terminals. Like their monochrome cousins, these new terminals provide full 132-column emulation of Digital Equipment Corp.'s VT220, as well as Tektronix Inc.'s 4205, 4207 and 4111. Selling for $2,995 to $5,995, the G-400 line supports DEC's Remote Graphics Instruction Set (REGIS) at a resolution of 800 by 520 pixels. The terminals use Sony Corp. of America's 14-inch Trinitron monitor and the Texas Instruments TMS34010 dedicated graphics processor. GraphOn plans to show them for the first time at the National Computer Graphics Association conference March 22-26 in Philadelphia.—*Mike Seither*

MICROSPEED ANNOUNCES 3-D I/O DEVICE

Look this month for FastTRAP—Microspeed Inc.'s (Fremont, Calif.) 3-D pointing device that allows users to enter X-Y-Z axis data into CAD/CAE and other graphics applications. The combination mouse, track ball and third pointing-axis device emulates current mouse hardware. It features a 200-pulse-per-inch track ball and finger wheel and three input buttons for menu selection. FastTRAP will be priced at $149, with OEM discounts available.
—*Megan Nields*

TEK TREKS INTO PC TERRITORY

Augmenting its venerable line of graphics terminals and workstations, Tektronix Inc. this month enters the high-end IBM Corp. PC graphics market with an $1,800 graphics board, a $950 high-resolution monitor and two terminal-emulation packages. The EGA-compatible PC4100 graphics board utilizes the 1-MIP, 50-MHz Texas Instruments TMS34010 processor. The 13-inch, 640-by-480-pixel monitor sports a 0.26-mm dot pitch and a cylindrical surface. Linking the system into mainframe-level graphics, the PLOT 10 PC-05 ($495) and PC-07 ($995) packages allow PC users to emulate Tektronix 4105 and 4107 terminals. The Beaverton, Ore. manufacturer aims the system—collectively called the PLOT 10 Advanced PC Graphics family—at CAD applications.
—*Dave Simpson*

WORKSTATION VENDOR JUMPS INTO VMEBUS BOARD BUSINESS

Sun Microsystems Inc., Mountain View, Calif., is broadening its product mix beyond workstations. In late March the company is expected to announce that it is entering the VMEbus board business. Sun has been building custom boards for its customers—OEMs and the federal government—but has never sold them on the open market. The first round of products includes a 20-MHz, MC68020-based CPU card; an Ethernet controller; a video interface; and a 4M-byte memory board.—*Mike Seither*

MAKES A BIG EFFORT TO GET SMALL

Digital Equipment Corp., Maynard, Mass., came a step closer to attaining CEO Ken Olsen's lofty goal of down-sizing the VAX minicomputer by a factor of 100,000-to-1 recently when it unveiled its smallest system yet, the MicroVAX

2000. Although measuring about the size of a toaster oven, the system packs up to 6M bytes of memory on a double-sided, surface-mounted board. It has a maximum disk storage of 142M bytes and 14 custom chips, manufactured by DEC, to control disk and graphics functions. The system, available for delivery within the next 30 days at a base price of about $10,000, was introduced as DEC shipped its 100,000th VAX system—to the Standard Oil Co. in Dallas. *— Tim Scannell*

SKY COMPUTERS CAUGHT IN VORTEX OF ACTIVITY

On March 9, Sky Computers Inc. of Lowell, Mass., a leading supplier of board-level array processors, will make a heady claim: near supercomputer performance for IBM Corp. PC/ATs and Multibus II, NuBus and VMEBus workstations. For less than $10,000 per single-slot board (PC/AT version), system integrators and OEMs in the technical/engineering workstation market can pick an arithmetic processor from Sky's Vortex line. The boards, with vectorizing capability, boost speeds of 20 MFLOPS in 32-bit mode and 10 MFLOPS in 64-bit mode. According to the company, Vortex products, when designed into high-end workstations from Apollo Computer Inc., Digital Equipment Corp., Sun Microsystems Inc., et al, will close the performance gap between them and minisupercomputers. Vortex for the PC/AT and Mulitibus II and NuBus systems will be available 60 days after receipt of order; for the VME, in the fourth quarter.—*Doug Pryor*

PUTS MIPS MUSCLE INTO PARALLEL PROCESSING

Although barely three years old, Encore Computer Corp., Marlboro, Mass., has latched onto what president and CEO Jim Pompa calls the technical wave of the future: general-purpose parallel processing. This type of processing employs super, high-performance workstations—not laboratory tools such as connection machines and butterfly architectures. In fact, Encore recently announced its official entrance into the parallel-processing market at the Uniforum conference. According to Pompa, Encore has been tapped by the Defense Department's Defense Advanced Research Planning Agency (DARPA) to develop a 1,000-MIPS processor within three years.—*Tim Scannell*

BUILDERS OF TOMORROW'S COMPUTERS SHOULD FOCUS ON STANDARDS

The future of computing can be summed up in four words, according to C. Gordon Bell, one of the architects of Digital Equipment Corp.'s VAX computer and presently with the National Science Foundation: "UNIX and open architectures." Bell noted that, at a recent meeting sponsored by the NSF, six supercomputer manufacturers and representatives from up to 20 universities agreed to implement UNIX as a standard in large-systems design. "UNIX as a standard and not as an option is essential," he said. "One cannot build a hierarchy without a standard." Bell also said that the great benefit of an open-systems' standard is that, when vendors and users can agree, systems development can proceed to the next generation. Standing in the way, however, he said, are problems with security, with network speed—and with the installed base of older systems.—*Tim Scannell*

27mW and you're ready to roll.

27 milliwatts. That's all it takes for standby mode on our FD-35 Series 3.5 inch floppy disk drives with the Power Saver option. And, in operation, they consume a mere 1.72 watts average at read/write, and 2.90 watts average at seek. These just happen to be the lowest numbers for any 3.5 inch drive.

This remarkable feat is made possible by the use of new custom LSI chips with CMOS technology for more efficient control over all the drive functions.

For added reliability and accuracy we shortened the gap between the band actuator and the head and included a more precise head position mechanism. This means stable reading and writing, even at high track densities.

And, as if all that weren't enough, we've thrown in special aluminum RF shielding to keep out noise pollution.

With the growing need for more portable systems, 27 milliwatts is a load anybody can carry.

Built To Fanatical Standards. **TEAC**®

INSTRUMENTATION AND COMPUTER PRODUCTS DIVISION, 7733 TELEGRAPH ROAD, MONTEBELLO, CA 90640

East (617) 475-7311 South/Midwest (312) 351-9124 Rocky Mountain (602) 242-4025 (303) 337-6329 (801) 532-2111

Northwest (408) 727-1427 Southern California (213) 726-0303

The Workgroup Server™ Family:

There are only three primary colors. But by mixing and matching these three colors, an artist can create any color in the rainbow. This is the principle we've used in developing our computer solutions.

Standards. Enhancements. Connectivity. Convergent has put them all together in a family of Workgroup Servers that give resellers the leverage to solve a wide variety of specific problems.

We started with industry standards for hardware, operating systems, networking and software. Things like UNIX* System V, Motorola's 68000 microprocessor family, and VME and SCSI buses. The standards.

Then we enhanced these standards to give your customers increased performance and productivity. The simple windowing interface to UNIX is one example. Our fully integrated office automation package is another.

And finally, we went one more step and connected our Workgroup Servers to a wide range of computers

Workgroup Server is a trademark and Convergent is a registered trademark of Convergent Technologies, Inc. UNIX is a trademark of AT&T. IBM is a registered trademark of International Business Machines Corporation. Apple and Macintosh are registered trademarks of Apple Computer Corporation.

CIRCLE NO. 18 ON INQUIRY CARD

Where great systems converge.

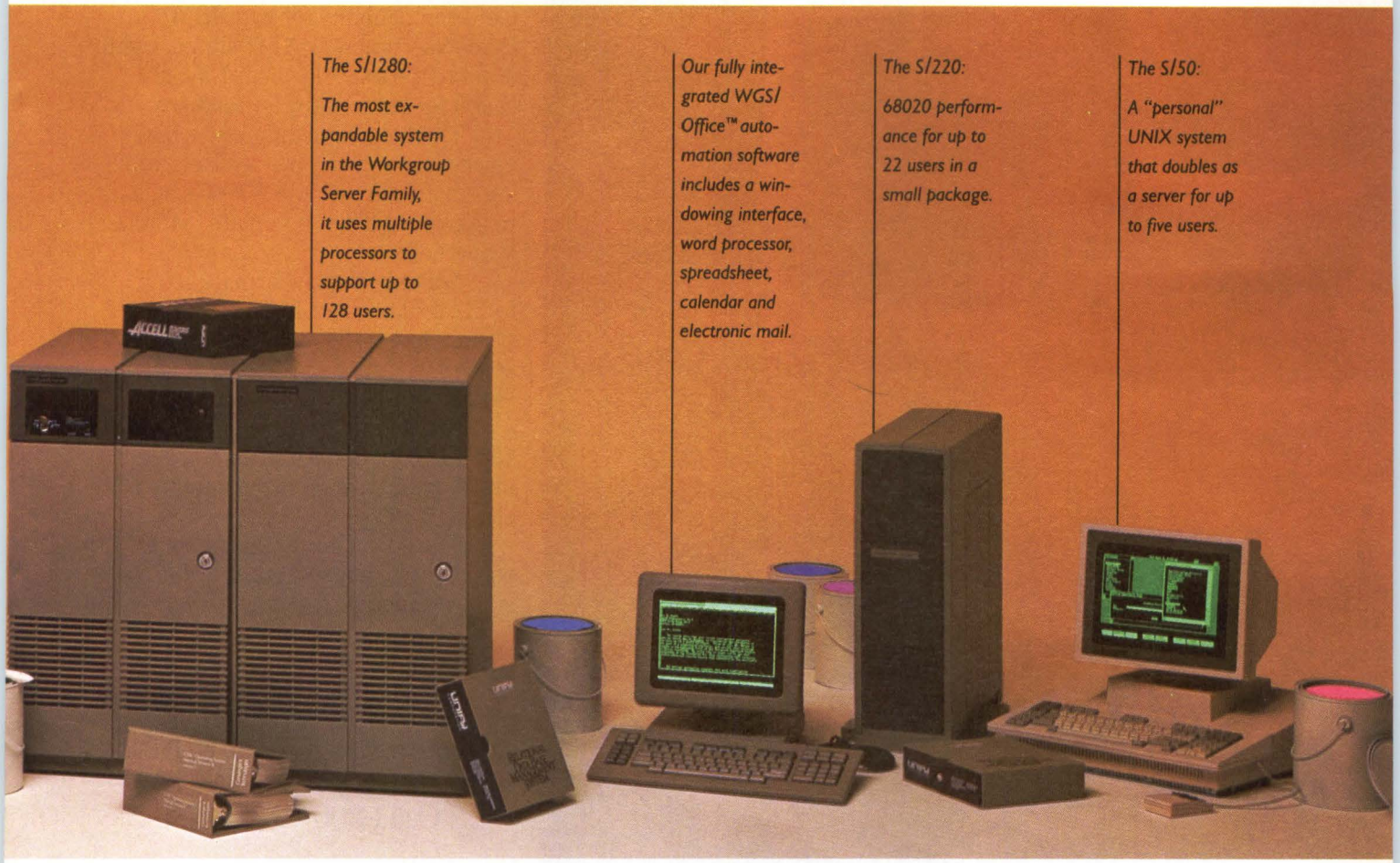
from other vendors. Including IBM* PCs and compatibles, Apple* Macintoshes,* other UNIX-based systems and IBM minis and mainframes.

Sound interesting? There's one more thing.

Convergent offers a comprehensive VAR program to complement this strong product offering. Featuring the margins and support services you'd expect from a company exclusively dedicated to resellers.
With no cross-channel conflict.

Standards, enhancements, connectivity and a great VAR program. To find out more about these areas of opportunity, call us today at 1-800-832-2255, ext. 296. In Europe, ring 44-3444-11707. Or write us: Convergent Technologies, 2700 North First Street, San Jose, CA 95150-6685, Mail Stop 10-015.

We'll help you find the end of the rainbow.



THE WORKGROUP SERVER FAMILY

	S/50™	S/120™	S/220™	S/320™	S/640™	S/1280™
Max Users	5	12	22	32	64	128
Max RAM	2 MB	5 MB	5 MB	16 MB	64 MB	24+ MB
Max Disk Storage*	80 MB	140 MB	280 MB	4.0 GB	4.0 GB	6 GB
Technology	10 MHz 68010 CPU	12.5 MHz 68020 CPU	12.5 MHz 68020 CPU	12.5 MHz 68020 CPU	25 MHz 68020 CPU	4x16.67 MHz 68020 CPU
MIPS	.75	2.0	2.0	2.0	4.25	8.8

*storage listed in unformatted capacities

Convergent

When great ideas converge, great products emerge.

The single best way to turn your PC-AT into a multi-user system.

Introducing the Wyse WY-60.

Now there's a perfectly compatible, reliable, economical, Wyse way to get multi-user mileage from your PC-AT. Wyse WY-60 terminals give you complete compatibility for your IBM Personal Computer AT systems, right down to the exact keyboard layout, character set and display features.

The only thing different is how much cleaner and more readable your information is with the WY-60's high resolution and flat, non-glare, 14" tilt/swivel screen.

Multiple display formats go up to 132 columns and 44 lines on one screen, to get the most out of applications such as Multiplan and WordStar.

And a 512-character downloadable soft font is also there when you need mathematical symbols or customized character sets.

The adjustable arm is optional, and you can choose a green, white or amber screen.

No wonder we ship more terminals than anybody but IBM.*

Call toll-free or write, today, for more information. Wyse Technology, Attn: Marcom Department 60-AT, 3571 N. First St., San Jose, California 95134.

Call 1-800-GET-WYSE

WYSE

YOU NEVER REGRET A WYSE DECISION.

HP's new line on connectivity: customer-owned X.25 networks

Mike Seither, Senior Editor

System integrators, network managers and data center professionals charged with masterminding corporatewide communications networks are caught between a rock and a hard place. Point-to-point connections, the rock, often mean an inflexible arrangement of costly leased lines that provides only limited connectivity. IBM Corp.'s Systems Network Architecture (SNA), the hard place, offers limited connectivity in multivendor environments.

That's how strategic planners at Hewlett-Packard Co. view the communications options available today. Their response is a repositioning of the company's AdvanceNet system and an array of standards-based products that will tie together an entire organization: engineering labs to manufacturing to regional sales office to business operations to branch offices.

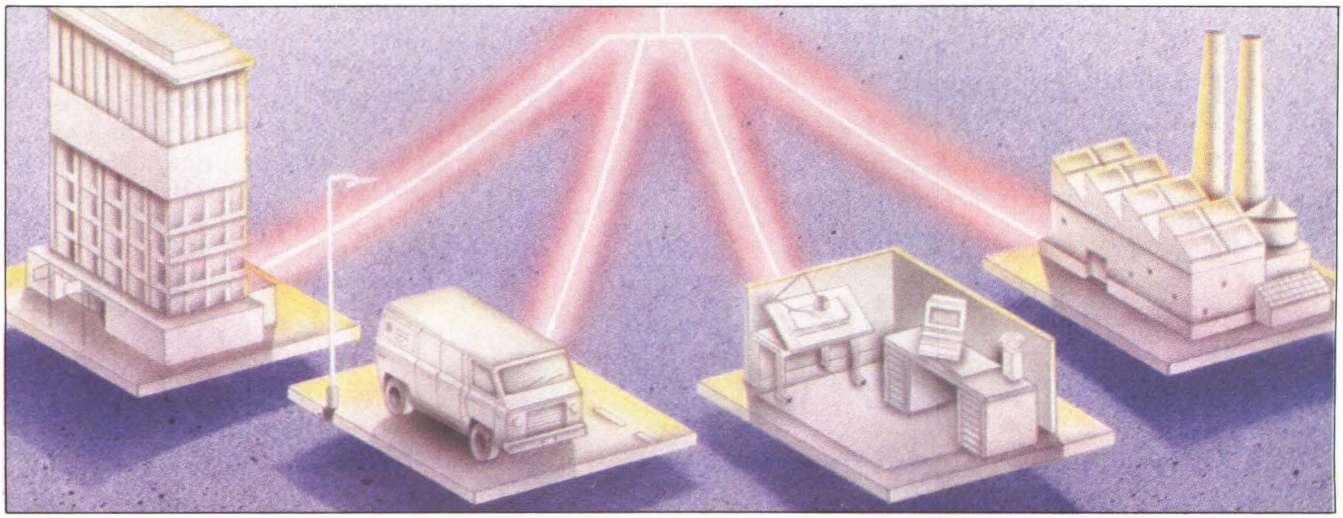
The tune Hewlett-Packard is singing is a variation on an old theme—X.25. Like many vendors, HP has long supported the X.25 interface as a way for its computers to communicate with each over long distances through public packet-switched networks. But now the company says it has acquired enough expertise, and developed a large enough product portfolio, that it can design, set up and maintain private X.25 networks. Compared with point-to-point connections over leased lines, private wide area networks (WANs) can cut data transmission costs 25 percent to 50 percent, HP says. Moreover, the company claims that private X.25 networks offer customers a higher degree of reliability than public telephone lines and more control over such things as recovering from errors and balancing traffic on circuits.

Perhaps most important, HP says it can put together a WAN that allows not only its computers to coexist but also those of other vendors, including IBM Corp. and Digital Equipment Corp. Such a network can be had for as little as $100,000, says Willem Roelandts, general manager of HP's Information Networks Group in Cupertino, Calif. That kind of barebones system would include three switching nodes for hooking up about 60 devices and a network-management system built around an HP 9000 technical workstation. From there the sky is the limit; large corporatewide networks can cost several million dollars.

Looking for a new image

HP unveiled its multivendor networking strategy in February just before its annual briefing for industry analysts. That announcement, which included 13 new products and services and a definitive statement about the company's plans for connectivity, is something of a turning point for the $7 billion electronics giant. Computers and instruments—not networking—have been the stuff of HP's reputation.

Indeed, both IBM with SNA and DEC with its DECnet have overshadowed HP in the WAN arena. That, in



spite of the fact that HP has an installed base of some 8,000 networks connecting 40,000 nodes through its proprietary set of Distributed Systems Network (DSN) protocols.

"HP has allowed DEC to get a reputation as the premier network vendor," says Sandy Gant, an analyst with InfoCorp., a Cupertino, Calif., market research firm. "While their approaches may be different, the deliverables are, in fact, not that far apart."

Other analysts agree about the image problem HP has built for itself. "They've certainly never been known for their networking solutions," says analyst Doug Gold of International Data Corp., Framingham, Mass. "This [X.25] strategy is very smart. It should help HP in the office-automation market, which they've been trying to break into for three or four years."

Searching for standards

Company officials seem to have no problem accepting this view of history, and in fact appear quite eager to begin writing some new chapters. John Young, HP's president and chief executive officer, calls the recent announcements the most significant ever made by HP in the area of computer interconnection. Declares Roelandts, the man in charge of overseeing the new HP program: "We haven't had the recognition in the marketplace [for networking], but with our capabilities now, that will change."

Those capabilities, to some extent, are a result of HP's finding new ways —through product modifications and marketing programs—to sell existing equipment. At the same time, the company has marshalled a small army of networking specialists to help customers worldwide define their needs. HP is also reiterating its support for networking standards, such as the Open Systems Interconnection (OSI) model put forth by the International Standards Organization.

While the OSI specifications are still being ironed out, HP has decided to move away from its DSN protocols, although it will still support customers who use them. Instead of DSN, the company is backing ARPAnet, the networking scheme

adopted by the Department of Defense Advanced Research Agency (DARPA) and in wide use throughout universities and military installations. HP is betting that the OSI will bear a strong resemblance to ARPAnet, says Roelandts. Right now, he adds, about 70 computer vendors support ARPAnet, and HP is working to support them all. The company has already made sizable inroads toward that end by being compatible with the ARPAnet protocols that the Wollongong Group Inc. has ported to some 20 different vendors' systems.

In another move towards standards, HP says it will support the Network File System which was developed by Sun Microsystems Inc. and which is quickly becoming a de facto standard.

In a few cases HP has improved older gear to make it easier for network owners to use. For instance, the HP 2334A Plus packet assembler/disassembler (PAD) and statistical multiplexor operates 25 percent faster than earlier models. Thanks to a new default mode, users can configure the system themselves and save an HP installation fee. The HP2334A Plus lists for between $2,800 and $5,350, depending on the number of ports (four, eight, 12 or 16).

There are other examples of improving on the old for a new class of customer. With the addition of a new $350 statistical-software package, for example, the existing HP 4952A protocol analyzer can be used to troubleshoot X.25 and SNA networks at the link level. Similarly, the HP 4953A protocol analyzer can be modified for $1,200 to detect network degradation.

Not all of HP's X.25 WAN solution comes from in-house. The company has OEM relationships with a number of other manufacturers to fill in the blanks. For X.25 switching nodes, HP is relying on M/A-COM Telecommunications Inc., Germantown, Md. For broadband to baseband conversion—getting information from workgroups into a companywide network—HP has turned to Ungermann-Bass Inc., Santa Clara, Calif. For network design tools to determine the least expensive and most efficient way to configure networks, HP uses both

IBM PC- and HP Vectra-compatible software developed by Connections Telecommunications Inc., West Bridgeport, Mass.

To tie it all together physically, HP has a newly announced Site Wire program, based on AT&T Co.'s PDS wiring scheme. This calls for a coaxial broadband cable as the networking backbone. An integral part of this approach is HP's support of Starlan, a 1M-bit-per-second local area network that runs over unshielded twisted telephone lines. HP is recommending Starlan as an inexpensive way to wire office environments. The IEEE approved the Starlan specifications (802.3) last year.

The other major pieces of HP's networking strategy revolve around four basic services: design, preparation, installation and maintenance. These services, coupled with equipment supplied by HP, in effect give large system integrators a turnkey approach to networking without a need for third-party vendors, says Roelandts.

HP believes there will be a growing market for private X.25 packet-switched networks, particularly within Fortune 100 companies. Research that HP has conducted shows that in 1985 there were 95 such privately owned networks. By 1994, the research indicates, there will be more than 1,000 networks worldwide. Hardware sales alone for PADs, switches and network control centers are forecast to be about $1 billion, says Roelandts.

Will HP succeed? Industry observer George Colony, president of Forrester Research, Cambridge, Mass., notes that HP is heading in the right direction by realizing that the technology of the 1990s will be "connectivity, not computers."

"Companies don't need a network," says Colony, "they need an application that involves a network. The biggest mistake Hewlett-Packard can make is trying to sell a technology instead of a solution." □

FACT FILE

Hewlett-Packard Co.
Information Networks Group
10520 Ridgeview Court
Cupertino, Calif. 95014
(408) 973-1919
Circle 473

**Private wide area network solution based on the X.25 interface for a typical company's sales and service, business, manufacturing and engineering operations.
**Turnkey approach involves all equipment and services for design, installation and maintenance.
**Network ties into IBM Corp. and Digital Equipment Corp. environments as well as those vendors who support ARPAnet protocols.

Apple opens Macintosh to system integrators

Mike Seither, Senior Editor

System integrators, software developers and third-party hardware vendors are likely to profit now that Apple Computer Inc., Cupertino, Calif., has opened up the architecture of its Macintosh computer.

With the introduction of two new versions of the popular machine—the Macintosh II and the Macintosh SE—Apple has broken with the past in two key areas. First, Apple has built expansion slots into the machines so that resellers or users can configure the systems for specific applications. Second, both new computers feature internal rigid disk drives. Until now, Mac users have had to use external drives.

In an effort to get the machines into the hands of serious business and technical users, Apple is offering optional keyboards that will work with either the Mac II or SE. The $129 version has 81 keys; the other, with 15 additional function keys and a cursor-movement pad, costs $199.

In a separate, but related, announcement, Apple has revealed its networking strategy finally is in place. After more than a year of delays, Apple announced the availability of AppleShare software last month at the Seybold desktop communications conference in San Francisco. Priced at $799, AppleShare allows a Macintosh Plus to act as a file server for up to 25 other Mac users. The company has published its networking protocols in an effort to attract third-party hardware software developers.

Like an IBM PC

Getting most of the attention is the Macintosh SE, a machine that outwardly looks more like an IBM Corp. PC than the Mac of old with its one-piece monitor and CPU. The SE comes with an external 640-by-480 pixel color or monochrome monitor and a standalone central-processing unit inside a cabinet that's 9.7 inches wide and 10.9 inches deep.

The Mac SE uses Motorola Inc.'s 16-MHz MC68020 as its main processor and features six expansion slots that tie into the NuBus. The NuBus, or IEEE P1196 standard bus, is a full 32-bit bus developed at the Massachusetts Institute of Technology and acquired by Texas Instruments that uses geographical addressing. That is, four pins on each expansion slot identify a card's function no matter where it's located in the cage. This method eliminates the need for DIP switches and allows the Macintosh SE to identify where each card is, and what it does, when the computer is booted.

Delbert Yocam, Apple's chief operating officer, says that about 20 vendors are readying add-in products for the SE. The products range from co-processors and Ethernet local area network adapters to cards that give the SE compatibility with the DOS operating system and IBM's 3270 world.

In addition, Apple gave early versions of the computer to about 20 software developers to get new—and existing—Mac applications running on the machines. This month, Apple is releasing the SE and Mac II specifications to other vendors who want after-market business.

Apple, planning to market the SE as a workstation, has designed-in plenty of power. Main memory on the mother board ranges from 1M bytes to 8M bytes, and can go to 2G bytes through the use of add-in memory boards. Internal rigid-disk drives that use the small computer systems interface

2,000,000 Dots Per Screen. That's What It Takes.

At least in order to get on-screen resolution of this quality. And to get an accurate representation of what a facing-page spread—*one that you can actually read*—will look like when it's printed.

Introducing the LaserView™ Display System.

From Sigma Designs.

LaserView consists of a large screen monitor, complete with display adapter, available in your choice of 15 and 19* inch models. Big enough to put everything from simple graphs and charts to Desktop Publishing to CAD in an entirely new perspective. And at virtually full size.

Offering a *noninterlaced* screen resolution of *1664 x 1200*—equal to 8 EGA™-sized or 11 Macintosh™ screens—LaserView's "easy-on-the-eyes" paper-white display brings workstation-quality graphics and text to the PC level. It can even generate *four levels of gray* for increased on-screen detail in photos and drawings.

LaserView works with all programs that run under Windows™ and GEM™ including programs like Aldus Pagemaker™ and Ventura Publisher™—plus familiar PC programs like Lotus 1-2-3™ and AutoCAD.™ We've even included a copy of PC Paintbrush Plus® to help you get started with LaserView.

So call Sigma Designs. Because if you're serious about making it to the big screen, Sigma Designs has what it takes today.

LaserView.

Sigma Designs Inc.
46501 Landing Parkway
Fremont, CA 94538
415.770.0100

CIRCLE NO. 20 ON INQUIRY CARD

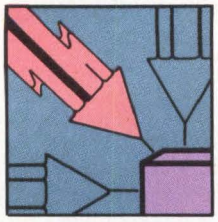
S I G M A D E S I G N S

Trademarks: LaserView: Sigma Designs, Inc.; EGA: International Business Machines Corporation; Macintosh: Apple Computer; Windows: Microsoft, Inc.; GEM: Digital Research Inc.; Pagemaker: Aldus Corporation; Ventura Publisher: Ventura Software Inc.; Lotus 1-2-3: Lotus Development Corporation; AutoCAD: AutoDesk Inc.; PC Paintbrush Plus: Z-Soft Corporation. *For commercial use only.

We've got

the most affordable, state-of-the-art data PBX you can buy.

Period.



Sequel's SDC family is the first series of intelligent data switches to offer you all large network management features, whether you need a few or hundreds. Features like single sign-on, time-of-day clock, toggling, redundant power and logic, security call-back, and more.

Think Small. Then Grow Big.
You can start out with as few as six local ports and expand to as many as 1,536, worldwide. ☐ Sequel's SDC family links together terminals, I/O ports, printers, modems, and any device that sends or receives data up to 19.2K bit/s. Without line drivers or multiplexers. Even at maximum usage, the 19.2K bit/s rate persists.

Meet The Three.
The SDC 660 gives you a range of six to 60 ports. ☐ If you outgrow it, keep all the cards and buy the SDC 6192 chassis. Now you can grow to 192 ports. ☐ If you need to expand further, the SDC 6192 Network is the answer. Plug Sequel's local networking card into as many as 8 chassis and expand up to 1,536 lines.

Break The $100-Per-Port Barrier.
With all this to offer and more, our switch costs less than any other. The low $100-per-port price begins at 30 ports.

Find Out For Yourself.
Call today and we'll demonstrate to you why Sequel's SDC family is so fast, flexible, and affordable. And why Sequel means "We're What's Next."

Standard Features Sampling

- ***Port contention by name, number, or class***
- ***Help menus***
- ***Simultaneous toggling***
- ***Priority queing***
- ***Auto baud***
- ***Network status display***
- ***Password-controlled protection***
- ***Alternate destination routing***
- ***Time-of-day reconfiguration***
- ***Single sign-on***

SEQUEL

Sequel Data Communications, Inc.
5246 Greens Dairy Road Raleigh, NC 27604
(919) 790-0300 Telex 5106002826

CIRCLE NO. 21 ON INQUIRY CARD

FACT FILE

Apple Computer Inc.
20525 Mariani Ave.
Cupertino, Calif. 95014
(408) 996-1010
Circle 474

**Macintosh SE, a 68020-based 32-bit personal computer with six expansion slots that tie into the NuBus

**Choice of 13-inch color or 12-inch monochome monitors, both with resolutions of 640 by 480 pixels and capable of displaying 256 colors or shades of gray

**Two optional keyboards, one with 81 keys, the other with 105, of which 15 can be programmed for specific functions

**Compatible with most applications packages written for earlier Macintosh versions, including the Mac 512 and Mac Plus

**Internal SCSI hard-disks available in capacities of 20M bytes, 40M bytes and 80M bytes.

(SCSI) are available in capacities of 20M bytes (3½-inch drive), 40M bytes and 80M bytes (5¼-inch drives. Also available is a 40M-byte tape backup system. This summer, Apple expects to release for the SE its own version of the UNIX operating system, which will accommodate multiuser and multitasking applications.

A Macintosh SE configured with 1M byte of memory, an 800K-byte, 3½-inch flexible disk drive, a 12-inch monochrome monitor with video adapter (taking up one slot) and a keyboard lists for about $4,500. Adding a 40M-byte rigid disk brings the price to about $6,000.

The SE is the high end of the Mac line; the Macintosh II sits in the middle of the product family, just ahead of the current Mac 512 and Mac Plus. While the Macintosh II looks like those older machines, it's been rebuilt inside. Now there's room for an optional internal 20M-byte rigid disk. Apple has also given the Macintosh II an expansion slot, which it expects system integrators to outfit with a networking adapter. Depending on configuration, the Mac II sells for between $2,800 and $3,500. □

NCR's platform strategy reaches to multiprocessors

Douglas Pryor, Senior Editor

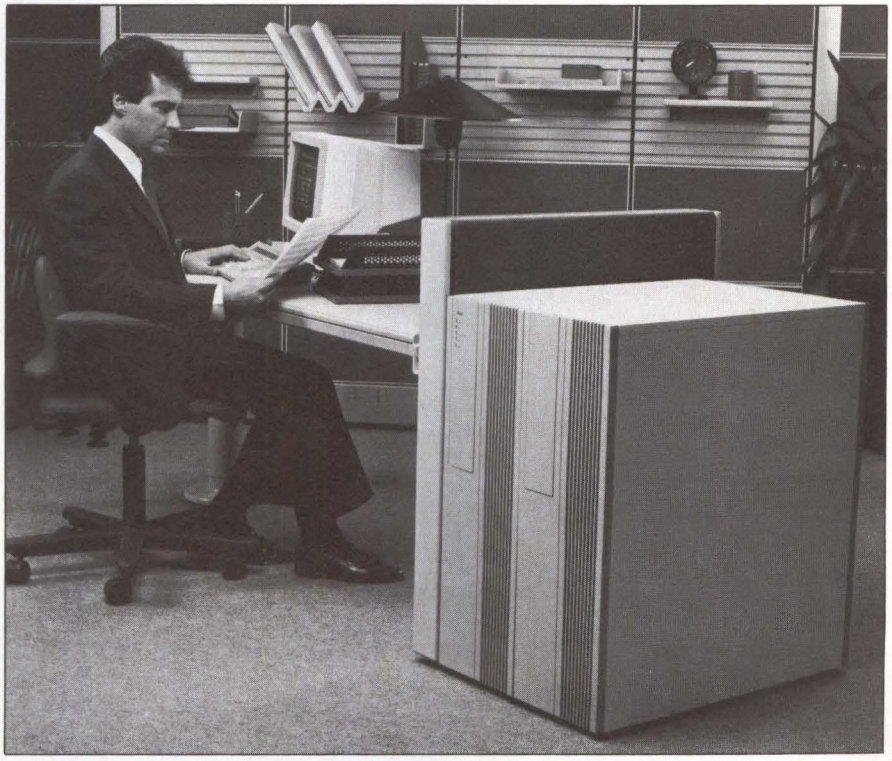
On Feb. 25, NCR Corp. announced the Tower 32/800 and became the first well-established computer vendor to endorse a multiuser supermicrocomputer architecture built around multiple Motorola Inc. MC68020 microprocessors linked by Intel Corp.'s Multibus II.

"Our approach has not been to hit a bunch of home runs. We really are trying to be steady hitters of singles," says Charles Exley Jr., chairman and president of NCR Corp., Dayton, Ohio.

Exley's corporate philosophy has influenced the computer developers in NCR's general-purpose systems division, makers of the Tower series. The company's newest product, the 32/800, bunches a number of singles that could add up to a big inning for system integrators, OEMs and value-added resellers looking for modular processing platforms built around industry standard components, buses and interfaces.

Housed in a Tower-like cabinet, the 32/800 measures 20 inches wide, 29 inches deep and just over 32 inches high. But its packed performance supports more than 100 users.

NCR engineers have distributed the processing chores across a number of job-specific processors in much the same way they did in the 32/600, introduced in 1985. However, they have added a twist—support for multiple CPUs, or applications processors. In fact, the design has become a full-blown, loosely coupled architecture. It means that control is shifted among microprocessors, each with local memory and a memory-management unit (an MC68461 MMU with 4G bytes of logical ad-



NCR's Tower 32/800, *a 32-bit multiprocessor system, supports more than 100 users.*

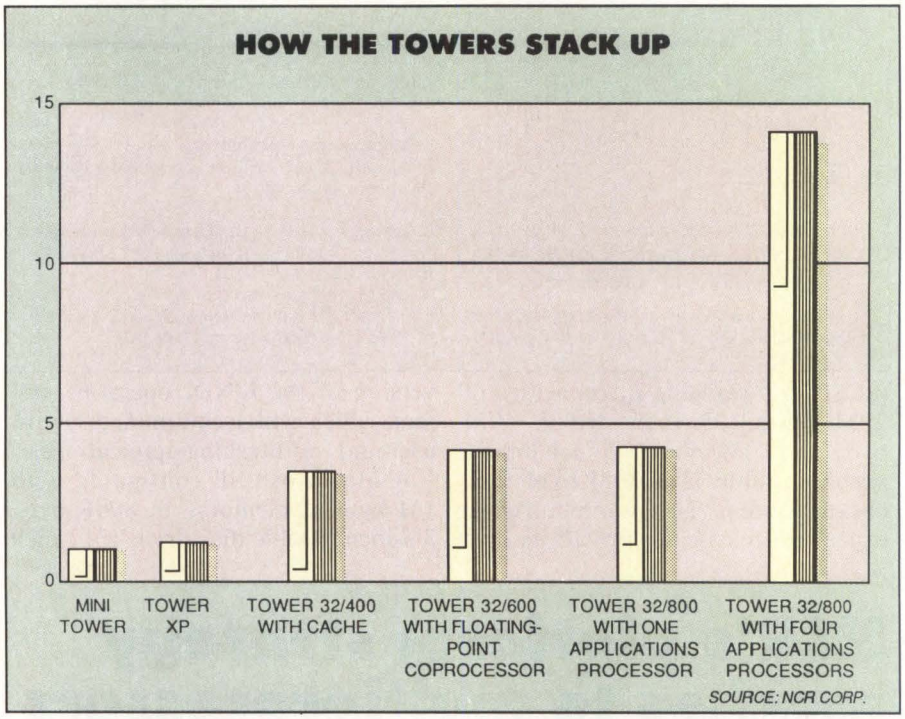
dress space) connected over a common bus—a Multibus II in this case. Previous Towers used Multibus I.

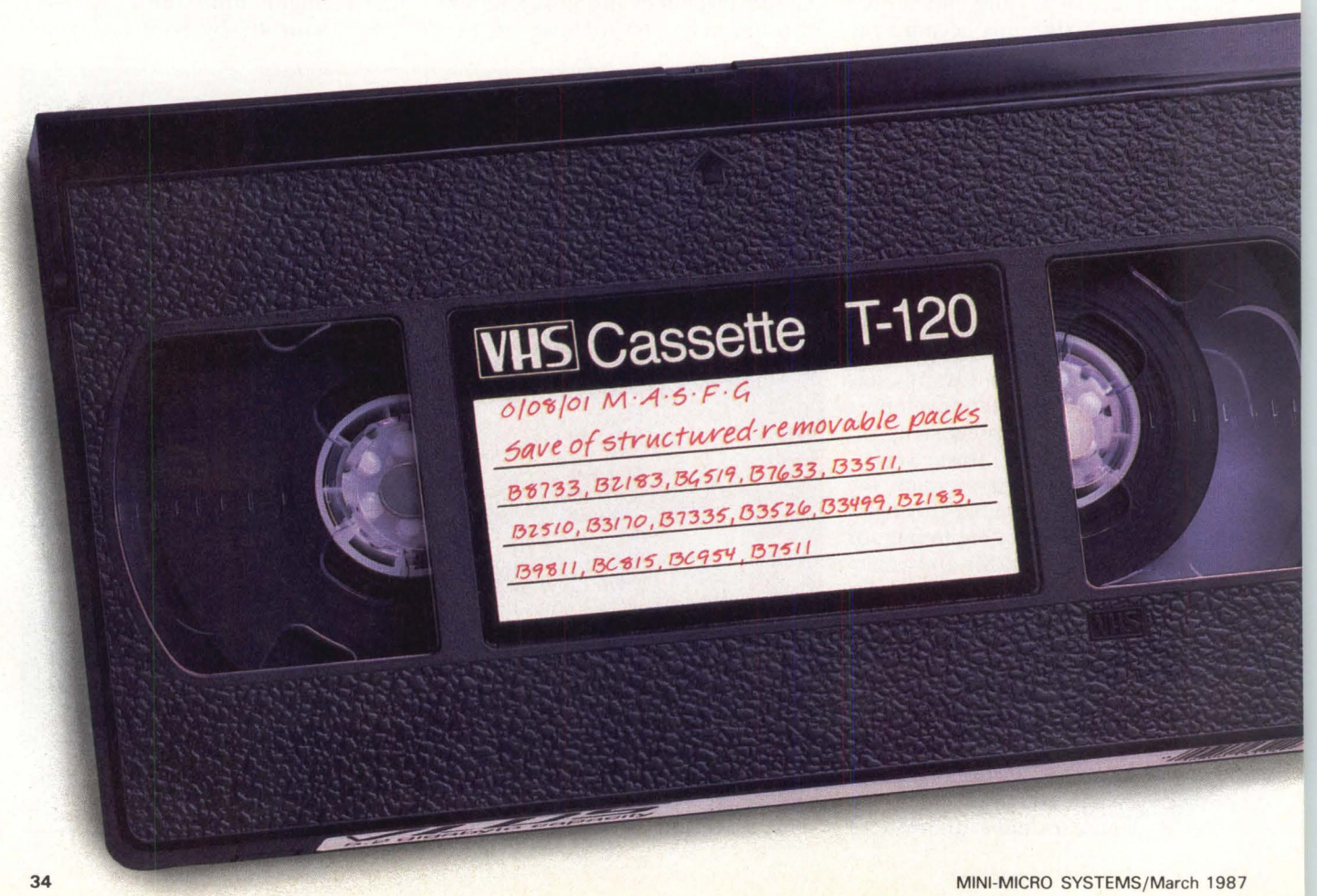
Building from the ground up

Each Tower 32/800 begins with a Master Application Processor module built around a 16.7-MHz 68020 CPU, 68881 floating-point coprocessor and 10K bytes of parity-checked cache.

For mass storage, a basic model could include two integrated 5¼-inch, 170M-byte fixed disk drives with a small computer systems interface (SCSI) master controller and 45M-byte streaming tape drive rated at 90 inches per second. The total formatted storage for fixed disks in this configuration is 298.8M bytes. Up to five SCSI drives can be added without adding an external SCSI interface and cabinet.

Also, the basic configuration includes a file-processor module made up of a 68000, a 68010, a Multibus II interface, two SCSI device controllers, 1M byte of local memory and a maximum of 64K bytes of electrically programmable ROM. The price per user in this configuration is about $3,500.





Software support for the Tower 32/800

With the introduction of the 32/800, NCR announced support for a long list of programming languages and applications.

PROGRAMMING LANGUAGES

Current

- ☑ C
- ☑ Language Processors Inc. COBOL, FORTRAN*, Pascal* and Debug*
- ☑ Micro Focus COBOL
- ☑ Silicon Valley Software Inc. FORTRAN and BASIC
- ☑ RM-COBOL-85*

*New to the Tower

Future

- ☑ Ada
- ☑ Common LISP
- ☑ BBX BASIC
- ☑ LPI BASIC with Micro Focus Extensions
- ☑ Oracle 5.0 database management
- ☑ Prolog

DEVELOPMENT AND PRODUCTIVITY SOFTWARE

Full support

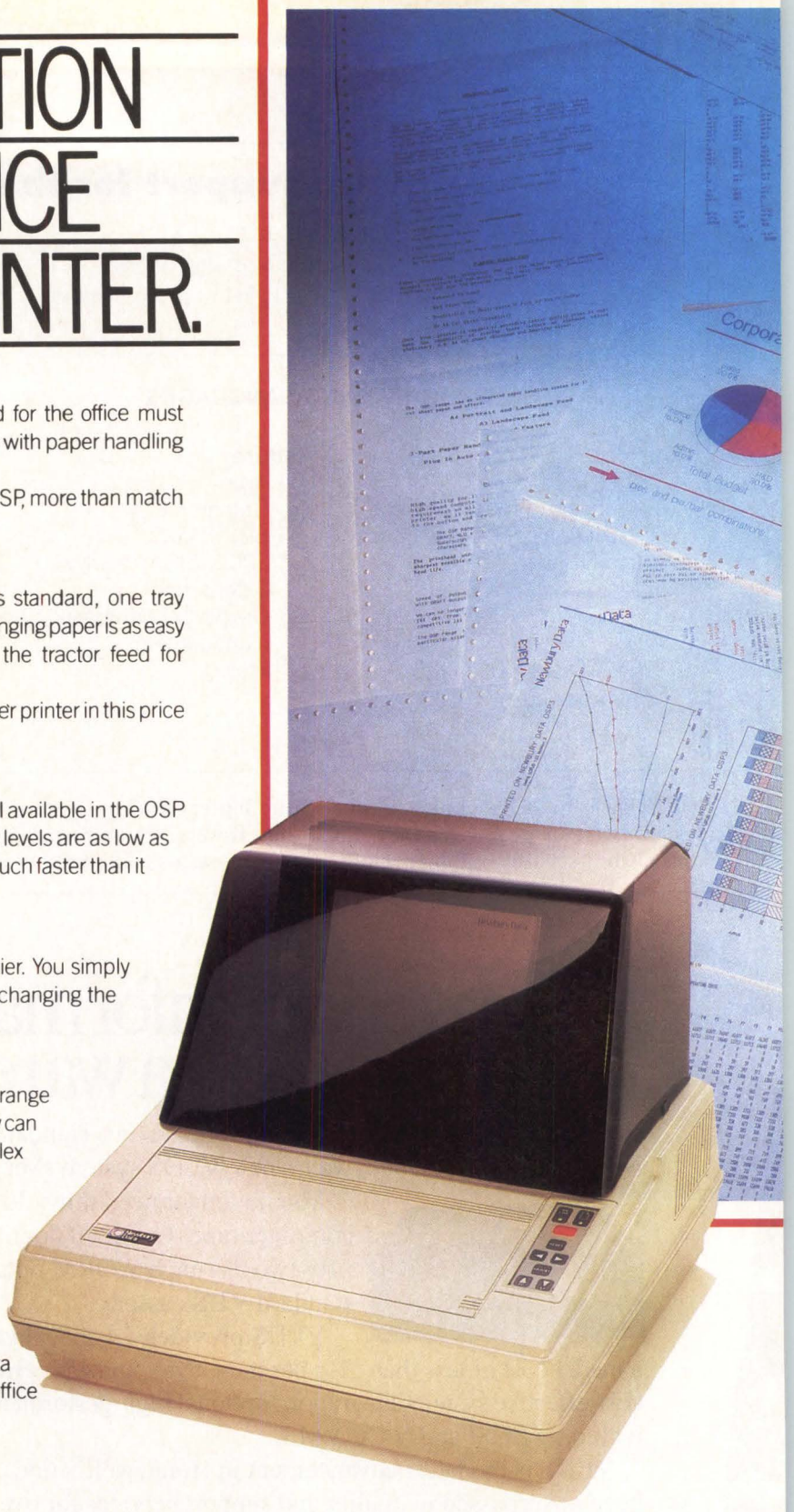
- ☑ Documenter's Assistant
- ☑ Multiplan Spreadsheet
- ☑ Multiplex (to link IBM Corp. PCs and compatibles)
- ☑ NCR-Alis office automation

Support by referral

- ☑ Informix database management
- ☑ Informix fourth-generation language
- ☑ P-Stat 4GL
- ☑ Q-Office O/A
- ☑ R-Office O/A
- ☑ Sculptor 4G/L
- ☑ Today 4G/L

The basic model includes another design twist: a power backup unit housed in a separate cabinet. Unlike the battery backup system for previous Towers, which maintained power until systems could be shut down, the new backup senses interruptions and maintains power for 10 seconds. After this time, the system starts sav-

THE DEFINITION OF AN OFFICE SYSTEMS PRINTER.



A range of printers specifically designed for the office must strike a balance between print speed and quality with paper handling flexibility and low noise levels.

Our range of Office Systems Printers—OSP, more than match this definition.

Simple Paper Handling

Automatic cut sheet feed is built in as standard, one tray handling both single and multi-part stationery. Changing paper is as easy as on a photocopier. Equally simple is using the tractor feed for continuous stationery.

A paper flexibility unmatched by any other printer in this price range.

Fast and Efficient Printing

Draft, NLQ and Letter Quality print are all available in the OSP range. And even when printing at 200 CPS noise levels are as low as 49dBA when using the acoustic option; OSP is much faster than it sounds.

Colour Printing

Introducing colour has never been easier. You simply change the ribbon for a colour one, as easy as changing the ribbon in a typewriter.

Graphics

When graphics are needed the OSP range incorporates pin addressability as standard, so they can print anything from Arabic to the most complex diagram.

Interface Flexibility

A range of plug-in interfaces with their own microprocessors mean OSP is easily adapted to suit OEM requirements.

Combining paper flexibility, high speeds, low noise, colour graphics and Newbury Data adaptability, OSP really is: The Definition of an Office Systems Printer.

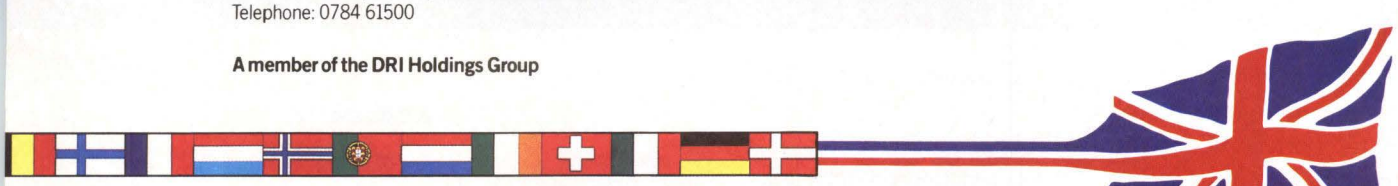
EUROPE'S LEADING INDEPENDENT PER

Germany: Data Recording Instrument GmbH Munchen Tel: 089 5141010 **France:** Data Recording Instrument Sarl Zone Industrielle de Buc Tel: 013 9568111

Newbury Data

Newbury Data Recording Ltd,
Hawthorne Road, Staines, Middlesex. TW18 3BJ
Telephone: 0784 61500

A member of the DRI Holdings Group

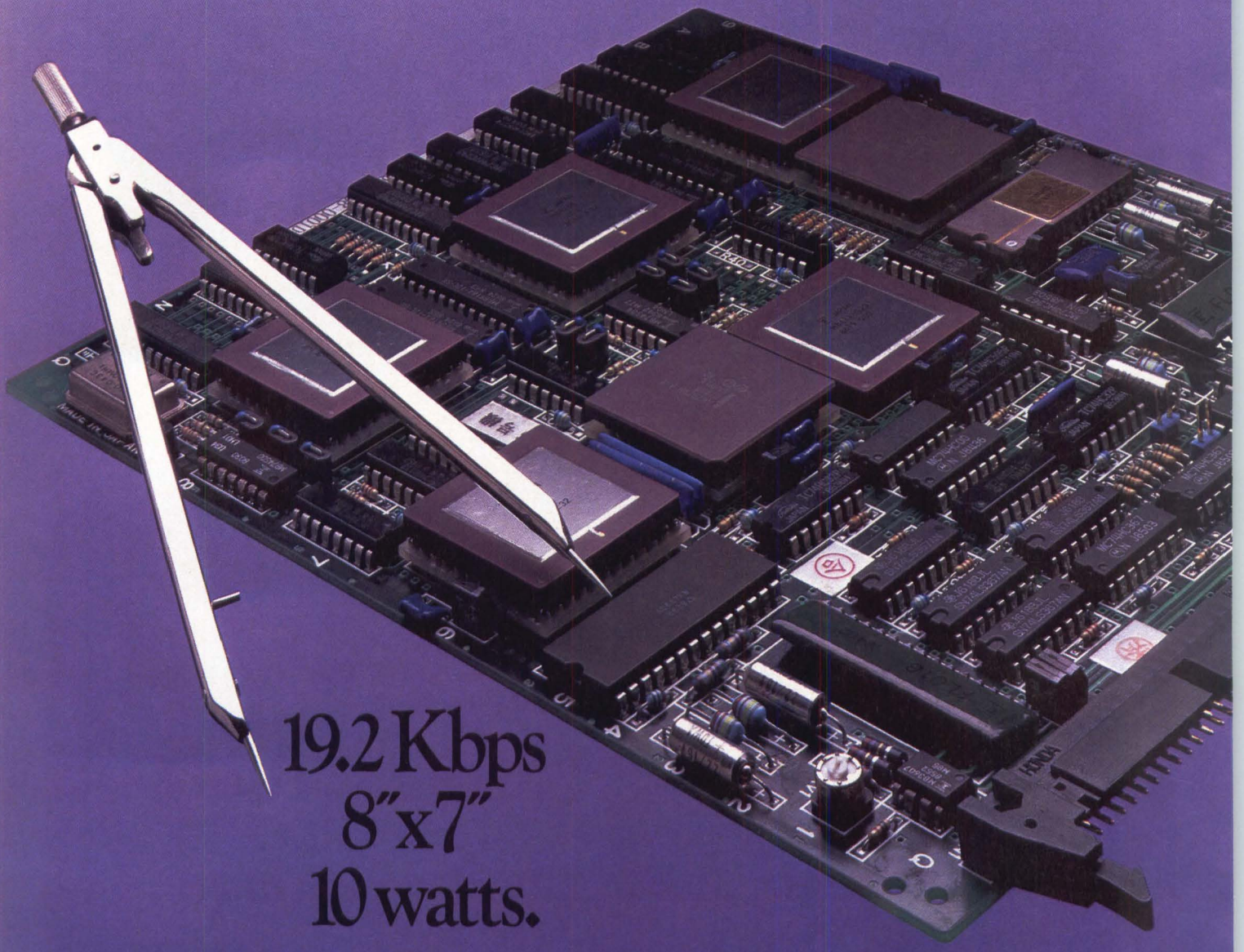


IPHERALS MANUFACTURER.

taly: Data Recording Instrument Srl Milano Tel: 039 638811 **Holland:** Newbury Data Recording (DRI) BV Ae Almere Haven Tel: 03240 48004

CIRCLE NO. 252 ON INQUIRY CARD

A new dimension in modem technology.



19.2 Kbps
8"x7"
10 watts.

Fujitsu's new 19.2 card modem will measure up to your demands for high performance.

It's the perfect modem for use in applications such as stat muxes, time-division multiplexers and packet-switching networks.

And, of course, it's built with Fujitsu's tradition of quality.

To add a new dimension to your products, call us. 800-422-4878. Or 408-432-1300 ext. 2377 in California.

FUJITSU

FUJITSU AMERICA, INC.
DATA COMMUNICATIONS
3055 ORCHARD DRIVE
SAN JOSE, CA 95134

CIRCLE NO. 25 ON INQUIRY CARD

See us at Interface, Booth 1050

ing memory and processing for up to 6 minutes at maximum load. If power returns during the 10-second period, the system resumes operation without affecting processing. "This is not fault-tolerance," says Tower program manager John Gray, "but it's certainly fault-resistance."

Optional communications processor modules make it possible for system integrators, VARs and users to connect to a variety of communications environments, including IBM Corp. Systems Network Architecture (SNA), 3270 bisynchronous and X.25 packet switching. Each module is driven by a 68010 microprocessor using a 2K-byte cache to speed I/O and program execution. Also, a local area network module option provides an 802.3 channel and runs Towernet, NCR's Ethernet implementation.

Creating value

But, without what Gray calls NCR's value-added UNIX, the hardware would suffer the problems often associated with multiuser systems: I/O bottlenecks, slow response times and low throughput. NCR's solution is to distribute the system's processing load by breaking down the System V operating system and assigning tasks to each specialized processor. For example, I/O chores are handled by kernel subsets residing in each file, terminal, communications and LAN processor. All common I/O functions are replicated on each processor. As a result, application processors are freed from a lot of time-consuming I/O.

"With the new Tower, we have platforms that can compete in medium-scale, general-purpose and commercial environments," says Khaled Marrei, assistant vice president of the general-purpose systems division. However, he suggests that NCR will announce further refinements to the 32-bit Tower family (the 32/400, 32/600 and now the 32/800), while continuing its support of the 16-bit MiniTower and Tower XP.

By midyear, NCR will announce a better than two-fold increase in connectivity, to 256 users. Also, in the near future, all Towers will use 1-megabit memory chips and faster microprocessors for applications and I/O. "We will use MC68030 chips when Motorola can deliver them in the volume we need; probably in early 1988," says Van Aggelakos, director of product management at NCR's West Columbia, S.C., manufacturing facility. When that happens, NCR could become a power hitter in the multiuser supermicrocomputer market. □

FACT FILE

NCR Corp.
1700 S. Patterson Blvd.
Dayton, Ohio 45479
(800) 222-1235
Circle 475

**Tower 32/800, an MC68020 32-bit loosely coupled multiprocessor system for up to 112 users
**Multibus II accommodates up to 20 expansion modules
**UNIX System 5 Release 2.0 Version 2 operating system
**Supports up to four applications processors, each with 4M bytes of RAM
**Supports up to five internal SCSI fixed disks. An optional external subsystem supports 8- and 9-inch disk drives and one half-inch tape drive. Unformatted mass-storage capacity ranges from 170M bytes up to approximately 7G bytes.

Without the right connections, your graphic output devices won't get the picture.

Your raster output devices need the right connections to deliver the results you're looking for. Without a high-performance processor to convert graphic images and text fonts to raster format, they'll rob your mainframe of precious time — and that's not a pretty picture.

At KMW, we've got the solution. We were the first manufacturer of graphic element processors. And for almost a decade, we've made the right connections happen for top Fortune 500 companies.

We offer easy answers to the problems of using a variety of raster hard copy devices. Our processors provide ultrafast, reliable graphic element-to-raster conversion. Interconnection to the host is made via our field-proven communications products or our Auscom channel interfaces. And most popular graphics software allows our processors to communicate with popular graphics and CAD/CAM systems.

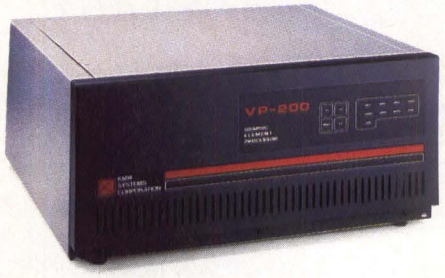
With KMW, you'll cut computer overhead normally required for vector conversion or graphics composition, eliminate the expense of trying to develop a solution in-house, and reduce the time for designing new products.

We have processors for controlling laser printers, electrostatic printers/plotters, a large variety of low cost raster hard copy devices, and integration of graphic images and text.

Our processors incorporate advanced multiplane imaging features, including color separation, resolution conversion, and sophisticated font handling features.

We can also provide custom products.

Focus on the right connections with KMW. Call today 1-800/531-5167 (in Texas, 512/288-1453) or write KMW Systems Corporation, 8307 Highway 71 West, Austin, Texas 78735.



KMW SYSTEMS CORPORATION

For the right connections

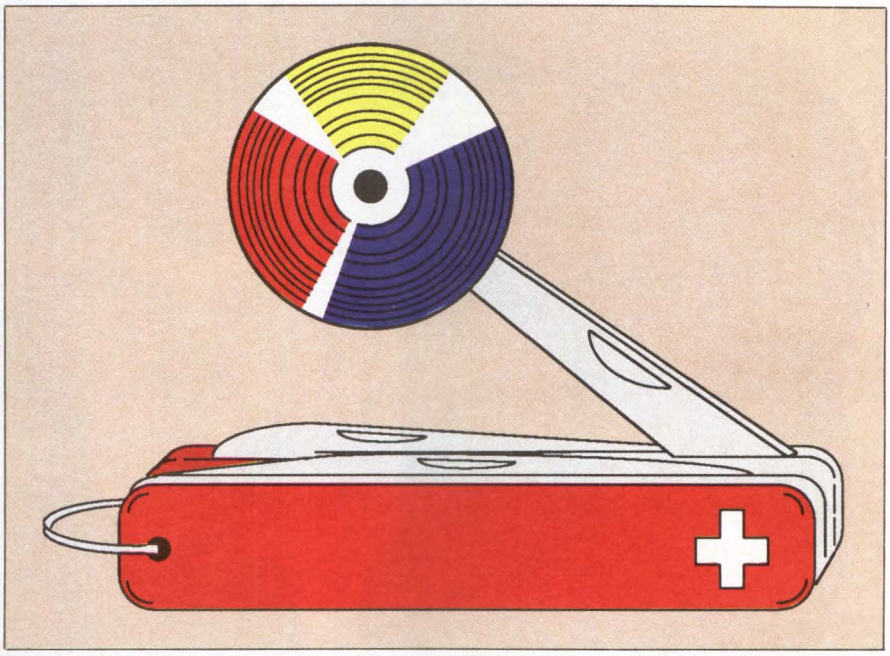
Auscom is now a division of KMW Systems Corporation.

CIRCLE NO. 24 ON INQUIRY CARD

OPTICAL DISKS

Optical memory goes multifunction—at last

James F. Donohue
Managing Editor



This is the year that some optical storage vendors say system integrators and value-added resellers finally will see a product they can make a buck with: multifunction optical disks and drives in the 5¼-inch form factor. Multifunction optical storage disks will combine write once read many (WORM) technology and the newly developed, erasable technology. Some of the disks may include compact disk ROM (CDROM) technology as well.

A cause for cheering? You bet. This development follows more than a decade of embarrassing hype for optical storage and of agonizing starts and stops for vendors and system integrators alike.

There are estimates that venture capitalists alone have dumped $150 million into optical storage start-ups, and none of them claim to have seen a penny of profit. System integrators, like Integrated Automation, Alameda, Calif., and Unisys Corp.'s System Development Group, Camarillo, Calif., have made some business but not much money doing pilot projects for the government and for biggies like General Electric Co.

But now the promised land of profit is in sight. Vendors like Larry Fujitani, director of marketing, Optimem, Sunnyvale, Calif., and seers like Edward S. Rothchild, Rothchild Consultants, San Francisco, predict that the first commercial multifunction 5¼-inch drives will appear this year and that volume shipments will start in 1988.

Erasability is the key

What's all the excitement about? What's the big deal about multifunction optical storage devices?

First and foremost, they will be erasable: that is, on at least one section of the disk you'll be able to write data, erase it, write data again, erase it—on and on, many times, depending on the media and the technology used.

Second, multifunction optical disks will have the two other optical functions: CDROM and WORM.

In CDROM, data goes on the disk when it's manufactured, and the disk is shipped to the customer. With WORM, users write on the disks themselves, just as they would on a flexible disk. In both CDROM and WORM, the data, once written, cannot be erased.

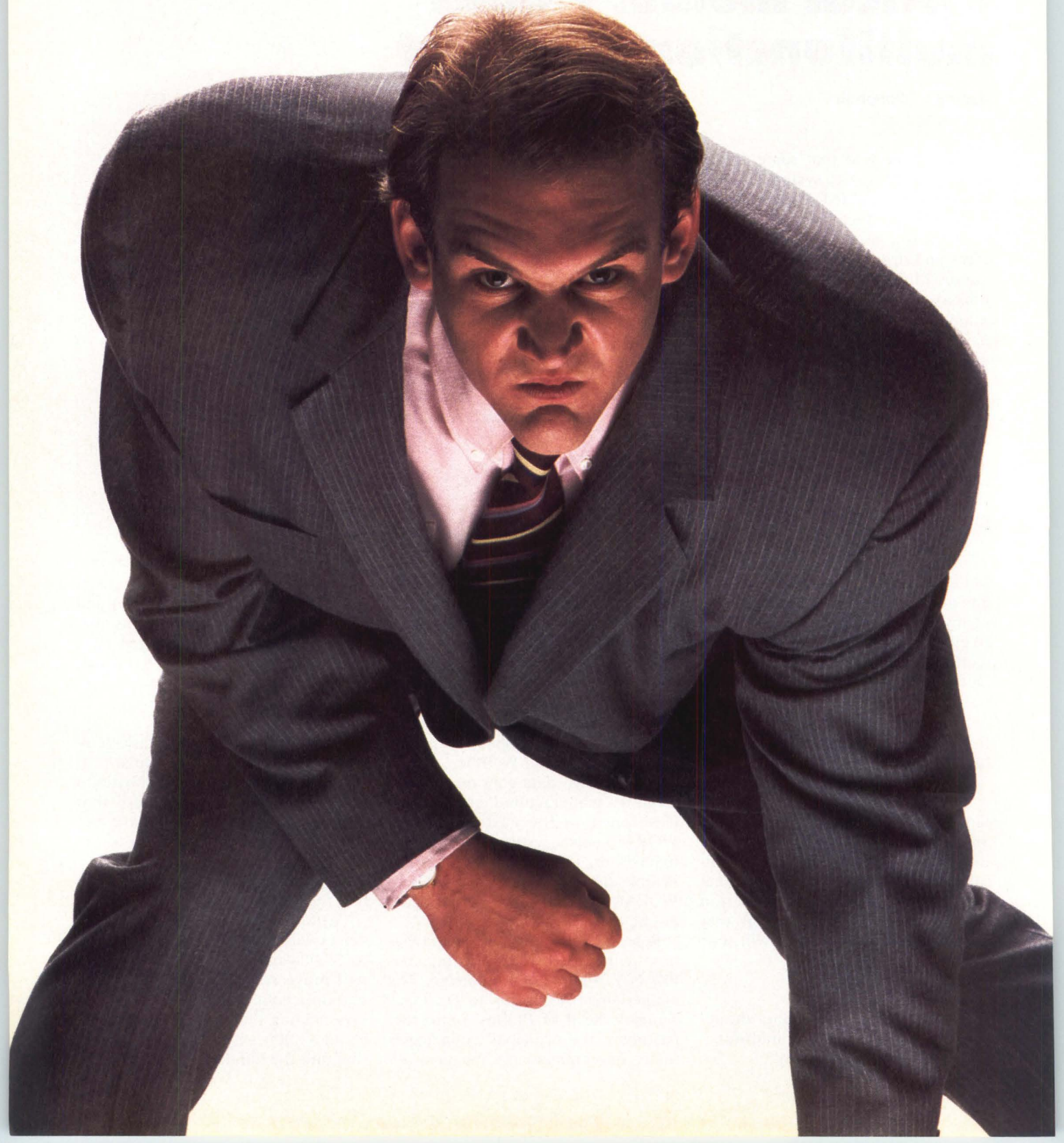
Research into erasable media has been going on for years at companies like N.V. Philips of Eindhoven, The Netherlands. According to Dr. Gary Thomas, head of Philips' optics department, the principal technologies under development are magneto-optic (a combination of magnetic media and laser read/write technology) and phase-transition (in which the media's physical state is changed back and forth from amorphous to crystalline by a laser).

Sectors for each function

What will multifunction disks look like? The way vendors explain it, disks with a capacity of 200M bytes to 300M bytes will be partitioned into sectors. Each sector will have the proper media to perform one of the functions. The drives likely will have different laser configurations to write and read each sector.

Fujitani says that multifunction drives will carry price tags of $2,000 to $3,000 each at first. Then prices will move rapidly toward $1,000 a unit once volume shipments begin, he says, adding that prices will stick at about $1,000: "I don't see prices getting into the hundreds [of dollars]."

WHY TEAM UP WITH A BIG COMPUTER COMPANY THAT PLAYS AGAINST YOU?



WE'RE ONE BIG COMPUTER COMPANY THAT'S ALWAYS ON YOUR SIDE.

With NEC you make the sale. You make the profits.

Value added reselling is not the easiest business in the world. And it can get tougher if you're dealing with the wrong computer company. Because a lot of them end up competing with you for the same sale.

NEC is different. We work with you. Not against you.

Our sales force isn't sneaking around selling to your prospects.

VARs like you are the only direct sales force we have. And we wouldn't have it any other way.

Why more and more VARs are sold on NEC's Preferred VAR program.

Because it works to your advantage.

For one thing, NEC offers larger discounts than the competition. Which means higher margins for you. Discounts are applied across all product families. So you can concentrate on selling the products your customers want. Not the ones the computer company is pushing. And our program doesn't penalize you to get in the game. Because NEC understands your business, we give the flexibility to ramp up gradually.

And when it comes to helping you sell, no one beats NEC. We provide an aggressive co-op plan. We train your sales force. We even have a teaming program to assist you in establishing co-licensing agreements in geographic markets you can't cover.

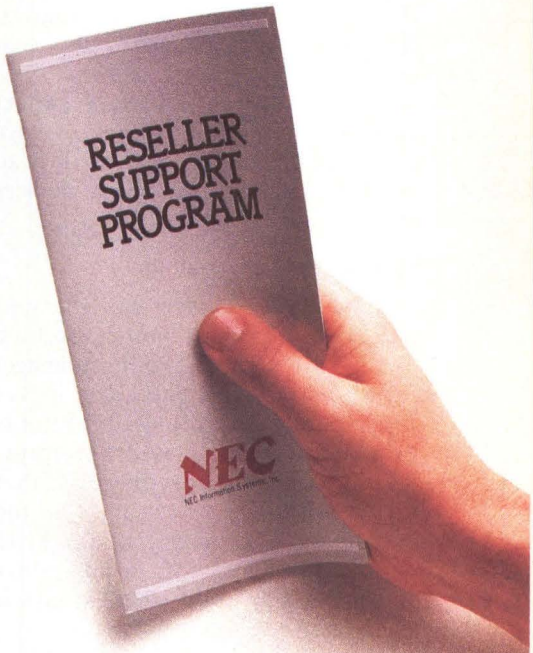
With NEC, you're selling one of the biggest and hottest product lines in the business.

NEC isn't just one of those one-product companies. We have an extensive line of mini and micro computers and printers.

Our newest mini computer family is the Astra® XL series. Take the Astra XL/32. It's a powerful, flexible 32 user system based on the UNIX® operating system and an open architecture.

Then there's our new APC IV™ Advanced Personal Computer. The machine for the power user. And we're backing it with a multi-million dollar tv, radio and print advertising campaign entitled, "Take it to the limit."

And then there's our legendary line of reliable Pinwriter® and Spinwriter® printers.



Products are only one ingredient. Support is another. Being able to convert your software is one more. We have a program for that too. A program that provides all the conversion tools and assistance you need.

Put a $13 billion leader on your side.

Call NEC. We keep pushing the limits in computers and communications. With our products. And with a program that helps our VARs sell them.

To receive our VAR information kit, call 1-800-343-4419. In Massachusetts call (617) 264-8635. Or write to NEC Information Systems, Inc., Dept. 1610, 1414 Massachusetts Ave., Boxborough, MA 01719.

NEC

UNIX is a trademark of AT&T Bell Laboratories.

C&C Computers and Communications

CIRCLE NO. 75 ON INQUIRY CARD

OPTICAL DISKS

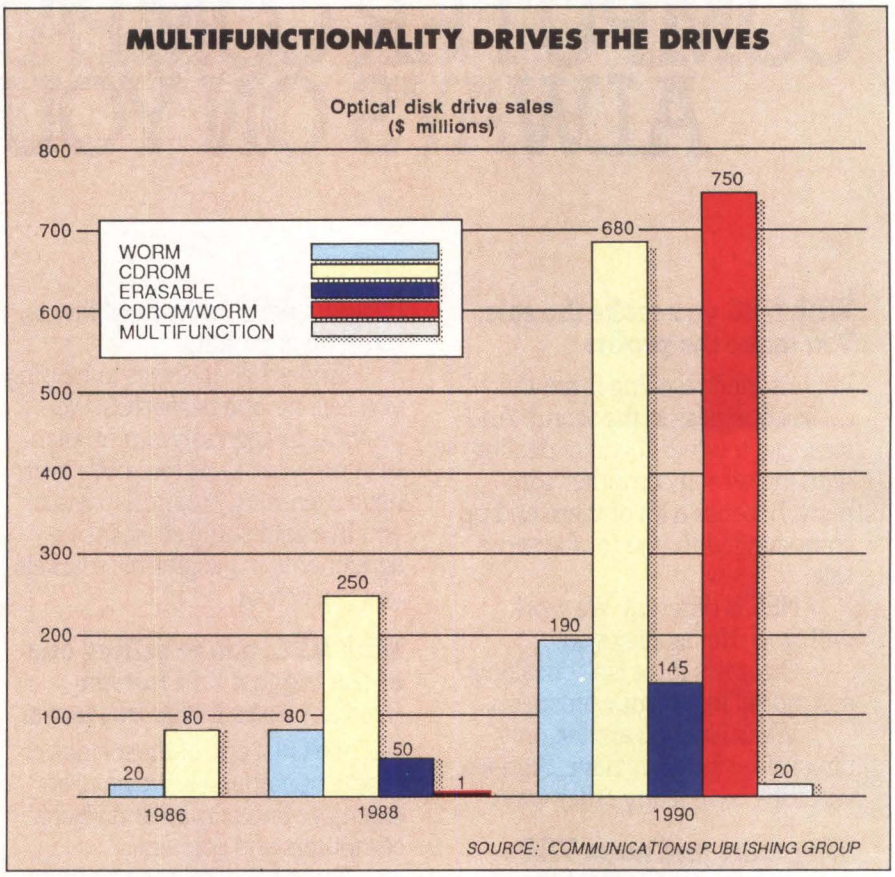
As multifunction drives in the 5¼-inch form factor get established toward the end of this decade, Rothchild says, you can expect the appearance of 3½-inch multifunction drives aimed at portable computers. IBM Corp. may be among the vendors.

Many industry watchers expect IBM, the only major player to have shunned optical storage so far, to come in once multifunction devices are available.

Caution and skepticism

Not everybody agrees with this rosy scenario, of course. Some vendors, like Neal Kuhn, marketing manager for disk drives at Ricoh Corp. in San Jose, Calif., are cautious. Multifunction disks and drives are coming, Kuhn says, but predictions that they'll appear this year may be too optimistic. "Some day we ought to put Ed Rothchild into a laboratory and make him build what he says is available," Kuhn says.

Kuhn, however, agrees that development engineers—including those at Ricoh—are approaching disk/drive design from the standpoint of combining erasability and WORM on the same disk.



Industry watchers like Steven Weissman of Communications Publishing Group, Natick, Mass., are skeptical about the whole idea. Weissman looks for erasable media and drives to appear this year, but he doesn't expect erasability to be com-

Three ways to go optical

If you're planning to convert your data storage to optical media, here are some guidelines from Robert Castle, director of product marketing, FileNet Corp., Costa Mesa, Calif., a vendor of optical disk drives.

He says there are three ways to manage the conversion:

1. Day One Forward. You pick a day and from then on every new document goes into optical storage. Old documents (those in your system before Day One) are never converted to optical. Castle says this method works best with documents that are perishable: that is, where you don't need the old documents at all—or at least not for very long. The drawback: Users for a time must deal with both the old and the new systems and may not know where to look for a document. They are forced to look for documents first in one system and then in the other.

2. Convert on Demand. This is like Day One Forward in that all new documents go into optical storage after a certain day. However, old documents are converted as well—but only when a user calls for them. That is, when somebody asks for an old document, it is pulled, converted to optical and then delivered to the user through the optical system. The advantage is that, unlike with Day One Forward, users must contend only with the optical system. It's up to somebody else to keep track of what's in each system. The disadvantage is that, early on at least, user demand for old documents can put a huge strain on the systems' optical scanners. And delivery of documents that must be converted first can be very slow.

3. Complete Conversion. As the name implies, you convert all documents to optical over a fixed period of time. Users stay on the old system until the conversion is complete, and then they switch.

A subset of this method is **Partial Conversion** of only critical documents. Example: a bank's mortgage records.

Castle says conversion costs average 11 cents to 15 cents a document. Labor and equipment account for 87 percent of the costs. The remaining 13 percent is accounted for by maintenance (7 percent), media (4 percent) and supervision (2 percent).

OPTICAL DISKS

bined with WORM and CDROM anytime soon. There's no demand for it, he says.

"There's a saying that all good ideas degenerate into hardware," he says. "Sure, theoretically you can do anything. But that doesn't mean you want to or that anybody else wants you to."

The capacity of WORM disks is so enormous—up to 2G bytes—that there is no need for erasability, he says. "Just update the info on another part of the disk and tell the computer to ignore what's been written before." Meanwhile, Weissman says, the earlier writing is still there and can be retrieved. "The beauty of write-once is that it gives you an audit trail," he says.

Another view comes from market watchers like Louis Giglio, technology market researcher at Bear, Stearns, the New York investment concern. He sees the first multifunction disks combining only CDROM and WORM, not erasability. Holding that combining optical disk technologies is a good idea, Giglio says, "A read/write drive—one that can be used with CDROMs and write-once disks—should be the first step in this direction."

Conclusion: money to be made

What conclusion can you draw from all this? It appears clear that multifunction disks and drives in just about any combination of erasability, WORM and CDROM will be available from some vendor someplace in, probably, 1988—surely in 1989 or '90. Then you can use whatever combination will make you the most money.

No matter what the time table, few doubt that, to play in the mainstream computer business (which means on the desktop where the 5¼-inch form factor is king) optical media needs erasability. "If they can combine erasability with CDROM and WORM," says a Pennsylvania system integrator, "look out."

Look out, especially, magnetic media. "We view erasable (disks) as having the potential to replace magnetic storage over the next 10 years," says Skip Kilsdonk, director of marketing at Maxtor Corp., San Jose.

Expected to be major players in multifunction drives are Japan's Hitachi Ltd., Ricoh and Sony Corp.; America's Maxtor; Optimem; Digital Equipment Corp., Maynard, Mass.; Optotech Inc., Colorado Springs, Colo.; Reference Technology Inc., Boulder, Colo.; Verbatim Corp., Sunnyvale; and Laser Magnetic Storage International Co., New York., the joint venture of Philips and Control Data Corp., Minneapolis.

Alcatel Thomson Gigadisc Inc., Waltham, Mass.; E.I. DuPont de Nemours & Co., Wilmington, Del.; Optical Storage International, Colorado Springs, Colo.; and 3M, St. Paul, Minn., have joined Philips and many of the other drive vendors in developing optical media and probably will be among the suppliers of multifunction disks. □

COMPANIES

Wang hopes for rebound as the Doctor's son steps in

James F. Donohue
Managing Editor

You can't help rooting for the Wangs: father, son and company—in order, Dr. An Wang, Frederick A. Wang and Wang Laboratories Inc. of Lowell, Mass. Fred and the company, who are the same age (36), are in a lot of trouble. Wang Labs has been leaking money like a sieve, and Fred's job as the new president is to plug up the holes. It won't be easy.

Wang Labs' fiscal year ends June 30. In the first two quarters of the 1987 fical year, the company lost $30 million and $79 million, respectively. Nobody thinks Wang Labs can wipe out all that red ink in six months, but Fred and others at the company look for a sharp turnaround beginning in the year's third quarter (see graph).

Supporters of this view are starting to turn up, even on Wall Street. One of these, Martin Simpson of Martin Simpson & Co., New York, believes that Wang Labs, after posting losses in 1985 and 1986, will show a profit this calendar year. Simpson sees Wang in strong contention with IBM Corp. and Digital Equipment Corp. in office automation.

"When companies are looking to buy office automation products—and we've just done a survey of over 3,000 such companies—they tend to look at only three suppliers: IBM, Digital Equipment and Wang," Simpson says. "In our survey, 64 percent of the companies responded that they would be making additional office automation purchases, which is a very high growth rate. And of these, 29 percent intend to purchase systems from Wang. That's compared with 31 percent for IBM and 17 percent for Digital."

War on two fronts

Wang Labs must attack its problems on two fronts. First, it has to cut expenses, and that's Fred's job. You hear the quip that Wang Labs is a $2.5 billion company being run as if it were an $8 billion company. The quipsters mean that Wang is full of big ideas and of waste, inefficiency and duplication. Fred, who is treasurer as well as president, says he'll cut expenses $50 million by July, largely by consolidating operations (two manufacturing plants in Massachusetts were the first), letting people go and cutting the pay of the remaining 30,000 employes 6 percent.

Second, Wang has to boost sales. That's the job of Ian Diery, the new head of U.S. operations. Diery, an Australian whose accent is a combination of outback and Oxford, is fresh from four successful years running Wang's European operations. In the last three years, Wang sales in Europe have been one of the company's few bright spots, enjoying a 40 percent compound annual growth rate.

Diery believes that Wang has been trying to sell to the United States as if it were one country when, in fact—like Europe—it is several countries:

Disk Crashes Negatively Impact

So Hitachi Disk Drives are Built to Last.

"That *$(#&!! system you sold us died. The disk drive crashed." To the customer on the phone it doesn't matter that you purchased the drive from someone else. Your logo is on the product.

Hitachi understands the feeling. After all, we're one of the largest OEM computer system manufacturers in the world, and we use disk drives in our own equipment, too. If a drive should fail in a piece of our equipment, we'd get those charming phone calls, same as you.

So we use the most reliable disk drives available anywhere: Hitachi disk drives.

The art of making disk drives better.

Hitachi has 1,500 design engineers who work on nothing but disk drives. We design and build our own motors, heads, microprocessors, and custom LSI to ultra-high specifications. Then we subject them to the most stringent Quality Assurance program in the industry. We've learned over the past 15 years of disk drive manufacturing that this is the only way to make drives good enough to use in our own systems.

A serious commitment to disk drive solutions.

We have one of the broadest lines of state-of-the-art disk drives you can find, including 3.5", 5.25", 8", and 8.8" Winchesters. We've also made the enormous R & D expenditures necessary to be one of the pioneers in optical storage technology.

Hitachi is serious about staying with the product line for the long haul. Very serious. We believe in forging long-lasting relationships through a combination of superior quality products and superior support.

With Hitachi, you choose a business partner who will be here to work with you, today and tomorrow . . . helping you to keep your phone ringing with new orders, not complaints.

Fast Action:
To obtain product literature immediately, CALL TOLL FREE 1-800/842-9000, Ext. 6901. Ask for literature number PB-001.

COMPANIES

California, the rest of the West, Texas, the rest of the Southwest, the South, the Midwest, New England, New York City and the rest of the East. So he's putting decision-making authority, and responsibility, into the hands of the company's 35 district staffs in the belief that local sales-and-service people best know the needs of local customers.

"People in Texas don't want to deal with a salesman from New York City," he says.

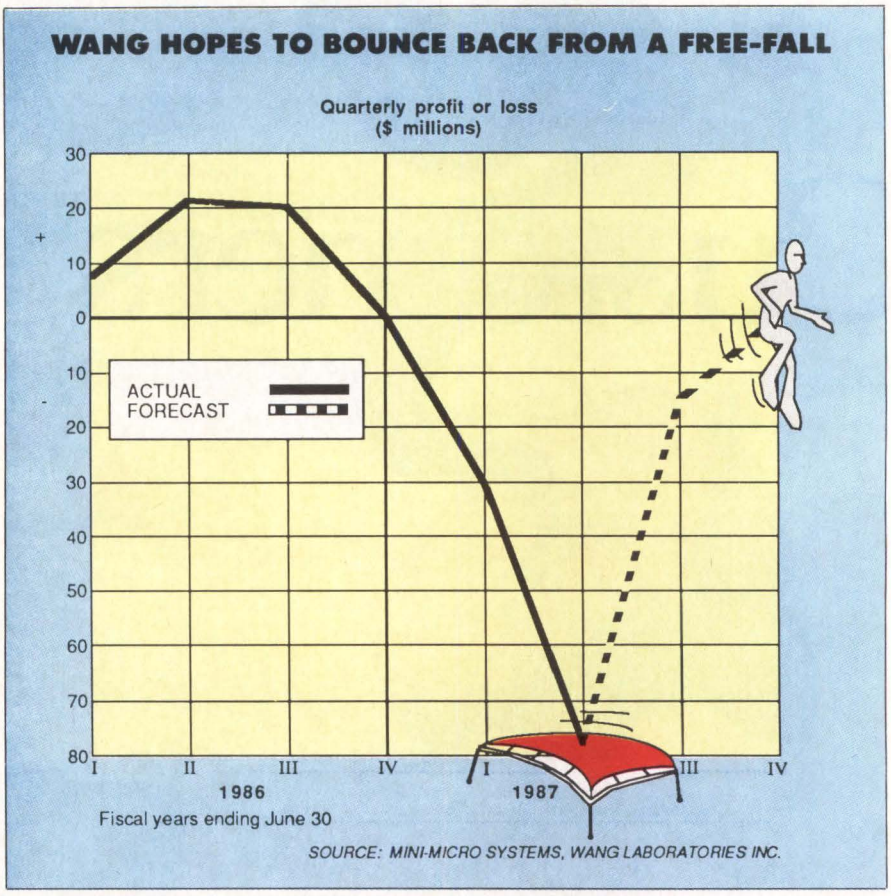
Customer is always right

Diery emphasized customer satisfaction in Europe (something Fred admits Wang "lost sight of" in the United States when growth was running 35 percent a year). The idea behind Diery's decentralization effort is to give one person, the project manager, total responsibility for a customer. No more passing the buck up the line to Lowell, which meant, Diery says, "that the problem never got fixed."

That's right, say customers like Philip D. Dowlin, director of information services at MidCon Services Corp., Houston. "When we started with Wang [late 1970s, early 1980s] and we had a problem, we couldn't get the attention of anybody," he says. But Dowlin confirms that Diery's passing down of responsibility already has made his Wang representatives a lot more attentive to his needs.

Wang Labs also plans, in the midst of cutting other personnel, to increase its sales force by 40 percent. Fred thinks a lot of these salespeople will come from IBM, where, he says, they'll have been fired as IBM cuts back on its own operations in the face of slumping sales. "The people they'll fire will be the people who didn't fit the IBM 'white shirt' mold," Fred says. "Those are the people we want at Wang."

Fred and Diery have taken charge like Franklin D. Roosevelt did in 1932 when the country was in about as bad a shape as Wang Labs is today. Roosevelt had his "first 100 days." Fred and Diery have their "first 45 days, their "first 100 days," and their "first six months" and so on, each segment filled with objectives.



This aggressive agenda is startling in that the company they're reforming is the one Fred's father, the venerable An Wang, 67, founded in 1951 and led as president (not counting the short reign of John F. Cunningham in 1985) until he retired for a second time in late 1986.

But the fact is that the Doctor, as the senior Wang is reverently called, let the company drift for several years in the early 1980s. Wang Labs had a lock on the booming word processing industry in those years, and nobody noticed the drift. "We were trying not to trip over our growth," Fred explains. Part of the problem was that the Doctor permitted speculation that Fred, his firstborn son, might not inherit the Wang helm when, in reality, there never was any doubt about it.

Fred has been in his father's company as an apprentice for 15 years, doing all sorts of jobs and running departments like R&D. People say that he's amiable and bright, but that he's not as smart as his father and that he wouldn't be president if he weren't his father's son.

It's certainly true that Fred became president of Wang Labs for the same reason that Robert F. Kennedy became attorney general of the United States: family connections. But, like Bobby Kennedy, Fred may have what it takes to be good at the job.

He's amiable and low key with an endearing way of discounting himself. Asked how long he'll keep the title of treasurer, he says, "Some people say until I learn the job." Despite graying hair and a three-piece suit, his demeanor is boyish: his hair is tousled and he's forever pushing it out of his eyes, and there's that famous can of Coke Classic forever in his hand.

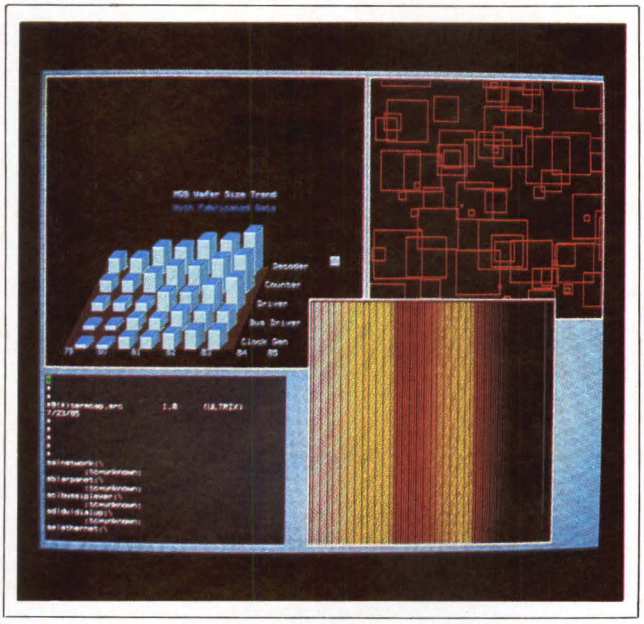
All that, of course, makes him charming. The question is: is he tough enough to turn Wang Labs around?

So far, he looks pretty tough. In his first 60 days, Fred laid off 1,000 employees while making pay cuts. Meanwhile, Diery, who looks like an ex-prizefighter, has established his own reputation for toughness. Of him, a Wang employee says, "Fred is the boss, but woe unto thee if ye get on the wrong side of Ian." □

GRAPHICS TRENDS

Major manufacturers join forces to support X Window graphics standard

Tim Scannell, Senior Editor



MIT's X Window *offers different vendors a "seamless" environmental relationship.*

It can reduce the cost of graphics software development and preserve investments already made in graphics hardware—particularly in expensive CAD workstations.

Those are two of the main reasons why nearly a dozen software and hardware companies—including such heavyweights as Digital Equipment Corp., Data General Corp. and Hewlett-Packard Co.—banded together recently, in an unusual show of mutual support, to commit themselves to a graphics workstation windowing system developed at the Massachusetts Institute of Technology (MIT) in Cambridge, Mass. Called X Window, the system basically allows vendors to develop high-level graphics applications in a window-oriented environment without concern for hardware compatibility. X Window is initially tailored for the UNIX operating environment, but it is expected to migrate to other operating systems —even MS-DOS—in the near future.

Other companies lending their official support to X Window include Apollo Computer Inc., Chelmsford, Mass.; Sony Corp., which sent a representative of its Super Micro Division in Tokyo; and Adobe Systems Inc. of Palo Alto, Calif., which announced plans to develop a version of its PostScript page-description language for use as an extension to high-performance graphics windowing systems. The new version of PostScript—a standard in desktop publishing—will be available sometime in the fourth quarter of this year, according to Adobe spokeswoman Anne Robinson.

The X Window System was developed as part of MIT's Project Athena, a five-year, $50 million effort launched in 1983 to explore the use of networked, high-performance workstations in educational environments. In essence, the system virtualizes the interface to a workstation's input and output, allowing each application to transparently handle high-level graphics data and programs over a local area network—in this case Ethernet. The arrangement also "gracefully accommodates heterogeneous computer components," explains MIT's Professor Steven Lerman, director of Project Athena.

The X Window System's ability to offer a "seamless" windowed environment is key to its acceptance among different vendors, says Vicki Brown, program manager for CAD, CAM and CAE at International Data Corp., a research company based in Framingham, Mass. Presently, about 400 vendors offer about 2,400 products in the graphics market, she said, concluding "portability is a primary concern."

Although MIT will retain ownership of the X Window System, it is nonproprietary and will be offered to any vendor for a nominal charge that covers the cost of media and documentation. MIT will continue to work with vendors to enhance the windowing system, acting more or less as a screening committee for future versions of the product and not necessarily as the primary system developer. "MIT is doing things that are important and useful and will try to convince people to adopt them," Lerman noted. "But, we are not out to develop standards."

The announcement of support for X Window was held in conjunction with a two-day technical conference focusing on the system. Sponsoring vendors were careful to point out that, while X Window is backed by vendors representing a combined total of more than 70 percent of the graphics workstation market, the system still had a long way to go before being completely developed. For example, in its present version, 10.4, the X Window System can only accommodate 2-D graphics. MIT does not have the resources in Project Athena to develop a 3-D version but will

GRAPHICS TRENDS

assist vendors who want to develop a 3-D system, to try and "keep everything together," observes Lerman.

Also, while a developmental toolkit is available for the current X Window version, a more enhanced toolkit will be offered with Version 11, which is expected to be released within the next few months, Lerman said.

Although X Window is just now emerging from MIT's developmental labs and entering the commercial world, most vendors at the announcement were quick to refer to it as at least a de facto industry standard. For example, HP added X Window to its price list in late January and expected to offer the system across its product line by the end of March, according to William G. Parzybok, vice president and general manager of the company's Design Systems Group in Fort Collins, Colo. Also, representatives from Sony of Europe and Siemens AG of West Germany pointed to their presence at the meeting as a symbol of the international importance of such a standard in the high-level graphics market.

The simple fact that major computer manufacturers have grouped together to commit their support to X Window should be a boon to companies that produce software for the third-party graphics market, observed Dr. David L. Nelson, vice president of advanced technology and chief technical officer at Apollo. "Our intent," he said, "is to limit redundancy in the industry and to send a clear signal to third-party developers and suppliers that, if they write to X, they have a ready platform to present their products."

Despite the vendors' enthusiasm, however, MIT is hesitant to tag X Window as the sole standard that is, or will be, available to the graphics community. MIT's Lerman pointed out that a number of companies already have proprietary windowing systems designed specifically for their hardware and do not see the need for a universally accepted system.

One of these companies, Sun Microsystems Inc., was invited to the MIT-sponsored press briefing and has stated it will support X Window but declined to attend and offer an official endorsement.

Also conspicuous by its absence from the MIT standards rally was IBM Corp., which reportedly supports the X Window System through Version 4.2 of its Academic Information System operating environment but apparently did not want to join DEC, DG and the other companies in a public commitment.

However, while MIT stops short of promoting X Window as the only way to fly in graphics window standards, Project Athena's Lerman does admit that its momentum, especially when driven by major companies in the computer industry, will be tough to counter.

"Once a rock starts rolling down a hill, especially if it is a big rock, you don't have to push it harder," he remarked. "My guess is that it will be harder to slow [X Window] down than to speed it up." □

Tandy has more experience in XENIX® multiuser systems than any other VAR vendor.

When it comes to selling XENIX-based multiuser systems, you need Tandy on your side. That's because Tandy has one of the largest installed base of XENIX systems in the world. And years of experience that put us head and shoulders above our competitors.

That's why it is to your advantage to become a Tandy Value-Added Reseller. Once you do, you will profit from our proven experience and expertise in XENIX systems.

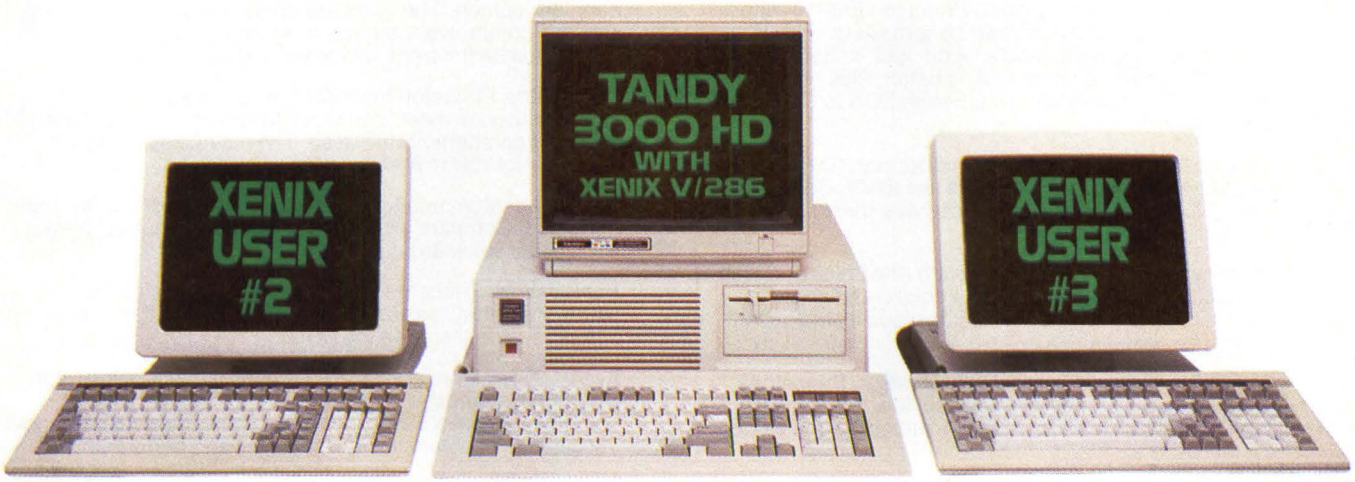
Multiuser efficiency
The high-performance Tandy 3000 HD and versatile XENIX System V operating system (based on UNIX® System V, the standard of the UNIX world), are the keys to making total office automation systems development more efficient and cost effective for your customers.

The Tandy 3000 HD is IBM PC/AT® compatible and has a 28ms 40 MB hard disk drive. With the 3000 HD's power, a XENIX operating system and inexpensive display terminals, you will be able to custom-tailor multiuser system solutions to meet your customers' needs. And that's a competitive edge that will help you grow your business.

Advanced 286 technology
Based on the 16-bit Intel® 80286 microprocessor, the 3000 HD operates at 8 MHz and features 640K main memory (expandable to 12 MB). A high-capacity 5¼" disk drive reads both 1.2 MB and 360K formats, allowing the 3000 HD to run either IBM® PC or PC/AT software.

Ready now for Tandy VARs
XENIX-based Tandy 3000 HD multiuser systems are available through the Tandy VAR Program. A program that includes the most complete computer product line in the industry, competitive pricing, strong after market support, fast order processing, plus a leasing program exclusively for Tandy VARs.*

For more information on Tandy's Value-Added Resale program and hot-selling industry-standard multiuser systems, write or give us a call today!



Tandy Corporation
Value-Added Resale
1400 One Tandy Center, Fort Worth, Texas 76102 (817) 338-2387

*Tandy VAR Leasing Program administered by Dana Commercial Credit. XENIX/Registered TM Microsoft Corp. UNIX/Registered TM AT&T. IBM PC/AT/Registered TM International Business Machines Corp.

CIRCLE NO. 26 ON INQUIRY CARD

PRINCETON. The in

And much more:

Full EGA and CGA support. Princeton EGA monitors bring you 64 brilliant colors and bright sharp images in enhanced graphics mode, with 640 x 350 resolution. Your EGA software never looked better. Plus our HX-12E and HX-9E automatically switch from EGA to CGA mode, when needed.

Compatibility. Princeton monitors are 100% compatible with leading personal computers like IBM®, Compaq®, and more. No matter what system you have, there's a Princeton monitor that's right for you.

Quality Image. A .28mm dot pitch (the finest dot pitch of all leading EGA displays), bright colors, and sharp resolution give Princeton monitors a quality image that cannot be beat.

Easy Viewing and Ergonomic Design. Princeton monitors are designed for easy use, too. You get easy viewing with the HX-12E's black matrix tube and etched nonglare screen. The lines are crisp, the characters sharp, and the colors even, so you're more productive. Controls are located on the front, where you can reach them.

Reliability. Princeton monitors are designed and manufactured to meet your most demanding needs. Only the finest components are used. The result: dependable performance day in and day out.

Value. No other monitor gives you more for the money than Princeton. Compare for yourself. Feature for feature there's not a better value around.

Availability. Princeton monitors are as easy to get your hands on as they are easy to use. You can find them at computer stores around the world.

Reputation. More and more, people are making Princeton Graphic Systems their number one choice in personal computer displays. Because people know Princeton delivers the ultimate in compatibility, reliability, and performance.

*Dot pitch is the measure of the distance between phosphors of like color (dots) on the display screen. The smaller the dot pitch, the closer the dots are to each other. Thus, there are more picture elements which can be displayed on the screen which results in a higher resolution.

finest dot pitch* EGA monitors.

And the finer the dot pitch, the sharper the image.

For the no-compromise enhanced graphics monitors, look for the Princeton Graphic Systems name. Princeton delivers everything you need in a quality EGA display, from crisp, clear, full EGA support to rugged reliability. When you choose Princeton you choose the best.

HX-9E. The first IBM compatible 9" high resolution color monitor to support EGA. Has a .28mm dot pitch black matrix tube and etched nonglare screen for sharp, crisp displays and features a built-in tilt/swivel stand and green/amber switch.

HX-12E. The first IBM compatible high resolution color monitor to support EGA with a .28mm dot pitch. The HX-12E builds on the award winning features of the HX-12 and features 640 x 350 resolution for sharp, crisp text and colorful graphics.

PRINCETON®

GRAPHIC SYSTEMS

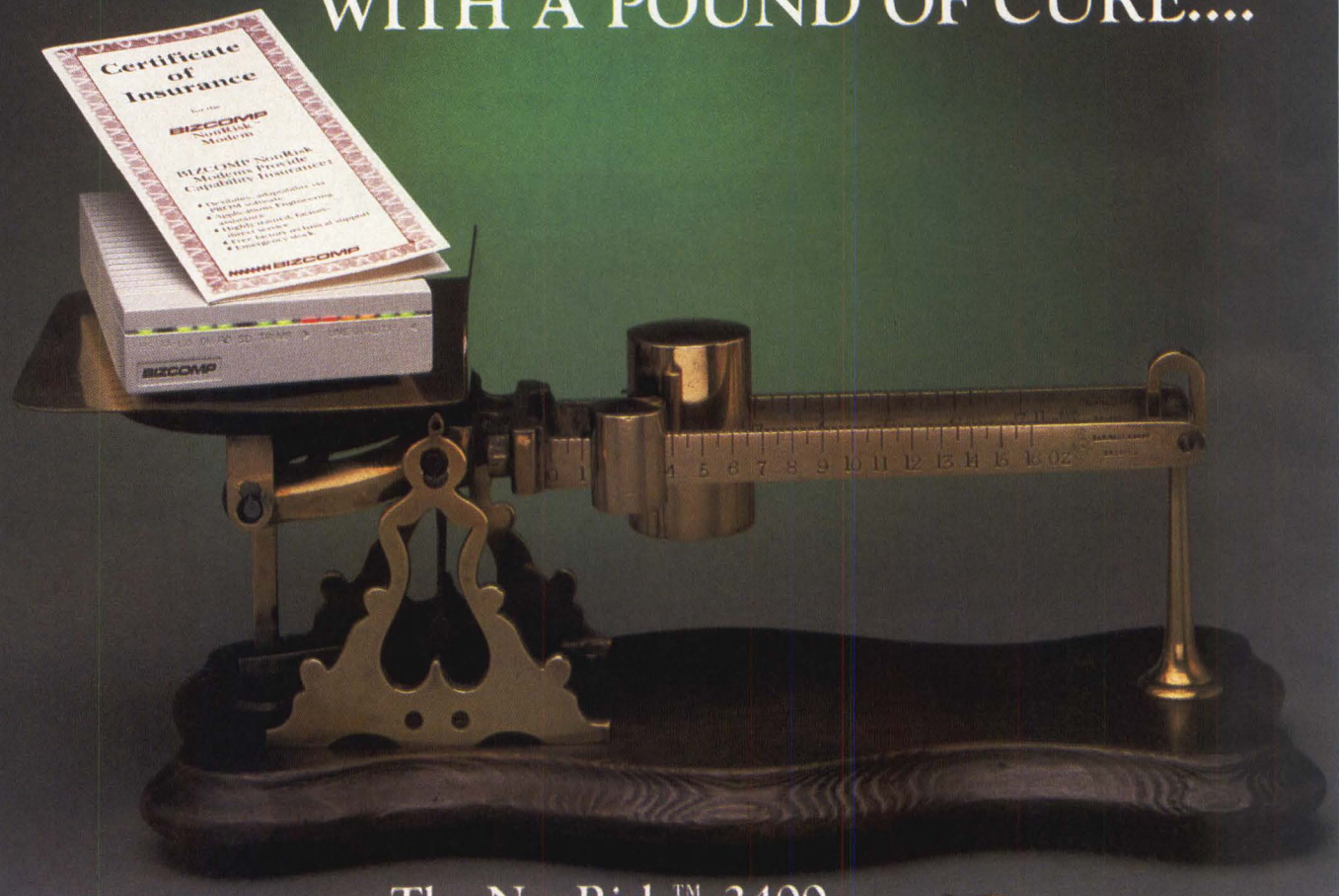
AN INTELLIGENT SYSTEMS COMPANY

601 Ewing Street, Bldg. A Princeton, NJ 08540, Telex: 821402 PGSPRIN, (609) 683-1660, (800) 221-1490

CIRCLE NO. 34 ON INQUIRY CARD

AN OUNCE OF PREVENTION,

WITH A POUND OF CURE....



The NonRisk™ 2400

One Pound, One Ounce. Together, they add up to one of the industry's most heavily weighted values. The NonRisk™ 2400 provides an ounce of prevention for your investment, with a pound of cure for your data connection.

Bizcomp safeguards your modem investment from changing standards and compatibility problems. Packaged with every NonRisk 2400 is our five point insurance policy. One of the major benefits of our coverage plan is your own NonRisk Agent, who is dedicated to solving your datacom needs.

Unlike commodity modems that have "Frozen" their design into silicon chips, The NonRisk 2400 is flexible and adaptable via PROM Software. In addition, we've innovated a new technology that provides up to a 1000 times performance improvement over noisy and weak data connections: AEC™ (Adaptive Echo Cancellation) Technology.

In total, the NonRisk 2400 is designed to outweigh its competition in performance, reliability, and flexibility. You'll get a solid investment without a hefty price tag.

For complete details on the NonRisk 2400 call anytime 800/422-9010 ext. 4048. Or for immediate applications assistance call 408/733-7800. CIRCLE NO. 35 ON INQUIRY CARD

BIZCOMP

The NonRisk™ Modem Company

 BIZCOMP Corporation, 532 Mercury Drive, Sunnyvale, CA 94086

CLONES vs. IBM: BUYER BEWARE

Personal computers compatible with IBM PCs offer significant price/performance advantages over Big Blue's originals, but system integrators should evaluate quality and level of support

Andrew Allison, Contributing Editor

The IBM Corp. family of personal computers has dominated the market since the introduction of the first IBM PC on August 12, 1981. The four years following the initial PC's appearance have seen the introduction of two other extremely successful siblings, the PC/XT and the PC/AT; the birth and disappearance of the PC Jr. and the Portable PC; and the launching of the PC Convertible.

The phenomenal success of the product family as a whole has given rise to de facto standard status for the PC/XT and PC/AT buses and to a vast body of PC-compatible software. It has also led to the emergence of a multitude of clones: personal computers more-or-less compatible with the IBM products.

Last year the personal computer market began to exhibit such early signs of maturity as product proliferation and ferocious competition. IBM responded by starting to move away from the overcrowded, low-end, open-architecture segment as its share of the overall market fell to around 50 percent for the first time and profit-margin pressure increased.

The clone vendors are just the latest in a long line of alternative-source suppliers seeking to better the cost/performance ratios of IBM's PCs. For example, the 64K-byte basic memory of the original PC presented an irresistible opportunity to provide more cost effective memory and I/O expansion than offered by IBM. This gave birth to the first wave of

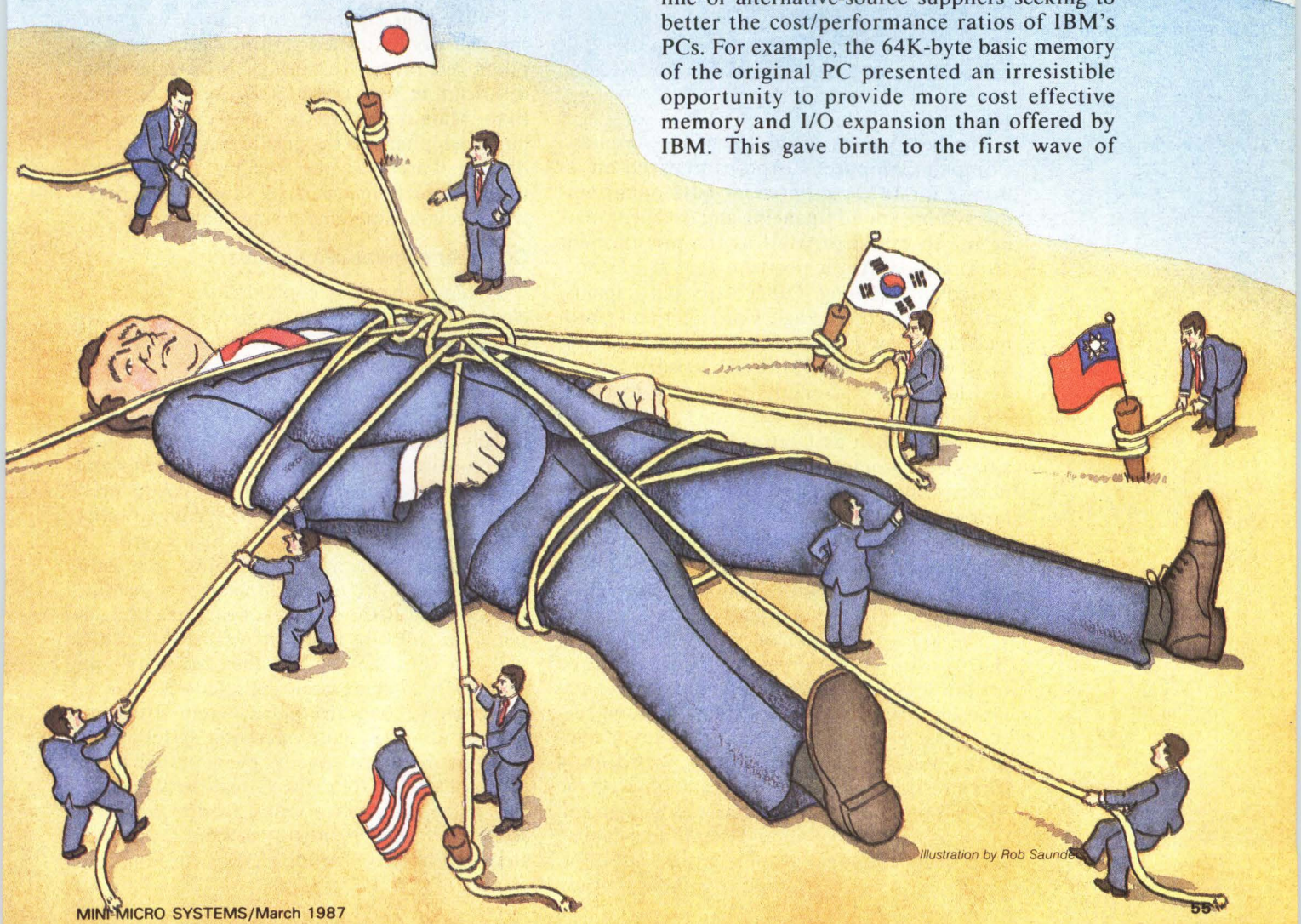


Illustration by Rob Saunders

alternative-source suppliers: the add-in board manufacturers.

Simple expanded-memory modules quickly gave way to memory-based multifunction cards and a broad range of other I/O controllers. Add-in accelerator boards provide PC/AT or better levels of performance via upgrades to the PC/XT.

The enormous, and entirely unanticipated, success of the IBM PC created a demand that IBM was unable to fill (with the AT's success having similar consequences). This vacuum was filled by the first of three waves of clone suppliers.

The PC/XT-compatible
WYSEpc+ from Wyse Technology packs 640K bytes of RAM, two half-height 360K-byte drives, one parallel and two serial ports, a graphics controller, a clock/calendar and two expansion slots into a 2.75-inch-high enclosure.

The best known of the first-wave suppliers, Compaq Computer Corp., capitalized on its license for IBM's proprietary basic input/output system, sound financing and excellent marketing to establish itself as the pre-eminent alternate source, a position that it has succeeded in retaining. Other early participants, such as the defunct Eagle Computer and Corona Data Systems (now Cordata Technologies Inc.), were sued by IBM for BIOS infringement and lacked the strengths necessary to reach critical mass.

Vendors such as Digital Equipment Corp. and Victor Computer Corp. (now Victor Technologies Inc.) introduced Intel Corp. 8088 microprocessor-based, but not IBM-compatible products, which were doomed to failure by the overwhelming success of the IBM PC and its operating system. (Both companies have since introduced fully PC-compatible products.)

The second wave of clones came from Japan. But, as with all the previous attacks mounted on the U.S. small-computer market by Japanese suppliers, they achieved only limited success. Last year, NEC Corp., the personal computer market leader in Japan, withdrew a machine that was software-compatible with the PC/XT and redirected its focus on the high end of the PC/AT market in an attempt to establish a presence. Japan's second largest supplier, Fujitsu Ltd. threw in the towel completely.

Seiko's Epson America Inc. subsidiary is the most visible Japanese supplier in the U.S. market, with a line of mid-priced PC clones based on proprietary gate arrays and BIOS. They utilize NEC's V-series alternatives to Intel microprocessors. Matsushita Electric Trading Co. Ltd. also appears to be committed to the U.S. market through its Panasonic line.

New Far East vendors arive

Last year saw the emergence of a third wave of clones: low-cost products from Korean and Taiwanese manufacturers. These come from three different types of vendors. First, Korean conglomerates such as Daewoo Electronics Co. Ltd., GoldStar Co. Ltd., Hyundai Heavy Industries Co. Ltd. and Samsung Electronics Co. and Taiwanese companies such as Tatung Co. of America Inc. The second group includes well-established electronics companies like Oriental Precision Co. Ltd. and TriGem Computer Inc., both of South Korea, and Taiwan's Multitech Electronics Inc. and American Mitac Corp. Finally, there is a bewildering array of small suppliers.

Unlike their Japanese competitors, which sell through wholly owned subsidiaries, these suppliers sell primarily through private labeling, distributors and manufacturers' representatives. Margin pressure is, however, forcing the larger suppliers to try and eliminate the middlemen. Last year also saw the beginning of serious efforts by overseas suppliers to penetrate the mass-merchandising channel.

Consider compatibility issues

System integrators contemplating the use of clones should consider a range of compatibility issues, including BIOS timing and capability, clock frequencies, wait states and interrupt processing.

Compatibility with IBM's PCs was rather loosely defined for the early clones: the ability to run Microsoft Corp.'s Flight Simulator and Lotus Development Corp.'s 1-2-3. As the market has matured, the definition of compatibility has changed to the point that high degrees of IBM compatibility are both required and readily available in PC clones. In fact, the leading independent BIOS suppliers guarantee that application software that runs with IBM's BIOS will run with their's. And they maintain support staffs to make good that pledge.

However, be aware that different BIOS implementations execute operating system functions at different speeds, even though their processor clock frequencies may be the same. For example, users of Award Software Inc.'s BIOS claim that it runs 11 percent faster than that of Phoenix Technologies Ltd. Hyundai

THANKS FOR THE MEMORIES

Have you ever noticed how time seems to change everything? Fashions change. Technology changes. Even the microcomputers we use change. Maybe that's why so many of our customers are saying goodbye to IBM in favor of a "good buy" from Wells American.

As time goes by, more and more computer users are realizing what an extraordinary value our A★Star II® truly is. It's the *only* AT class microcomputer that can run at 6, 8, 10 *and* 12 MHz! It's also the *only* PC/AT compatible that's "network ready." Better yet, each A★Star II now comes with your choice of keyboards - the original AT version or the enhanced "RT" style. Best of all, A★Star II prices start at only $995!

But what about quality and support? Don't worry! We've been making microcomputers *longer* than IBM! And it shows. Our A★Star® computers have been top rated by leading industry trade journals. Even so, we've heard that some "big blue" old-timers still worry about trading their IBM "security" blanket for better priced, higher performance equipment. (Remember how difficult it was to give up *your* baby blanket?) That's why we've arranged for RCA, one of the world's largest technical service organizations with 18,000 employees, to provide low cost, nationwide maintenance for our A★Star II. And if that's not enough, every unit includes free schematics and a no risk money-back guarantee.

THE A★STAR II IS MADE IN THE USA.

Still need a blanket? We've got you covered! Try out one of our A★Star II's and we'll send you one. It's baby blue, monogrammed and...it's absolutely free! We'll also include a $395 option, at no charge, with your first A★Star II purchase. This offer *is* limited, so call or write us today. Just because you'll be saying goodbye to IBM doesn't mean you'll have to say goodbye to quality, support *or* security. Besides, at least you'll still have your memories...and your money!

Wells American.

Corporate Headquarters: 3243 Sunset Boulevard • West Columbia, South Carolina 29169 • 803/796-7800 • TWX 510-601-2645

IBM, Personal Computer AT and AT are trademarks of International Business Machines.

CIRCLE NO. 36 ON INQUIRY CARD

BLUER THAN BLUE

The Genicom IBM compatible printers. More than IBM. For less.

Genicom has gone IBM® two better. Presenting the Genicom 3500 dot matrix series and 4500 line matrix series printers. Both 100 percent plug, panel and protocol compatible with IBM. And designed to work hand in hand with IBM 3270 cluster controllers or IBM 34/36/38 systems.

In fact, these printers are so true blue you could operate them with an IBM manual.

So what's the difference?

Plenty. The Genicom 3500s and 4500s are faster. And packed with more features. All for up to 40 percent less than what you'd pay for IBM. So why pay more for basic blue?

Printers That Beat The Blues.

If you're looking for speed and versatility in a reliable dot matrix printer, you can depend on the Genicom 3500 series.

Select from four models. And get printing at double the speed of IBM: up to 400 cps data processing and 120 cps letter quality.

Choose options like bar code printing. Alternate fonts. A cut sheet feeder. Even a 55 dBA extra quiet enclosure.

King of the Blues.

For heavy duty applications, the Genicom 4500 series is king. Fly through drafts at 800 lines per minute. Then, shift easily into high speed letter quality printing or high resolution graphics. And of course, Genicom offers a wide range of 4500 series options, including bar code printing.

Like all its products, Genicom stands by the 3500s and 4500s with an international service organization. Giving you the full support of America's largest independent printer manufacturer.

So, when it's time to choose the perfect printers for your IBM system, don't settle for second best. Color them bluer than blue with Genicom.

For more information, contact your nearby Genicom distributor. Or call 1-800-437-7468. In Virginia, call 1-703-949-1170.

GENICOM®

The Printers That Mean Business.

Genicom Drive, Waynesboro, VA 22980

CIRCLE NO. 37 ON INQUIRY CARD

IBM is a registered trademark of International Business Machines Corporation.

asserts that its PC clones' Falcon BIOS runs 2 to 2½ times faster than IBM's.

Thus, a clone's BIOS implementation can have a significant impact on system-level performance—an impact at least as important as clock frequency. In addition, there is a slight chance that a high-performance, i.e., faster, BIOS might cause compatibility problems that could not be solved by the usual expedient of dropping back to the standard clock frequency.

In addition, some clone BIOSes offer extended capability in regard to maximum addressable mass storage and networking. However, this raises the possibility that OEM software developed for use with this type of enhanced BIOS will not run under the IBM BIOS and/or other compatible BIOSes.

This is unlikely to occur for commercially available software, which must run on IBM PCs and strictly compatible clones. But OEMs and system integrators who develop custom packages could conceivably be locked into a specific clone by timing dependencies.

None of these issues should prevent system integrators or value-added resellers from taking advantage of the obvious cost/performance benefits offered by clones. Just make sure that the software specified (or developed) actually runs on the clone of choice.

Other compatibility issues encountered with clones include the effects on performance of clock frequency, wait states and interrupt processing. Application software with internal timing loops (fortunately a small and declining class consisting mostly of games) is obviously clock-frequency sensitive, and expansion modules (most notably enhanced graphic adapter controllers) are affected by all three parameters. In addition, programs developed for standard-clock-speed systems that directly access I/O ports (bypassing the BIOS) may cause difficulties on faster systems.

Clock frequencies vary

PC clones offer a variety of clock frequencies and ways of handling wait states. Most clones that operate at higher clock rates than standard IBM rates also include mechanical and/or software switches to provide 4.77-MHz operation for the PC and PC/XT and 6 MHz for the PC/AT. IBM has followed clone suppliers by (optionally) increasing the clock frequency of the PC/AT to 8 MHz. And the industrial-strength model 7552 PC/AT, announced in November, speeds along at 10 MHz.

Wait states raise another timing-related consideration. The IBM PCs impose wait states for off-motherboard operations, whereas at least some of the clones make the use of wait states optional. Although wait states are most widely employed to permit the use of slower (and less costly) main memory RAM, their use has implications for I/O controllers that have been designed around the IBM specifications.

As with software compatibility, wait-state and expansion-card compatibility should be examined early in the clone-selection process. Note in this regard that some so-called clones that are software compatible (i.e., PC-DOS and ROM-BIOS compatible) with IBM PCs nonetheless utilize incompatible I/O buses. Compatibility with expansion boards must therefore be considered in addition to the number and type of expansion slots provided.

Implementations differ

Clone vendors have taken a number of different approaches to implementing their products. One aforementioned alternative is the use of NEC's V-Series processors, some members of which Intel has claimed infringe upon its copyrights.

The huge market represented by IBM-compatible PCs has also encouraged the development of application-specific integrated circuits (ASICs) that replace the SSI/MSI (small- and medium-scale integration) component "glue" representing most of the non-memory components in IBM PC implementations. ASICs are also being utilized to integrate other major portions of system logic, notably graphics and disk controllers.

In half the volume *of an IBM PC/AT, Cordata's AT-compatible CS4200 furnishes serial and parallel ports, a half-height 360K-byte flexible disk and 20M-byte rigid disk, 640K bytes of RAM, four expansion slots and a clock/calendar.*

This high level of integration has had two main results. First, many of the functions previously implemented on expansion boards can now be incorporated within a clone's motherboard. Thus, large amounts of memory and controller logic can be integrated without suffering the delays inherent in utilizing I/O buses. The potential drawback is reduced repairability; if a controller fails, it can't simply be unplugged and replaced.

Second, at the other end of the spectrum, the basic motherboard functionality can be implemented on a standard expansion module that


TELECAT 286
PC/XT
PC/XT
Size Performance Price
TeleVideo
TeleVideo

AT performance at an XT price. Introducing the TeleCAT-286. $2995. Complete.

With TeleVideo, you always settle for more.

Up till now, with a mid-range budget, you had to settle for mid-range performance. And a mid-range set of features.

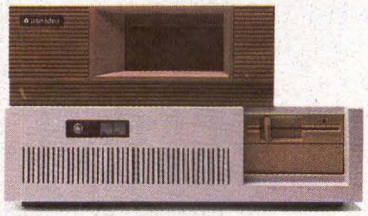
But not anymore. Because now, there's the new TeleCAT-286,™ from TeleVideo. An IBM AT-compatible machine that lets you settle for an entirely new concept in medium-priced PCs: more.

More Performance.

The TeleCAT-286 retails for $2995, roughly the same as a comparably-equipped IBM XT. But the similarity ends there. Instead of starting you off with a stripped-down box, we've loaded up the TeleCAT-286 with 512K RAM. A 20MB hard disk. A 1.2MB floppy. And everything else you need. Like an Intel 80286 CPU that runs at either 6 or 8 MHz clock speed. There's even a high-resolution monitor for text and graphics.

28% Smaller Footprint:

What you do with the extra desk space is up to you, but as you can see here, the TeleCAT-286 gives you a lot more of it than the IBM AT.



To make even better use of internal space, we socketed the TeleCAT-286 for one MB of RAM, and also included serial and parallel ports on the motherboard. As a result, we can still give you three extra expansion slots.

More Productivity.

Using our experience in building terminals and systems for 750,000 users worldwide, we've designed a machine that's the last word in ergonomics. With sculptured keycaps on a high-quality keyboard. LEDs on the three critical locking keys. And a footprint that's 28% smaller than the IBM AT's. So you get more of your desk back, too.

LEDs On Locking Keys:

For maximum visibility, we put our LEDs right on top of the three critical locking keys, so they won't get covered up by overlays.

Find Out Even More: 1 (800) TELECAT.

There's a whole lot more we can show you about the TeleCAT-286. So get in touch with your TeleVideo distributor. Or call us at 1 (800) TELECAT, Dept. 195, and we'll give you the name of the one nearest you.

The TeleCAT-286. Our 20MB version is $2995; 30MB, $3495. For high performance at a low price, don't settle for less.

TeleVideo®
Settle for more.

TeleVideo Systems, Inc. 1170 Morse Avenue
Sunnyvale, California 94088-3568 • (408) 745-7760

CIRCLE NO. 42 ON INQUIRY CARD

simply plugs into a (motherboard-less) PC bus backplane.

Faraday Electronics introduced the first integrated PC chip set in the spring of 1984, and was the first company to eliminate the motherboard on its PC bus products. The four-member FE30x0 AT chip-set, introduced last October, supports 6-, 8- and 10-MHz operation with no, one, or two wait states. It allows the basic AT motherboard to be replaced by an AT bus expansion module. Other suppliers of PC and PC/AT chip sets include Chips & Technologies Inc. (five chips), and Daewoo subsidiary ZyMOS Inc. (two chips plus address and data buffers).

Standard cells on the way

The first generation of these products utilized gate arrays to implement the required logic. Although the overall market is large enough to support full custom implementations, the individual market shares of the semicustom chip suppliers probably isn't. Hence, the next significant step will be to switch to standard-cell implementations—already done by ZyMOS. It seems likely that all the major players in the ASIC business will jump on this bandwagon, with the usual downward effect on prices.

The "super-motherboard" approach has had several benefits. It frees up expansion slots, permits additional functions to be incorporated in the basic chassis and reduces the overall size of the system. Several clone suppliers have "shrunk" their products to varying degrees, and the Wyse Technology WYSEpc+, introduced in September, carries this process about as far as it can go.

This PC/XT clone incorporates a 4.77-MHz or 9.54-MHz 8088-1 processor, up to 640K bytes of RAM, a monochrome/color graphics controller, two serial ports, a parallel port, a real-time clock with battery backup and either two half-height 360K-byte flexible disk drives or one flexible-disk drive and a 20M-byte rigid disk drive. All this plus two expansion slots packs into an extremely compact (2.75-by-18.75-by-15.75-inch) chassis, which occupies only 42 percent of the area of IBM's 6-by-20-by-16-inch PC/XT box. The system unit is complemented by a 14-inch ergonomic display.

The same technique is being applied to reduce the size of the even bulkier AT systems unit. IBM's initial step in this direction, the attempt to plug the performance gap between the PC/XT and PC/AT lines with its new 286 XT, sought to limit the impact on the PC/AT product line by not supporting 16-bit, AT-style expansion modules.

This is similar to the strategy adopted with the PC RT, i.e., coupling a very powerful processor to an inadequate bus. And it is a strategy that is likely to lead to the same result: lukewarm (at best) product acceptance.

A more elegant example of PC compression is the PC/AT compatible Cordata CS4200 series clone, which, like the rest of Cordata's computer products, is manufacturered by majority owner Daewoo. Although not quite as compact as the Wyse computer, the CS4200 system unit is, at 5 by 18.25 by 16 inches, much smaller than the standard AT.

The motherboard integrates the usual 640K bytes of RAM, a dual 360K-byte flexible disk drive controller, serial and parallel I/O ports and a clock/calendar. Optional 20M-byte rigid disk and monitor controllers occupy two of the four AT-style expansion slots provided. The CS4200 incorporates other attractive features, such as an 8-MHz 80286 processor and a front-panel power switch.

Ruggedized units appear

In addition to shrinking, PC clones are also being ruggedized, a trend driven by the penetration of PC family products into industrial and instrumentation applications. Thus, IBM, AT&T Co. and Hewlett-Packard Co. introduced industrial versions of PC family products during 1986. Typically rack-mountable, these systems utilize shielded enclosures and the enhanced cooling, filtering and power conditioning necessary to operate over a temperature range of zero to 55 degrees C.

Faraday Electronics' Stepstone is an example of the motherboard-less, single-board computer implementations that are penetrating industrial applications. A rackmountable PC/AT bus

CLONES OUTSPEED IBM PC CLOCKS

PC clock frequencies (MHz)

	4.77	6	7.16	8	9.54
IBM PC/XT	✓				
PC/XT clones	✓	✓	✓	✓	✓
		6	8	10	12
IBM PC/AT		✓	✓	✓	
PC/AT clones		✓	✓	✓	✓

Source: Manufacturers' specifications

CLOCK SPEEDS DETERMINE WAIT-STATE OPTIONS

PC and PC/XT clock frequencies vs. RAM-chip access times

Clock frequency (MHz)	Wait states	Access times (nsec)
4.77	N/A	150
6	1	150
6	0	150
8	1	150
8	0	120
10	1	120
10	0	100

Source: Faraday Electronics

Flexibility.

That's what makes Ampex the number one OEM terminal maker in the world

Flexibility is the key to Ampex's relationship with OEMs. We offer you more choices than any other terminal manufacturer around - in firmware, in monitors, in keyboards, in phosphors. Plus, you get all the usual customization in plastic and keycap colors, and your own logo.

But we don't stop there. We offer the deep base, a packaging concept designed especially for OEMs. The deep base provides more internal capacity than the standard terminal base. Still, it's compatible with the entire Ampex family of terminal products and options. And we build your product to our high quality standards. You get the benefit of our large volume and efficient manufacturing in a product that is uniquely yours. Call us today and find out just how flexible we are.

Ted Odolecki, Business Manager — Terminals

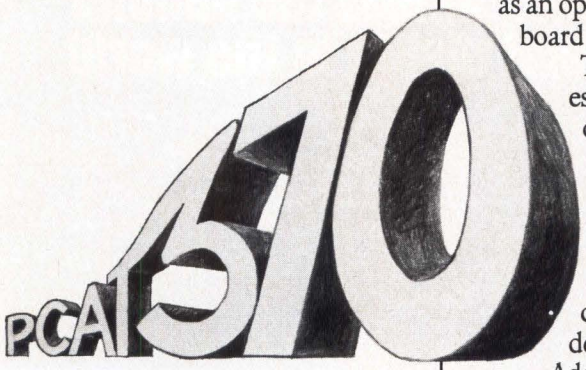
AMPEX

Make the right choice.
Call Ampex Computer Products Divison
at 800-538-7838 (in CA: 800-231-1036)
Ampex. We stand for excellence.

Check out our full line of ASCII, ANSI/DEC & PC Terminals.

CIRCLE NO. 48 ON INQUIRY CARD

Alsys launches PC AT-TO-370 ADA Cross-Compiler at November ADA Expo; 80286 Debugger also introduced.



A new Alsys cross-compiler permitting Ada programs to be written on an IBM-PC AT and executed on an IBM 370 was introduced at the November Ada Expo in Charleston, W. VA. The cross-compiler, pre-validated to AJPO test suite 1.7, is priced at $2,995 and includes a 4 MB RAM board.

Two compilers, the Alsys validated PC AT self-hosted compiler, and the AT-to-370 cross-compiler, are offered as an option at $4,995. One RAM board serves both compilers.

The cross-compiler, and especially the two-compiler option, implements a "distributed programming" environment for which the Ada language and its "package" concept is particularly suited. The two-compiler option permits developers to program in Ada and test their results at their workstations before uploading 370 object code to the mainframe.

Alsys also introduced its PC AT debugger called AdaPROBE at the Expo. AdaPROBE combines a unique Ada-VIEWER with regular debug facilities.

alsys

ALSYS, INC.,
1432 Main Street, Waltham, MA 02154

ADA NOW. Tell me more about the cross-compiler.

Name/Title _____

Company _____

Address _____

City/State/Zip _____

Phone/Ext _____

In the US: Alsys Inc., 1432 Main St., Waltham, MA 02154 Tel: (617) 890-0030

In the UK: Alsys Ltd., Partridge House, Newtown Rd., Henley-on-Thames, Oxon RG9 1EN Tel: 44 (491) 579090

In the rest of the world: Alsys SA, 29, Avenue de Versailles, 78170 La Celle St. Cloud, France Tel: 33 (1) 3918.12.44

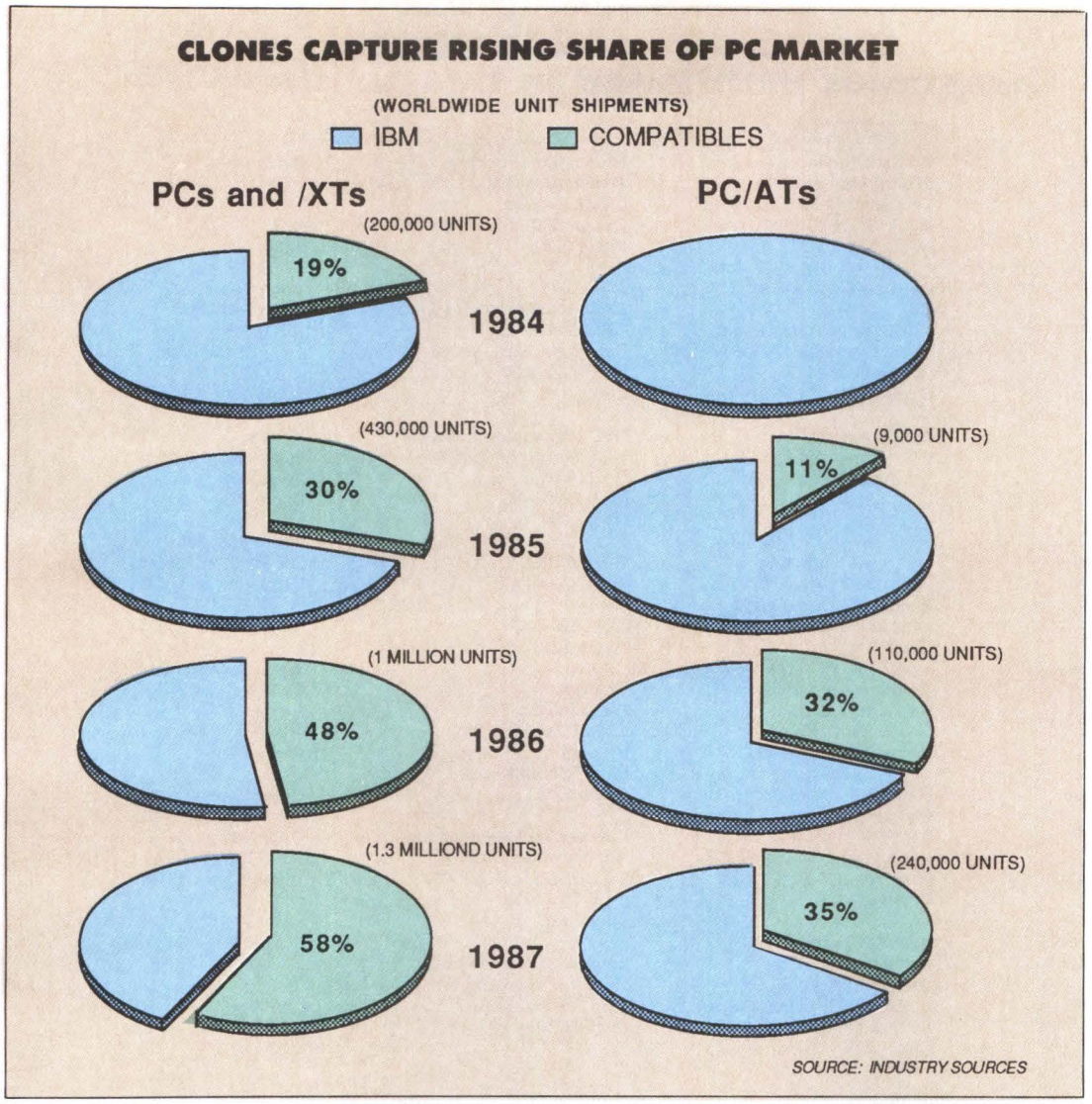
*Ada is a registered trademark of the U.S. Government (AJPO). Alsys is the trademark of Alsys, Inc. References to other computer systems use trademarks owned by the respective manufacturers.

Prices refer to U.S. only. Contact Alsys for prices in other countries.

CIRCLE NO. 39 ON INQUIRY CARD

NOW AVAILABLE AdaPROBE™ Program Viewer and Symbolic Debugger for the AT and compatibles.

Ada now



industrial computer system, it combines single-board implementations of the PC and PC/AT, system monitor board, maintenance panel, modular power supply and disk drives. With its industrial-grade keyboard and a 10-slot card cage, it becomes a robust and flexible industrial controller.

Two significant changes occurred in the IBM PC and compatible market last year: the legitimization of the use of clones in professional and resale applications and the emergence of Korean suppliers. As one consequence of these developments, IBM's share of the PC and PC-compatible market, while probably remaining above 50 percent for 1986 as a whole, slipped below 50 percent during the second half of the year. Because IBM cannot live with the low margins acceptable to clone vendors with lower overhead, new, harder-to-clone, down-sized products can probably be expected from the market leader. Indications at press time that IBM is no longer manufacturing the PC and is shipping PC/XTs in its stead may be the first reaction to this trend.

The entry of major Korean computer manufacturers into the clone market will impact the other suppliers as distribution channels develop and volume increases. At least some of the Korean suppliers have indicated their interest in other areas of the computer market, a transition facilitated by the availability of 32-bit microprocessors. This has profound implications for minicomputer and superminicomputer manufacturers.

Tandy Corp. has recently emerged as the No. 1 clone supplier in terms of units shipped, according to InfoCorp of Cupertino, Calif. That, coupled with the recent introduction of IBM PC-compatible products by Atari Corp. and Commodore Business Machines Inc., means that the market battle is truly joined.

Whatever their apparent source, most clones originate in the Far East, with few U.S. suppliers doing any manufacturing below the major

Companies mentioned in this article

American Mitac Corp.
3385 Viso Court
Santa Clara, Calif. 95054
(408) 998-0258
Circle 308

Atari Corp.
1196 Borregas Ave.
Sunnyvale, Calif. 94086
(408) 745-2000
Circle 309

AT&T Information Systems
1776 On the Green
Morristown, N.J. 07960
(201) 898-8000
Circle 310

Award Software Inc.
236 N. Santa Cruz Ave.
Los Gatos, Calif. 95030
(408) 395-2773
Circle 311

Chips & Technologies Inc.
521 Cottonwood Drive
Milpitas, Calif. 95035
(408) 434-0600
Circle 312

Commodore Business Machines Inc.
Computer Systems Division
Brandywine Industrial Park
West Chester, Pa. 19380
(215) 431-9100
Circle 313

Compaq Computer Corp.
20333 FM 149
Houston, Texas 77070
(713) 370-7040
Circle 314

Cordata Technologies Inc.
275 E. Hillcrest Drive
Thousand Oaks, Calif. 91360
(805) 495-5800
Circle 315

Daewoo Electronics Co. Ltd.
4701 Patrick Henry Drive
Santa Clara, Calif. 95050
(408) 748-8604
Circle 316

Epson America Inc.
2780 Lomita Blvd.
Torrance, Calif. 90505
(213) 539-9140
Circle 317

Faraday Electronics
749 N. Mary Ave.
Sunnyvale, Calif. 94086
(408) 749-1900
Circle 318

GoldStar Co. Ltd.
C.P.O. Box 2530
Seoul, South Korea
Circle 319

Hewlett-Packard Co.
Personal Computer Group
974 E. Arques Ave.
Sunnyvale, Calif. 94086
(408) 720-3000
Circle 320

Hyundai Heavy Industries Co. Ltd.
San 136-1 A-Mi-Ri
Bu-Bal-Myun Echon-Kun
Kyungkido, South Korea
Circle 321

Matsushita Electric Trading Co. Ltd.
C.P.O. Box 288
Osaka, 530-91, Japan
Circle 322

Multitech Electronics Inc.
1012 Stewart Drive
Sunnyvale, Calif. 94086
(408) 773-8400
Circle 323

NEC Information Systems
1440 Massachusetts Ave.
Boxborough, Mass. 01719
(617) 264-8000
Circle 324

Olivetti USA
765 U.S. Highway 202
Somerville, N.J. 08876-1289
(201) 526-8200
Circle 325

Oriental Precision Co. Ltd.
194-27 Tae-Wha Bldg.
Insa-dong, Chongno-gu
Seoul, South Korea
Circle 326

Phoenix Technologies Ltd.
320 Norwood Park S.
Norwood, Mass. 02062
(617) 769-7020
Circle 327

Samsung Electronics Co.
150 2-Ka Taepyung-Ro Chung-Ku
Seoul, South Korea
Circle 328

Tandy Corp.
1 Tandy Center
Fort Worth, Texas 76102
(817) 390-3011
Circle 329

Tatung Co. of America Inc.
2850 El Presidio St.
Long Beach, Calif. 90810
(213) 637-2105
Circle 330

TriGem Computer Inc.
Yongdong P.O. Box 619
Seoul, South Korea
Circle 331

Victor Technologies Inc.
380 El Pueblo Road
Scotts Valley, Calif. 95066
(408) 438-6680
Circle 332

Wyse Technology
3571 N. First St.
San Jose, Calif. 95134
(408) 946-3075
Circle 333

ZyMOS Inc.
477 N. Mathilda Ave.
Sunnyvale, Calif. 94086
(408) 730-8800
Circle 334

subassembly level. As a consequence, clone-related purchases were a significant contributor to the U.S. electronic trade deficit in 1986.

Although most minicomputer companies offering private-label clones get them from the Far East, some manufacture PC-compatible clones themselves. Of these, only HP and Olivetti USA are active in the OEM market.

HP is pursuing vertical applications with desktop publishing and CAD/CAE workstation systems, in addition to supplying PC-DOS-compatible workstations to its minicomputer customer base.

HP's current PC-compatible Vectra product is particularly interesting in that it is manufactured in the United States on a highly automated assembly line. In fact, Vectra incurs a direct-labor content so low that the company no longer bothers to keep track of it. Low production costs combined with Japanese, Korean and Chinese character capability enables the computer to be sold successfully in Far Eastern markets—a significant accomplishment for a U.S. manufacturer.

Some buyer caveats

Clones have a number of attractions for OEMs and system integrators. In addition to the price differential between clones and the IBM products, quality and level of support are often more than adequate. And, in many cases, there are performance benefits to be had as well.

With the proliferation of PC/AT clones, and the resulting price reductions, you should give careful consideration to the trade-off between PC/XT and PC/AT prices and performance. Use of Intel 80386-based systems, on the other hand, remains risky until IBM establishes the standard in this area.

A few other caveats are in order for system integrators, OEMs and VARs. Some of the smaller clone suppliers offer extremely aggressive pricing, but one should carefully evaluate

Jon Garman, Director of Product Engineering
Workstation Division,
Sun Microsystems, Inc.

XYLOGICS SUPPORTS THE POWER OF THE SUN.

When Sun Microsystems began looking at Multibus disk and tape controllers for their high performance engineering workstations, they demanded a lot.

"We needed a fast Multibus SMD disk controller, one that could read fast drives, like the Fujitsu Eagle, at full speed," says Sun Director Jon Garman. *"The boards we were evaluating simply couldn't measure up."*

That's when Sun discovered Xylogics.

"Getting Xylogics' 440 controllers operational with Sun's workstations was a positive experience," Garman remembers. *"What the manual said, the Xylogics boards did, and the software interface was simple to use.*

"We had our first Xylogics board up and running with UNIX in just four hours. It was quite phenomenal," he says.

Next, Sun integrated the Xylogics 450 in its second-generation family of workstations because it was the fastest, most reliable Multibus board they could find.

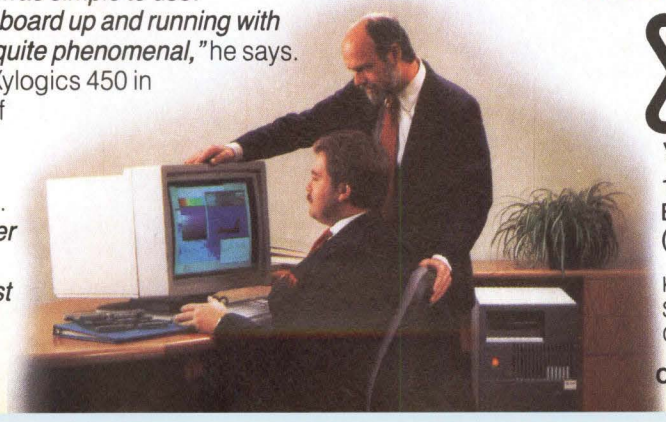
"From the start, our number one concern has been performance," says Garman. *"But just as important is the support Xylogics gives us. They've always been very responsive. They listen. And take us seriously. We have a close working relationship: engineering to engineering and management to management. They've always delivered on their promises."*

Xylogics' newest product, the 751 VME controller, is now being integrated into Sun's third generation of workstations, The Sun-3 Series.

Little wonder that Xylogics is the secret behind virtually every supermicro and workstation company. Or that nearly half of all high performance Multibus disk and tape controllers in use today are Xylogics.

Find out how Xylogics performance, reliability and support can be part of *your* success story. Call or write for information about our complete line of Multibus and VME bus products.

THE SECRET'S OUT.



Xylogics®

Your Partner For Performance

144 Middlesex Turnpike
Burlington, Massachusetts 01803
(617) 272-8140

Kevin Gonor, Xylogics and Jon Garman, Sun Microsystems, with Sun-3/160 C Color Workstation

CIRCLE NO. 40 ON INQUIRY CARD

The first choice in plotting.

First in monochrome. Versatec invented the wide format electrostatic plotter in 1974. Three generations later, Versatec plotters are still the fastest, most accurate, most reliable of all monochrome electrostatics.

Only Versatec offers 200 and 400 ppi resolution in plotting widths of 22, 24, 36 and 44 inches. Get paper and film output, twin roll media supply, "plug-in anywhere" international power supply, and lowest operating costs.

And only Versatec gives you all these options – high accuracy (±0.01%), automated media cutter, tilt to 15 degrees, line enhancement, and hardware character generator.

First in color. Versatec invented electrostatic color plotting in 1982. We give you a choice of plotting widths (24, 36 and 44 inches), 200 and 400 ppi resolution, and color/monochrome output.

Dual axis tracking and an integral alignment pass assure unparalleled accuracy. High quality paper and film with mirror imaging enable proofing and final output on the same plotter. And a character generator creates banner pages quickly and efficiently.

Compact size, light weight, and low power requirements simplify installation. And an easy-to-use control panel simplifies operation.

First in connectivity. Versatec offers more interfaces to more computers, a larger library of integrated plotting software packages, and a bigger family of modular standalone and embedded rasterizers accepting both parallel and industry-standard serial data formats.

Discover why Versatec sells more electrostatic plotters than all competitors combined. Circle the readers' service number or call toll-free 800/538-6477.*

*In California, call toll-free 800/341-6060

Versatec is a trademark of Versatec, Inc.
Xerox is a trademark of Xerox Corporation.

Plot data courtesy of Intergraph Corporation, Unigas and Zeh Engineering Systems.

VERSATEC
A XEROX COMPANY

CIRCLE NO. 41 ON INQUIRY CARD

See Versatec plotters at NCGA, ASPRS-ACSM, AIDD, and AIIM.

the quality of their products, degree of compatibility, level of local support and potential longevity in the market. In any case, the minimum requirements for PC clone products are an ability to put 640K bytes (PC/XT) or 1M byte (PC/AT) of memory on the motherboard, a power supply rated for at least 190W, a guaranteed IBM-compatible BIOS and stateside technical support.

And there are other things to consider. First, the clone must have the required degree of IBM PC compatibility. This means, in addition to a compatible BIOS, the ability to select the standard clock frequencies for those products that can operate at higher clock frequencies than IBM products. A hardware reset should also be a prerequisite, as should adequate capability (slots and power supply) for systems expansion. Other features may be mandated by the application or be desirable for product differentiation.

Overall, evaluate products on the basis of quality, level of support and price—in order of decreasing importance. Ascertaining the identity of the actual manufacturer of a clone under consideration is a good first step.

The largest cloud on the clone horizon is IBM. Specifically, the big question is what the company will do about its loss of market share and the margin pressure induced by the explosive growth of the clone market. It seems clear that any IBM 80386 processor-based product will have proprietary hardware and software. And this proprietary content will migrate down in the PC family, at least to 80286 processor-based products.

However, despite these developments, and the apparent demise of the IBM PC, the market for 8088- and 80286-based, MS-DOS personal computers will not disappear. The PC, PC/XT and PC/AT are standards that will survive both the introduction of proprietary content by IBM into its new personal computers and the onslaught of 386-based products. □

Andrew Allison, Los Altos Hills, Calif., is an independent consultant specializing in the evaluation of small-systems technology and its application to product and market development.

Interest Quotient (Circle One)
High 483 Medium 484 Low 485

What made manual mechanical engineering drawing obsolete in Japan?

Hitachi HICAD GM-1000™ micro-CAD software. Now, for $1,950, you can use the design tool that's #1 in Japan.

It took thousands of hours of engineering drawing for Hitachi to become one of the world's five largest producers of electrical and electronic hardware. But, you don't design computers without learning how to use them to become more productive. That's why Hitachi also became Japan's largest supplier of innovative CAD/CAM software.

The HICAD GM-1000 software package brings full-function CAD system capability to your desk top, turning your IBM PC®, XT® AT®, or compatible into a CAD workstation.

HICAD GM-1000 gives you the features you need the way you need them—easy to learn and use. HICAD GM-1000 provides prompts, error messages, and a help button to guide you.

Lines and basic figures can be drawn free hand or automatically constructed, then combined, moved, copied, rotated, or scaled to create complex geographic constructions. All entities are stored in a mathematical database that allows high-speed dynamic pan and zoom without interrupting another function. True elipses and true splines are built-in commands.

User definable features include menus, keyboards, mouse, line styles, batches, and advanced macros. Dimensioning, leader lines, balloons, and fail-safe ten-command storage are automatic. Drawings may be separated into as many as 255 layers and displayed independently or grouped.

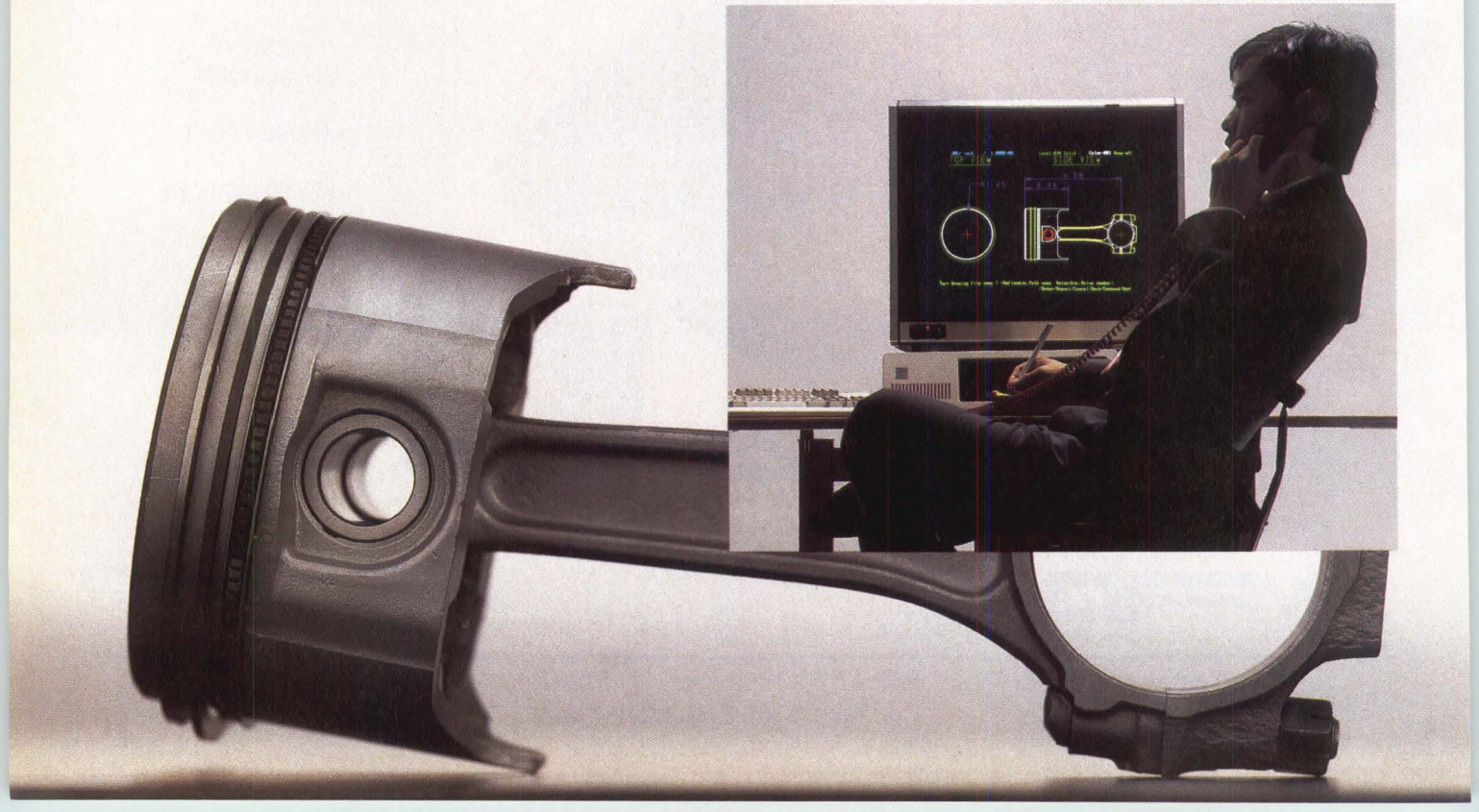
HICAD GM-1000 is a package that will make manual drawing obsolete for you, too. Our demo will show you why. Send for details today.

Hitachi America, Ltd.
Computer Division
950 Elm Avenue, San Bruno, CA 94066
Telephone: 1-800/842-9000 ext. 6672
In Canada: 1-800/843-9090 ext. 6672

HITACHI

IBM PC, XT, and AT are registered trademarks of International Business Machines Corporation.

CIRCLE NO. 43 ON INQUIRY CARD



POWERFUL SOFTWARE ORGANIZES LARGE JOBS

At every price level, integrated scheduling and cost accounting programs—called project management software—enable users to monitor and control complex projects

Edward R. Teja, Contributing Editor

Illustration by Jon McIntosh

For users who require computer systems to orchestrate work, system integrators must enter the world of what is known as "project management." Unfortunately, the bewildering array of software that falls loosely under the generic heading of project management makes specifying the best package for a particular application difficult. Adding to the confusion is the fact that not every program suitable for project management is, in actuality, project management software. There are important differences between certain management tools—such as databases and spreadsheets—and project management packages.

The common underlying characteristic of project management software is that each program applies a particular set of formalized organizational and analytical techniques to the process of estimating and measuring the performance of individual tasks that can be grouped together into a single project (see "Understanding project management"). The individual tasks may be either dependent on the completion or partial completion of other tasks or be independent, as long as all the tasks are inherently part of the project.

The various performance levels of project management software relate to the origins of a program—whether it migrated from mainframe environments or was created specifically for microcomputer environments. Although there are over 40 project management packages on the market, a look at a few examples from the various levels enables system integrators and value-added resellers to better understand the differences and similarities.

Packages control costs

Project management isn't a new concept. In fact, much interest results simply because powerful and inexpensive desktop computers are putting potent, well-understood management tools into the hands of small businesses. And no longer do software developers concern themselves with the limitations of microcomputers. They now write programs that put microcomputer-based software in head-to-head competition with mainframe software. Their programs are based on the same assumptions as traditional mainframe packages and often have similar capabilities.

Typical of the migration of project management software from computer room to desktop is Promis, from Strategic Software Planning Corp. This $2,995 package runs on a PC/XT, PC/AT or compatible with 512K bytes of memory, a CGA (color graphics adapter) or EGA (enhanced graphics adapter) and a color or monochrome display. The system connects to plotters or 132-column printers.

Promis features complete budgeting and cost control for single- or multiple-project operations. It tracks projects using several calendars (a unique calendar for each project), supports networks and exchanges data with Lotus Development Corp.'s Lotus 1-2-3 spreadsheet program.

Plantrac furnishes the standard analysis tools required for true project management software and adds earned-value analysis and project trending.

Computerline Inc.'s Plantrac is another industrial-strength package that is capable of handling an unlimited number of projects, with each project containing as many as 250,000 individual activities and using as many as 200 resources. The program runs on a PC with 256K bytes of RAM and a rigid disk drive. The main disadvantage of the microcomputer-based program over its mainframe competitors is speed. For example, time analysis of 1,000 activities takes from 2 to 6 minutes, a process that would only require seconds on a mainframe.

Plantrac furnishes the standard analysis tools required for true project management software and adds earned-value analysis and project trending. However, such capabilities cost: Plantrac carries a price tag of $3,000 for the first year and $995 for each following year. But the program is sufficiently powerful that it is being used to manage the New York City Transit Authority's more than 200 underground and surface construction projects.

Some software vendors integrate project management programs into larger software systems that run on mainframes, minicomputers and PCs. For example, SAS Institute Inc.'s SAS System combines a powerful fourth-generation language with a wide range of data-management procedures. One of the procedures in the system is SAS/OR, a project management and decision support tool. SAS/OR performs critical path analysis and linear programming and determines minimum and maximum cost flow, as well as other project management functions. The software runs on IBM mainframes and PCs, as well as mid-range systems from major minicomputer vendors.

One company that offers project management packages aimed specifically at software development environments is Expertware Inc. Its POWER management-support package helps users evaluate and monitor the software-development process. The company's CMT and DST toolkit packages increase programmer productivity by controlling and managing changes in software projects and generating documents and templates.

What to look for

Most large-system programs carry large-system price tags. However, the new generation of project management programs for PCs do a bit less than the large-scale competition, and the prices come down accordingly.

For example, Microsoft Corp.'s $395 Project is a generic project management program for microcomputer users that does exactly what you would expect a project manager to do. The program handles up to 200 activities and 255 resources.

At the beginning of a project, users can define the available resources, their costs, outline the project and milestones, and forecast the work. The calendar that the computer uses for scheduling can be customized to accommodate variables such as scheduled overtime, dead time and holidays, as well as normal workdays.

Using the program is simple. You enter the data and create a forecast that can periodically be compared to the actual progress of a job. The program provides comparisons between the forecast and the actual job in terms of both cost and time (did the team meet all of its

Understanding project management

Whether a person or a computer program, a project manager must coordinate available resources with the job at hand in an efficient manner. Then, as work progresses, results must be compared to forecasts in such a way that corrective action can be taken in time to ensure that the inevitable snags don't mean missed deadlines, and that all costs are accounted for. Periodic review of the project management data should provide information that will guarantee better forecasts the next time around.

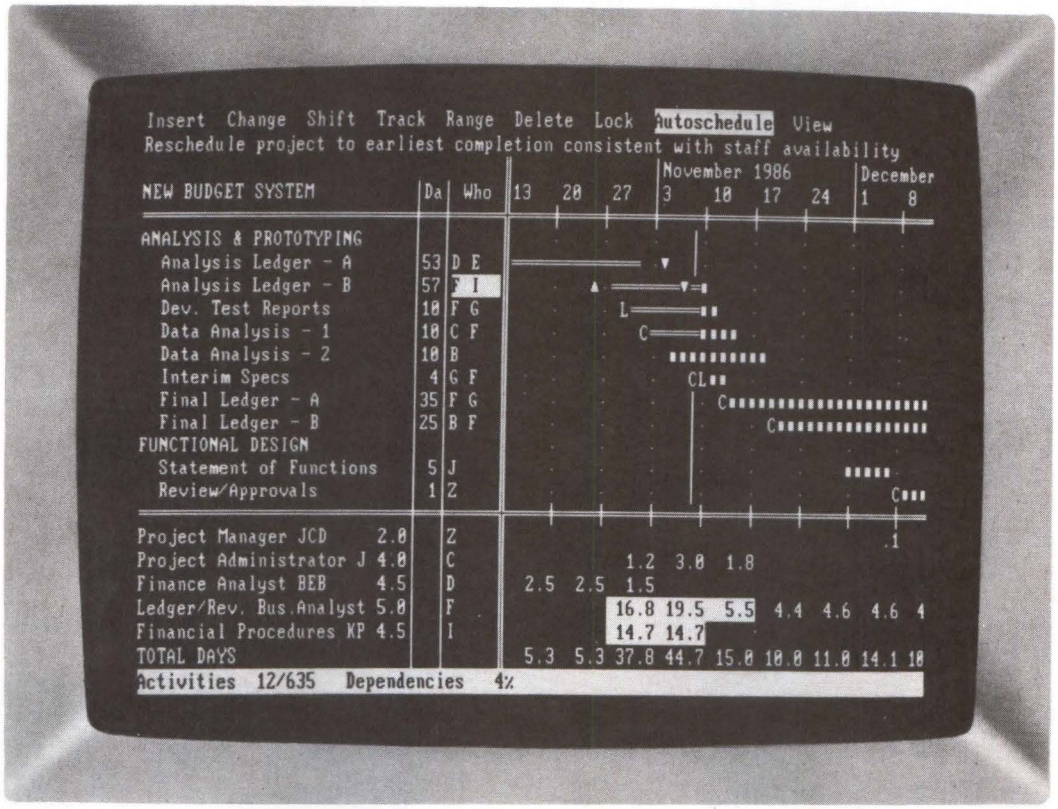
To accomplish these fundamental goals, project management software programs provide:

- Critical-path analysis—a process to determine the sequence of tasks to expedite the job
- Resource tracking—a method of knowing that materials, personnel and cash are available
- Cost accounting—procedures for separately identifying the expense of each task
- Cash-flow analysis—a means of tracking revenue.

These tools come in a variety of forms and vary from package to package. Although the tools are all required, the user must dictate the form of output. The most useful analysis might be in the form of a display of critical paths via network diagrams on a PERT chart. Such a graphical analysis shows the job flow, focusing on the order of the separate tasks and their relationship to one another. For another kind of analysis, Gantt charts might prove more appropriate. Gantt charts are time-based, rather than order-based, and provide a visual schedule of activities.

There are, in fact, myriad ways to manage—perhaps as many as there are managers. But the thing to remember is that the fundamental goals of project management are project scheduling and costing. A program that doesn't control and analyze these two factors in some fashion is less than a true project management package.

Does this look like an ordinary Gantt Chart?



Look again.

It's a Gantt Chart ***and a resource spreadsheet.*** Revise the Gantt and the spreadsheet changes automatically.

On one screen, Project Workbench combines the two displays a project manager refers to most often for easy, ***simultaneous*** viewing. Logical, don't you agree?

Then why is Project Workbench the only system designed this way?

Probably because Workbench was designed by experienced project managers who understand your needs. Like automatic staff overload alert. Resource loading across multiple projects. Interproject dependencies. Automatic project rescheduling around target dates. LAN support. Even full text editing for explicit, presentation-quality reports.

Our free demo diskette explains all these features, and more. To see what Project Workbench can do for you, think about your projects and then ***take another look at our screen!***

Call (212) 219 8945 for a free demo diskette!

ABT *THE POWER IN PROJECT MANAGEMENT*

APPLIED BUSINESS TECHNOLOGY CORPORATION ■ 365 BROADWAY ■ NEW YORK, NY 10013

In Europe, Asia & Africa: Hoskyns Group Ltd., 130 Shaftesbury Ave., London W1V 7DN. Telex 893529

CIRCLE NO. 44 ON INQUIRY CARD

Let Your CPU Reach Its Full Potential

With Data Access and Retrieval At Electronic Speeds

For disk intensive applications you need a peripheral storage device that performs as quick as your CPU. That's why we designed the MegaRam *solid-state* disk. It can access stored data thousands of times faster than a rotating disk. With this dramatic speed, your computer is kept working...not waiting. In fact, it can provide a typical increase of 50% in CPU throughput! And, the MegaRam is completely transparent to your software and hardware; your CPU will treat it as another disk drive.

When to Buy a MegaRam Solid-State Disk

1. When you need to have more users simultaneously accessing a data base without degrading response time.
2. When you need to monitor more status inputs with process control computers while working in real time.
3. When your telecommunications computers need to handle more lines and more traffic.
4. When you need your sort routines to run faster and compile programs to take less time.
5. When you need a peripheral storage device for hostile environments.

Or, for any other disk intensive application, including Data Base Management, Graphics, Process Control, or for real time processing situations such as Image Processing and Data Acquisition.

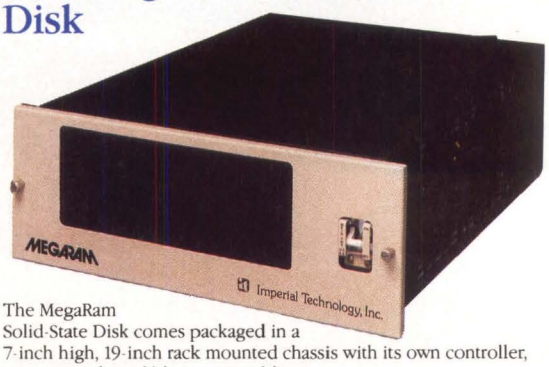
With Reliability and Reduced Maintenance

The solid-state MegaRam, with no moving parts, provides the performance and reliability of main memory while maintaining the storage capacity and convenience of a peripheral. It requires no adjustments and virtually no maintenance. So, your CPU not only runs faster but uninterrupted as well.

Your CPU Can Deliver Its Full Promise of Performance

If your CPU requires faster data access and retrieval, operates in hostile environments, or demands maximum disk reliability, you'll find the MegaRam a smart, cost-effective investment. Call or write today for full details.

The MegaRam Solid-State Disk



The MegaRam Solid-State Disk comes packaged in a 7-inch high, 19-inch rack mounted chassis with its own controller, power supply and blower assemblies.

Available from 2 to 512 Megabyte capacities for the following computers:

DEC • Hewlett Packard • Gould • Prime • Data General • C.D.C. • Westinghouse • Sperry Univac • Many Others.

Features

Full Software and hardware compatibility • Error detection and correction • Field expandable • Zero latency time • No moving parts.

Options

Battery Back-Up • Megastream tape back-up • Custom designed interfaces • Dual port capability.

Imperial Technology, Inc.
831 S. Douglas Street
El Segundo, California 90245
Telephone: (213) 536-0018
Telex: 664469 • FAX: (213) 536-0124

CIRCLE NO. 45 ON INQUIRY CARD

Low-cost packages attack single tasks

Not every project management program provides tools for dealing with large and complex projects. Broderbund Software Inc., for example, has developed ForComment to deal specifically with the often disagreeable task of documentation. Treating documentation as a separate project might appear a step away from the goal of integrated project management, but Broderbund's president, Douglas Carlston, sees documentation as the often orphaned stepchild of other projects. Thus ForComment addresses the repetitive tasks of reviewing and commenting on written documents with the idea that automating this task will produce significant management control and productivity benefits even for projects that don't justify full-function project management software.

ForComment, an add-on package, accepts documents created with most word processors and uses data from spreadsheets (as ASCII files). The $195 package allows as many as 15 people to suggest changes, make comments and ask questions. Most importantly, the program allows users to make the changes to see how they look, without altering the source document.

For large or distributed operations, a networked version of ForComment ($995) lets users make comments and suggestions independent of others. They can also pass along comments and information via popular local area networks—including those from IBM Corp., Novell Inc. and 3Com Corp..

deadlines?). You can even pull together data from several independent jobs to ensure that there is no conflict in the use of available resources.

Like the large-scale programs, Project works equally well whether the work being managed is a construction job or a software-development process. Microsoft Project Version 3.0 runs on MS-DOS (Version 2.0 or higher) machines that have at least 256K bytes of RAM and two flexible disk drives or a rigid disk drive.

An interesting benefit of Project is that, if you want more features than it offers, you can link data from the program to more powerful (and more expensive) project management systems. For example, a program called MSP3 transfers data from Project into the files of Primavera Systems Inc.'s Project Planner, a $2,500 PC-based program. Thus, a job that outgrows the capabilities of Microsoft's Project (one that requires more than 200 activities) can migrate to the Primavera system, capable of 10,000 activities. Or, users can take advantage of resource leveling. This is a reasonably standard feature in the high-priced programs that helps even out the use of people and materials during a project.

Another reason for migrating files is to take advantage of Primavera's Primavision graphics package ($1,500). This program supplements the output offered by either Microsoft Project or Primavera Project Planner, using cut-sheet or continuous roll plotters to create time-scaled bar charts and network logic diagrams.

If the price of the software package is a prime consideration, and the project management job is not too complex or specialized, consider Westminster Software Inc.'s $69.50 IN CONTROL! package, which can schedule and organize 75 activities. Oregon State University is using the program to design and plan projects within its forestry department. The program runs on PCs with 128K bytes of memory and outputs to Epson America Inc. or IBM dot-matrix printers. Businesses with several users involved in project management can also purchase a site license that, for $6,950, offers unrestricted duplication of both the program and documentation and 30 days of technical support.

How to select a package

As useful as generic project management programs are, their existence doesn't provide an easy out for system integrators or VARs who don't want to learn about project management. Certainly, you can install the package and ignore the nature of the customer's business, but don't count on having either satisfied customers or repeat business. To know enough to select the optimum program, you must ask three important questions:

1. Does the user's job really require project management software?

2. What features will get users to actually employ the program?

3. What special requirements does the user's job entail?

The first question is the most important. Although the customer may want to manage a project, classic project management software might lead to overkill. In some applications the problems can be best solved with a quality database manager, customized to the user's task.

The answer to the second question isn't all that obvious. Typical users do not employ a computer because of infatuation with the technology. Users most often only tolerate computers because they do the job. Many programs, such as Strategic Software's Promis and Microsoft's Project, try to accommodate these users

Although the customer may want to manage a project, classic project management software might lead to overkill.

Companies mentioned in this article

Broderbund Software Inc.
17 Paul Drive
San Rafael, Calif. 94903-2101
(415) 479-1700
Circle 301

Computerline Inc.
P.O. Box 308
52 School St.
Pembroke, Mass. 02359
(617) 294-1111
Circle 302

Expertware Inc.
2685 Marine Way
Mountain View, Calif. 94043
(415) 965-8921
Circle 303

Microsoft Corp.
16011 N.E. 36th Way
Box 97017
Redmond, Wash.
98073-9717
(206) 882-8080
Circle 304

Primavera Systems Inc.
2 Bala Plaza
Bala Cynwyd, Pa. 19004
(215) 667-8600
Circle 305

SAS Institute Inc.
Box 8000, SAS Circle
Cary, N.C. 27511
(919) 467-8000
Circle 306

Strategic Software Planning Corp.
245 First St.
Cambridge, Mass. 02142
(617) 577-8800
Circle 307

Westminster Software Inc.
2570 El Camino Real
Mountain View, Calif. 94040
(800) 822-8298
In Calif. (415) 941-6800
Circle 308

by making their screens self-explanatory and by taking liberal advantage of a computer's special function keys. Still, Promis' price includes a one-day basic training session and both Promis and Project come with tutorials on disk. Project, in fact, comes with a 30-lesson interactive training disk that teaches both project management and system operation.

In any case, users will have to make a significant effort to learn to use these tools. Some users will run the tutorial disk; some will respond better to formal, factory-sponsored training. So, in light of the second question, part of the system integrator's evaluation of the application must include getting to know the user.

The third question—dealing with a user's special requirements—reflects the fact that many industries have unique terminologies and business practices. Knowing these can help avoid misunderstanding as well as ensure that the product the system integrator delivers is the right one for the job. A classic example of this problem arises in reporting strategies.

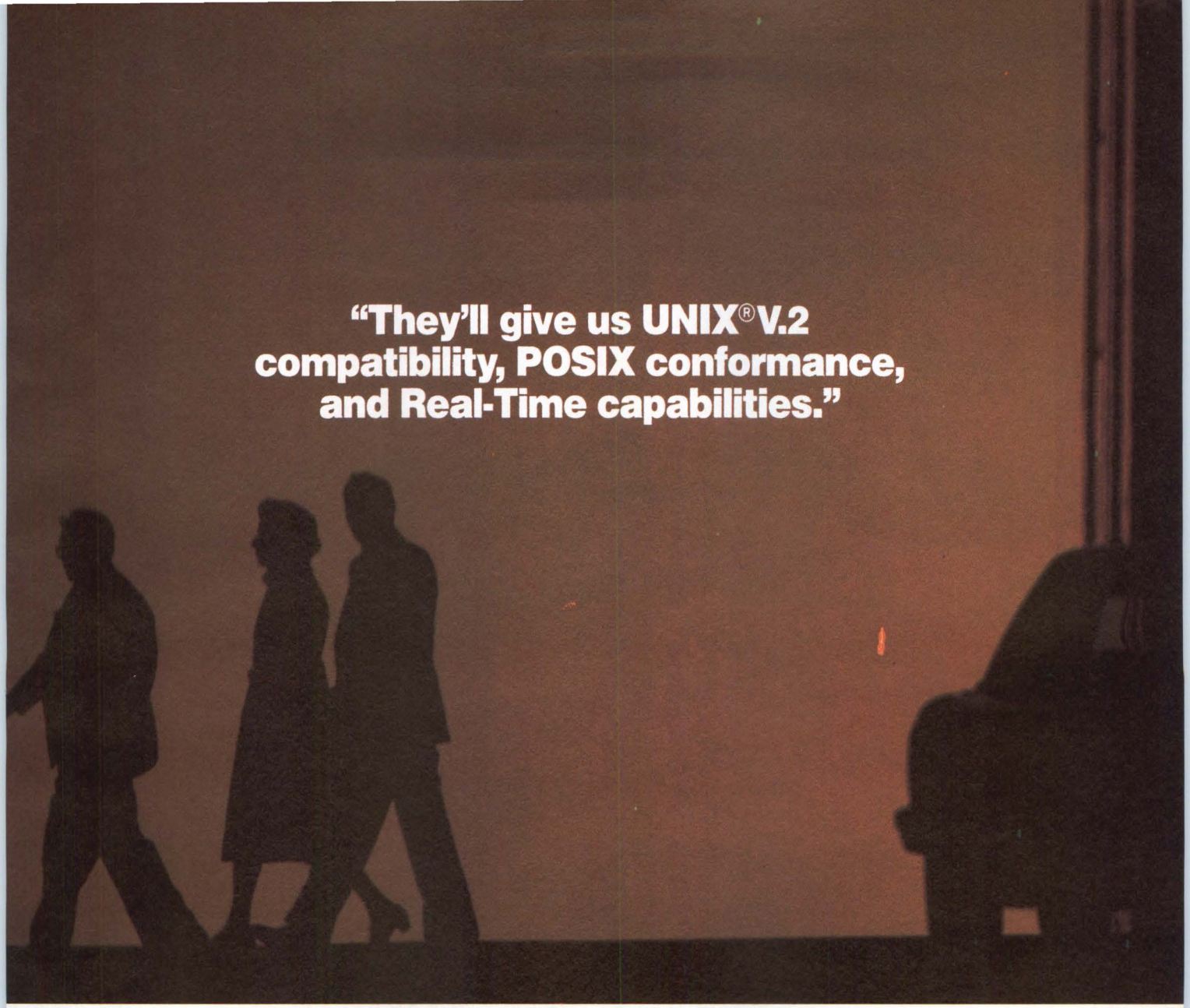
Reports the results

The way a program outputs information can make a significant difference in whether it suits a user's needs. For example, a user might need a variety of standard charts and reports, such as Gantt charts, network diagrams, critical-path diagrams, histograms and pie charts. The project management software must provide the type of output traditionally used in the client's business for the system to be effective. Furthermore, if the user is making bids for government contracts, the output must meet certain particular and, sometimes, unique requirements. For example, the Department of Defense requires a specialized report form, termed a "C" spec. Programs that don't include C spec output would be worthless to a company that gets a significant portion of its income from DOD contracts.

When looking at project management packages, remember that system integration itself is a project that decomposes into discrete tasks—both dependent and independent. If the number and complexity of system integration projects makes management of those tasks a chronic problem, consider making your own business a test site, thus giving you a closer understanding of the power and capability of the programs. Furthermore, by using the programs in your own operation, you'll not only get better acquainted with the products, you may gain unexpected insights about the nature of your business. □

Edward R. Teja is president of Freehold Corp., Santa Cruz, Calif., specializing in marketing and writing services for high-technology companies.

Interest Quotient (Circle One)
High 486 Medium 487 Low 488



If you're a hardware OEM or system integrator, you have to build a product that can win in the marketplace.

You need a computer supplier who can give you more than the same off-the-shelf package your competitors have.

Charles River is the only supermicro builder who offers a UNIX System V.2-based operating system, plus conformance to the new IEEE POSIX trial-use standard, plus a compatible real-time kernel, UNOS™, that lets you tackle tough real-time jobs.

For more on how we can help you build a winner, from customizing to multi-vendor networking, contact Charles River Data Systems, 983 Concord St., Framingham, MA 01701, (617) 626-1000, Telex 681-7373 CRDS UW.

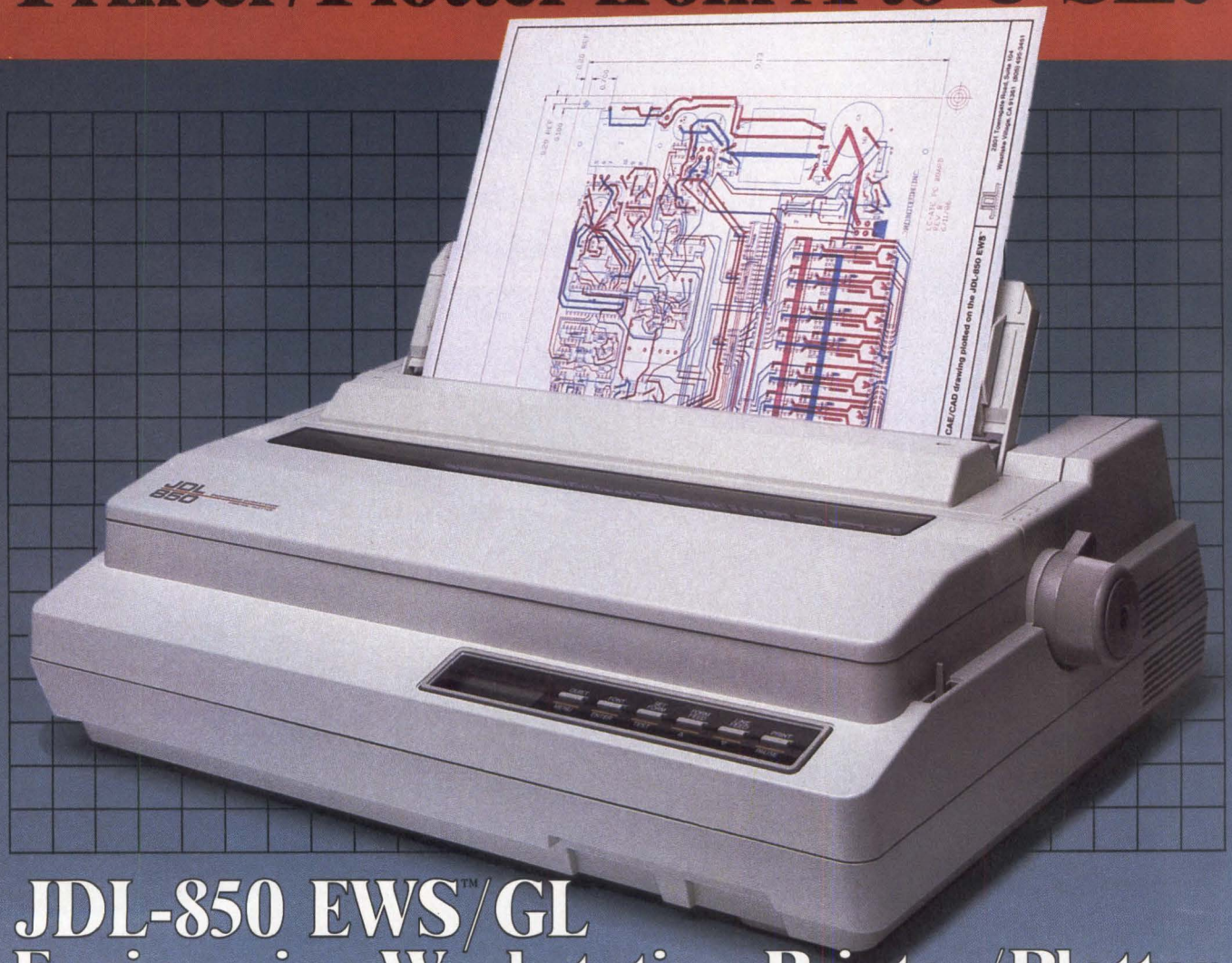
We'll help you build a winner.

Charles River™

UNIX is a registered trademark of AT&T. UNOS is a trademark of Charles River Data Systems.

CIRCLE NO. 47 ON INQUIRY CARD

The Only HP-GL™ Compatible Printer/Plotter from A to C-Size



JDL-850 EWS™/GL
Engineering Workstation Printer/Plotter

HP-GL compatibility and performance. The 850 EWS/GL emulates HP-GL protocol to produce high quality drawings from A to C-size in 14 colors, with line quality, accuracy, and speed exceeding most pen plotters. Plotting on paper and vellum up to 18 inches wide you have true unattended operation with no pens to change or run out of ink mid-plot.

Faster plotting and increased system productivity. The 850 EWS/GL not only outperforms pen plotters, vector files can be transmitted to the printer/plotter at up to 19.2K baud freeing your system in less than half the time. You gain 100% more productive system time. A copy mode allows you to make up to 99 copies of a plot without re-transmitting the vector file. And an image size control feature lets you fit your drawing to the paper size with reduction or enlargement from 5% to 200%.

In micro, mini and mainframe applications the 850 EWS/GL provides high resolution plotting with virtually every CAE/CAD/AEC and graphics software package that supports HP-GL (HP-7475A).

For high speed text and data applications the 850 EWS/GL features a 1MB print spooler and speeds of 144 cps in letter quality and 360 cps in draft quality.

Emulating the Diablo 630, IBM 5182 Color Printer and Epson printers, the 850 EWS/GL is compatible with word processing, spreadsheet, project management and business graphics programs.

HP-GL compatibility, speed, media and output versatility, and desktop size make the 850 EWS/GL Printer/Plotter the number one performance and price choice for your CAD workstation.

The JDL-850 EWS Series:

- 850 EWS Printer/Plotter
- 850 EWS/GL (HP-GL compatibility built-in)
- 850 EWS with GL Processor Controller

JDL INCORPORATED

For specifications and a plot sample call:
West: (805) 495-3451
East: (704) 541-6352

2801 Townsgate Road, Suite 104
Westlake Village, CA 91361

CIRCLE NO. 38 ON INQUIRY CARD

386, GRAPHICS CARDS PACK EXTRA PUNCH

80386-based accelerator boards speed system processing—despite a lack of 386 software—and application-specific coprocessor boards enhance graphics and offload host processing

Carl Warren, Senior Editor

To boost CPU processing speed, and to attack specific applications such as graphics, system integrators are pairing powerful coprocessor cards with standard CPU boards. These cards accelerate performance for general jobs like word processing, as well as increase speed for specific tasks.

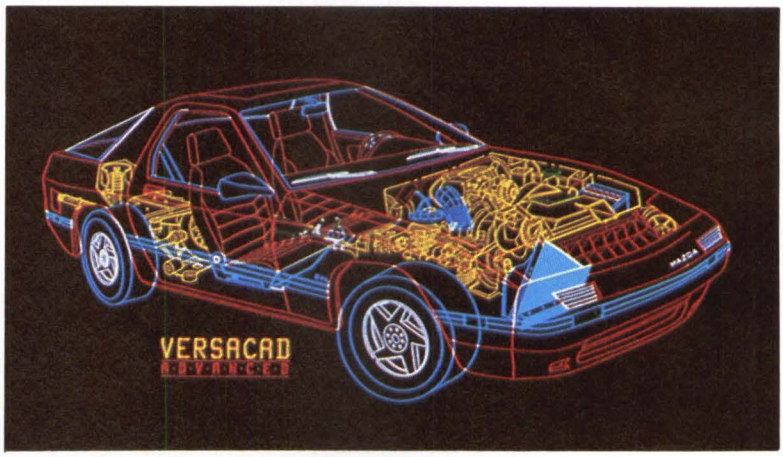
Many coprocessor board manufacturers are focusing on Intel Corp.'s 80286 and 80386 microprocessors and IBM Corp. architectures. Of these, some companies provide 80286-driven coprocessor boards for older machines, such as the PC, while others—including Intel, Definicon Systems Inc., Orchid Technology and Quadram—offer 80386 coprocessor boards for the PC/XT and PC/AT buses as well.

For example, Definicon Systems, primarily known for supplying coprocessor boards based on chips from National Semiconductor Corp. and Motorola Inc. for a variety of buses, uses Intel's 80386 on its DSI-386 board. Designed for the PC/AT, the 16-MHz DSI-386 supports from 1M to 16M bytes. A 1M-byte version costs $2,495 and comes with the utilities developers need to create 80386-specific programs.

Orchid Technology's $1,499 80386-based coprocessor board, the JET 386, is also designed for the PC/AT. This 16-MHz board fits into a slot on the system motherboard; a cable connects to the existing 80286 microprocessor socket. The 80286, in turn, is plugged into an adapter socket on the cable. A 64K-byte cache on the JET 386 speeds program execution, but the board still relies on existing 16-bit system memory and 8-bit I/O.

Look over product choices

An unusual coprocessor board is Quadram's $595 Quad386 XT, an 80386-based card designed for the 8-bit I/O slots on the PC/XT backplane. Although this design would seem to limit the board's performance, the company claims the Quad386 delivers the expected 80386-level performance because of its on-board 32-bit memory.



Graphics software packages *benefit from the high resolution (1,024 by 1,024) obtainable with graphics coprocessor boards. This screen was created using T & W Systems Inc.'s VersaCAD Advanced software and Vectrix's PEPE graphics coprocessor board.*

Aimed at the PC/AT, Intel's Inboard 386/AT coprocessor card delivers 16-MHz speed and up to 2M bytes of memory for $1,145. For an extra $495, system integrators get a 10-MHz 80287 math coprocessor.

Of course, not everyone is interested in the raw power of the 80386. Qualogy Inc., for example, offers the $1,245 QPC-5101, which is essentially an IBM PC/XT on a plug-in card. The board uses a Harris Semiconductor CP80C88 CMOS processor, has room for a math coprocessor and includes both a graphics controller and a small computer systems interface (SCSI) controller. The board is designed for PC backplanes that have sufficient line drivers and receivers on each address and data line.

Computer Peripherals Inc. has a different way of mining the growing coprocessor market. Although it offers the RACER 80286-based accelerator card, the company's approach to the 80386 environment is through increased memory. Its 386 Memoire card, priced at $745 for 1M byte of memory and $1,095 for 2M bytes, matches Compaq Computer Corp.'s Deskpro 386 memory-expansion add-on connectors. Asif Kahn, CPI's director of interna-

tional marketing, maintains that the 386 add-in and add-on market will be characterized by a need for increased memory capacity. "The 80386 is power hungry, and that will call for lots of additional semiconductor and disk memory," says Kahn.

Despite the focus on IBM architectures, coprocessor board manufacturers aren't ignoring other buses. For example, Force Computers Inc. offers the CPU-386 for the VMEbus. The $5,775 board operates at 16-MHz with no wait states and comes with FORCEbug, the company's debugging package. The board's 2M bytes of DRAM avoids wait states during memory cycles by operating in a pipelined architecture.

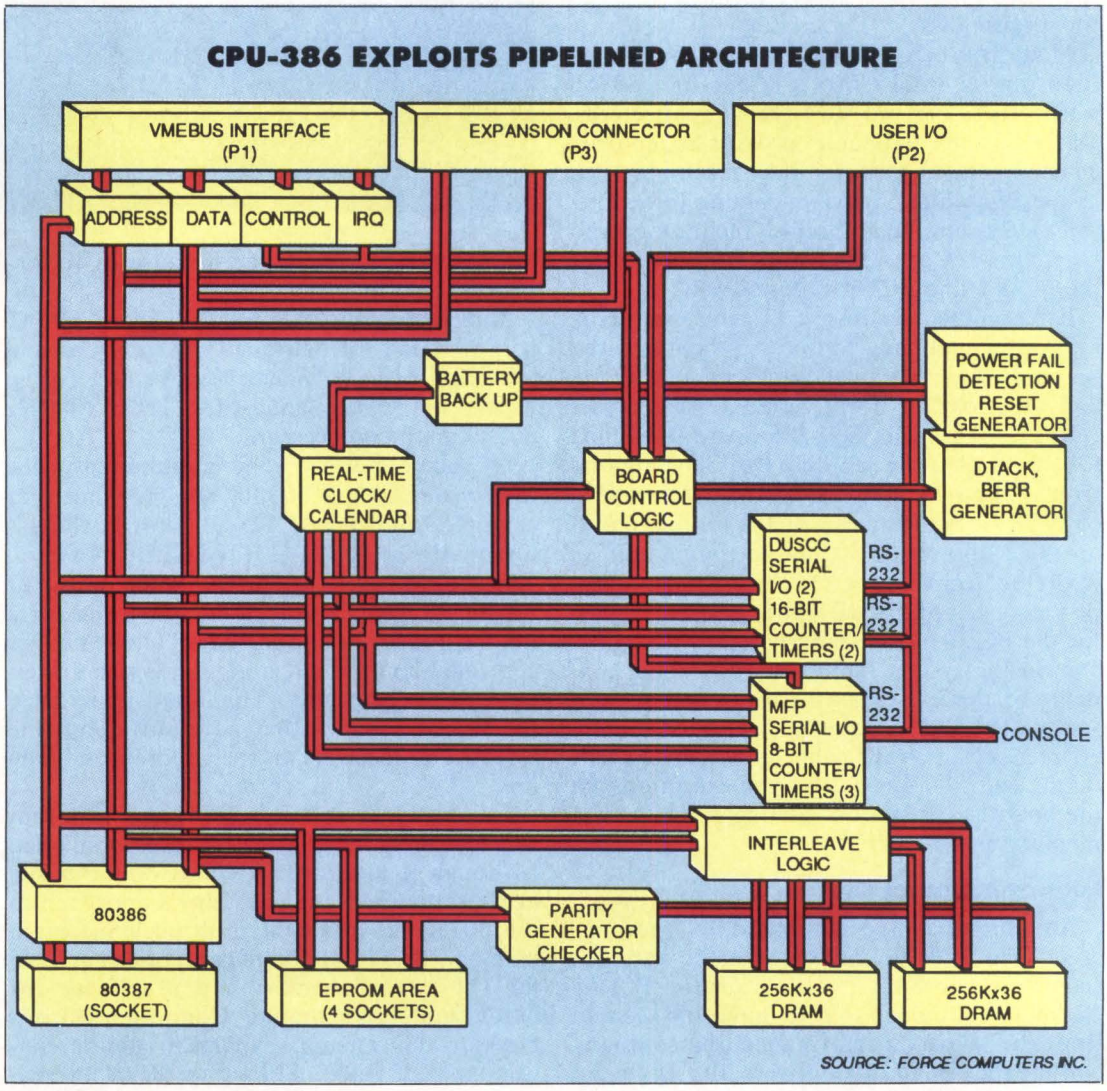
Strobe Data Inc. gives Data General Corp. Nova minicomputer-level power to IBM PC, XT and AT users. Strobe's Falcon coprocessor board uses a Fairchild Semiconductor Corp. F9445 microprocessor that runs RDOS, DISCOS and other Nova operating systems and comes with 512K bytes of memory to handle Nova instructions and programs. The Falcon board is expensive compared to other PC coprocessor boards—$3,975 in single units and $2,385 in quantities of 200—but protecting existing software investment may make it a good buy.

Software lags behind

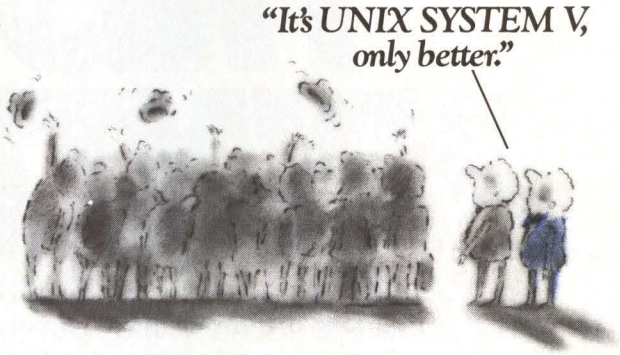
Softguard Systems Inc.'s vice president of marketing, Joseph Diodati, contends: "When you add an 80286 coprocessor card to an XT system, or an 80386 coprocessor card to an AT-type system, you get little more than blazing speed and not much extra functionality. There is nothing to take advantage of what these processors offer."

Specifically, today's system-level software (e.g., operating systems and development tools) isn't using the ability of the 80286 and 80386 to operate in protected mode and to manage large arrays of memory in the 4G-byte to 4-terabyte range.

"The coprocessor," says Mike Knox, software engineer for West Coast Consultants, San



Built for the VMEbus, *Force Computer's CPU-386 coprocessor board uses a pipelined architecture to avoid memory cycle wait states and to set up I/O addresses on the VMEbus.*



The fastest way to say UNIX® is "XENIX." Microsoft's XENIX® System V/286 is the fastest version of UNIX available for the Intel architecture. And speed is only half the story. XENIX is full UNIX System V—with a complete set of developer's tools including make, SCCS, and the Berkeley enhancements. Add improvements like the acclaimed Microsoft® C Compiler and it's obvious why XENIX—with over 160,000 installations—is the number one choice for UNIX developers.

And now we've made 386 software development faster as well. Our new XENIX System V/386 Toolkit—available for only $395—lets you develop and run 386 programs on advanced machines like the COMPAQ® DESKPRO 386.®

For more information on the XENIX Toolkit, call (800) 227-4679.

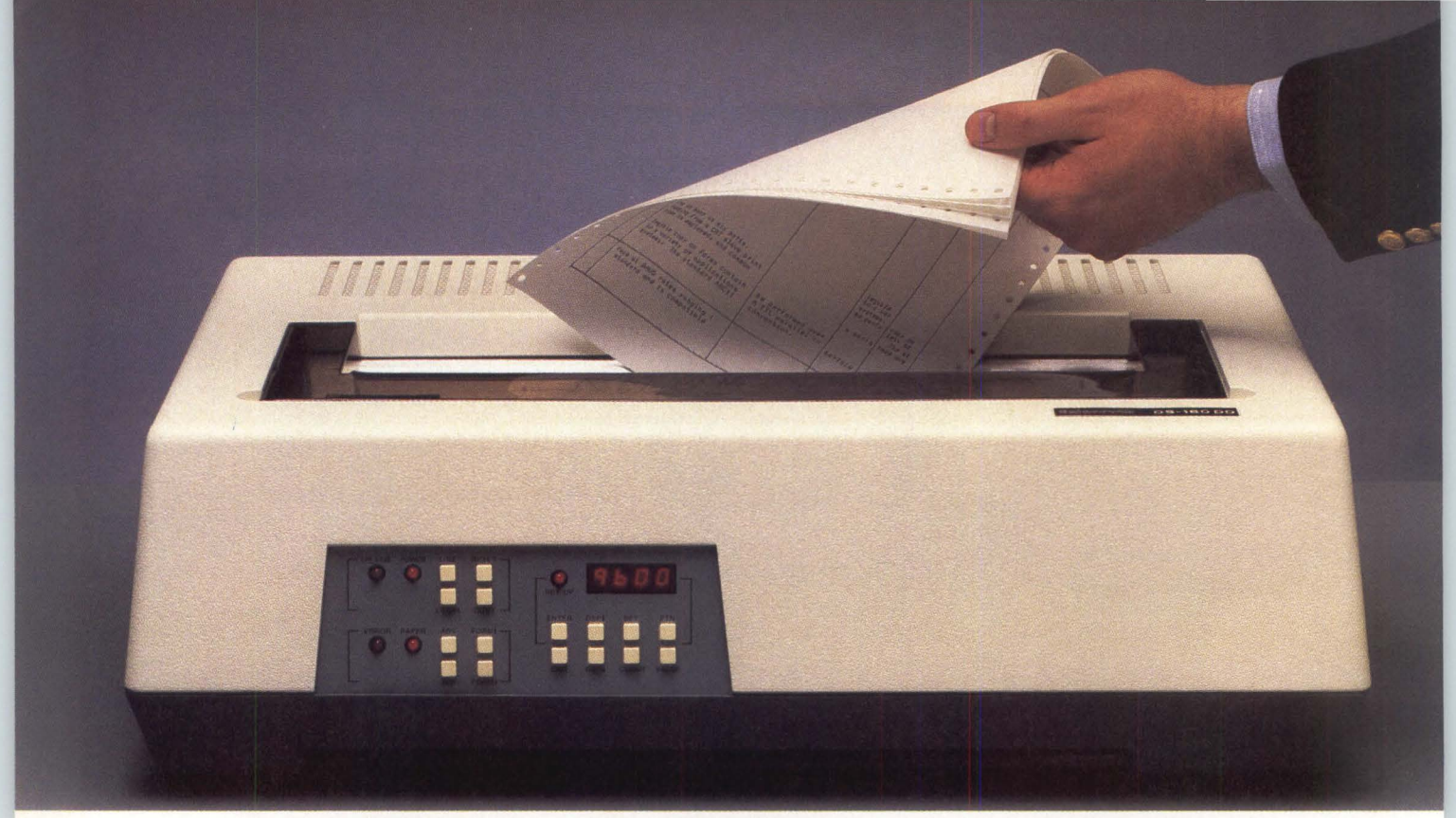
Microsoft® XENIX®

The High Performance Software.

Microsoft and XENIX are registered trademarks of Microsoft Corporation. UNIX is a registered trademark of AT&T. IBM is a registered trademark of International Business Machines Corporation. COMPAQ and DESKPRO 386 are registered trademarks of COMPAQ Computer Corporation.

The Microsoft XENIX System V/386 Toolkit requires either an IBM® PC AT with IBM PC XENIX Release 2.0 or SCO XENIX System V or a COMPAQ DESKPRO 286 or DESKPRO 386 with COMPAQ XENIX System V/286. Price shown is Microsoft's suggested retail price, and is subject to change without notice.

CIRCLE NO. 49 ON INQUIRY CARD



RIP OFF THIS PRINTER.

Rip off hotel bills, airline tickets, invoices or any other type of form, up to six copies thick. Datasouth Demand Document printers put them out day and night, and let you rip them off without losing the next form.

Datasouth Demand Document printers feature bidirectional dot matrix printing at 180 cps. You can print to within ½ inch of the tear-off bar, without affecting the next form. The push-button front panel and LED readout make our printers exceptionally easy to use.

There's a Datasouth Demand Document printer for almost any communications environment. The DS 180 DD has standard Serial and Centronics-type parallel interfaces. The TX 5180 DD emulates the IBM 5256, 5224 and 5225 printers in System 34/36/38 environments. And the CX 3180 DD emulates the IBM 3287 in 3270 environments.

No matter what kind of form you're printing, there's a Datasouth printer that could be doing it better. So call us at 1-800-222-4528, and ask about our Demand Document printers.

When you consider all the money-saving advantages, it's really quite a steal.

Datasouth

AMERICA'S HIGH PERFORMANCE PRINTER COMPANY

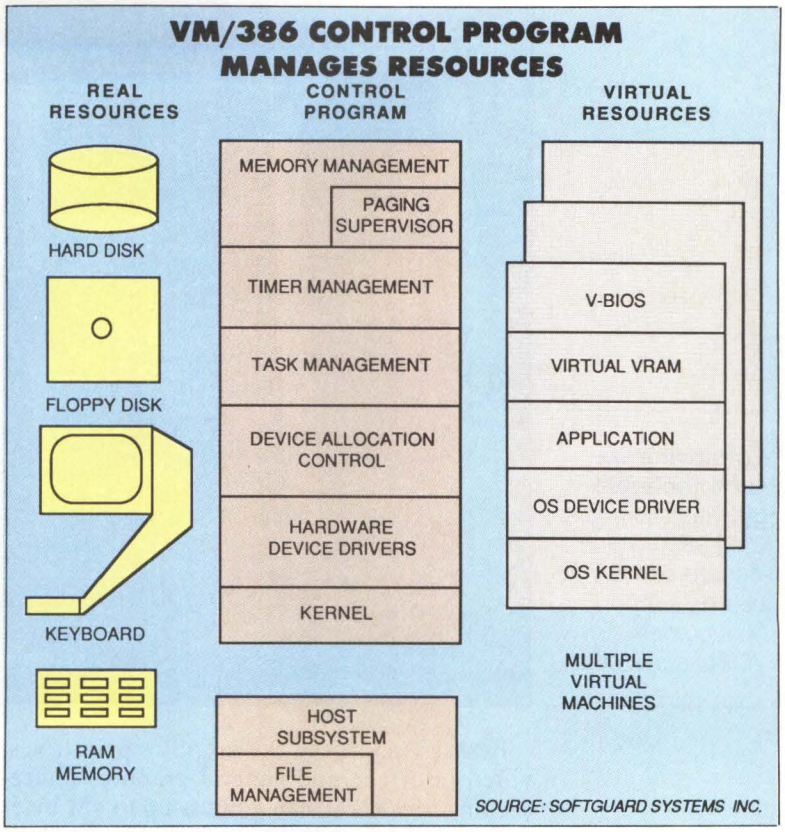
P.O. Box 240947, Charlotte, NC 28224, (704) 523-8500, Tlx: 6843018, DASO UW SALES: 1-800-222-4528, SERVICE: 1-800-438-5050; West Coast Office: 415-940-9828.

CIRCLE NO. 50 ON INQUIRY CARD

Diego, "is basically a way of optimizing the work load in a system. But right now with the 80386, there really isn't any software that lets you take advantage of all that power."

However, Softguard Systems recently introduced VM/386, an under-$300 software package that provides users with a multitasking environment and the ability to manage the virtual capability of the 386. VM/386 allows an 80386 computer to perform like several virtual 8086/8088 machines. Softguard claims that, with VM/386, users can plug in an Orchid JET-386 board, for example, and establish as many virtual machines as they want. The virtual machines can run concurrently, each with its own operating system, and all resources available to the 80386 machine are available to each virtual machine.

The VM/386 environment is managed by a central control program that determines how each device is allocated in the system and supervises the memory by handling real and virtual pages, system timers and tasks. Because the program provides the linkages to real and virtual devices, any number of "virtual machines" can be established at boot time. Thus, a single AT with an 80386, or a Compaq Deskpro 386, can be set up as "n" machines. Hot keys are used to switch between each machine. In the VM/386 software architecture the existing host DOS (i.e. MS-DOS or PC-DOS 3.2) is still used for basic file management and I/O.



The control program *in Softguard's VM/386 software supervises memory by handling real and virtual pages, system timers and tasks and determining allocation of each device in the system.*

Works side-by-side with DOS

In operation, a host system can be established as several machines, each responsible for a variety of tasks. VM/386 allocates available memory to all the tasks and determines which machine is idle and which isn't. VM/386 keeps tabs on the location of various system elements and is able to get data from the proper virtual device and put it into executable memory. Multiple operations can take place in the VM/386 environment while DOS executes single-threaded operations.

To assist system integrators, Softguard also offers a $2,000 DOS developer's package that consists of MetaWare Inc.'s C and Pascal compilers, Phar Lap Software Inc.'s assembler and Softguard's 32-bit linker and loaders. The entire kit gives developers the ability to create 32-bit code and load and link it in the 4G-byte memory space while the DOS manages the I/O.

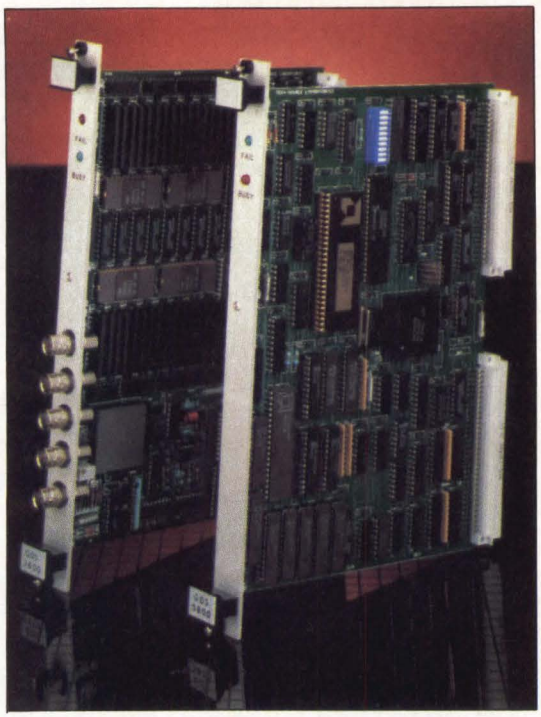
Other companies also are jumping on the 80386 software bandwagon. Theos Software Corp., for example, recently introduced the THEOS 386 operating system, which addresses up to 16M bytes of memory and supports as many as 32 units in a multiuser environment. The company expects to add other enhancements, such as full virtual operation, by mid-year. Pricing depends on licensing arrangements and CPU implementation.

The company that was expected to be the biggest supplier of software for the 80386 may be the last to ship product. Although Microsoft Corp. has plans to provide (possibly as early as this month) a DOS 4.0 that will support the virtual mode of the 80286, company designers at a Windows development conference held late last year told independent software vendors not to expect a 386 version of DOS until 1988.

Graphics chips offload host

An exciting trend in coprocessor boards is the development of powerful graphics chips; specifically, the Intel 82786 graphics coprocessor, Motorola 6845 CRT controller, NCR Corp.'s 7300 series and Texas Instruments' 34010 graphics system processor.

Intel's 82786 graphics coprocessor, a dedicated microprocessor that is about equal in processing power to an 8086, employs a graphics-specific instruction set. The graphics instructions are maintained in ROM built into the 82786 and are activated by assembly language routines triggered by the host computer. Therefore, the host system needs only to send a single instruction to draw, for example, a circle or a polygon. The 82786 takes over and issues instructions to the on-board video controller to perform the action on the screen.



Employing bit-slice technology, *Tech-Source's GDS-3800 graphics coprocessor boards support Multibus or VMEbus systems.*

Besides managing the graphics primitives, video interface and general graphics housekeeping, the 82786 can address up to 4M bytes of RAM video memory—which increases the resolution and number of colors that can be displayed. For example, managing 4,096 colors on a 2,000-by-2,000-pixel resolution would be possible using the Intel chip.

Number Nine Computer Corp. uses the Intel chip in its $999 Pepper graphics board. The board comes with 256K bytes of memory (expandable to 4M bytes) and can manage up to a 1,280-by-700-pixel resolution. The company makes it easy for system integrators to add value via software by employing the virtual device interface (VDI), which eases device driver design.

Texas Instrument's 34010 processor achieves a still higher performance level. The 34010 is based on a 32-bit reduced instruction set computer roughly equivalent to the processor for IBM's RISC, the RT PC. The 34010 can manage high-level language routines, such as those written in C, and can operate completely independent of the host computer.

Conographic Corp. uses the TI chip in its raster image processor (RIP) board. "We process images—specifically, fonts—based on the concept of curves," says company president Luis Villalobos. He continues: "The goal is to create 'what you really see is what you really get.' Right now, you only see almost what you will get. This means that we have to aim for an increase in apparent resolution of about 8-to-1." By employing the 34010 and sophisticated algorithms, the Conographic RIP system provides 1,280-by-1,024 resolution, and drives laser engines at double the typical resolution. For example, using the Conographic board, resolutions of 300-by-600 dpi can be achieved on a Hewlett-Packard Co. Laserjet Plus.

NCR's approach to graphics processors is similar, but it uses chip sets. Its 7300 chip set is designed to replace all the glue logic typically found on a graphics board. Like the Intel and TI processors, the 7300 chips manage graphics functions and provide lookup-table capability. Graphics functions are managed by the 7300 color graphics controller, while the 7301 memory interface controllers serve as memory multiplexers and raster operations processors that can support two bit planes. If more resolution is required, NCR recommends adding additional 7301 chips and frame buffer memory.

Some terminal manufacturers, such as Wyse Technology, are using the Motorola 6845 CRT controller to support resolutions as high as 1,280 by 800, and to emulate all the popular PC operating modes. Wyse packages the display controller with a 15-inch monochrome monitor as the Wyse 700, a display subsystem that costs $995.

Besides providing end users with full-page display capability, the subsystem also gives integrators and VARs a base to build on. Although the 700 comes with a built-in character set in ROM, new character sets can be added, along with more display memory than the 128K bytes found on the basic card.

Some board manufacturers prefer proprietary processors. For example, Vectrix Corp.'s $2,750 PEPE professional graphics board uses a proprietary bit-slice processor to achieve 1,024-by-1,024 pixel resolution. The basic model supports 16 colors and four bit planes. For an additional $200, system integrators can add lookup-table capability to manage 4,096 colors. The product comes in five models.

Of course, the IBM PC isn't the only game in town, and companies such as Matrox Electronic Systems Ltd. are providing high-performance color display processors for Multibus II systems. The Matrox MMG-640 employs the Hitachi America Ltd. 63484 ACRTC controller, combined with a 16- or 32-bit microprocessor and a memory-management unit, to support a 640-by-480-by-8 display resolution; with an increase to 1,024 by 1,024 due later this year. The company expects the board to fit into high-speed imaging applications where standalone graphics capability is an important feature.

Another company making inroads into the high-speed graphics business is Tech-Source Inc. The GDS-3800 graphics display system uses a bit-slice microprocessor on a VMEbus or Multibus II card to provide developers with a

GOOD LOOKS. GREAT PERSONALITY.

We've got more than just good looks. At $599 the Freedom® ONE Turbo terminal has more horsepower than DEC's VT220 and WYSE's WY-50 combined. The Turbo is loaded with emulations of the most popular ANSI and ASCII terminals plus the extra personality of a PC terminal that allows you to use it as an added workstation in a Personal Computer AT multi-user application. These versatile operating modes, ultra-sleek styling and display clarity second to none, make the Freedom ONE Turbo a pretty, smart alternative.

Built by the same people who manufacture Princeton Graphic monitors and workstation products for Harris Lanier, the Freedom ONE Turbo is backed by a "no worry" **three year limited warranty** and a nationwide network of Authorized Service Centers.

To get a good look at the great personality of the Freedom ONE Turbo, call us today at (415) 742-7000.

Liberty
We make terminals.

DEC, VT220, VT100, and VT52 are registered trademarks of Digital Equipment Corporation.
Personal Computer AT is a registered trademark of IBM Corporation.
Princeton is a registered trademark of Princeton Graphic Systems.
WYSE is a registered trademark, WY-50 is a trademark of Wyse Technology.
Freedom is a registered trademark of Liberty Electronics, U.S.A.

CIRCLE NO. 51 ON INQUIRY CARD

BEAUTY IS NOT SKIN DEEP

The Series 3000 is a remarkable piece of design. No other terminal can offer such elegant ergonomics allied to such a comprehensive range of user benefits.

The stylish design masks a range of terminals that can emulate from the Televideo 925* to the powerful DEC VT 220*. But compatability is only part of their beauty. Productivity tools like a fully integrated calculator and soft keys make this the most flexible terminal on the market.

The Series 3000 was also designed with the user in mind. Each terminal has a full range of tilt and swivel, plus an optional height adjustment. They occupy minimum desk space and the character display on their 14" flat square etched screen is unmatched by any comparable terminal.

Features that combine to make the Series 3000 quite simply the best in its class.

But a Series 3000 terminal is no prima donna. Its good looks hide a sturdy design and rugged manufacture that ensure that kid gloves are not part of the package.

Combining style, elegance and the "muscle" to get the job done, the Series 3000 is yet another example of our commitment to applying design solutions to practical problems. Conclusive proof that with the Series 3000 at least, beauty is definitely not skin deep.

* Televideo 925 is a trademark of Televideo Systems Inc.

* DEC VT-220 is a trademark of the Digital Equipment Corporation

Newbury Data

Newbury Data Recording Limited,
Hawthorne Road, Staines, Middlesex TW18 3BJ.
Telephone: 0784 61500.

A member of the DRI Holdings Group

EUROPE'S LEADING INDEPENDENT PERIPHERALS MANUFACTURER.

Germany
Data Recording Instrument GmbH
Munchen Tel: 089 5141010

France
Data Recording Instrument Sarl
Zone Industrielle de Buc Tel: 013 9568111

Italy
Data Recording Instrument Srl
Milano Tel: 039 638811

Holland
Newbury Data Recording (DRI) BV
Ae Almere Haven Tel: 03240 48004

CIRCLE NO. 253 ON INQUIRY CARD

Companies mentioned in this article

Computer Peripherals Inc.
Suite 5, 2635 Lavery Court
Newbury Park, Calif. 91320
(805) 499-5751
Circle 335

Conographic Corp.
17841 Fitch
Irvine, Calif. 92714
(714) 474-1188
Circle 336

Definicon Systems Inc.
31324 Via Colinas
Westlake Village, Calif. 91362
(818) 889-1646
Circle 337

Force Computers Inc.
727 University Ave.
Los Gatos, Calif. 95030
(408) 354-3410
Circle 338

Harris Semiconductor
Digital Products Division
P.O. Box 883
Melbourne, Fla. 32902
(305) 724-7407
Circle 339

Intel Corp.
5200 N.E. Elam Young Parkway
Mail Stop TOD-07
Hillsboro, Ore. 97124-6497
(503) 629-7354
Circle 340

Matrox Electronic Systems Ltd.
1055 St. Regis Blvd.
Dorval, Quebec
H9P 2T4, Canada
(514) 685-2630
Circle 341

Microsoft Corp.
16011 N.E. 36th Way
P.O. Box 9097017
Redmond, Wash. 98073
(206) 882-8080
Circle 342

Motorola Inc.
Semiconductor Products Sector
P.O. Box 2952
Phoenix, Ariz. 85062
Circle 343

NCR Corp.
Microelectronics Division
1635 Aeroplaza Drive
Colorado Springs, Colo. 80916
(303) 596-5612
Circle 344

Number Nine Computer Corp.
725 Concord Ave.
Cambridge, Mass. 02138
(617) 492-0999
Circle 345

Orchid Technology Inc.
47790 Westinghouse Drive
Fremont, Calif. 94539
(415) 490-8586
Circle 346

Quadram
1 Quad Way
Norcross, Ga. 30093
(404) 923-6666
Circle 347

Qualogy Inc.
2241 Lundy Ave.
San Jose, Calif. 95131
(408) 946-5800
Circle 348

Softguard Systems Inc.
Suite 201
2840 San Tomas Expressway
Santa Clara, Calif. 95051
(408) 970-9240
Circle 349

Strobe Data Inc.
Suite 22, 13240 Northrup Way
Bellevue, Wash. 98005-2077
(206) 641-4940
Circle 350

Tech-Source Inc.
2955 Xenium Lane
Minneapolis, Minn. 55441
(612) 559-5716
Circle 351

Texas Instruments
P.O Box 225012
Dallas, Texas 75265
(214) 995-2011
Circle 352

Theos Software Corp.
Suite 100
201 Lafayette Circle
Lafayette, Calif. 94549-4370
(415) 283-4290
Circle 353

Vectrix Corp.
2606 Branchwood Drive
Greensboro, N.C. 27408
(919) 288-0520 **Circle 354**

Video-7 Inc.
550 Sycamore Drive
Milpitas, Calif. 95035
(408) 943-0101
Circle 355

Wyse Technology
3751 N. First St.
San Jose, Calif. 95134
(408) 433-1000
Circle 356

graphics board that operates at video speeds. "The board is designed to be a bus-oriented intelligent graphics/imaging subsystem," says Joseph Lamm, product manager, R&D.

Despite all the capabilities of graphics coprocessor chips, software developers, such as Kai Krause, vice president of R&D for 3D Graphics Inc., Pacific Palisades, Calif., insist that problems exist. "There is a great deal of confusion," says Krause. "There are standards, and everyone has one. Each graphics-chip implementation provides a different level of functionality, and that makes it impossible to create a generalized software product."

Krause further warns that the installed base for any one of the boards using a superfast graphics coprocessor chip is small. "We have to figure out which one will win, and support it."

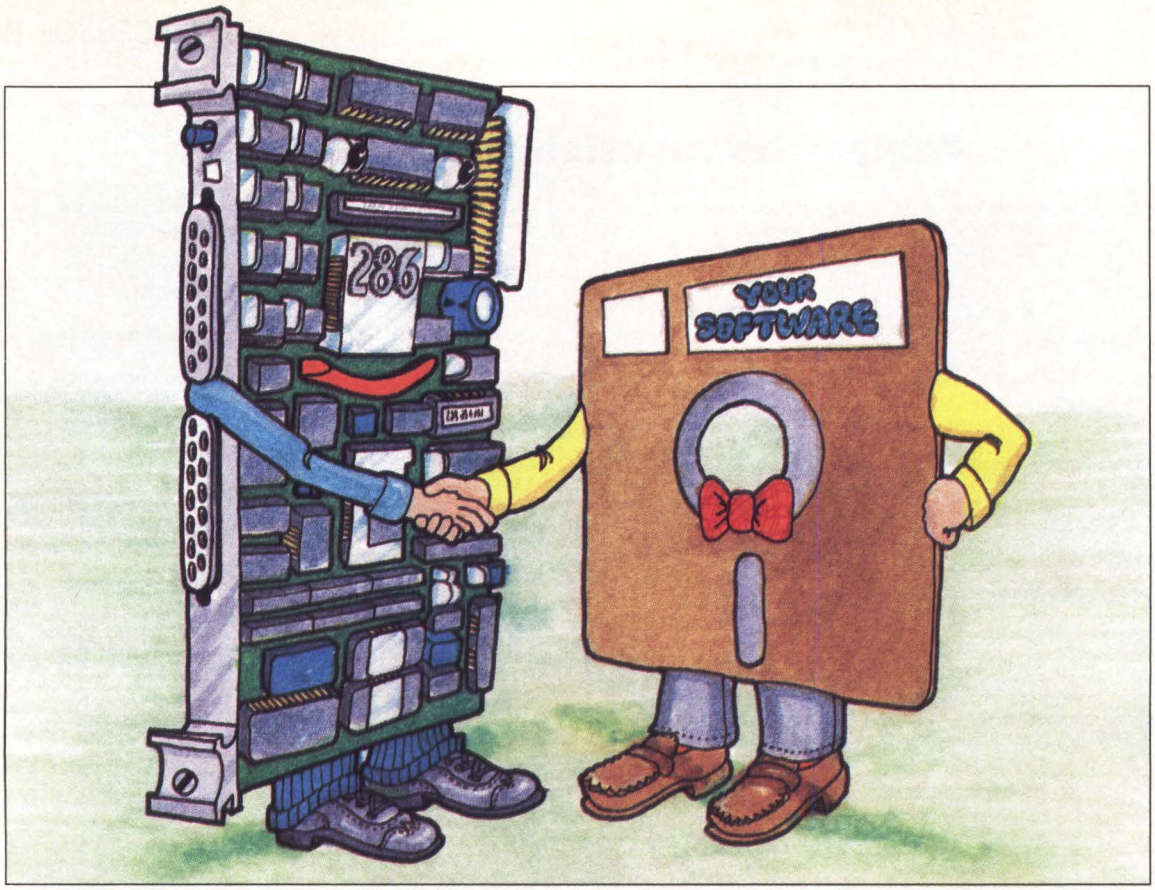
Standards ease coprocessor conflict

Software developers are concerned about the impact of coprocessor boards on existing systems. This concern arises largely because system devices are getting smarter and are acting as separate computers. At some point there could be major conflicts. To avoid these potential conflicts, developers and system integrators have banded together to set bus and BIOS standards for devices like the 80386 and the newer graphics processors.

Nevertheless, Greg Resnick, Video-7 Inc.'s director of marketing, believes that standards will be used primarily to achieve backward compatibility to support existing software. "You want to upgrade the coprocessor with little or no impact on the system as a whole. This ability comes about by having a level of transparency built in, and this comes from establishing common operating environments such as the direct graphics interface specification (DGIS) and the virtual device interface (VDI) to simplify integration," says Resnick.

"The goal, at least in software," says John Butler, Microsoft's marketing director, and developer of the Windows environment, "is to decouple the application from the hardware—that's the purpose of the graphics device interface (GDI)—Microsoft's version of VDI." Butler believes that, by making the system flexible for application developers, hardware devices such as coprocessor boards can be richer in functionality. □

Interest Quotient (Circle One)
High 489 Medium 490 Low 491



FAST FRIENDS

With a firm grasp of the most popular software, Iskra's VMEbus boards get you to market . . . *fast.*

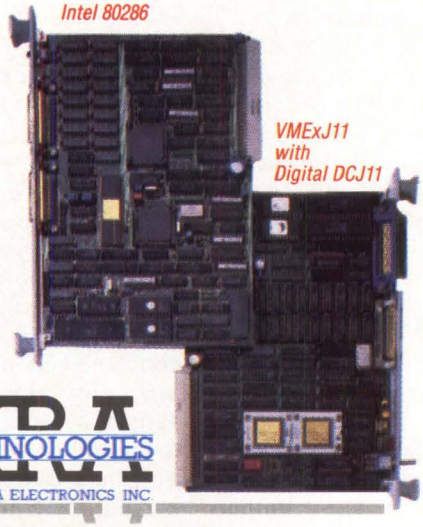
Getting acquainted gets expensive. Especially if your VMEbus CPU boards require you to extensively modify your software.

Fortunately, now ISKRA makes CPU boards with Intel** and Digital microprocessors that show up ready for work, Day 1. ISKRA's VMEx286, with an 8MHz 80286 microprocessor, is already fluent in XENIX†, iRMX**, and MS-DOS†. And our VMExJ11 has an equally firm grasp of Digital's DCJ11* and RSX-11M*, and adapts to single and dual processor configurations.

If you want to skip over the formal introductions and get right down to business, then write to us at 222 Sherwood Ave., Farmingdale, NY 11735 or call toll-free **1-800-862-2101**. In NY, call **516-753-0400**.

VMEx286 with Intel 80286

VMExJ11 with Digital DCJ11



ISKRA
VME TECHNOLOGIES
A DIVISION OF ISKRA ELECTRONICS INC.

HIGH PERFORMANCE VME BOARDS

*Trademark of Digital Equipment Corp. †Trademark of Microsoft Corp. **Trademark of Intel Corp. VMEx286 and VMExJ11 are trademarks of Iskra VME Technologies.

CIRCLE NO. 53 ON INQUIRY CARD

SINGLE-BOARD MICROCOMPUTERS

Company Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
ALCYON CORP.										**Circle 405**
5010 Shoreham Place, San Diego, CA 92122, (619) 587-1155										
A68VME	MC68010 (10)		VMEbus	processor	REGULUS	C, FORTRAN, Pascal	1M (128K)		3,095(Q1); 2,011(Q100)	SCSI bus controller, 2 serial ports, clock/calendar, interrupts
A68VME-020	MC68020 (16.67)		VMEbus	processor	REGULUS	C, FORTRAN, Pascal	1M (128K)		4,500(Q1): 2,925(Q100)	2 serial communication ports, clock/calendar, battery backup
ALLEN SYSTEMS										**Circle 406**
2151 Fairfax Rd., Columbus, OH 43221, (614) 488-7122										
DP-31/535	8051, 80535 (12)	CMOS, NMOS		process control	proprietary	Assembly, BASIC	60K (60K)	4×6×0.5	250(Q1); 212(Q100)	2 serial, 6 parallel ports; 8 counter/timers
FX-11	68HC11 (8)	CMOS		process control	proprietary	Assembly, BASIC, Pascal	16K (16K)	4×7×0.5	375(Q1); 318(Q100)	2 serial, 4 parallel ports; 1 counter/timer
FX-97	8097 (12)	NMOS		process control	proprietary	Assembly, BASIC, Pascal	24K (24K)	5×8×0.5	450(Q1); 382(Q100)	2 serial, 4 parallel ports; 8 counter/timers
ALLOY COMPUTER PRODUCTS INC.										**Circle 407**
100 Pennsylvania Ave., Framingham, MA 01701, (617) 875-6100										
Bi-TURBO	NEC V20 (8)		IBM PC bus	processor	MS-DOS 3.0, 3.1	MS-DOS languages	1M	3.875×13.25 ×0.5	995(Q1)	2 serial ports
PC-SLAVE/16	NEC V20 (8)		IBM PC bus	processor	MS-DOS	MS-DOS languages	1M	3.875×13.25 ×0.5	995-1,045(Q1)	2 serial ports
AMPRO COMPUTERS INC.										**Circle 408**
67 E. Evelyn Ave., Mountain View, CA 94041, (415) 962-0230										
Little Board/186	80186 (8)	NMOS	SCSI	processor	CP/M-86, Concurrent DOS, PC-DOS	BASIC, C, FORTH, FORTRAN, Pascal	512K (128K)	7.75×5.75 ×0.75	495(Q1); 399(Q100)	flexible and rigid disk controllers; 2 RS232C serial, 1 parallel printer port(s)
Little Board/PC	NEC V40 (8)	CMOS	IBM PC bus	processor	PC-DOS	BASIC, C, FORTH, FORTRAN, Pascal	640K (128K)	7.75×5.75 ×0.75	595(Q1); 499(Q100)	flexible and rigid disk controller, SCSI interface
Little Board/ PLUS	Z80A (4)	NMOS	SCSI	processor	CP/M	BASIC	64K (32K)	7.75×5.75 ×0.75	289(Q1); 199(Q100)	flexible and rigid disk controllers; 2 serial, 1 Centronics port(s)
APPLIED BUSINESS COMPUTER										**Circle 409**
765 S. State College Blvd., Suite F, Fullerton, CA 92631, (714) 738-8131										
ASBC-8	6502, 6809 (1, 2)	CMOS, NMOS		processor	ADOS	Assembly, BASIC, FORTH, PL/65	8K (24K)	6.5×9.75 ×0.5	200(Q1); 160(Q100)	RS232C, printer port(s); battery backup; keyboard
ASBC-64	6502, 6809 (1, 2)	CMOS, NMOS		processor	ADOS	Assembly, BASIC, FORTH, PL/65	64K (64K)	6.5×9.75 ×0.5	250(Q1); 200(Q100)	2 RS232C, printer port(s); battery backup; day/date clock; keyboard
DT 6000	68E09 (1.8)	NMOS		processor	ADOS	Assembly, FORTH	64K (30K)	8×9×0.5	350(Q1); 280(Q100)	flexible disk controller; RS232C serial, printer port; keyboard
AT&T TECHNOLOGY SYSTEMS										**Circle 410**
555 Union Blvd., Dept. KB, Allentown, PA 18103, (800) 372-2447										
WE 321SB	AT&T WE 32100 (14, 18)	CMOS	VMEbus	processor	UNIX, System V/VME	BASIC, C, FORTRAN, Pascal	1M (256K)	6.3×9.2	3,800(Q1); 2,900(Q100)	2 serial ports, MMU, math accelerator, 3 counter/timers
CARINT LTD.										**Circle 411**
One Waters Park Dr., Suite 101, San Mateo, CA 94403, (415) 345-4040										
XK-186	80186 (10)	CMOS		processor	MS-DOS, PC-DOS, PC UNIX	C Compiler, Lattice, Mark Williams, Microsoft	512K	8×10×0.5	595(Q1); 469(Q100)	flexible disk controller; 2 serial, Centronics port(s); battery-backed real-time clock
CENTRAL DATA CORP.										**Circle 412**
1602 Newton Dr., Champaign, IL 61821, (217) 359-8010										
CD21/8286	80286 (8)	NMOS	Multibus	processor	RMX-86, RMX-286, XENIX-286	BASIC, C, FORTRAN, Pascal, PL/M	1M (128K)	6.75×12 ×0.5	2,200(Q1); 1,600(Q100)	4-channel DMA controller, 4 RS232C serial I/O ports
CD21/8630	8086 (5, 8, 10)	NMOS	Multibus	processor	MS-DOS, RMX-86	BASIC, C, FORTRAN, Pascal, PL/M	256K (256K)	6.75×12 ×0.5	1,330(Q1); 1,000(Q100)	1 serial I/O port
CD21/8635	8086 (5, 8, 10)	NMOS	Multibus	processor	MS-DOS, RMX-86	BASIC, C, FORTRAN, Pascal, PL/M	1M (256K)	6.75×12 ×0.5	1,710(Q1); 1,285(Q100)	1 serial I/O port

Company Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
COMARK CORP.										**Circle 413**
93 West St., P.O. Box 474, Medfield, MA 02052, (617) 359-8161										
CAT 286	80286 (6, 8)	HMOS	PC AT bus	processor	C-DOS, PC-DOS, XENIX		(128K)	4.5×13.3 ×0.5	750(Q1)	
MC85	8085 (5)	NMOS	Multibus	processor	CP/M		4K	7.125×12 ×0.5	895(Q1)	1 RS232C port
MC8630/35	8086 (10)	HMOS	Multibus	processor	Concurrent CP/M		up to 1M (up to 256K)	7.125×12 ×0.5	1,017(Q1)	1 RS232C, 2 iSBX port(s)
COMPUPRO/VIASYN CORP.										**Circle 414**
26538 Danti Court, Hayward, CA 94545, (415) 786-0909										
CPU 286	80286 (10)	NMOS	S-100/ IEEE 696	processor	Concurrent DOS	all		5×10×0.5	1,095(Q1)	
SP186	80186 (10)	NMOS	S-100/ IEEE 696	slave processor	Concurrent DOS	all	512K	5×10×0.5	795(Q1)	2 serial ports
SPIO	80188 (10)	NMOS	S-100/ IEEE 696	I/O, slave processor	Concurrent DOS		256K (64K)	5×10×0.5	895(Q1)	8 serial ports
COMPUTER DYNAMICS INC.										**Circle 415**
105 S. Main St., Greer, SC 29651, (803) 877-8700										
CPU-2	Z80 (6)	CMOS	STDbus	processor	CP/M-80	BASIC, C	48K (96K)	4.5×6.5	191(Q1); 156(Q100)	4 counter/timers, DMA
CPU-9	Z80 (8)	CMOS	STDbus	processor, I/O, communications	CP/M-80	BASIC, C	64K (32K)	4.5×6.5	280(Q1); 230(Q100)	2 RS232C, RS422 serial ports; 1 printer port; 2 timers; battery-backed clock/calendar
CPU-188	80188 (10)		STDbus	processor, I/O, communications	MS-DOS	BASIC, C	1M (128K)	4.5×6.5	425(Q1)	2 serial ports, 12 counter/timers
DATA GENERAL CORP.										**Circle 416**
4400 Computer Dr., Westboro, MA 01580, (617) 366-8911										
MV15000 Model 8	2800 AL5	CMOS	Multibus	processor	AOS/VS	BASIC, COBOL, FORTRAN, Pascal	4M	10.5×19 ×28.7	57,200 (Q1)	10 communication ports, clock/calendar, battery backup
DATAVUE TECHNICAL SYSTEMS										**Circle 417**
P.O. Box 2687, Norcross, GA 30091, (404) 564-5780										
8612-00	80861, NEC V30 (10)	CMOS, HMOS	IBM PC bus	processor	MS-DOS, PC-DOS	BASIC, C, Pascal	512K (128K)	13.5×4	457(Q1); 411(Q100)	
DATRICON CORP.										**Circle 418**
16398 S.W. 72nd Ave., Portland, OR 97224, (503) 684-3232										
ACS-2A	Z80A (2.5, 4, 6)	NMOS	STDbus	processor	CP/M		28K	4.5×6.5 ×0.425	195(Q1); 158(Q100)	power/restart circuit
ACS-09	MC6809 (1, 2)	NMOS	STDbus	processor	OS9	FORTH	40K	4.5×6.5 ×0.425	195(Q1); 158(Q100)	1 serial port
ACS-68SBC	MC68008 (8, 10)	NMOS	STDbus	processor	OS9	C	128K	4.5×6.5 ×0.425	495(Q1); 401(Q100)	2 serial ports, battery-backed clock/calendar, 16-bit timer
DAVIDGE CORP.										**Circle 419**
94-E Commerce Dr., P.O. Box 1869M, Buellton, CA 93427, (805) 688-9598										
DSB-4000	Z80A, Z80B (4, 6)	NMOS	SASI	processor	CP/M 2.2	CP/M compatible	64K (32K)	5.75×10 ×0.5	315(Q1); 252(Q100)	flexible disk controller; up to 4 RS232C, Centronics port(s); DMA
DSB-8000	HD64180 (6)	NMOS	SCSI	processor	CP/M 2.2, MP/M-II	CP/M compatible	512K (64K)	5.75×10 ×0.5	445(Q1); 356(Q100)	flexible disk controller; up to 6 RS232C, parallel port(s); DMA
DSB-8100	HD64180 (6)	NMOS	SCSI	processor	CP/M 2.2	CP/M compatible	256K (32K)	3.9×6.75 ×0.5	365(Q1); 292(Q100)	flexible disk controller; 2 RS232C, Centronics port(s)
DIGITAL EQUIPMENT CORP.										**Circle 420**
146 Main St., Maynard, MA 01754, (617) 897-5111										
KXJ11-C	J-11 (10)	CMOS	Q-bus	processor	MicroRSX, MicroVMS, RSX, RT	PDP-11, VAX languages	512K (64K)	10.5×8.9	3,500(Q1)	coprocessor; 2 serial, 1 parallel port(s); 2-channel DMA
KXT11-AB	T-11 (7.5)	NMOS	Q-bus	processor	RT-11	MicroPower/ Pascal	32K (32K)	5.25×8.9	790(Q1)	2 serial ports, clock
LSI-11/73	J-11 (15)	CMOS	Q-bus	processor	RSTS/E, RSX, RT, ULTRIX-11	PDP-11 languages		5.25×8.9	2,390(Q1)	memory management

SIEMENS

The choice is yours... promises or product.

Any company can make great promises about their products. At Siemens, we make great products – and promise immediate delivery now.

Around the world, OEM professionals depend on Siemens for the finest storage technology available. Our customized robotic production line guarantees extremely high yield and consistent standards of manufacturing excellence. A sophisticated control system insures precise, repeatable quality.

310 The 310 megabyte capacity MegaFile Series offers a wide range of design and performance features for high capacity, high performance 5¼″ hard disk drives.

125 The 125 megabyte ¼″ Streaming Cartridge Tape Drive is the ideal performance solution for backup requirements of high capacity 5¼″ disk drives, as well as archival storage, data interchange and software distribution.

Call today for superior performance, reliable product support...and immediate product delivery.

Siemens.
Technological leadership for OEM professionals.

Siemens Information Systems, Inc.
Memory Products Division
5655 Lindero Canyon Road, Suite 325
Westlake Village, California 91362
818-706-8872

CIRCLE NO. 54 ON INQUIRY CARD

CC/4110-059A WLM 553

Three New 68020 VME Processor Boards from Plessey!

CIRCLE NO. 55 ON INQUIRY CARD

One Blue Hill Plaza, Pearl River, NY 10965-8541 **(800) 368-2738,** (914) 735-4661
22931 Triton Way, Suite 231, Laguna Hills, CA 92653-1237 (714) 855-4947

Company / Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
DUAL SYSTEMS CORP. 2530 San Pablo Ave., Berkeley, CA 94702, (415) 549-3854										Circle 421
vmpu-32	MC68020 (16.7)		VMEbus	processor	UNIX System V 2.2	BASIC, C, COBOL, FORTH, Pascal	1M	6.3×9.2	4,450(Q1)	68851, 68881 floating point processor, MMU, battery-backed day clock
DY-4 SYSTEMS INC. 1475 S. Bascom Ave., Suite 202, Campbell, CA 95008, (408) 377-9822										Circle 422
DVME-104	MC68010 (12.5)	NMOS	VMEbus	processor	UNIX System III, Harmony Real-Time	C, RM/COBOL, FORTRAN, Pascal	1M (256K)	8.7×9.2 ×0.8	2,600(Q1); 2,230(Q100)	2 serial ports, ruggedized version, built-in test equipment
DVME-107	MC68010 (10)	NMOS	VMEbus	processor	P-DOS, M-DOS	FORTRAN, Pascal	512K (128K)	8.7×9.2 ×0.8	2,486(Q1)	error detection/correction memory, 2 asynch I/O ports, built-in test equipment, 5 interrupt levels
DVME-134	MC68020 (12.5, 16.7)	CMOS	VMEbus	processor	UNIX System V, Harmony Real-Time	C, FORTRAN, Pascal	1M (64K)	8.7×9.2 ×0.8	4,361(Q1)	1 serial communications port, 7 interrupt levels; opt. 68881 floating point processor
ENTERPRISE SYSTEMS CORP. P.O. Box 698, Dover, NH 03820, (603) 742-7363										Circle 423
10809	6809 (1, 2)	NMOS	STDbus	processor			up to 24K (up to 24K)	6.5×4.5 ×0.5	250(Q1); 185(Q100)	power fail detect, serial port, 4 programmable timers
10812	6502 (1, 2)	NMOS	STDbus	processor			up to 24K (up to 24K)	6.5×4.5 ×0.5	250(Q1); 185(Q100)	power fail detect, serial port, 4 programmable timers
FARADAY ELECTRONICS INC. 749 N. Mary Ave., Sunnyvale, CA 94086, (408) 749-1900										Circle 424
BUS AT	80286 (6, 8)	NMOS	PC AT bus	processor	CP/M-86, MS-DOS	BASIC, FORTH, Pascal	512K (64K)	13.2×4.8		15 interrupts; 2 DMA controllers; keyboard, reset, speaker ports; CMOS clock/calendar
BUS PC	8088 (4.77)	NMOS	PC bus	processor	CP/M-86, MS-DOS	BASIC, FORTH, Pascal	256K (64K)	13.15×4.2		8 interrupts; 2 serial, 1 parallel port(s); 3 timers
CMOS Micro PC	80C88 (4.77)	CMOS	PC bus	processor	CP/M-86, MS-DOS	BASIC, FORTH, Pascal	256K (64K)	6.2×4.2		8 interrupts; 8087 coprocessor; 3 timers; keyboard, speaker ports
GENERAL MICRO SYSTEMS INC. 4740 Brooks St., Montclair, CA 91763, (714) 625-5475										Circle 425
GMSV06	68010 (10, 12.5)		VMEbus	processor	OS9, P-DOS, pSOS, UNIFLEX, UNIX, VERSAdos	BASIC; BASIC, C and FORTRAN Compilers; Pascal	(128K)		1,995(Q1); 1,496(Q100)	68881 math coprocessor; 2 multiprotocol serial, parallel port(s); 4 timers; real-time, battery-backed clock/calendar
GMSV06/020	MC68020 (16)		VMEbus	processor	OS9, P-DOS, pSOS, UNIFLEX, UNIX, VERSAdos	BASIC Compiler, Pascal	up to 2M (128K)		2,995(Q1); 2,246(Q100)	68881 math coprocessor; 2 multiprotocol serial, parallel port(s); 4 timers
GMSV07	MC68020 (16, 20, 24)		VMEbus	processor	OS9, P-DOS, pSOS, UNIFLEX, UNIX, VERSAdos	BASIC; BASIC, C and FORTRAN Compilers; Pascal	(128K)		1,995(Q1); 1,496(Q100)	coprocessor; 2 multiprotocol serial, parallel port(s); 2 expansion connectors
GESPAC INC. 50 W. Hoover Ave., Mesa, AZ 85202, (602) 962-5559										Circle 426
GESMPU-4B	MC68000 (8)	NMOS	G-64	processor	OS9, P-DOS	BASIC, C, FORTH, FORTRAN, Pascal	64K (128K)	4×6×0.8	395(Q1); 316(Q100)	2 RS232C ports; 3 (16-bit) timers
GESMPU-20	MC68020 (16)	NMOS	G-64	processor	OS9	BASIC, C, FORTH, Pascal	512K (512K)	4×6×0.8	1,170(Q1); 936(Q100)	
GESSBS-5	8088 (8)	NMOS	G-64	processor	MS-DOS	GENESCOPE	64K (64K)	4×6×0.8	595(Q1); 476(Q100)	2 RS232C serial ports; real-time clock/calendar; 10 (8-bit) timers

Company Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
GMX INC.										**Circle 427**
1337 W. 37th Place, Chicago, IL 60609, (312) 927-5510										
Micro-20	MC68020 (12.5, 16.67, 20)			processor	OS9, UNIFLEX	BASIC, C, FORTH, FORTRAN, Pascal, Sculptor	2M (256K)		2,565 (12.5 MHz); 1,795(Q100)	flexible disk controller, 68881 math coprocessor, 4 serial ports, battery-backed day clock, I/O expansion connector
Micro-20 MMU	MC68020 (12.5, 16.67, 20)			processor	OS9, UNIFLEX-VM	BASIC, C, FORTH, FORTRAN, Pascal, Sculptor	3M (256K)		3,395(Q1); 2,395(Q100)	flexible disk controller, 68881 math coprocessor, 8 serial ports, battery-backed day clock, up to 8M bytes of memory
HEURIKON CORP.										**Circle 428**
3201 Latham Dr., Madison, WI 53717, (608) 271-8700										
HK68/M220	MC68020 (up to 24)	NMOS	Multibus II	processor	OS9, pSOS, UNIX System V, VRTX	BASIC, C, COBOL, FORTRAN, Pascal	4M (256K)		3,795(Q1); 2,695(Q100)	DMA, 68881 math coprocessor, 2 serial ports, iSBX connector, SCSI interface, MMU
HK68/V10	MC68010 (10, 12.5)	NMOS	VMEbus	processor	OS9, pSOS, UNIX System V, VRTX	BASIC, C, COBOL, FORTRAN, Pascal	4M (128K)		2,495(Q1); 1,795(Q100)	DMA, 68881 math coprocessor, 2 serial ports, SCSI interface, MMU
HK68/V20	MC68020 (up to 24)	NMOS	VMEbus	processor	OS9, pSOS, UNIX System V, VRTX	BASIC, C, COBOL, FORTRAN, Pascal	4M (128K)		2,795(Q1); 1,995(Q100)	68881 math coprocessor, serial port, MMU, VXB memory bus
INDOCOMP INC.										**Circle 429**
5409 Perry Dr., P.O. Box 157, Drayton Plains, MI 48020, (313) 674-2294										
IND-68011	MC68010 (8, 10, 12.5)	CMOS	proprietary	processor, I/O	MTOS-68K, MTOS-UX 68K	Assembly, C, Pascal	up to 128K (up to 128K)	15×9.5 ×0.5	3,125(Q1); 2,500(Q100)	interrupts, up to 3 serial ports, real-time clock, 16 analog inputs, 4 analog outputs
IND-68021	MC68010 (8, 10, 12.5)	CMOS	proprietary	processor, I/O	MTOS-68K, MTOS-UX 68K	Assembly, C, Pascal	up to 128K (up to 128K)	15×9.5 ×0.5	2,448(Q1); 1,958(Q100)	interrupts, up to 3 serial ports, real-time clock, 5 counter/timers
IND-68041	MC68010 (8, 10, 12.5)	CMOS	proprietary	processor, I/O	MTOS-68K, MTOS-UX 68K	Assembly, C, Pascal	up to 128K (up to 128K)	15×9.5 ×0.5	2,100(Q1); 1,774(Q100)	interrupts, up to 3 serial ports, real-time clock, 16 analog inputs, 2 analog outputs, 2 counter/timers
INTEGRATED SOLUTIONS										**Circle 430**
1140 Ringwood Court, San Jose, CA 95131, (408) 943-1902										
VME-68K10	MC68010 (11.2)	NMOS	VMEbus	processor	Berkeley UNIX Version 4.2	C, FORTRAN, Pascal	16K (64K)		2,000(Q1); 1,320(Q100)	2 serial ports, MMU
VME-68K20	MC68020 (16.67)	NMOS	VMEbus	processor	Berkeley UNIX Version 4.2	C, FORTRAN, Pascal	(64K)		2,500(Q1); 1,650(Q100)	2 asynch serial ports, MMU
INTEL CORP.										**Circle 431**
3065 Bowers Ave., P.O. Box 58065, Santa Clara, CA 95052-8065, (800) 548-4725										
iSBC 186/xxx	80186		Multibus, Multibus II	processor	iRMX, UNIX, XENIX		up to 16M (512K)		1,300-2,000(Q1)	8087-1 coprocessor, built-in self-test, advanced DMA
iSBX 286/xxx	80286 (8, 10)		Multibus, Multibus II	processor	iRMX, UNIX, XENIX		up to 16M (512K)		2,000-7,900(Q1)	80287 coprocessor, built-in self-test, advanced DMA
iSBC 386/xxx	80386 (16)		Multibus, Multibus II	processor	iRMX, UNIX, XENIX		up to 16M (512K)		4,000-12,000(Q1)	80287 coprocessor, built-in self-test, advanced DMA
INTERCONTINENTAL MICRO SYSTEMS CORP.										**Circle 432**
4015 Leaverton Court, Anaheim, CA 92807-1692, (714) 630-0964										
CPS-MS	NEC V40 (8)		S-100	processor	PC-DOS, TurboDOS	BASIC, C, FORTH	640K	5.1×10 ×0.65	995(Q1); 597(Q100)	flexible disk controller, power/restart circuit
CPS-PC	NEC V40 (8)		PC bus	processor	NetWare 86, PC-DOS, TurboDOS	BASIC, C, FORTH	768K	4.2×10.5 ×0.75	795(Q1); 477(Q100)	flexible disk controller, power/restart circuit
CPZ-186	80186 (8)		S-100	processor	TurboDOS	BASIC, C, FORTH	1M	5.5×10 ×0.56	1,195(Q1); 717(Q100)	flexible disk and DMA controllers, MMU

INTERPHASE PULLS A FAST ONE

30 MBytes/s on VMEbus

INTERPHASE® shatters the old speed limits of the VMEbus with its second generation of VME disk controllers boasting 30 megabytes per second bus speeds and above. Using a new INTERPHASE technology breakthrough called the BUSpacket Interface℠ ... the new V/SMD 4200 Cheetah and V/ESDI 4201 Panther triple existing VMEbus speeds and approach the VMEbus theoretical bandwidth of 40 megabytes per second!

SIMPLY THE FASTEST

The combination of the BUSpacket Interface and a large (128 KBytes) cache memory provide the V/SMD 4200 and V/ESDI 4201 with unequalled speed, and make them the fastest SMD and ESDI controllers by a factor of three. No one even comes close!

In simple terms, the new INTERPHASE technology preformats packets of data to go across the bus before acquiring it. The INTERPHASE BUSpacket approach unharnesses the VMEbus from slow devices through deep, high-speed bus FIFOs and an asynchronous delay line-based state machine, which controls bus transfers. Data is emptied onto the bus in packets at speeds 30 megabytes per second and above.

STICK WITH THE WINNERS

The V/SMD 4200 and V/ESDI 4201 also incorporate the proven INTERPHASE features of the multitasking Virtual Buffer Architecture℠, Intelligent Caching, and zero latency operation found on other popular INTERPHASE products. The four drive V/ESDI 4201 Panther even adds an integral SCSI port for easy addition of back up devices.

Both products complement INTERPHASE's high-performance V/Tape 3209 1/2" tape controller, and are **PLUG & PLAY** software compatible with the industry's most successful SMD and ESDI controllers, our V/SMD 3200 and V/ESDI 3201.

THEY'RE GOING FAST

To learn more about the fastest SMD, ESDI and 1/2" tape controllers around, call or write today ... but you better move fast ... INTERPHASE certainly is.

(214) 350-9000

INTERPHASE corporation

2925 Merrell Road • Dallas, Texas 75229 • Telex: 9109976245 NASDAQ-NMS:INPH

Interphase International
93a New Street, Aylesbury, Bucks. HP20 2NY, England (0296)35661 Telex: 826715 AERO G

CIRCLE NO. 56 ON INQUIRY CARD

The wait is over. You can evaluate this ½" cartridge tape drive today.

Fujitsu delivers products, not just promises.

It's here—a high-performance ½" cartridge tape drive, in a 5¼" form factor.

Fujitsu America has it. We're ready today with evaluation units. And we have a product that performs.

Our M2451A cartridge tape drive gives you up to 120 MB of formatted storage capacity. It runs in both streaming and start/stop modes, at streaming speeds of 75 and 50 ips, so it fits almost any application. Its ESDI interface assures easy, cost-effective system integration.

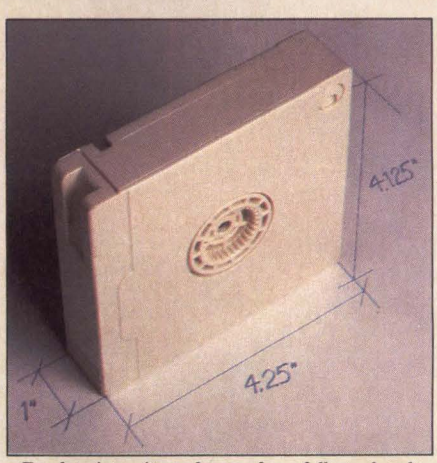
And for your SCSI system, the optional high-performance M1008A SCSI controller is now available.

Most importantly, these cartridge tape drives are already proven and working in systems today. And with second sources available for both drives and media, you can be sure of protecting your investment in this technology.

For more information about Fujitsu's ½" cartridge, or other tape drives, call (408) 946-8777. Or write Fujitsu America, Inc., Storage Products Division, 3055 Orchard Drive, San Jose, CA 95134-2017.

Fujitsu tape drives meet the quality standards and technical requirements that have made this one of the world's leading companies. That's leadership you can depend on to develop the technology you need. And deliver it.

CIRCLE NO. 57 ON INQUIRY CARD



For data integrity and ease of use, fully enclosed ½" media is packed in a single reel, in a compact plastic enclosure.

We're developing technology for you.

FUJITSU

FUJITSU AMERICA

Need a High Resolution Graphics Controller?

Prism | Performer I | Performer II

Take Your Choice!

Prism	Performer I	Performer II
800×600, 1024×768	640×480, 800×600	1024×768, 1280×1024
NEC 7220A	Hitachi ACRTC	Hitachi ACRTC
16 Color (4096)	16 Color	256 Color (4096)
Analog/TTL	TTL (RGBI)	Analog
RS-232 Port		

Many More Useful Features are Standard in These High Performance Cards
These Boards Support Popular CADD and WINDOWS Applications
Call Now: 617-229-4800

Dealer/Distributor and OEM Discounts Available

Modgraph

149 Middlesex Turnpike, Burlington, MA 01803

CIRCLE NO. 30 ON INQUIRY CARD

Images courtesty of ARC, Ltd., Autodesk, Inc., Point Line, Inc.

It's a simple fact of VAR life. Some vendors just don't supply you with the kind of hardware you need to reach a wide range of customers. Fortunately, there is someone with more for you to sell. Hewlett-Packard. And what we have for you is the broad, fully compatible HP 3000 family.

The breadth of the HP 3000 family means that you can meet the needs of a wide range of customers. From small businesses all the way up to Fortune 500 companies.

Compatibility across the HP 3000 line means greater flexibility in the configurations you can offer your customers. And it means that as your customers grow, they'll be able to upgrade easily—without modifying software.

What's more, Hewlett-Packard quality and support will help keep your customers satisfied. Just look at our record. In the 1986 *Datapro Survey,* Hewlett-Packard received top ratings for Overall Support Satisfaction. And in the 1986 *VARBUSINESS Annual Report Card Review,*® our current VARs gave us highest ratings among major vendors for Quality of Products, Provision for Hardware Maintenance, and Overall Impression of Vendor.

Added to all of this are some of the most attractive financial incentives in the industry. An entire arm of our sales force dedicated exclusively to supporting you. And our ongoing commitment to always asking "What if..." about your business needs.

So if you're looking to sell more, look to those who give you more to sell. Hewlett-Packard.

For more information call 1 800 367-4772, Dept. 694E.

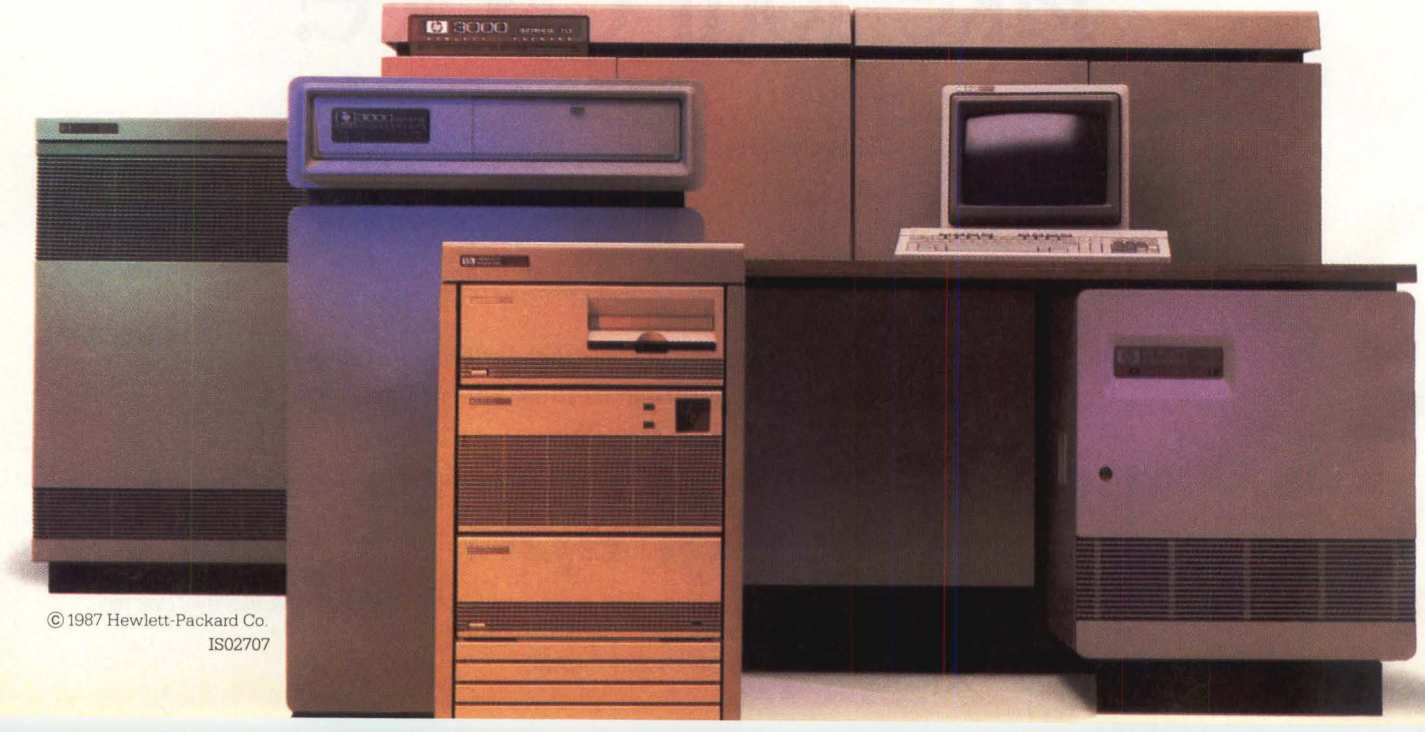
® Reprinted with permission from *Computer Systems News (VARBUSINESS).*

HEWLETT PACKARD
Business Computing Systems

CIRCLE NO. 27 ON INQUIRY CARD

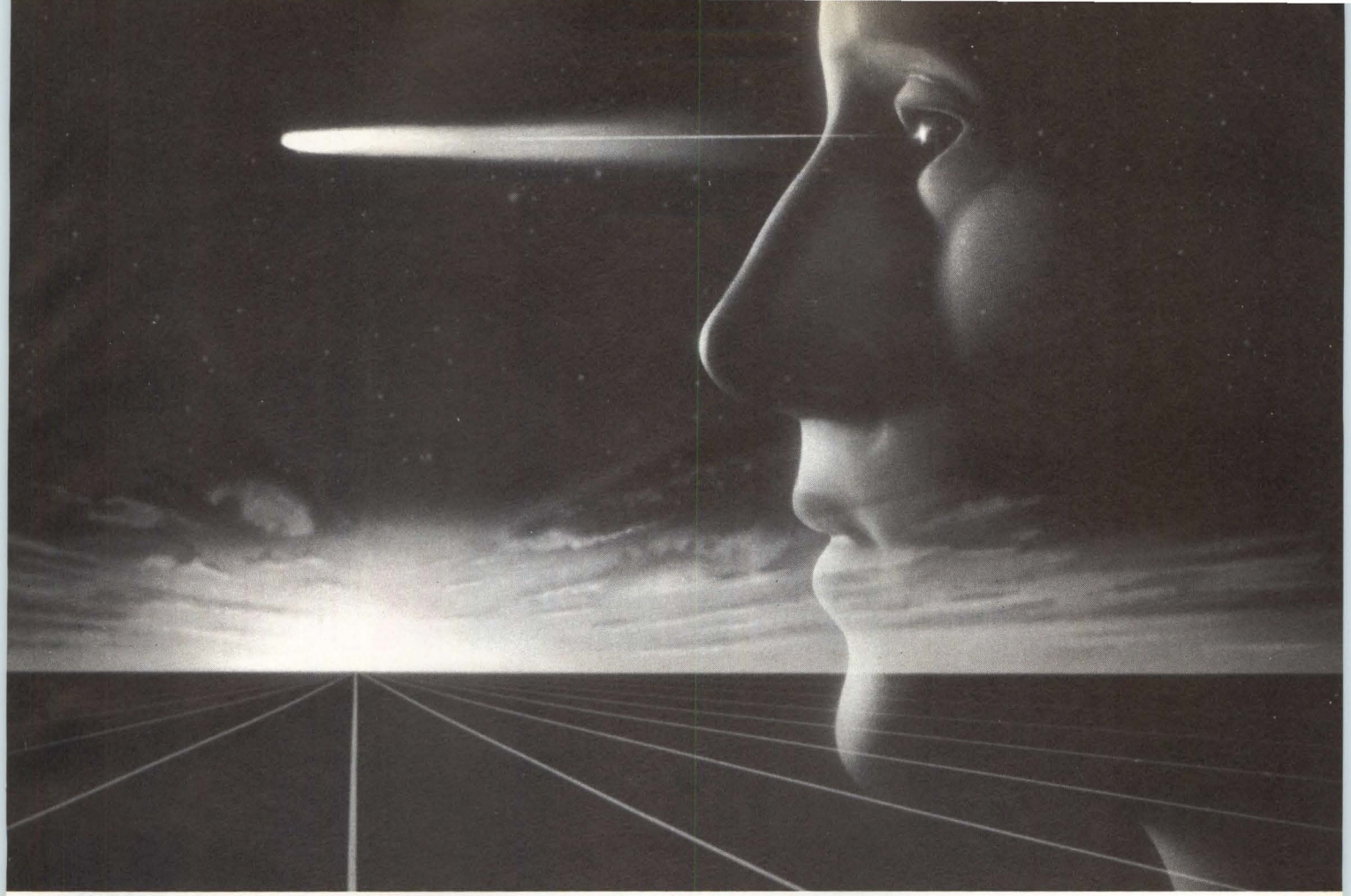
we never stop asking "What if...?"

You'll sell more if you've got more to sell.



Company / Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
INTERPHASE CORP.										**Circle 433**
2925 Merrell Rd., Dallas, TX 75229, (214) 350-9000										
BASEboard	MC68010 (10)		VMEbus	processor	UNIX	C	512K	14×11.5 ×1.5	2,995(Q100)	disk controller; serial, parallel ports; 5 expansion slots
IRONICS INC.										**Circle 434**
798 Cascadilla St., Ithaca, NY 14850, (607) 277-4060										
IV-1602	MC68010 (10, 12.5)	CMOS	VMEbus	processor	pSOS, UNIFLEX, UNIX System V.2		512K		1,995(Q1)	2 multiprotocol serial, 2 parallel I/O ports
IV-1624	MC68010 (10, 12.5)	CMOS	VMEbus	I/O, communications	pSOS, UNIFLEX, UNIX System V.2		256K		2,445(Q1)	4 dual channel I/O controllers, 8 multiprotocol serial I/O ports
IV-3201	MC68020 (12.5, 16)	CMOS	VMEbus	processor	pSOS, UNIFLEX, UNIX System V.2		1M		3,395(Q1)	programmable counter/timer, real-time clock/calendar
ISKRA VME TECHNOLOGIES										**Circle 435**
222 Sherwood Ave., Farmingdale, NY 11735, (516) 753-0400										
VMEx286	80286 (8)	NMOS	VMEbus	processor	iRMX-86, MS-DOS, XENIX		512K (64K)	6.3×9.2	2,280(Q1); 1,870(Q100)	interrupt controller, 80287 coprocessor, reset circuit, 2 serial ports, real-time clock
VMExJ11	DCJ-11 (15)	NMOS	VMEbus	processor	RSX-11		512K (4K)	6.3×9.2	2,395(Q1); 1,964(Q100)	interrupt controller; reset circuit; 1 serial, 1 parallel port; real-time clock; 3 timers
JF MICROSYSTEMS										**Circle 436**
3641 Frontier Rd., Pasco, WA 99301, (509) 297-4294										
4102	8088 (8)	NMOS	STDbus	I/O processor			2K (16K)	4.5×6.5 ×0.4	460(Q1); 345(Q100)	3-channel timer, interrupt controller
4188	8088 (5)	NMOS	STDbus	I/O processor			8K (16K)	4.5×6.5 ×0.4	400(Q1); 300(Q100)	3-channel timer, parallel I/O processor, interrupt controller
8759	8088 (5, 8)	NMOS	STDbus	processor	CP/M-86		(32K)	4.5×6.5 ×0.4	500(Q1); 375(Q100)	3-channel timer, master interrupt controller
LAPOLE SYSTEMS INC./LCA-NY										**Circle 437**
575 Fifth Ave., 21st Floor, New York, NY 10017, (212) 953-3440										
LPU-68K-1M-D10	MC68000 (10)		Multibus	processor	CP/M-68K, OS9, REGULUS	C, FORTH, FORTRAN, Pascal	1M (128K)	6.76×12 ×0.55	2,100(Q1); 1,400(Q100)	DMA controller, 16-bit counter/timer, 2 iSBX expansion connectors
LPU-DAC	HD64B180 (6)	CMOS	Multibus		CP/M-80	BASIC, C, FORTRAN, Pascal	256K (192K)	6.76×12 ×0.55	2,000(Q1); 1,350(Q100)	
LITTLE MACHINES INC.										**Circle 438**
4241 Jutland Dr., Suite 103, San Diego, CA 92117-3652, (619) 483-3606										
DPX86/ME	80286, 80186 (6, 8)	CMOS	Multibus	applications, communications	CORTEX, iRMX-286, UNIX System V, XENIX	Assembly, C, PL/M	512K	12×6.75 ×0.6	2,200(Q1)	3 RS232C or RS422/423 ports; 1 parallel, 1 Ethernet ports; Centronics interface
LOGICRAFT INC.										**Circle 404**
410 Amherst St., Nashua, NH 03063, (603) 880-0300										
HCP-11	8088 (8)	NMOS	UNIbus	processor	MS-DOS, RSX, RSX-11M-PLUS, RT-11, TSX, VMS	MD-DOS languages	768K	8.5×15.625	6,350(Q1); 3,492(Q100)	RS232C port
QCP-11	8088 (8)	NMOS	Q-bus	processor	MS-DOS, RSX, RSX-11M-PLUS, RT-11, VMS	MS-DOS languages	768K	8.5×5.18	2,225(Q1); 1,223(Q100)	RS232C port
LOMAS DATA PRODUCTS INC.										**Circle 439**
182 Cedar Hill St., Marlboro, MA 01752, (617) 460-0333										
Lightning 286	80286 (10)	NMOS	S-100	processor	Concurrent DOS, CP/M-86, MS-DOS	BASIC, C, FORTH, FORTRAN, Pascal		5×10×0.5	1,095(Q1)	8 vectored interrupts, IEEE 696 bus expansion, 80287 math coprocessor

Company Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
Thunder/Plus	80186 (10)	NMOS	S-100	processor	Concurrent DOS, CP/M-86, MS-DOS	BASIC, C, FORTH, FORTRAN, Pascal	1M (128K)	5×10×0.5	1,195(Q1)	flexible disk controller; 8087 math coprocessor; 2 serial, 1 parallel port(s)
MICROBAR SYSTEMS INC. 785 Lucerne Dr., Sunnyvale, CA 94086, (408) 720-9300										**Circle 440**
COM16A	8086 (8)		Multibus	communications	UNIX System V	Assembly, C	128K-512K (256K)	6.75×12×0.5	1,450(Q1); 950(Q100)	DMA channel, 8 serial ports, iSBX expansion connector, UNIX Terminal I/O
GPC68020	MC68020 (12.5, 16.67)		Multibus	processor	UNIX System V, VRTX	Ada, Assembly, C	1M-8M (256K)	7.75×12×0.4	2,785(Q1); 1,950(Q100)	dual serial I/O ports; 7 interrupt levels; 5 (8-bit) counter/timers
MT68020	MC68020 (12.5, 16.67)		Multibus II	processor	UNIX System V, VRTX	Ada, Assembly, C	1M-4M (256K)	9.2×0.78×8.9	3,490(Q1); 2,443(Q100)	dual serial I/O ports; 7 interrupt levels; 5 (8-bit) counter/timers
MICRO-LINK CORP. 14602 North U.S. Highway 31, Carmel, IN 46032, (317) 846-1721										**Circle 441**
STD-203	MC68000 (4, 8)		STDbus	processor	CP/M-68K, OS9, P-DOS	BASIC, Lattice and Alcyon C, FORTH, Absoft FORTRAN	(4K)	4.5×6.5×0.5	425(Q1); 340(Q100)	Z80 vectored interrupts
STD-206	80188 (8)		STDbus	processor			256K (64K)	4.5×6.5×0.5	475(Q1); 380(Q100)	2 serial, 1 parallel port(s); iSBX expansion connector
STD-247	Z80A (4)		STDbus	processor	CP/M 2.2	BASIC, C, FORTH, FORTRAN, Pascal	64K (32K)	4.5×6.5×0.5	285(Q1); 228(Q100)	1 RS232C, 1 parallel ports; battery-backed, real-time clock/calendar; 2 timers
MICRO/SYS INC. 1011 Grand Central Ave., Glendale, CA 91011, (818) 244-4600										**Circle 442**
SB8020	Z80 (4)	NMOS	STDbus	processor	CP/M 2.2	C	32K (32K)	4.5×7×0.5	395(Q1); 290(Q100)	2 serial, 1 parallel port(s); battery-backed clock/calendar; 4 counter/timers
SB8082	NEC V20 (5, 8)	NMOS	STDbus	processor	PC-DOS	C	32K (32K)	4.5×7×0.5	395(Q1); 290(Q100)	2 serial, 2 parallel ports; 5 counter/timers
SB8088	8088 (5, 8)	NMOS	STDbus	processor	PC-DOS	C	32K (32K)	4.5×7×0.5	345(Q1); 250(Q100)	1 serial, 2 parallel port(s); 5 counter/timers
MILLER TECHNOLOGY INC. 647 N. Santa Cruz Ave., Los Gatos, CA 95030, (408) 395-2032										**Circle 443**
MCPU-800	Z80A (4)	NMOS	STDbus	processor, I/O	CP/M	Assembly, BASIC, C	64K (32K)	7×4.5×0.5	645(Q1); 535(Q100)	serial port, memory mapping
MCPU-900	Z80A (4)	NMOS	STDbus	processor, I/O	CP/M	Assembly, BASIC, C	64K (16K)	7×4.5×0.5	795(Q1); 735(Q100)	flexible disk controller; serial, printer port; 3 counter/timers, memory mapping
MOTOROLA INC.(MICROCOMPUTER DIV.) 2900 S. Diablo Way, Tempe, AZ 85282, (602) 438-3501										**Circle 444**
MVME105	MC68010 (10)	NMOS	VMEbus	processor	VERSAdos	C, FORTRAN, Pascal	512K (256K)	9.2×0.8×6.3	995(Q1); 850(Q100)	2 serial, 8-bit parallel port(s); 4 timers
MVME133A	MC68020 (20)	HCMOS	VMEbus	processor	VERSAdos, VRTX	C, FORTRAN, Pascal	1M (256K)	9.2×0.8×6.3	4,250(Q1); 3,188(Q100)	math coprocessor; 2 multiprotocol serial ports; 3 (8-bit) timers; real-time clock
MVME135	MC68020 (16.67)	HCMOS	VMEbus	processor	UNIX System V, VERSAdos	C, FORTRAN, Pascal	1M (128K)	9.2×0.8×6.3	5,245(Q1); 3,934(Q100)	math coprocessor; 2 serial ports; 2 (16-bit) timers
OCTAGON SYSTEMS CORP. 6510 W. 91st. Ave., Westminster, CO 80030, (303) 426-8540										**Circle 445**
880B	8088 (5.12)		STDbus	processor	ROBASIC	ROBASIC	16K, 64K (64K)	4.5×7×0.468	545-595(Q1); 366-406(Q100)	8-level interrupt controller, 2 RS232C serial ports, real-time clock, 5 counter/timers, includes ROBASIC
886	8088 (5.12)		STDbus	processor	ROBASIC	ROBASIC	32K (64K)	4.5×7×0.468	645(Q1); 446(Q100)	1 RS232C serial port, 5 counter/timers, 8 analog inputs, includes ROBASIC



YOU'RE FACING THE PROBLEMS.

NOW COME FACE-TO-FACE WITH THE SOLUTIONS.

INTERFACE '87
The force behind communications and information networking solutions.

INTERFACE '87 unites you with the latest innovations in communications equipment and services. Networking products. LANs. Peripherals. Fiber optic systems. Software. Cabling systems. Office automation equipment and systems. Satellites. Earth stations. The solutions at the core of greater productivity.

To help you understand and implement the solutions you need, the INTERFACE '87 Conference reveals and explains the most pressing technical, applications and management issues. Industry experts explore such topics as Virtual Connectivity, Voice/Data Integration, Network Implementation, and LANs. You'll examine case studies that reveal how others have solved problems you're facing. Learn new methods of meeting the increasing challenges your people and systems face. And equip yourself with new skills for coping with and conquering the age of technology.

And with such highlights as the gala Awards Banquet and the Executive Briefing, the show gleams with excitement and innovation.

INTERFACE '87 turns technological promises into solutions. Register now.

INTERFACE®'87

March 30–April 2, 1987
Las Vegas Convention Center

I WANT SOLUTIONS NOW! MMS 3 87

☐ Send me complete attendee information.
☐ Send me information on exhibiting.

Name _____

Title _____

Company _____

Address _____

City _____

State _____ Zip _____

Return to: Mr. Irwin Stern
The Interface Group, Inc.,
300 First Avenue, Needham, MA 02194.

Produced by
☒THE INTERFACE GROUP, Inc.

Co-sponsored by
BusinessWeek and Data Communications

It's a major power shift.

To Ricoh. Because our 20MB removable cartridge drive meets the new government and industry requirements on secure data storage.

And it's available now. In production quantities.

Ready to be built into any device where secure, unlimited and portable data storage is needed. PC. Voice mail system. Whatever.

Plus all kinds of extras as standard equipment.

Like ANSI-standard cartridges. Economically available from Ricoh and second sources.

100% interchangeability. So users can swap cartridges among different drives, without losing data.

And your choice of an ST506 or SCSI interface. So you can meet today's and tomorrow's requirements. Without another costly re-evaluation.

All brought to you by Ricoh. Two-time Deming Award winner for quality. And a 50-year track record of innovation and leadership.

For specs and an evaluation unit, call 408-946-6200. We'll show you a great way to pull off a contract.

RICOH SYSTEMS, INC., Sales Department, 2071 Concourse Drive, San Jose, California 95131-1887. Tel: (408) 946-6200. Fax: (408) 262-0662.

RICOH

CIRCLE NO. 52 ON INQUIRY CARD

Announcing the greatest pull-out in government history.

Company / Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
SYS-2Z	Z80A (4)	CMOS	proprietary	processor	OEM BASIC	OEM BASIC	8K (16K)	4.5×7 ×0.468	345-380 (Q1); 236-264 (Q100)	1 RS232C serial port, 8 analog inputs, digital I/O, includes OEM BASIC
OMNIBYTE CORP. 245 West Roosevelt Rd., West Chicago, IL 60185, (312) 231-6880										**Circle 446**
OB68K1A	MC68000 (10)		Multibus	processor	IDRIS	C, Pascal	128K-512K (256K)	6.75×12 ×0.062	1,295(Q1); 971(Q100)	2 RS232C serial, 2 (16-bit) parallel ports
OB68K/VSBC1	MC68000 (12.5)		VMEbus	processor	IDRIS	C, Pascal	512K (256K)	6.3×9.19 ×0.062	1,695(Q1); 1,271(Q100)	up to 4 serial ports
OB68K/VSBC20	MC68020 (16.7)		VMEbus	processor	IDRIS	C, Pascal	1M-4M (128K)	6.3×9.19 ×0.062		up to 4 serial ports
ONSET COMPUTER CORP. 199 Main St., P.O. Box 1030, N. Falmouth, MA 02556, (617) 563-2267										**Circle 447**
CPU-8088	80C88 (4)	CMOS	C-44	processor	monitor	Assembly	256 (8K)	5.25×4.5 ×0.5	550(Q1); 380(Q100)	real-time clock, 14-bit timer
Tattletale Model II	6303Y (4.91)	CMOS		process control	TTBASIC	Assembly, TTBASIC	256K (32K)	2.9×5×0.8	595(Q1); 410(Q100)	on-board voltage regulator, 8-channel A/D converter
Tattletale Model IV	6301 (4.91)	CMOS		process control	TTBASIC	Assembly, TTBASIC	32K (16K)	2.25×3.725 ×0.8	395(Q1); 275(Q100)	lithium battery backup, on-board voltage regulator, 11-channel A/D converter
PEP MODULAR COMPUTERS INC. 600 N. Bell Ave., Pittsburgh, PA 15106, (412) 279-6661										**Circle 448**
MPM68008	MC68008 (8, 10)	NMOS	intelligent I/O channel	processor	OS9	BASIC, C, Pascal	64K (256K)	4×6.25	498(Q1); 400(Q100)	2 serial, 2 parallel ports; 2 timers; power fail detect
VMPM68KB	MC68010, MC68HC000 (10)	CMOS, NMOS	VMEbus	processor	OS9, P-DOS, VERSAdos	BASIC, C, Pascal	128K (128K)	4×6.25	1,095(Q1); 895(Q100)	2 serial, 1 parallel port(s); 2 timers; power fail detect
VMPM68KC	MC68020 (12, 16, 20)	CMOS, NMOS	VMEbus	processor	OS9, VERSAdos	BASIC, C, Pascal	1M (256K)	4×6.25	4,000(Q1); 2,500(Q100)	2 serial ports, power fail detect
PERFORMANCE TECHNOLOGIES INC. 435 W. Commercial St., East Rochester, NY 14445, (716) 586-6727										**Circle 449**
PT-VME100	MC68010 (10)		VMEbus		UNIPlus+, UNIX System V	BASIC, C, FORTRAN, Pascal	64K (64K)	9.2×6.3 ×0.8	2,700(Q1); 1,995(Q100)	dual MMU
PT-VME102	MC68010 (10)		VMEbus	processor	P-DOS	BASIC, C, FORTRAN, Pascal	2M (256K)	9.2×6.3 ×0.8	1,995(Q1); 1,500(Q100)	7-level interrupts, battery backup, 68881 math coprocessor
PT-VME103	MC68010 (10)		VMEbus		DEBUG, Monitor	Assembly	64K (120K)	9.2×6.3 ×0.8	2,750(Q1); 2,050(Q100)	MMU
PERIPHERAL TECHNOLOGY 1480 Terrell Mill Rd., Suite 870, Marietta, GA 30067, (404) 984-0742										**Circle 450**
PT68K-1	MC68008 (10)	NMOS		processor	OS9, SK*DOS	BASIC, C, FORTRAN, Pascal	768K (64K)	5.75×8	595(Q1); 350(Q100)	flexible disk controller; 2 RS232C, 2 (8-bit) parallel ports; real-time clock
PT69-3	6809 (1)	NMOS		processor	0S9, STAR-DOS	BASIC, C, Pascal	59K (4K)	5.5×6.5	269(Q1); 180(Q100)	flexible disk controller; 2 RS232C, 2 (8-bit) parallel ports; real-time clock
PT69-5	6809 (2)	NMOS		processor	OS9, SK*DOS	BASIC, C, Pascal	60K (8K)	5.75×7	349(Q1); 235(Q100)	flexible disk controller; 4 RS232C, 2 (8-bit) parallel ports; real-time clock
PERSONAL MICRO COMPUTERS INC. 275 Santa Ana Court, Sunnyvale, CA 94086, (408) 737-8444										**Circle 451**
PC-101	Z80A (4)			processor	CP/M 3.0	CBASIC	128K (4K)	5.7×11.7 ×0.5	325(Q1)	flexible disk controller; 2 RS232C, Centronics port(s); real-time clock
PLESSEY MICROSYSTEMS One Blue Hill Plaza, Pearl River, NY 10965, (914) 735-4661										**Circle 452**
PME 68-14	MC68000 (10)	NMOS	VMEbus, GPIB	processor	P-DOS, pSOS, VERSAdos	BASIC, C, FORTRAN, Pascal	2M (512K)	6.3×9.2 ×0.8	2,081(Q1)	2-channel DMA controller, dual serial I/O ports, programmable real-time clock

Company / Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
PME 68-21	MC68020 (16, 20)	NMOS	VMEbus, VSB	processor	P-DOS, pSOS, VERSAdos	BASIC, C, FORTRAN, Pascal	2M (64K)	6.3×9.2 ×0.8	5,635(Q1)	dual serial I/O ports, programmable counter/timer
PME 68-22	MC68020 (16, 20)	NMOS	VMEbus, SCSI	processor	P-DOS, pSOS, UNIX System V, VERSAdos	BASIC, C, FORTRAN, Pascal	2M (64K)	6.3×9.2 ×0.8	4,495(Q1)	dual serial I/O ports, programmable counter/timer, real-time clock
PRO-LOG CORP. 2560 Garden Rd., Monterey, CA 93940, (800) 538-9570										**Circle 453**
7808	Z80 (6.144)	NMOS	STDbus	processor		Assembly, BASIC	128K (128K)	4.5×6.5 ×0.5	320(Q1); 253(Q100)	2 RS232C ports; power/restart circuit; 3 (8-bit) counter/timers
7843	Z80 (6.144)	NMOS	STDbus	processor		Assembly, BASIC	128K (128K)	4.5×6.5 ×0.5	350(Q1); 277(Q100)	2 RS232C/422 ports; power/restart circuit; 3 (8-bit) counter/timers
7863	8088 (4.915)	NMOS	STDbus	processor	MS-DOS	Assembly, BASIC, C	32K (128K)	4.5×6.5 ×0.5	395(Q1); 312(Q100)	1 RS232C, 1 RS422 port; power/restart circuit
QDP COMPUTER SYSTEMS INC. 23632 Mercantile Rd., Beachwood, OH 44122, (216) 464-6600										**Circle 454**
SCS-I	Z80B (6)	NMOS	S-100	processor	TurboDOS 1.3	all	256K (64K)	19.5×18×8.25		board links up to 24 users
QUALOGY INC. 2241 Lundy Ave., San Jose, CA 95131, (408) 434-5200										**Circle 455**
QPC-5101	8088 (4.77)	CMOS	PC bus	processor	MS-DOS, PC-DOS	BASIC, C, FORTH, Pascal	640K (64K)	13.15×4.2	1,295(Q1)	flexible and Winchester disk controllers, battery-backed clock/calendar
QPC-5121	80286 (8, 10)	CMOS	PC AT bus	processor	MS-DOS, PC-DOS, XENIX	BASIC, C, FORTH , Pascal	1M (128K)	13.15×4.2	1,695(Q1)	flexible and Winchester disk controllers; 2 serial, 1 parallel port(s); clock/calendar
QUAY CORP. 22 Meridian Rd., P.O. Box 783, Eatontown, NJ 07724, (201) 542-7340										**Circle 456**
94MPS .	Z80A (4)	NMOS			CP/M, MP/M	BASIC, FORTRAN, Pascal	64K (14K)	8×16×0.12	795(Q1); 636(Q100)	
94F/MPS	Z80A (4)	NMOS			CP/M, MP/M	BASIC, FORTRAN, Pascal	64K (14K)	8×16×0.12	895(Q1); 716(Q100)	
QUICKWARE ENGINEERING & DESIGN INC. 139 Brighton Ave., Suite 5, Allston, MA 02134, (617) 782-8330										**Circle 457**
QED 11/85CPU	J-11 (15)	CMOS	UNIbus	processor	RT-11, RSX-11, RSTS, UNIX	PDP-11 languages		9×16×0.5	6,000(Q1); 4,000(Q100)	16K-byte cache memory, 2 serial lines, line clock
R.J. BRACHMAN ASSOCIATES INC. P.O. Box 1077, Havertown, PA 19083, (800) 228-7264, (215) 622-5495										**Circle 458**
MMC/02	6502 (1, 2)	CMOS, NMOS	proprietary	processor	any 6502-based system	Assembly, PL/65	1K (6K)	4.5×6.5 ×0.5	159(Q1); 119(Q100)	manual reset, ribbon connector, battery backup, on-board power supply
MMC/E02	6502 (1, 2)	CMOS, NMOS		processor	any 6502-based system	Assembly, PL/65	3K (4K)	3.9×6.3 ×0.5	139(Q1); 99(Q100)	2 serial ports, 4 timers
R.L.C. ENTERPRISES 1117 Hillview Dr., Milpitas, CA 95035, (408) 946-7471										**Circle 459**
SBC-188	80188 (5, 8, 10)	NMOS	STDbus	processor	MS-DOS	Assembly, C, FORTRAN, Pascal	96K (256K)	6.5×4.5 ×0.5	499(Q1); 384(Q100)	DMA, interrupt controllers; 8087 coprocessor; 1 serial, 2 parallel port(s); real-time clock
SCC-188	80188 (5, 8, 10)	NMOS	STDbus	processor	MS-DOS	Assembly, C, FORTRAN, Pascal	96K (256K)	6.5×4.5 ×0.5	499(Q1); 384(Q100)	DMA, interrupt controllers; 2 serial ports; real-time clock
SBE INC. 2400 Bisso Lane, Concord, CA 94520, (415) 680-7722										**Circle 460**
COM-2	MC68000, MC68010 (10)	NMOS	Multibus	communications	REGULUS	ASM, BASIC, C, FORTRAN 77, PROBUG	128K (256K)	6.7×12 ×0.6	2,475(Q1); 1,240(Q100)	24-bit parallel port, iSBX connector

The TeleVideo 955. Seeing is believing.

WYSE WY-50
(Unretouched photo)

TELEVIDEO 955
(Unretouched photo)

SALES ANALYSIS LATEX SPECIALITY PRODUCTS INC. PERIOD: Q3, 1985

RSON	ID NUMBER	TERRITORY	CUSTOMER	CUST.NUMBER	PART	NUMBER	ITEM	SHIPDATE	WAREHOUSE	SHIPDEST	CARRIER	CUST.TOT
	1010000000	NEW YORK	APEXINC	333333888899	KL234	87654	200	10/02/85	NWPHILIDE	NEW YORK	ACMETRS	250.
	102277754	BOSTON	ZINCINC	33388990044	KL234	50987	007	12/01/85	CENTRALLA	BOSTON	AJAXAIR	150.
	1000000456	CHICAGO	AASEWER	98750372378	KL230	90867	999	ONHOLD	WOODLAWN	CHICAGO	DUMAIR	100.
	1098657363	ATLANTA	TVSINC	77493887549	KL239	99999	808	11/19/85	ATLANTANW	AUGUSTA	EWFRT	500.
	107584948	MINNIAP	XYZCORP					/07/85	MINNSTPAUL	MINNIAP	TRUCKER	12.
	108958488	SANFRAN	JAKINC					/28/86	SANJOSESE	SANMATEO	SHORTAIR	500.
	106574637	SANJOSE	ACDCORP					/08/85	SACRAMENTO	SANJOSE	EZHAULER	50.
	107563848	LOSANGEL	LYNINC					/18/87	IRVINECA	WESTLAWN	LATRUCK	500.

TELEVIDEO 955 VS. WYSE WY-50

FEATURES	TVI 955	WY-50
Screen Color	Green or Amber	Green Only
Optional Graphics model	Yes	No
Dynamically allocated non-volatile function key memory	512	128
Maximum non-volatile bytes per function key	256	4
High contrast super dark Matsushita screen	Yes	No
List price	$549	$499

Sure, most $600 terminals can scrunch 132 columns onto a 14" screen. But you need a magnifying glass to read them.

Not so with the TeleVideo® 955. That's because we redesigned the proportion of our characters and put more space between them. And then put them on a high contrast, super dark screen. The result is the most readable 132 column ASCII display available.

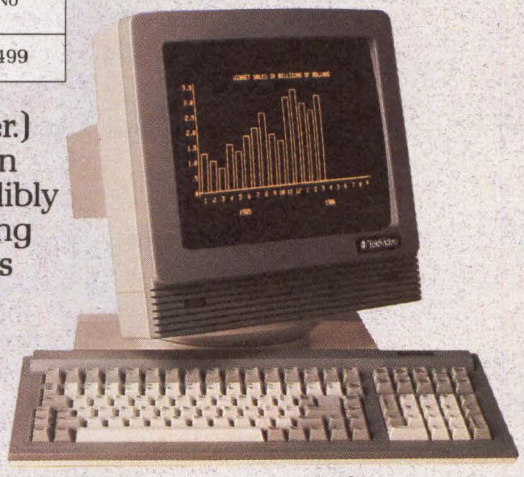
But there's more to the 955 than meets the eye.

Take our tilt-and-swivel positioning, for example. The screen rotates through a full 270° right and left, and from −5° to +15° up and down. (Which makes backs and necks feel a lot better.)

Then we put all this in a machine with an incredibly small footprint, measuring just 9" x 12." The result is a terminal that meets all the human factors standards recommended for adoption by the American National Standards Institute.

For more information about the TeleVideo 955, call the nearest TeleVideo regional office listed below, and we'll give you the name of your nearest distributor.

The TeleVideo 955. It's a real eye-opener.



TeleVideo®
Settle for more.

TeleVideo Systems, Inc., 1170 Morse Avenue, Sunnyvale, CA 94088-3568, (408) 745-7760, Regional Offices: Northwest (408) 745-7760, Southwest (714) 476-0244, South Central (214) 550-1060, Southeast (404) 447-1231, Midwest (312) 397-5400, East (516) 496-4777, Northeast (617) 890-3282. Amsterdam: 31.2503.35444, Paris: 33.1.4687.34.40, London: 44.9905.6464.

CIRCLE NO. 79 ON INQUIRY CARD

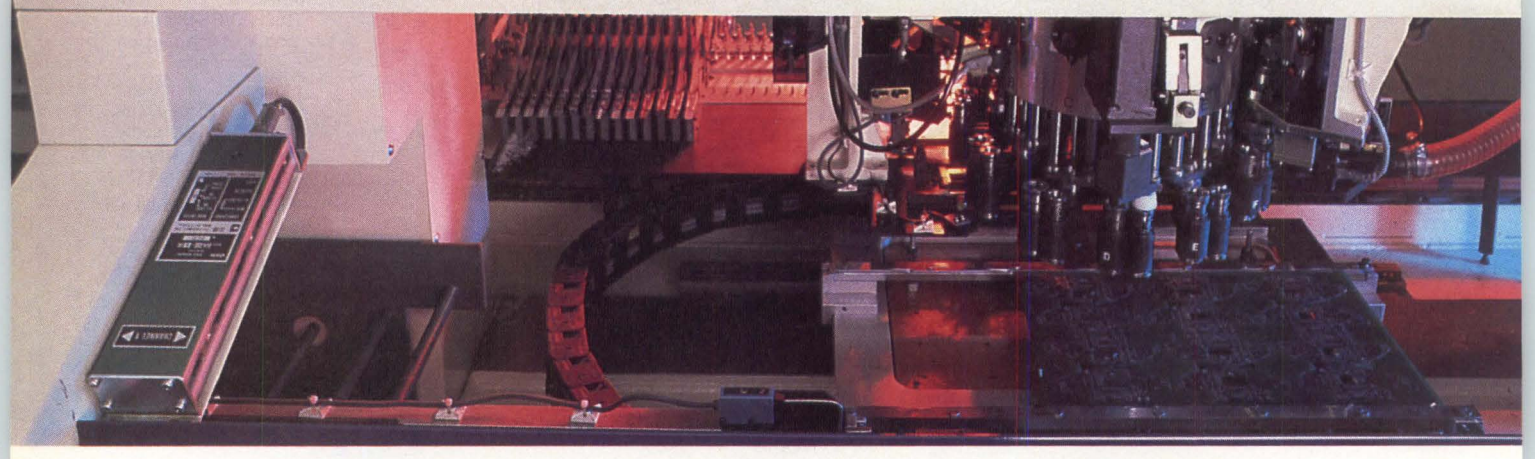
Company Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
MPU-20	MC68020 (12.5, 16.7)	NMOS	Multibus	processor	REGULUS, UNIX System V	ASM, BASIC, C, FORTRAN 77, PROBUG	1M (256K)	6.7×12 ×0.6	3,995(Q1); 1,995(Q100)	2 RS232C serial, 24-bit parallel port(s); 2 (16-bit) iSBX connectors; 24-bit timer
SKY COMPUTERS INC. Foot of John St., Lowell, MA 01852, (617) 454-6200										**Circle 461**
321	TMS 32010 (20)	CMOS	PC bus, Q-bus	digital signal processor	MS-DOS	C	128K	13×5	2,300(Q1); 1,495(Q100)	dual auxiliary ports, up to 8 I/O ports
Challenger	TMS 32020 (40)		VMEbus	digital signal processor	Berkeley UNIX Version 4.2, VERSAdos	FORTRAN	256K	9×6.75	2,990(Q1); 1,945(Q100)	2 CPUs, programmable ports, shared memory
SOLARCOM TECHNOLOGY INC. P.O. Box 4715, Hayward, CA 94544, (415) 489-3141										**Circle 462**
SCMT-11	8085 (3)		proprietary	processor, I/O			256 (2K-8K)	4.5×6.5 ×0.5	139(Q1); 105(Q100)	14-bit counter/timer, interrupts
SCMT-85	8085 (3)		STDbus	processor, I/O			256 (2K-8K)	4.5×6.5 ×0.5	164(Q1); 124(Q100)	14-bit counter/timer
SCMT-88	8088 (5)		STDbus	processor			8K-32K (up to 12K)	4.5×6.5 ×0.5	290(Q1); 225(Q100)	
SPURRIER PERIPHERALS CORP. 10513 LeMarie Dr., Cincinnati, OH 45040, (513) 563-2625										**Circle 463**
68008	68008 (8-10)	CMOS, NMOS	STDbus	processor	CP/M-68K	BASIC, C	32K	4.5×6.5	375(Q1); 225(Q100)	9511/12 coprocessor
68020-SBC	68020 (10-20)	NMOS		processor	OS9	BASIC, C	1M	10×12	999(Q1); 699(Q100)	
Z-80-II	Z80 (1-6)	CMOS, NMOS	STDbus	processor	CP/M-86	BASIC, C, FORTRAN	32K	4.5×6.5	375(Q1); 215(Q100)	9511/12 coprocessor
SYSTECH CORP. 6465 Nancy Ridge Dr., San Diego, CA 92121, (619) 453-8970										**Circle 464**
DCP-Series	80186 (8)		Multibus, VMEbus	processor			512K (128K)	6.3×9.2	2,200-2,810(Q1); 1,330-1,680(Q100)	2 DMA channels, 4 multiprotocol serial channels, 3 programmable counter/timers
HPS Series (The Unplug)	MC68010 (10, 12.5)		Multibus I, II; VMEbus	processor, I/O	UNIX		512K (32K)		1,445(Q1); 855(Q100)	cluster controllers, host adapter, control software, links 128 terminals
SYSTEK 1027 N. Kellogg St., Kennewick, WA 99336, (509) 735-1200										**Circle 465**
8800	8088 (5, 8)	CMOS, NMOS	STDbus	processor	MS-DOS 3.2	Assembly, BASIC, C, FORTH, FORTRAN, Pascal	(32K)	4.5×6.5 ×0.4	175(Q1)	
8810	8088, NEC V20 (5, 8)	CMOS, NMOS	STDbus	processor	MS-DOS 3.2	Assembly, BASIC, C, FORTH, FORTRAN, Pascal	64K (96K)	4.5×6.5 ×0.4	395(Q1)	interrupt controller, power fail detect, iSBX expansion connector, battery-backed RAM
8887	8088 (5, 8)	NMOS	STDbus	processor	MS-DOS 3.2	Assembly, BASIC, C, FORTH, FORTRAN, Pascal	(8K)	4.5×6.5 ×0.4	225(Q1)	
TELETEK ENTERPRISES INC. 4600 Pell Dr., Sacramento, CA 95838, (916) 920-4600										**Circle 466**
SBC 86/87	8086, 8087 (8)		S-100	slave processor	CP/M-86, TurboDOS	BASIC, C	512K	10×5×0.25	995(Q1)	
Systemaster II	Z80H (8)		S-100	processor	TurboDOS	BASIC, C	128K	10×5×0.25	995(Q1)	
TEXAS INSTRUMENTS INC. P.O. Box 1255, Johnson City, TN 37605-1255, (800) 221-9804										**Circle 467**
990/101-MB	TMS 9900 (12)	NMOS	TM 990	processor	P-DOS	Assembly, BASIC, FORTH, Pascal	32K (32K)	7.5×11×1	850(Q1)	16 interrupt levels: 2 RS232C, 1 (16-bit) parallel port(s)

SINGLE-BOARD MICROCOMPUTERS

Company Model	CPU type (Clock rate/MHz)	CMOS or NMOS	Bus	Type of board	Operating system	Programming languages supported	Memory/bytes RAM (ROM)	Dimensions (H×W×D/inches)	Price $ (quantity)	Notes and Features
990/102-3	TMS 9900 (12)	NMOS	TM 990	processor	P-DOS	Assembly, BASIC, FORTH, Pascal	128K (16K)	7.5×11×1	1,350(Q1)	16 interrupt levels: 2 RS232C port(s)
990/103-1	TMS 99105 (24)	NMOS	TM 990	processor	P-DOS	Assembly, BASIC, FORTH, Pascal	64K (64K)	7.5×11×1	1,950(Q1)	16 interrupt levels: 2 RS232C, 1 (16-bit) parallel port(s)
VESTA TECHNOLOGY INC. 7100 W. 44 Ave., Suite 101, Wheatridge, CO 80033, (303) 422-8088										**Circle 468**
OEM188	80188 (8)	NMOS	IBM PC bus	processor	CP/M, MS-DOS	MS-DOS languages	256K (64K)	8×8×0.5	329(Q1); 269(Q100)	interrupt controller, 2 RS232C serial ports, reset, battery-backed real-time clock
SBC88	8088 (4, 5, 8)	CMOS, NMOS		processor, I/O	Vesta Basic, Vesta Forth	BASIC, FORTH	32K (32K)	5×6×0.5	199(Q1); 139(Q100)	real-time clock; 8-channel, 8-bit analog to digital converter
WINSYSTEMS INC. P.O. Box 121361, Arlington, TX 76012-1361, (817) 274-7553										**Circle 469**
LPM-SBC3	Z80 (4)	CMOS	STDbus	processor		Assembly, BASIC, C, FORTH	64K (64K)	7.5×4.5 ×0.5	295(Q1)	power fail detect; 2 RS232C, RS485 serial ports; 4 counter/timers
LPM-SBC8	80C88 (8, 5)	CMOS	STDbus	processor		Assembly, BASIC, C, FORTH	32K (64K)	7×4.5×0.5	495(Q1)	8 interrupt channels; power fail/reset circuit; RS232C/RS485 serial port; iSBX expansion connector
LPM-SBC50	NEC V50 (8, 5)	CMOS	STDbus	processor		Assembly, BASIC, C, FORTH	512K (512K)	7×4.5×0.5	695(Q1)	interrupt controller; power fail/reset circuit; RS232C/RS485 serial port; iSBX expansion connector; real-time clock
WINTEK CORP. 1801 South St., Lafayette, IN 47904, (800) 742-6809, (317) 742-8428										**Circle 470**
MCH68	6809 (1)	NMOS	Wintek	processor		Assembly, C	24K (8K)	4.5×6.5 ×0.5	282(Q1); 169(Q100)	power-on reset; 2 RS232C, 4 parallel ports; real-time clock
MCV45	6800 (1)	NMOS	Wintek	processor		Assembly, C	512 (4K)	4.5×6.5 ×0.5	188(Q1); 113(Q100)	1 serial, 4 parallel port(s)
ZIATECH CORP. 3433 Roberto Court, San Luis Obispo, CA 93401, (805) 541-0488										**Circle 471**
ZT 8806/8807	8088 (5/8)	NMOS	STDbus	processor	FORTH, PC-DOS, VRTX	BASIC, C, FORTH, Pascal	128K (320K)	4.5×6.5 ×4	345/425(Q1)	interrupt controller; 5 (8-bit) counter/timers
ZT 8814/8815	80188 (5/8)	NMOS	STDbus	processor	PC-DOS, VRTX	BASIC, C, FORTH, Pascal	32K (64K)	4.5×6.5	425/455(Q1)	interrupt controller, 2-channel DMA, 3 counter/timers
ZT 8816/8817	NEC V50 (5/8)	NMOS	STDbus	processor	PC-DOS	BASIC, C, FORTH, Pascal	512K (256K)	6.5×4.5 ×0.79	995/ 1,025(Q1)	interrupt controller, power fail detect, 2 serial ports, real-time clock, 3 counter/timers, 16K-byte battery-backed RAM

Need Electronics Manufacturing Capability Without Capital Expenditure?

FUJI CP-II



Avco Electronics Textron Is The Answer.

Avco Electronics Textron has been providing cost effective manufacturing solutions for commercial and government customers for over 20 years.

As a full service contract manufacturer we offer a wide variety of *surface mount technology (SMT)* and *through-hole* computer-aided design, assembly and test services. Our capabilities include SMA Types I-III, and range from build-to-print p.c. assembly through complete unit design to delivery.

Our value engineering services ensure that your product is designed for manufacturability/testability and produced at the lowest possible cost. Continuous flow manufacturing processes, thorough operator training and certification programs, and our stringent quality assurance program result in consistent product quality.

If you need either capability or capacity, consider the Avco Electronics alternative. We can significantly reduce your capital expenditure, your manufacturing costs and your product's time to market. For more information about the Avco Electronics advantage or a plant tour, contact our Director of Marketing at (205) 837-6500.

Avco Electronics Textron.
Experienced. Cost Effective. Customer-Oriented.

Avco Electronics TEXTRON

Avco Electronics/Subsidiary of Textron Inc.

4807 Bradford Drive, Huntsville, Alabama 35805

CIRCLE NO. 59 ON INQUIRY CARD

NEW PRODUCTS

SYSTEMS

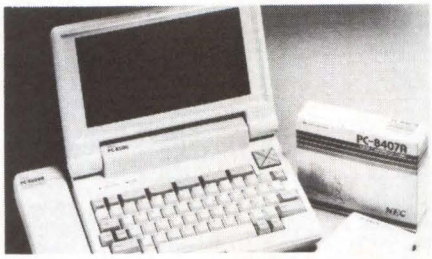
Megan Nields, Staff Editor

Computer emulates IBM PC/AT

- 80286 processor
- 640K bytes of RAM
- 1.2M-byte disk drive

An IBM PC/AT-compatible computer, the 365/AT utilizes an 80286 microprocessor. The system offers a 30M-byte rigid disk drive with a 40-msec access time, a 1.2M-byte flexible disk drive and 640K bytes of RAM. A Western Digital disk controller and a Hercules-compatible video controller are standard. Features include a parallel printer port and a 12-inch amber monitor. An 80287 coprocessor is available. $2,395 to $4,695; OEM prices available. **Computer Components Corp.,** P.O. Box 12017, Research Triangle Park, N.C. 27709, (800) 843-7012.

Circle 357



Portable computer weighs 6 pounds

- 64K bytes of RAM
- 80-by-25 display
- Serial, parallel ports

The 6-pound, PC-8500 portable personal computer supplies an 80-column-by-25-line display and 64K bytes of internal RAM. A parallel printer port and RS232C port are standard. The unit targets VARs and features built-in software. An RGB monitor or a 1,200-baud modem can be supported, and proprietary software packages are included. $999. **NEC Home Electronics (U.S.A.) Inc.,** 1255 Michael Drive, Wood Dale, Ill. 60191-1094, (312) 860-9500.

Circle 358

Publishing system suits IBM PC/AT

- 300-dpi scanner
- 8-ppm laser printer
- 200-font software

The Epsilon AT+ Publishing System is compatible with the IBM PC/AT. It includes an 8-ppm laser printer, a 300-dpi scanner and a 13-inch display. A PC/AT-compatible rigid disk drive and a scanner and printer controller are also supplied. The system's software has over 200 fonts and a 70-page capacity per document. $7,995. **Epsilon Graphics Systems,** 1370 E. Edinger Ave., Santa Ana, Calif. 92705, (714) 558-1288.

Circle 359

REGIONAL SALES OFFICES

NEW ENGLAND
John J. Fahey
Regional Manager
275 Washington St.
Newton, MA 02158
(617) 964-3030

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

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

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

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

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

SOUTHERN CALIFORNIA/ NEVADA
Len Ganz
Regional Manager
18818 Teller Ave.
Irvine, CA 92715
(714) 851-9422

NORTHERN CALIFORNIA/ NORTHWEST
Frank Barbagallo
Northwestern Regional Sales Manager
Rick Jamison
Regional Manager
Sherman Building, Suite 100
3031 Tisch Way
San Jose, CA 95128
(408) 243-8838

UK/BENELUX/SCANDINAVIA
Jan Dawson
Cahners Publishing Co.
c/o Computaprint
39A Bowling Green Lane
London, EC1R OBJ, England
011-44-278-2152
Telex: 28339

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

JAPAN
Kaoru Hara
Dynaco International Inc.
Suite 1003, Sun-Palace Shinjuku
8-12-1 Nishishinjuku, Shinjuku-ku
Tokyo, 160, Japan
03-366-8301
Telex: J2322609 DYNACO

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

EUROPE, EXCEPT UK/ BENELUX/SCANDINAVIA
Elan Marketing Group
Neutor g. 2
P.O. Box 84
1013 Vienna, Austria
Tel. 43-222-663012

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

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

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

Cahners Magazine Division
William Platt, President
Tim Burkholder, Vice President
Computer Group
Tom Dellamaria, VP/Production

Promotion Staff
Mary Gregory
Promotion Manager
Beth-Ann Legare
Promotion Assistant

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

The Answer to Your DEC Computing Questions.

It's no wonder you have questions about finding the right compatibles for your Digital Equipment computer. Trying to keep track of the thousands of products on the market can be overwhelming ... unless you let DEXPO South 87 provide the solutions.

This show is the right source for all the DEC-compatible hardware, software, systems, services and supplies you need. Review 10,000 products from 250 leading vendors. Compare technology, price and performance.

DEXPO is for everyone who is installing, expanding, or improving DEC systems. Get hands-on demonstrations of products for every DEC computer. From DECmate to MicroVAX II. PDP-11 series to VAX 8000 series. Plus personal attention and consultations from vendors eager to serve your special needs.

A bonus for DECUS* symposium attendees

If you attend the Digital Equipment Computer Users' Society symposium in Nashville, you'll receive FREE admission to DEXPO South 87. Write or call for complete information.

FREE: Show Preview features over 100 DEC compatibles

Register today and we'll send you a free Show Preview with news of over 100 of the very latest DEC-compatible products. You'll also get money-saving VIP tickets to the *only* show exclusively serving DEC users.

To Register ...

Call (800) 628-8185 between 8:30 a.m. and 5:30 p.m., Eastern Time (in New Jersey, call (609) 987-9400).

Call TOLL-FREE 800-628-8185. In New Jersey 609-987-9400.

Organized by Expoconsul International, Inc., 3 Independence Way, Princeton, NJ 08540.

DEXPO® SOUTH 87

The Twelfth National DEC*-Compatible Exposition

CONVENTION CENTER · NASHVILLE, TN

APRIL 28 – 30, 1987

*DEC and DECUS are registered trademarks of Digital Equipment Corp. DECUS is not sponsored by or affiliated with DEXPO.

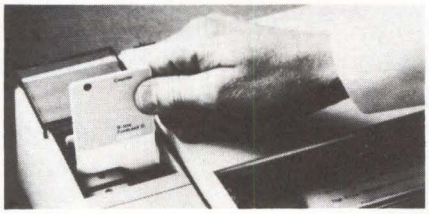
PRINTERS

Printer emulates Diablo, Epson, IBM, Toshiba

- 19.2K baud rate
- Two interfaces
- Seven colors

The ProWriter C-715 is a seven-color, 24-pin dot-matrix printer that emulates the Diablo 630, Epson LQ-1000, IBM Proprinter XL and Toshiba 351. The unit prints 100 cps, letter quality and 300 cps, draft mode. RS232C and Centronics interfaces are standard. Features include a 19.2K baud rate, a 32K-byte buffer, proportional spacing and automatic paper loading. $1,295. **C. Itoh Digital Products Inc.,** Suite 220, 19750 S. Vermont Ave., Torrance, Calif. 90502, (213) 327-2110.

Circle 360

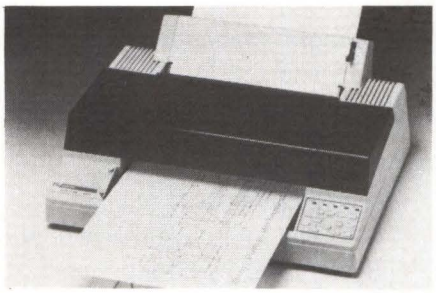


Printer changes type with font cards

- 250 cps
- RS232C, Centronics ports
- IBM resident commands

The B3350 general purpose printer uses font cards to change type styles. It produces 250 cps at 12 cpi, 200 cps at 10 cpi and 90 cps, at near-letter quality. An RS232C serial and Centronics parallel interface are standard. Resident commands such as Epson FX/JX, Facit and IBM ProPrinter are supplied. Options include single-bin and dual-bin sheet feeders and color printing. $1,195. **Facit Inc.,** 9 Executive Drive, Merrimack, N.H. 03054, (603) 424-8000.

Circle 362

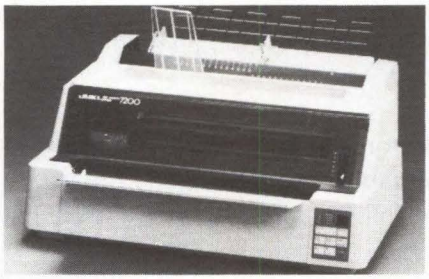


Four-pen plotter handles 100 sheets

- Desktop unit
- 18 ips
- A-, B-sized paper

A four-pen desktop plotter, the PD 9311/F features an automatic paper feed that handles up to 100 sheets of A- and B-sized paper. The device generates 18 ips with 0.0002-inch resolution. It is compatible with AutoCad, VersaCad, Lotus 1-2-3 and Symphony. Two command protocols are available. $3,295. **Western Graphtec Inc.,** 12 Chrysler St., Irvine, Calif. 92718, (800) 854-8385.

Circle 361



Dot-matrix printer achieves 324 cps

- 10, 12 cpi
- 24-pin unit
- 55 dB(a) noise level

The model 7200 is a 24-pin dot-matrix printer with front and rear paper-loading capabilities. It prints 90 cps at 10 cpi and 108 cps at 12 cpi in letter-quality mode, and 270 cps at 10 cpi and 324 cps at 12 cpi in draft mode. Noise level is less than 55 dB(a), and MTBF is 4,000 hours. Features include a 7K-byte buffer memory, expandable to 15K bytes, and RS232C or Centronics interfaces. $2,445. **Juki Office Machine Corp.,** Printer Divsion, 20437 S. Western Ave., Torrance, Calif. 90501, (800) 325-6134.

Circle 363

SCSI FORUM

A technology conference, featuring 2 days of business and technical sessions on the **Small Computer System Interface**, an optional one-day SCSI Tutorial, and a SCSI Exhibitors Program.

WHERE The Doubletree Hotel on Great American Parkway in Santa Clara, California

WHEN May 12-14, 1987

WHO Engineering, Planning, Marketing and Management Personnel of companies using SCSI, or considering its use, should not miss this conference.

SCSI BUSINESS AND TECHNICAL PROGRAM

This two-day program (May 13-14) consists of the following sessions:

- A User's Perspective of SCSI
- SCSI Market Structure, Size and Trends
- Interface Alternatives: A Business Perspective
- Future SCSI Directions
- SCSI Performance Issues
- SCSI Test and Evaluation Issues
- SCSI Firmware and Software Issues
- SCSI Hardware Issues
- Storage Technology — The Driving Force Behind SCSI
- SCSI for Tape

SCSI TUTORIAL

On Tuesday, May 12, 1987 an Introduction to SCSI and SCSI Protocol will be covered in the morning, and SCSI Commands and SCSI Variants will be covered in the afternoon. Attend the 1-day SCSI Tutorial, or with the SCSI Business and Technical Program as part of the 3-day SCSI Forum Program.

SCSI EXHIBITORS PROGRAM

Exhibitors Workshops will be held on May 12-14. On the evening of May 13, an Exhibitors Reception will provide delegates and guests with the opportunity to see SCSI products.

KEY ISSUES

- Is high performance SCSI an oxymoron?
- Should SCSI remain a configurable standard?
- Is the copy command useful or useless?
- Who really needs multihost support?
- Who's using search?

FEATURED SPEAKERS

- **Norman Petersen**, Fujitsu America, President and General Manager
- **Roger Johnson**, Western Digital, President, Chairman and C.E.O.
- **Bill Frank**, InfoCorp, Senior Vice President, Director of Mass Storage Services

SPONSORS

- Adaptec
- Cipher Data Products
- Control Data
- Dataquest
- Emulex
- Endl
- Fujitsu America
- Maxtor
- Micropolis
- Mini-Micro Systems
- NCR
- NSA/Hitachi
- Priam
- Scientific Micro Systems
- Siemens Information Systems
- System Surety Group
- Technology Forums
- Western Digital

Please register me for the ☐ entire 3-Day SCSI Program for $995; ☐ 2-Day SCSI Business and Technical Program for $795; ☐ 1-Day SCSI Tutorial for $395. I have printed the following information as I want it to appear on my name tag and the list of delegates.

NAME _____

TITLE _____ **PHONE** (____) _____

COMPANY _____

ADDRESS _____

SCSI Forum registrations cannot be accepted without full payment. Please make checks payable to SCSI Forum and mail with this registration to:

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

CIRCLE NO. 66 ON INQUIRY CARD

DATACOM

Software emulates DEC VT52, VT100

- Graphic communications
- Data compression
- Electronic mail

A graphics communications software package for personal computers, TeleVision enables images and text to be sent and received through electronic mail systems. The software utilizes data compression and encoding techniques that can reduce transmission times by a factor of 10. Graphics can be captured from Lotus 1-2-3 and enhanced before being transmitted. The product emulates DEC VT52 and VT100 terminals. $99. **LCS/Telegraphics Inc.,** 261 Vassar St., Cambridge, Mass. 02139, (617) 547-4738.

Circle 364

Modems operate at up to 2.4K bps

- Bell 212A compatible
- 40-character buffer
- Half, full duplex

Intelligent internal and external modems, the Starcom 1200 and 2400 transmit data at 1.2K and 2.4K bps, respectively. The units are compatible with Bell 103 and 212A. The first model is a half-card device. Features include full- and half-duplex operation, auto dial/auto answer and a 40-character command buffer. $249 and higher, 1200; $599 and higher, 2400. **SCOA Systems,** Suite 100, 2100 Golf Road, Rolling Meadows, Ill. 60008, (312) 640-8782.

Circle 365

Datacom board furnishes 4, 8 serial ports

- Onboard coprocessor
- 80188 processor
- Four or eight ports

IBM PC/XT- and /AT-compatible communication boards, the COM/4i and Com/8i provide four or eight serial ports, respectively. The units utilize 10-MHz 80188 microprocessors and 256K bytes of dual-ported RAM. Proprietary software includes an MS-DOS device driver that allows the system to access up to 32 ports per system. An onboard coprocessor is supplied. $969, COM/4i, $1,195, COM/8i. **DigiBoard Inc.,** 6751 Oxford St., St. Louis Park, Minn. 55426, (612) 922-8055.

Circle 366

Full-card modem operates at 2,400 bps

- Bell-212A compatible
- Hayes command set
- Full-duplex operation

A full card internal modem, the Lightning f/i operates at 300, 1,200 or 2,400 bps and complies with Bell 212A and V.22 bis specifications. It suits the IBM PC, PC/XT, PC/AT and compatibles and uses the Hayes Smartmodem command set. Diagnostics such as power-up self-test are provided. Features include full-duplex operation, auto-dial/auto-answer and error correction. $599. **Anchor Automation Inc.,** 6913 Valjean Ave., Van Nuys, Calif. 91406, (818) 997-6493.

Circle 367

Controller suits VMEbus-based systems

- Six serial channels
- 64K bytes of RAM
- Self-test

An intelligent communications controller, the VMExICC targets VMEbus-based systems. The device includes six serial channels, 64K bytes of RAM and self-test capabilities. It supports Digital Equipment Corp., IBM and Sperry communications protocols. In asynchronous mode the unit can be configured with baud rates of up to 38,400. Features include an optional token ring LAN contoller or X.25 port. $1,495. **ISKRA VME Technologies,** 222 Sherwood Ave., Farmingdale, N.Y. 11735, (516) 753-0400.

Circle 368

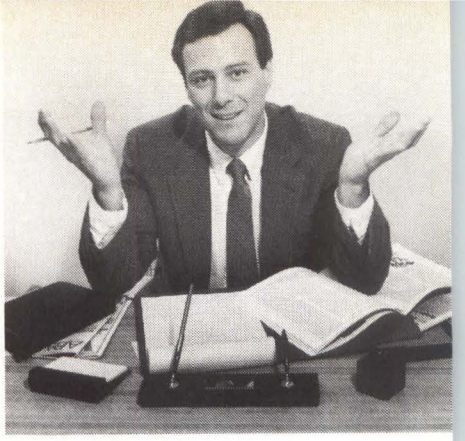
Multiplexers connect up to 14 terminals

- 300 to 9,600 bps
- X-on/X-off, CTS
- Full duplex

Operating at 300, 1,200, 2,400 and 9,600 bps, the SPL family of statistical multiplexers concentrates up to 14 aysnchronous terminal ports over one composite communications channel. The devices supply full-duplex operation, X-on/X-off and CTS protocols. Models are available in two- to four-port increments. $2,995. **Data Comm for Business Inc.,** 807 Pioneer, Champaign, Ill. 61820, (800) 637-1127.

Circle 369

NCC



WHAT'S IN IT FOR ME?

Quite simply, NCC '87 is THE conference that provides you with the knowledge you need to use technology to its fullest potential.

Only at NCC will you DISCOVER:

NEW TRENDS AND TECHNOLOGIES

Participate in highly targeted technical sessions led by industry experts on the newest developments, applications and directions.

NEW SOLUTIONS

Discover the answers to your specific computing needs at the most comprehensive business computer conference.

NEW PRODUCTS

Explore the latest hardware, software and communications innovations from more than 300 of the leading companies in the industry.

There is a need for one event to bring it all togethe and give you the chance to sort it out—that event i THE NATIONAL COMPUTER CONFERENCE.

Make plans now to attend.

The National Computer Conference
June 15-18, 1987
McCormick Place, Chicago, Illinois

Call 1-800-NCC-1987
or
return the coupon below.

Sponsored by:
AFIPS, ACM, DMPA, IEEE-CS, SCS

REDISCOVER NCC — DISCOVER THE POWER OF INFORMATION

NCC '87
JUNE 15-18/CHICAGO

For additional NCC '87 information, call 1-800-NCC-1987 or return this coupon to:
NCC '87, 1899 Preston White Drive, Reston, VA 22091

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

0 L

CIRCLE NO. 76 ON INQUIRY CARD

Spreadsheet transfers files to Lotus 1-2-3

The C-Calc Plus spreadsheet and analysis system transfers entire worksheets to and from Lotus files, allowing for integration of minicomputer and personal computer information management. The software runs on Digital Equipment Corp.'s VMS, ULTRIX and UNIX systems. A proprietary graphics drive is supplied. Features include user-definable select codes. $3,500 and higher. **DSD Corp.,** 10632 N.E. 37th Circle, P.O. Box 2669, Kirkland, Wash. 98083-2669, (206) 822-2252.

Circle 370

Window software interfaces with UNIX

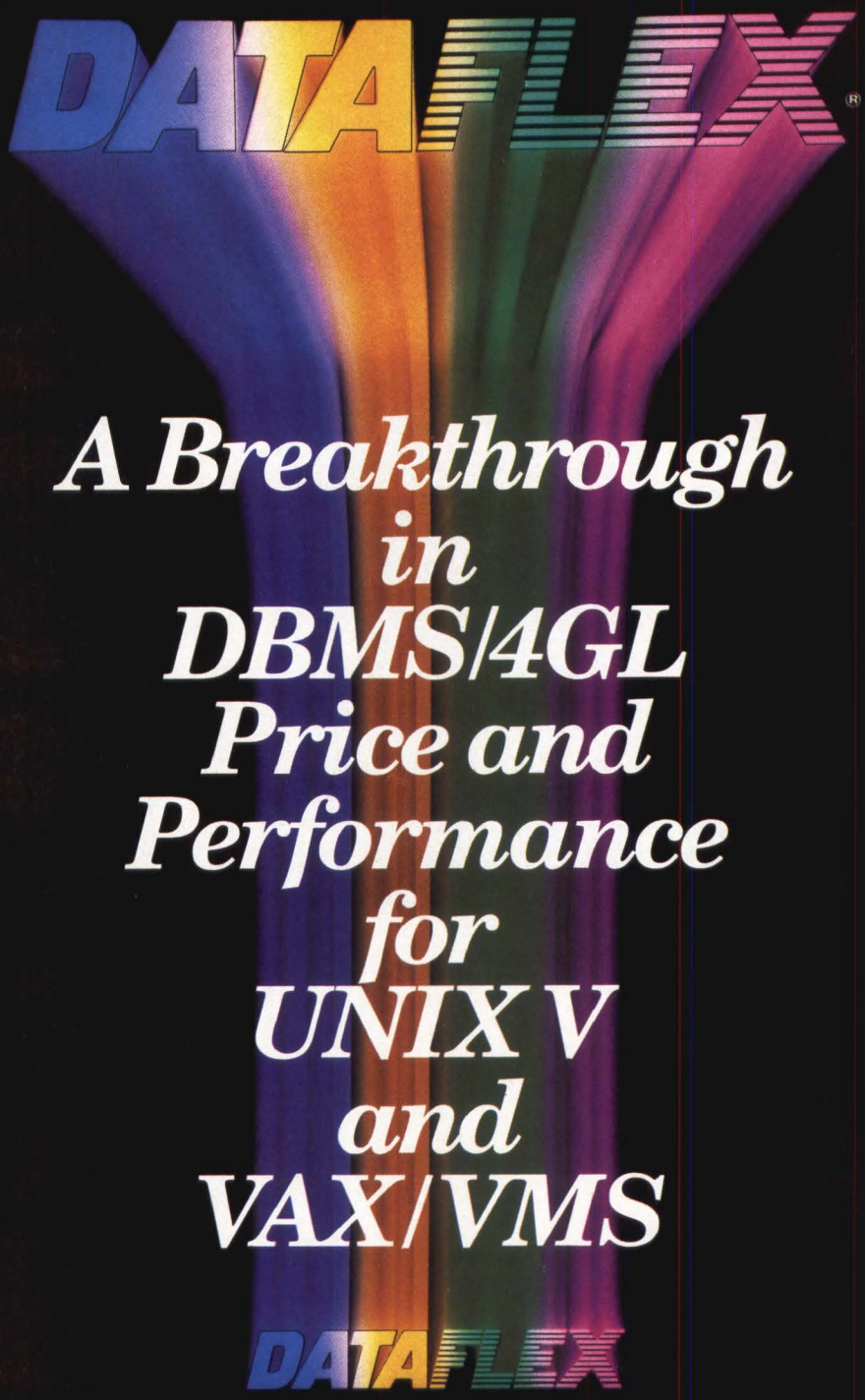
Software for the UNIX operating system, the Directory Shell features a windowing interface for asynchronous terminals. The package replaces many UNIX commands with a visual approach. It includes "plain language" error messages, a multilevel help system and a full-screen editor. $300, OEM discounts available. **American Management Systems Inc.,** 1777 N. Kent St., Arlington, Va. 22209, (703) 841-6021.

Circle 371

Multiuser software targets LANs

A multiuser software package, Data-Ease LAN provides a common database to a network. The product offers both automatic and manual record- and file-locking for users linked in the network. Features include transparent access. $700. **Software Solutions Inc.,** 12 Cambridge Drive, Trumbull, Conn. 06611, (203) 374-8000.

Circle 372

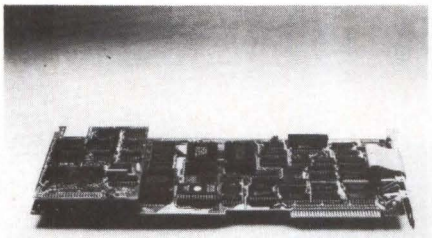


DataFlex is a high performance applications development database system with a rich 4th generation command language and automatic code generators. DataFlex's on-line multi-user transaction processing and powerful multi-file Query give you the information you need when you need it. Plus, applications can be transported to and from VAX, UNIX V, XENIX and PC systems without change. Pricing for UNIX V and VAX systems starts at $1,800. Call today for complete details.

DATA ACCESS CORPORATION
8525 S.W. 129th Terrace, Miami, FL 33156-6565 (305) 238-0012 Telex 469021 DATA ACCESS CI

VAX and VMS are trademarks of Digital Equipment Corporation, UNIX V is a trademark of AT&T. XENIX is a trademark of Microsoft. DataFlex is a Registered Trademark of Data Access Corporation.

CIRCLE NO. 69 ON INQUIRY CARD



Graphics board furnishes 16 colors

- 640 by 480 pixels
- 256K bytes of RAM
- Standard parallel port

Targeting CAD/CAM, business graphics and desktop publishing applications, the MultiSync Color Graphics Board model GB-1 furnishes a 640-by-480-pixel resolution. The device offers 256K bytes of display RAM and 16-color graphics. Features include hardware zoom and scrolling and screen drivers that access software programs such as Lotus 1-2-3 and Microsoft Windows. A parallel port is standard. $700. **NEC Home Electronics (U.S.A.) Inc.,** Computer Products Division, 1255 Michael Drive, Wood Dale, Ill. 60191-1094, (312) 860-9500.

Circle 373

Adapter turns PC/AT into VMEbus processor

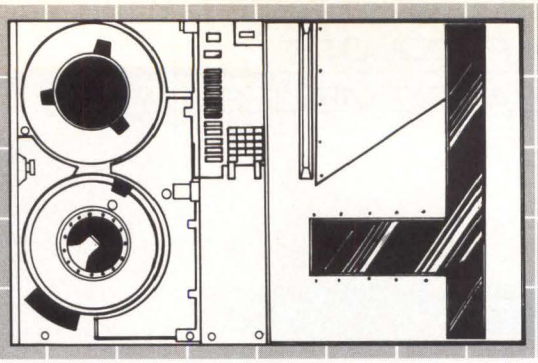
- Two circuit cards
- Three addressing modes
- Dual-port RAM

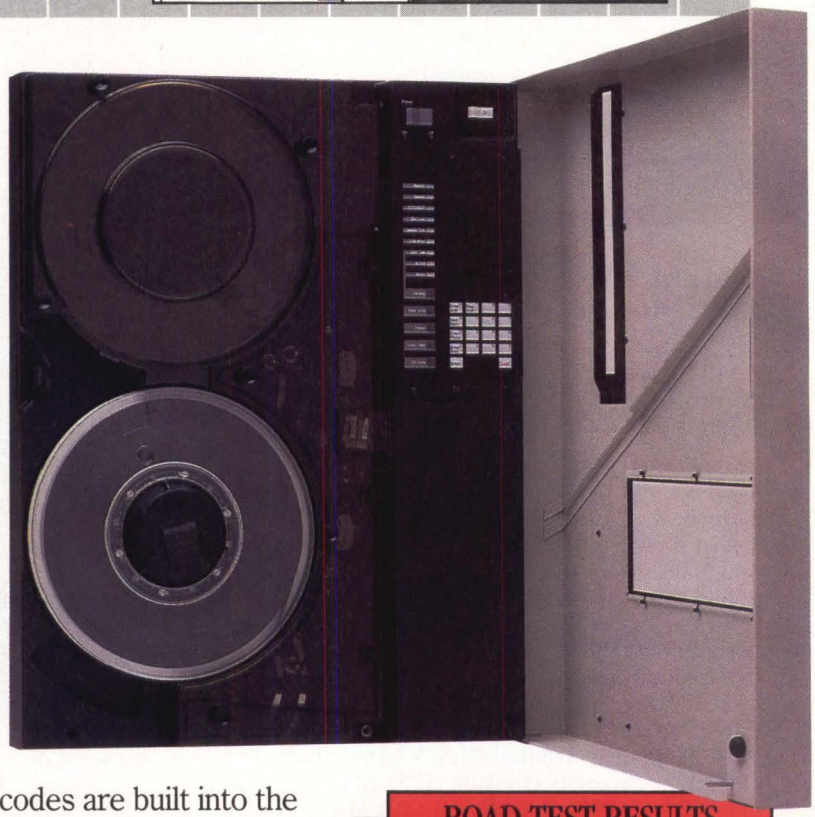
The Adaptor turns an IBM PC/AT into a VMEbus processor via direct, page-mode and dual-port, RAM-shared memory addressing. It consists of two printed circuit cards: One fits in the PC/AT and one in the VMEbus card cage. Up to 14M bytes of VMEbus memory can be mapped onto PC/AT memory-address space. Both the PC/AT and VMEbus devices can use optional 32K-byte and 128K-byte dual-port RAM. $1,280. **Bit 3 Computer Corp.,** 8120 Penn Ave. S., Minneapolis, Minn. 55431, (612) 881-6955.

Circle 374

Storage Technology's New 2925 Tape Accelerator.

It goes with unsurpassed speed.
It comes with unsurpassed features.





TAKE THE PERFORMANCE DRIVE.

StorageTek's Model 2925 gives you the speed you need, and the features your customers demand. The 2925's Accelerator (Cache) feature dynamically adapts to system requirements and the host's capability ...at transfer rates ranging from 100 kilobytes per second up to 1.25 megabytes per second. The 2925 goes with speed indeed; but what it *comes with* is even more remarkable.

AT A GLANCE

Series Standard Features

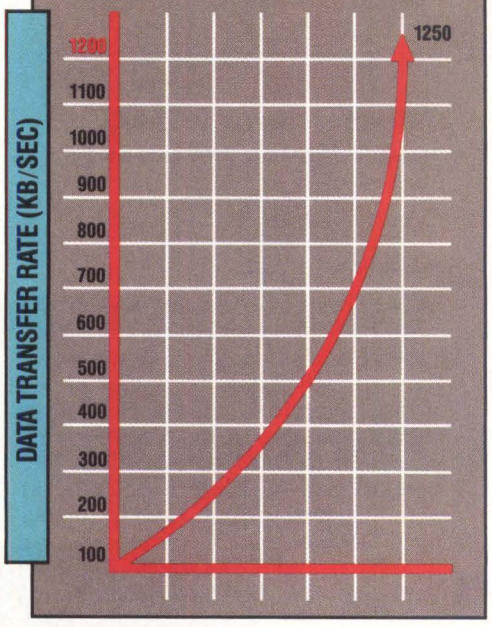
- *Dual-speed 50 ips Start/Stop and 100 ips Streaming with Buffered or Synchronous mode*
- *ANSI Standard 1600 bpi/6250 bpi formats*
- *Convenient Auto-Threading*
- *Integrated Formatter/Controller*
- *Service Panel with Alpha/Numeric Display*
- *Resident Diagnostics*
- *Host-optimized Data Transfer Rates*

Error correction codes are built into the cache's 256k of multi-record memory; so your data is checked both as it enters cache and as it is written onto tape. Data can be retrieved directly from cache–should defective media be encountered. The 2925 allows OEM systems integrators to attach ANSI-compatible 1600/6250 bpi capability to systems ranging from micros to minis...without software modification. For ease of integration, the 2925 is available with either StorageTek- or Pertec-compatible interfaces.

That's still only the beginning–be sure to read the accompanying list of features. You'll understand at a glance that 2925 performance is not only *speed...but reliability, flexibility and ease of operation.* StorageTek's experience with GCR 6250 bpi technology includes a full 11 years of pioneering, proving and perfecting. Our 2920 Series includes the 2921 (50 ips start/stop), the 2922 (50 ips start/stop with 100 ips streaming)in addition to the 2925 subsystem.

Take a drive in our 2920 Series...
and experience performance you'll be proud to call your own.

ROAD TEST RESULTS



StorageTek

Storage Technology. It's More Than Our Name...It's Our Commitment.

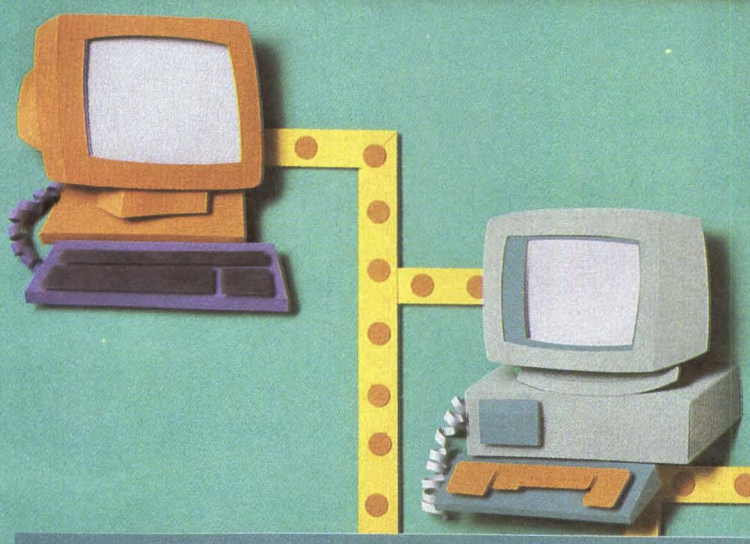
CIRCLE NO. 70 ON INQUIRY CARD

OEM MARKETING/3N, Louisville, Colorado 80028-0001 USA (303) 673-4066

Mini-Micro Systems
THE MAGAZINE FOR COMPUTER SYSTEMS INTEGRATION
A CAHNERS PUBLICATION

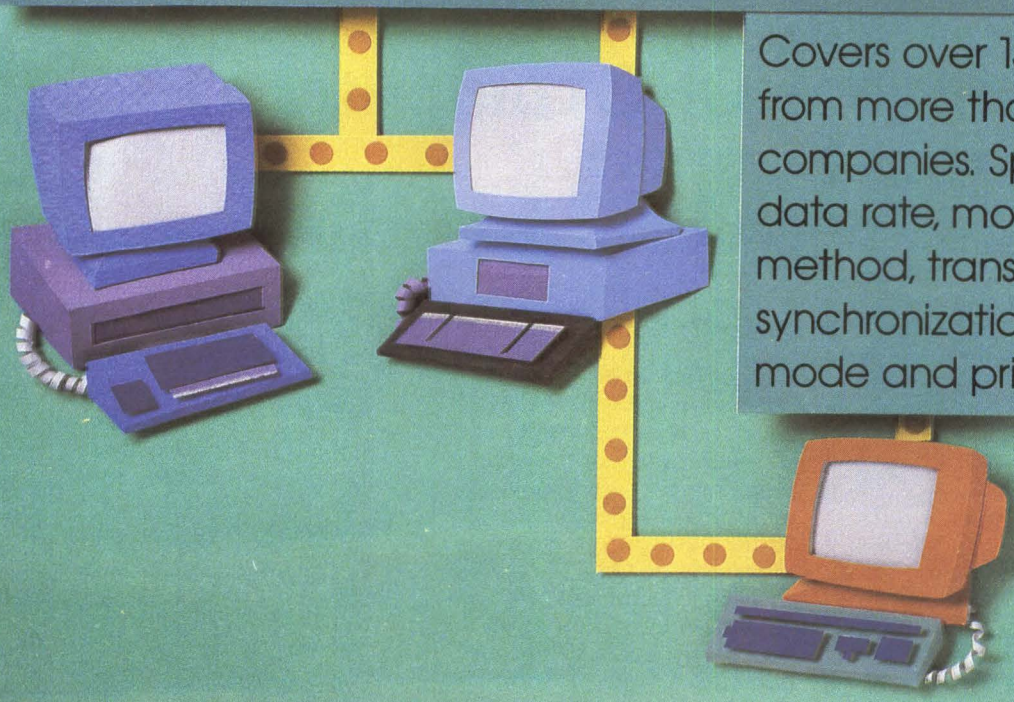
COMMUNICATIONS HANDBOOK

Modems accelerate capabilities



To meet the needs of high-volume data communications, dial-up modems push beyond 9,600 bps, and special-purpose devices adapt to SNA, fiber-optic and coaxial networks pg.121

Product Table: MODEMS



Covers over 130 modems from more than 50 companies. Specs include data rate, modulation method, transmission mode, synchronization, calling mode and price pg.131

The best communications tools for your DEC computer come from Simpact.

COMPUTERS
Our turnkey packages reduce communications loads for all DEC™ PDP, MicroVAX, VAX and VAXBI computers. Simpact products are compatible with Q-bus, UNIBUS and the new VAXBI bus from DEC.

PROTOCOLS
We currently implement X.25 PPI, X.25 SVI, HDLC-LAPB, ADCCP-HDLC, ADCCP-NRM, DDCMP and SDLC protocols on our intelligent communications front-end processors, COM-FEPs. Our packages provide host connectibility to DEC and non-DEC computers.

OPERATING SYSTEMS
RSX, MicroVMS, VMS, ULTRIX and the UNIX™V operating system are supported.

PERFORMANCE
Simpact intelligent COM-FEP packages let you compute and communicate – at the same time. Our packages deliver multiple high speed channels without using up your computing resources. On a MicroVAX II, a single COM-FEP with two X.25 channels operating at 64K bits/sec uses only 15% of the host CPU's time — leaving 85% available for primary processing functions.

CIRCLE NO. 67 ON INQUIRY CARD

To get more information on the best standard or custom communications tools for your DEC computers—including VAXBI, call Simpact today.

simpact

Simpact Associates, Inc.
9210 Sky Park Court
San Diego, CA 92123
619-565-1865

Simpact is a licensed VAXBI vendor.

MODEMS ACCELERATE CAPABILITIES

To meet the needs of high-volume data communications, dial-up modems push beyond 9,600 bps, and special-purpose devices adapt to SNA, fiber-optic and coaxial networks

Jesse Victor, Associate Editor

Consider these data-communications scenarios:

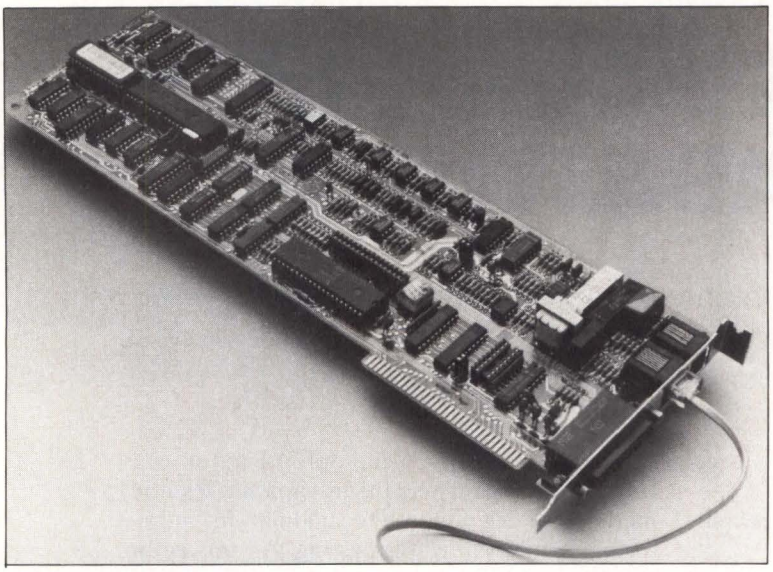
- Automatically polling hundreds of geographically dispersed point-of-sale terminals after business hours and transmitting sales data back to the host while simultaneously updating inventory numbers on the terminals;
- Transmitting screens of CAD/CAM bit-mapped 3D modelling data to and from a minicomputer or mainframe;
- Transferring high-density synchronous data streams with minimal error between host computers and attached personal computers or terminals;
- Sending messages over multiple satellite, fiber-optic, and/or microwave links between San Francisco and New York or Paris;
- Handling data communications in the harsh environment of a factory or nuclear power plant.

To make these and other sophisticated data transmission applications possible, mid-range and high-end dial-up modems have evolved far beyond basic modulater/demodulator functions. Today's 4,800-bit-per-second (bps) and faster devices offer a panoply of automatic transmission and reception capabilities and methods of telephone line modulation, monitoring, conditioning and testing. All this is for one purpose only: to speed the transmission of digital data over the analog public switched telephone network (PSTN) with minimal or no error. However, dial-up modems transmitting at 9,600 bps or higher rates have become embroiled in controversy regarding compatibility, the necessity for trellis-coded modulation (TCM) and the role of international CCITT standards.

Software cuts costs

Specialized modems and communications packages can interact with devices under IBM Corp. systems network architecture (SNA) and exchange data over fiber-optic cable or coaxial cable networks. For example, if you want to communicate between an IBM PC, PC/XT, PC/AT or Convertible and a remote System/34, 36 or 38 minicomputer and save the cost of an external modem, communications card and cable, consider IDEAssociates Inc.'s IDEAcomm 5250/Modem software. Used with Universal Data Systems Inc.'s Sync-Up model 208

The V.32 9,600-bps RM-9632 dial-up modem *from Racal-Milgo employs trellis-coded modulation, an automatic adaptive equalizer and local and remote adaptive echo cancelling.*



With hooks into SNA networks, *Network Software Associates' synchronous AdaptModem eliminates the need for a separate SDLC adapter and a telephone handset.*

4,800-bps (or model 201 2,400 bps) internal synchronous modem card, it emulates the IBM 5251 model 12 terminal controller and model 5294 cluster controller as well as all 5250 terminals, and accesses nine concurrent 5250 sessions.

The package configures both serial and parallel printers to emulate IBM 5256 model 1, 5224 model 1 and 5225 model 1 printers, allowing a remote PC to use a PC printer as a system printer or to direct output to a system printer.

File-transfer package support includes IBM's PC Support/36 or 38 and a documented programmatic interface for custom implementations. Advanced error detection and recovery and hot keying between PC-DOS and 5250 sessions are also provided.

"The 5250/Modem eliminates interfacing problems, a hefty 5250 cable to an external modem and the potential problem of servicing a communications card from another vendor," asserts Tom Cotton, IDEAssociates manager of modem development. "We are also working on a 4,800-bps remote IBM 3278-emulation product. The emulation market is growing. People want to get information from a remote mainframe or a mini to the PCs on their desks and share resources."

Network Software Associates Inc.'s synchronous AdaptModem also has hooks into SNA networks. A plug-in board for IBM PCs and compatibles, the 4,800-bps (Bell 208 A/B compatible) or 2,400-bps auto-dial/auto-answer unit eliminates the need for a separate SDLC (synchronous data link control) adapter as well as a telephone handset. The automatic call control (ACC) software module dials up to 180 numbers.

Used with the company's AdaptSNA 3270 software, the modem and ACC furnish auto-dial micro-to-mainframe links; with AdaptSNA APPC, they provide LU (logical unit) 6.2 protocol and advanced program to program communications (APPC) functions.

GammaLink Synchronous Communications claims substantial cost savings in SNA/SDLC service for its 9,600-bps half-duplex GammaComm modem compared to full-duplex 2,400-bps devices. According to the company, transferring 250K-byte files from 100 locations, five times in a 12-hour period using a 2,400-bps modem requires 15 synchronous front-end-processor ports at the host, if the dialing-in PC is to experience a busy signal less than 5 percent of the time. It also incurs $32,000 in monthly phone charges (based on zone 5, nationwide, lowest rate 800 service). In contrast, operating at its effective 7,200-bps rate over a micro-to-mainframe link, the GammaComm modem needs only six synchronous ports and incurs only $11,000 in monthly phone charges, a savings of $21,000.

Combining a 9,600-bps synchronous modem with an SNA/SDLC protocol converter on one plug-in card, DecaTek Inc.'s auto-dial ZIPmodem PC, when used with the mainframe ZIPmodem/FM, furnishes 3270 and 3770 (batch-transmission) emulation for IBM PCs and compatibles. Packaged with communications software and compatible with V.29 and V.27ter, in interactive 3278 mode, it emulates SNA Physical Unit (PU) 2 with LU 2 terminals or LU 1 or 2 printers.

Modems from AT&T Technology Systems and Allen-Bradley Co. suit demanding applications and harsh environments. Claimed to be the first optical data link that provides full-duplex transmission over one single-fiber optical cable, AT&T's ODL RS232-2 fiber-optic modem saves the cost of another cable plus associated connectors. Plugging into an RS232C port and offering CCITT V.24 compatibility, the 25-pin device affords secure asynchronous data rates of DC to 19.2K bps over 1 km with a bit-error rate not greater than 10^{-9}. Transmission is immune from EMI/RFI (electromagnetic interference/radio-frequency interference), crosstalk and ground loops.

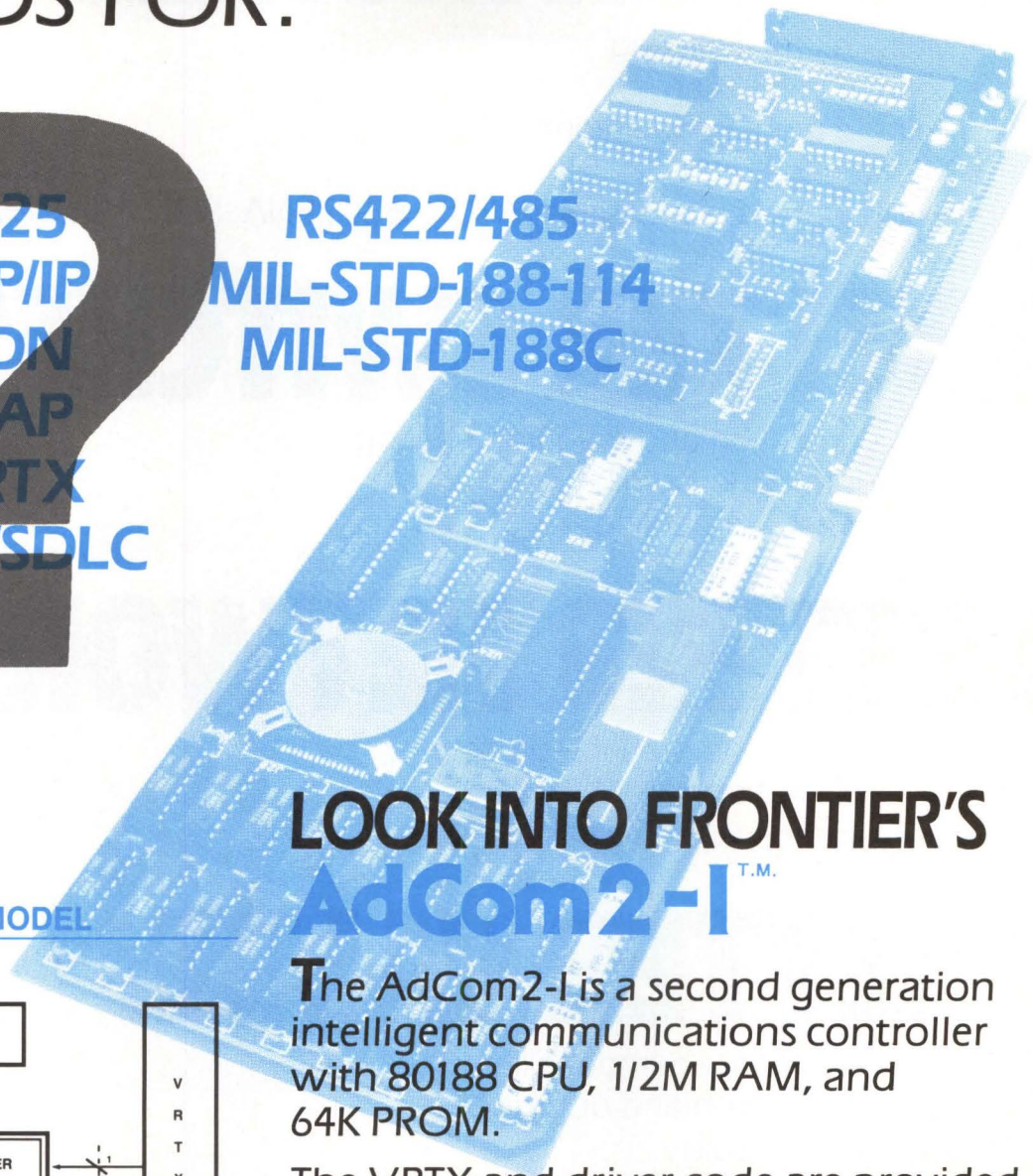
A 1.2K-bps secondary data line, multiplexed in each direction, can transfer handshaking signals. The modem complements the ODL RS232-1, which can time division multiplex data (and clock signals) on six full-duplex data channels. It allows asynchronous rates to 100K bps and synchronous rates to 64K bps.

"RS232 lines normally extend a maximum of 80 feet," notes Mitch Bloom, senior product planner at AT&T. "You can cause interference if you extend them further, especially in factory-automation applications. With the RS232-2

PC COMMUNICATION NEEDS FOR:

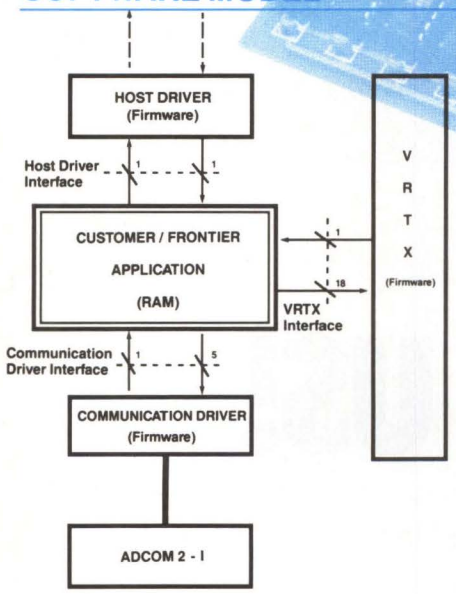
X-25
TCP/IP
DDN
MAP
VRTX
SNA/SDLC

RS422/485
MIL-STD-188-114
MIL-STD-188C



LOOK INTO FRONTIER'S AdCom2-I™

SOFTWARE MODEL



The AdCom2-I is a second generation intelligent communications controller with 80188 CPU, 1/2M RAM, and 64K PROM.

The VRTX and driver code are provided in the PROM for easy software development. Any complex application can be built using standard calls of the AdCom2-I's software model.

For more information call . . .

Frontier Technologies Corporation

3510 North Oakland Avenue, Milwaukee, Wisconsin 53211, (414) 964-8689

CIRCLE NO. 68 ON INQUIRY CARD

BETTER MUXES.

- Multi-link multiplexing
- Local multiplexing
- Point to point connections
- X.25 muxes
- Single or mixed protocols: ASCII, BSC, SNA, SDLC, ALC/PARS

BETTER SWITCHES.

- Port contention and resource sharing
- Full redundancy available
- As low as $80 per line

BETTER NETWORKS.

- Local and wide area integration
- Channel speeds to 19.2K bps
- Link speeds to 64K bps

BETTER VALUE.

- Multiple vendor compatibility
- Easy expansion and upgrade
- Superior reliability
- Low cost per connection

BETTER CALL US!

We have a better solution. For detailed information, call us toll-free at 800-235-6935. Outside the continental U.S., call 805-964-9852.

ComDesign

Leaders in Data Communications
A division of Network Equipment Technologies

751 South Kellogg Avenue
Santa Barbara, CA 93117

CIRCLE NO. 71 ON INQUIRY CARD

modem, you can go to 1 km, and you won't have trouble with ground loops."

Radio-frequency VistaModems from Allen-Bradley target high-speed data transport using broadband coaxial cable over long distances in harsh environments. Employing frequency-shift-keyed modulation of a crystal-controlled carrier frequency, they can be configured in point-to-point networks or for multidrop applications at rates to 100K bps.

"VistaModems replace large bundles of wires where people have many terminals connecting to one host," explains Tom Holmes, manager of the company's VistaLAN product line. "With a well-designed site plan, you can just move your terminal and plug it into the next office outlet without having to install a new hardwired connection. The move-and-change cost for a hardwired star network can be between $1,000 and $4,000 a node."

HIGHER SPEED MODEMS SLASH TRANSMISSION TIME...

	Speed (bps)			
Data transmitted	**1,200**	**2,400**	**9,600**	**18,000**
One screen of graphics	3 min	1.4 min	21 sec	11 sec
20 pages of text	10.4 min	5 min	1 min	42 sec
IBM PC 360K disk	1 hr	31 min	8 min	4 min
1M-byte file	3 hr	1.4 hr	22 min	11.6 min

...AND CUT LINE COSTS

	Speed (bps)			
Data transmitted	**1,200**	**2,400**	**9,600**	**18,000**
One screen of graphics	$ 1.49	$ 1.07	$ 0.65	$ 0.65
20 pages of text	4.85	2.75	1.07	0.65
IBM PC 360K disk	26.69	13.67	3.59	2.33
1M-byte file	73.31	36.77	9.47	5.27

Note: Based on AT&T direct-dial daytime rates for San Francisco to New York

Reduce line problems

The problems of implementing near-error-free data transmission at 2,400 bps or 4,800 bps rise by orders of magnitude at 9,600 bps, mainly because the PSTN is subject to a host of transmission problems. These include impulse noise, phase jitter, phase or gain hits, dropouts, attenuation distortion, envelope distortion and nonlinear distortion (clipping).

Local telephone companies' conditioning of private lines can eliminate some of these impairments, enabling leased-line modems to reach 16.5K bps or higher rates, while dial-up modems struggle to attain 9,600 bps. For example, C levels of conditioning can control envelope or differential-delay distortion. This type of distortion subjects signals to a greater delay at high frequencies. It either distorts the shape of a pulse or causes successively transmitted characters to overlap.

Vendors of 9,600-bps dial-up modems designed to operate over unconditioned lines have adapted several responses to these problems, including TCM, multiple carriers, adaptive equalization and echo cancellation. For example, Codex Corp.'s 2260 modem uses 32-state TCM to speed data over two-wire dial-up or leased lines at 9,600 bps. In accordance with CCITT V.32 recommendations, it provides synchronous and asynchronous operation, communicates with non TCM modems at 9,600 bps and can fall back to a 4,800-bps rate if line conditions deteriorate.

The modem has other features found on many 9,600-bps units. An automatic adaptive equalizer dynamically adjusts the modem to compensate for differential delay and other types of line distortion. Nonvolatile memory stores four sets of user-defined modem settings or a phone log of nine 40-character entries. The auto-dial/redial unit responds either to the Hayes Microcomputer Products Inc. AT command set, a de facto standard, or Codex's own.

Echo-cancellation choices

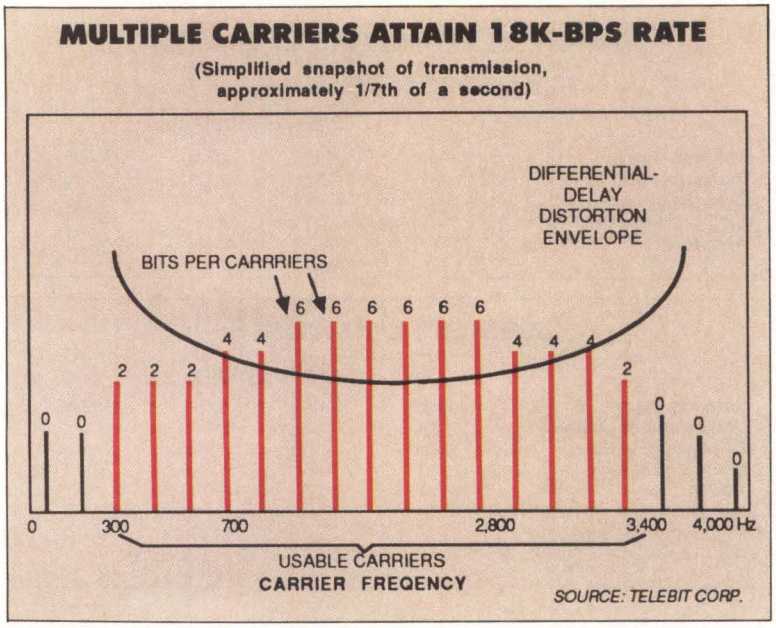
V.32 requires some form of echo cancellation but leaves the precise form unspecified. The 2260 substitutes for full-duplex transmission the echo cancellation normally supplied by the phone company for half-duplex voice transmission.

"A 9,600-bps modem must be capable of cancelling multiple echos of the same signal, occurring at different times, with various degrees of distortion under different line conditions," asserts Rick Arena, Codex product manager for V.32 modems. "Our scheme is one of the best out there in cancelling both local and remote echos. TCM is necessary for 9,600-bps modems to be competitive in today's market." The modulation method furnishes, on the average, a 4-dB improvement in signal-to-noise (S/N) ratio.

"A V.32 modem with TCM is more immune to line noise," he maintains. "A 3-dB improvement in the S/N ratio supplies double the noise power. Thus you can double the noise on the line and the TCM modem will perform as well or better than one without TCM at a lower noise level."

Racal-Milgo's RM-9632 V.32 9,600-bps modem also employs TCM and automatic adaptive equalizing. Its adaptive echo cancelling for local and remote echos can cope with delays of up to 2.2 seconds for multihop satellite links. The auto-dialer stores up to 10 32-digit numbers in nonvolatile memory. The RS-366/V.25 parallel interface accepts an external

The problems of nearly error-free data transmission at 2,400 bps or 4,800 bps rise by orders of magnitutde at 9,600 bps.



Using a maximum of 500 carriers, *a low 7.5-baud rate and up to 6 bits per usable carrier, Telebit's TrailBlazer modem overcomes differential delay distortion to speed data at 18K bps over dial-up phone lines.*

Bell 801 auto-dialer; the RS232C interface supports the Racal-Vadic 831 command set and the Concord Data Systems Inc. set.

"TCM allows fewer bits to send more information," contends Tom Casey, Racal-Milgo's product line manager, RM Series modems. "It increases immunity to noise, reduces the necessity for call-back and reduces errors on the line."

Concord Data claims a 3-dB increase in immunity to line noise for its CDS V.32 9,600-bps TCM modem. It also offers full auto-dialing capability, remote configuration mode and automatic transfer to a dial-up line if the leased line degrades.

Fast modems from Anderson-Jacobson Inc., Infinet Inc. and Universal Data Systems Inc. furnish the expected auto-dial features and extensive diagnostics. Anderson-Jacobson's V.32 AJ 9631-S full-duplex 9,600 modem also provides automatic dial-line backup for leased-line operation, as well as TCM, nonvolatile storage of eight 43-digit numbers, three levels of access security and continuous on-line monitoring of S/N ratio. Local and remote echo cancelling allows for a 2-second delay for double satellite hops.

Infinet's TCM V.32 9,600-bps modem operates in full-duplex mode over two-wire dial lines, with fallback to 4,800 bps. The device provides automatic adaptive equalization with echo cancelling and soft strapping for modem configuration via an asynchronous control port.

Economies found with V.29

The UDS 9,600A/B from Universal Data Systems furnishes synchronous transmission at 9,600 bps as well as fallback to 7,200 bps and 4,800 bps using CCITT V.29 signal-point methods, and automatic adaptive equalization.

USRobotics Inc. retains TCM but dispenses with V.32 compliance in its 9,600-bps Courier HST modem. "V.32 makes for a much more complex and expensive product than the market will bear," asserts Mark Smith, director of marketing. "You can purchase seven of our modems for the price of two competitive V.32 modems."

An asymmetric-modem design, the Courier provides simultaneous 9,600-bps and 300-bps data or error-control channels, with the direction of the high-speed channel automatically assigned according to data-flow demand. A proprietary error- and flow-control protocol—an enhanced version of MNP (Microcom networking protocol)—allows the error-free transmission of up to 1,000 characters per second over a variety of dial-up line conditions, claims Smith. At fallback data rates, the modem is compatible with CCITT V.22 bis at 2,400 bps, Bell 212A at 1,200 bps and Bell 103 at 300 bps.

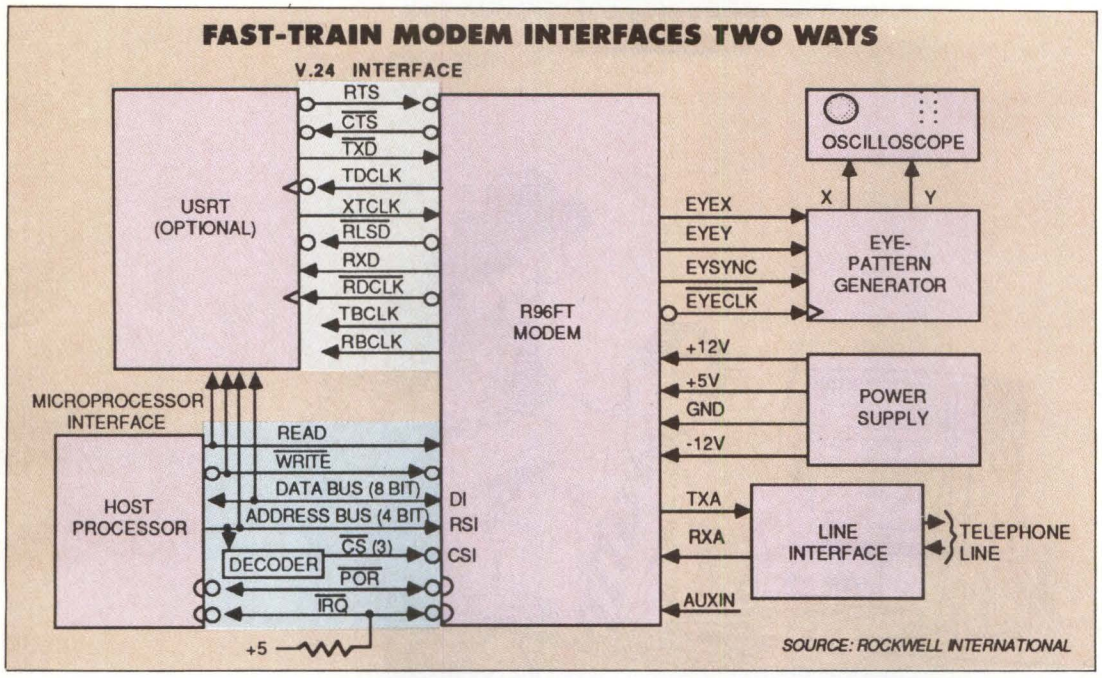
"V.32-compatible modems are generally expensive to produce and cost in the $3,000-to-$3,500 range. We can sell our 9,600VP 9,600-bps modem for approximately half that price," asserts Mark Passell, senior sales applications engineer at Racal-Vadic.

The auto-dial, auto-answer asynchronous or synchronous device offers four types of flow control, is compatible with the expanded Hayes AT command set and implements a superset of the MNP Level 4 error-control protocol with 3:1 data compression.

"Our adaptive packet-assembly technique varies the packet size to maximize throughput," Passell says. "We also have selected ARQ (automatic request repeat). If retransmission is necessary, we can go back to a particular frame and send that frame only."

Several 9,600-bps modem vendors emphasize fast-train features that maximize throughput by reducing the training time required for local and remote modems to synchronize, adjust line speed and line equalization prior to transmission. For example, Penril DataComm's Datalink 9,600 Fast Train modem reduces to 23 msec the training (or retraining) time required for remote modems on a multidrop link. It also features a bar-graph display of S/N ratio, automatic dial-line backup from leased-line operation and multidrop message broadcast, which can send commands simultaneously to all modems on a multidrop line.

Rockwell International Corp. also claims a training time of 23 msec at 9,600, 7,200 or 4,800 bps on its R96FT synchronous modem. Operating in full-duplex mode over four-wire



Operating full-duplex over four-wire lines *and half-duplex on two-wire links, Rockwell International's 100-mm-by-160-mm R96FT synchronous modem has a training time of 23 msec at 9,600, 7,200 or 4,800 bps.*

lines and half duplex over two-wire links, the unit can transfer data serially via its CCITT V.24, RS232C-compatible interface or in parallel over an 8-bit microprocessor bus. The R96FT/SC version offers a 75-bps secondary channel. CMOS and TTL compatible, both 100-mm-by-160-mm units interface via a 64-pin DIN connector.

Telebit Corp. utilizes a unique modulation technique to push its TrailBlazer dial-up modem past the competition's 9,600 bps to a blazing 18,000 bps. In contrast to conventional modems that use only one or two data carriers, this modem can employ up to 512 carriers spaced 7.8 Hz apart to transmit data, increasing the usable line bandwidth by 50 percent.

TrailBlazer automatically measures the S/N ratio at each of the possible carriers and simultaneously sends data packets of 2, 4 or 6 bits at each usable frequency, approximately every one-seventh of a second.

"Modem vendors have always assumed that the baud rate has to be very high for high-speed transmission," explains Mary Schaller, marketing director. "But the lower the baud rate, or number of symbols transmitted each second, the more data carriers you can have in the telephone bandwidth. With an average of 400 usable data carriers and 6 bits per carrier, the modem can transmit a packet of 2,400 bits approximately every one-seventh of a second (7.5 baud) for an 18,000-bps data rate."

Telebit claims 100 percent error-free transmission with its ARQ and CRC-16 error-correcting scheme. "Because we predict very closely the S/N ratio at each of the frequencies, we are already transmitting fairly accurately," Schaller claims. "If we reach a bit error rate of less than 10^{-12}, the modem automatically reconfigures the carriers."

Both TrailBlazer and Digital Communications Associates Inc.'s version, Fastlink, are bundled with Microstuf Inc.'s Crosstalk-Fast communications software.

Compression attains 14,000 bps

Data Race Inc. uses proprietary data-compression and error-correction techniques and V.29 modulation on its RACE-BMX block-mode-tranmssion modem to attain a basic rate of 9,600 bps and maximum throughput of 14,000 bps in simulated-full-duplex mode (high-speed line turnaround). It functions with Hewlett-Packard Co. and Unisys Corp. terminals.

An asymmetric-modem implementation, the RACE-IM or RACE-AF employs V.27 techniques, buffering, synchronous transmission and 2.5:1 compression on its main 4,800-bps line and 200-baud transmission on its return line. Depending on compression, effective throughput runs from 6,500 bps to 10,000 bps. The modem appears to the host computer and attached terminals as though it were an asynchronous device. The AF and IM versions are Hayes AT command set compatible.

Lack of compatibility could deter users

The multiplicity of modulation methods and error-correction techniques used on 9,600-bps and faster modems and their compliance or lack of compliance with CCITT V.32 standards

"Look! That's ALL-IN-1 on my PC screen...and a couple of minutes ago we looked at DATATRIEVE graphs... ***tomorrow*** *Fred's going to show me how to put my LOTUS files into a VAX library!"*

Give Your IBM PC *New* Power as a VAX Workstation with Software from Polygon.

Let your PC join the big leagues. Polygon's® family of terminal emulation, file transfer, and file sharing software lets IBM® PCs (and compatibles) share information with Digital's VAX™ and PDP™ systems.

Our new ***poly-STAR***® file transfer and VT220/VT240™ terminal emulation software has pop-up window menus, hot-key switching, international keyboard support, remote-control features, automated error-free file transfer, smart modem support, an online "phone book" for computer connections, and a user-programmable communication language.

Our ***poly-SHARE*** librarian software creates an easily-accessed VAX-based electronic library of PC and VAX files. PC users can store, organize, and share files and applications with each other as well as with VAX users.

VAXFR enhanced file transfer software – with fill-in-the-blanks formats, wildcard transfers, VAXmail™ pickup and delivery, PC-to-VAX-printer transfers, PC disk and directory backup on VAX, and ALL-IN-1™ support – let even the most inexperienced users accomplish complex data transfers between PCs and VAX systems.

Connect your PC to the power of a VAX.
Call Polygon today for more information at 314/576-7709.

polygon

CIRCLE NO. 72 ON INQUIRY CARD

makes it risky to assume that devices from two different modem vendors will talk to each other. The resulting confusion of product specifications and lack of firm standards may impede users' migration from 2,400 bps or 4,800 bps devices.

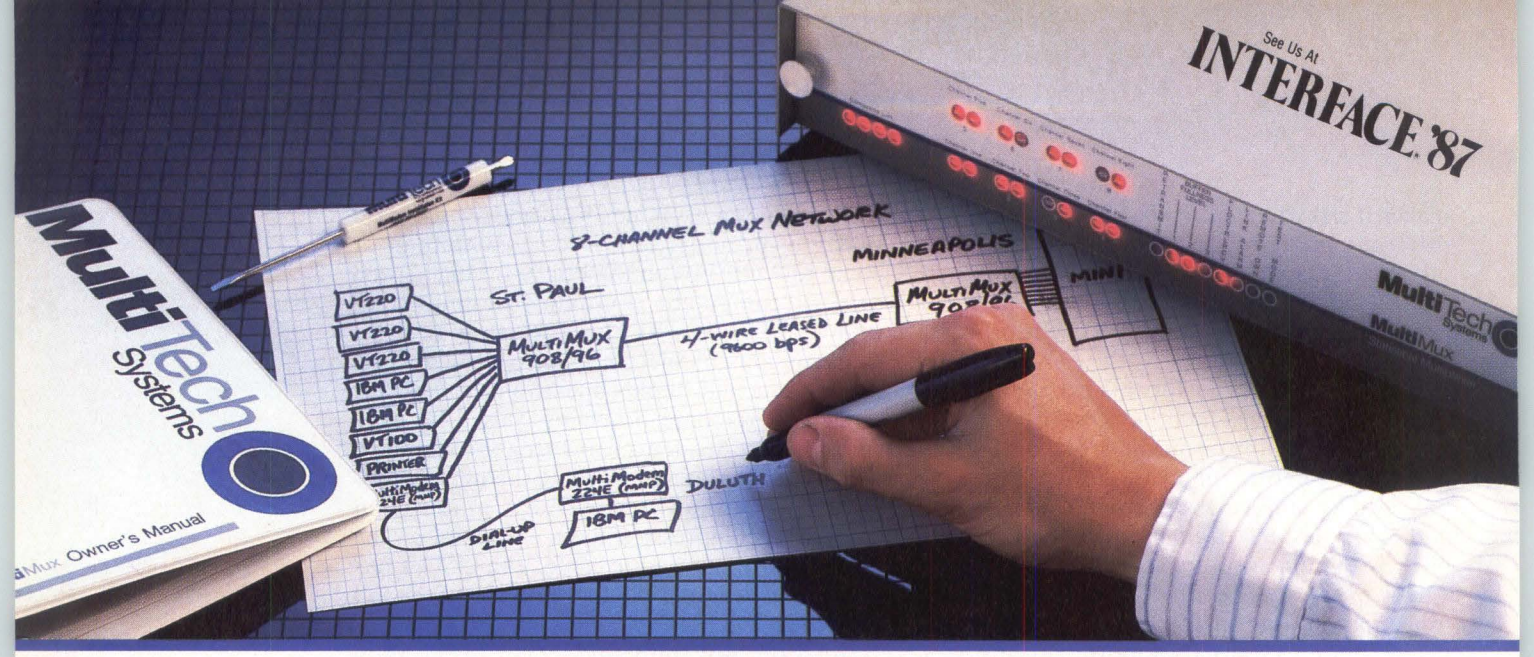
As a partial remedy for this problem, some modem vendors test their devices with competitive products and issue lists of compatible software. Telebit, for example, certifies approved Fastlane software for its TrailBlazer, and Codex has tested its products for compatibility with modems from several other vendors.

However, despite problems, the cost and transmission-time savings from 9,600 bps and faster modems constitute powerful lures for system integrators and end users. A 1M-byte file, for example, which takes 3 hours to transmit at 1,200 bps speeds along in 22 minutes at 9,600 bps and in only 11.6 minutes at 18,000 bps. Transmitting data from an IBM PC 360K flexible disk between New York and San Francisco can cost $26.69 at 1,200 bps but only $3.59 at 9,600 bps.

A new standard from the CCITT may offer at least a partial solution to compatibility problems. CCITT Study Group 17 is currently working on an asymmetrical-modem standard that will provide data rates greater than or equal to 9,600 bps on the PSTN for high-speed personal computer and Group 4 facsimile communications. It will also furnish a reverse-transmission channel for error control and accommodate half-duplex operation as a fallback mode to overcome problems caused by echo suppressors. Modems following the standard will also have to accommodate the use of adaptive differential pulse-code modulation (ADPCM) compression to be employed on the new TAT-8 transatlantic cable. The CCITT has set a target year of 1988 for adoption of the full standard.

Until the full implementation of the integrated services digital network (ISDN) eliminates the need for modulator/demodulators, the only certainty in the high-speed-modem market is users' continuing need for greater device compatibility and ever faster data-transmission speeds. □

Interest Quotient (Circle One)
High 498 Medium 499 Low 500



Four- and Eight-Channel Statistical Multiplexers from Multi-Tech Systems:

When it has to be as simple as it is smart

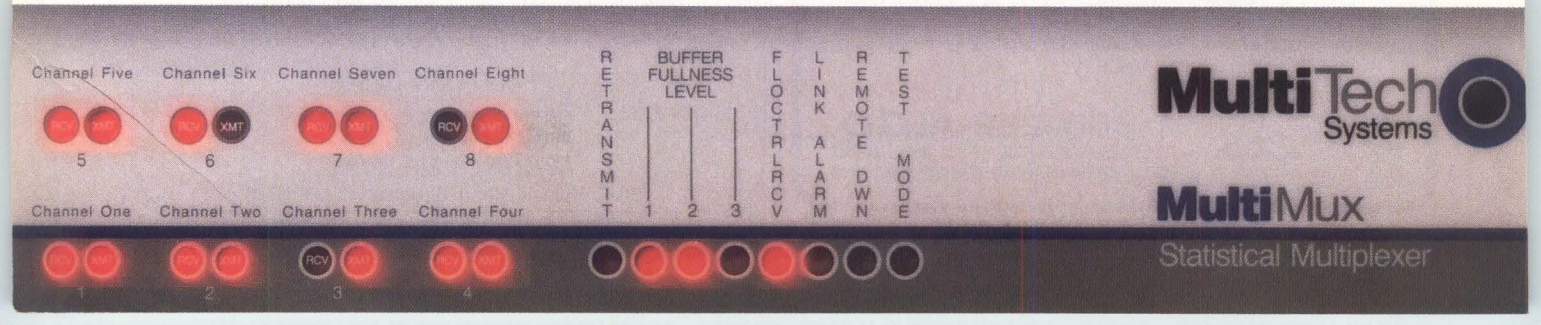
- There are a lot of good reasons to buy a pair of statistical multiplexers. Reduced line expenses, network security and the elimination of transmission errors are the three main ones.
- Unfortunately, most multiplexers come with a big reason not to buy them: They're nearly impossible for mere mortals to install and understand. In other words, they're just not worth the trouble.
- With that in mind,we'd like to introduce you to the new MultiMux,™ from Multi-Tech Systems. The biggest difference between the MultiMux and other muxes is that you can easily install a pair of them yourself, without the excessive time, expense and frustration you've avoided in the past.
- You may know us best for our MultiModem™ line of 1200 and 2400 bps dial-up modems. The same simple approach we use for our modems is now used for our MultiMux. We even use similar "AT" type commands.
- The MultiMux is offered in four- and eight-channel versions, with or without an integral 9600 bps V.29 modem. Instead of paying for up to eight dial-up lines for your asynch terminals, PCs or printers, you can use a pair of MultiMuxes to combine them all into a single leased line, for much less money.
- Convinced? If not, consider that the MultiMux is completely command driven, with a supervisory port, help menus, downline loading, full LED display, statistical reporting, and an integral 1200 bps dial-up modem for remote configurations and diagnostics. Also, consider that the MultiMux (like all of our products) is manufactured and supported by us in Minnesota, and that we've been doing so since 1970. Finally, consider our price. You'll find that to be a pleasant surprise too.
- Please call us toll-free at **1-800-328-9717,** for additional information…get a multiplexer that's as simple as it is smart!

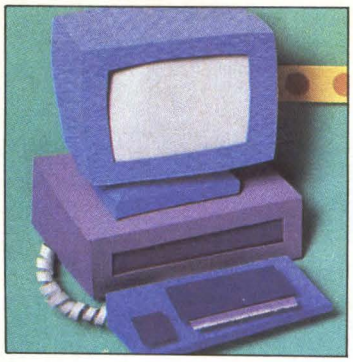
MultiTech Systems

The right answer every time.

Multi-Tech Systems, Inc. • 82 Second Avenue S.E. • New Brighton, Minnesota 55112 U.S.A.
1-800-328-9717 • 1-612-631-3550 • FAX 612-631-3575 • TWX 910-563-3610 (Domestic) • Telex 4998372 MLTTC (International)

CIRCLE NO. 91 ON INQUIRY CARD





VOICE GRADE DDD MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Price $ (quantity)	Notes, features
ANCHOR AUTOMATION INC.							**Circle 574**
6913 Valjean Ave., Van Nuys, CA 91406, (818) 997-7758							
Express i	300, 1200	FSK, DSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	299(Q1)	Bell 212A, Hayes compatible; plugs into IBM PC/AT/XT; includes LYNC software
Lightning 24	300, 1200, 2400	FSK, PSK, DPSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	499(Q1)	Bell 212A, 1224, CCITT, V.22 bis compatible
Volksmodem 12	300, 1200	FSK, PSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	199(Q1)	Bell 212A, Hayes compatible
ANDERSON JACOBSON INC.							**Circle 575**
521 Charcot Ave., San Jose, CA 95131, (408) 435-8520							
AJ 2412-STH	300, 1200, 2400	FSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	395(Q1)	Bell 103, 212A, CCITT V.22, V.22 bis, Hayes compatible
AJ 2441-1	300, 1200, 2400	FSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	695(Q1)	Bell 103, 212A, CCITT V.21, V.22, V.22 bis compatible; rackmount or standalone
AJ 9631-5	4800, 9600	QAM, TCM	full duplex	synch	auto dial/ auto answer	2,995(Q1)	CCITT V.32 compatible, rackmount or standalone
ASHER TECHNOLOGIES INC.							**Circle 576**
1009 Mansell Rd., Roswell, GA 30076, (404) 993-4590							
Quadmodem II	300, 1200, 2400		half, full duplex	asynch	auto dial/ auto answer	425-695(Q1); 276-452(Q100)	Bell 103, 212A, CCITT V.22 bis compatible; plugs into IBM bus compatible; includes CROSSTALK XVI software
AT&T INFORMATION SYSTEMS							**Circle 577**
One Speedwell Ave., Morristown, NJ 07960, (800) 247-1212							
4024	2400	FSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	750(Q1)	Bell 103, 212, CCITT V.22 bis compatible
4112	1200	FSK	full duplex	asynch	auto dial/ auto answer	489(Q1)	Bell 103, 212, CCITT V.22 bis compatible; plugs into PC 6300, IBM PC bus compatible; includes SoftCall software
4112V	1200	FSK	full duplex	asynch	auto dial/ auto answer	599(Q1)	Bell 103, 212, CCITT V.22 bis compatible; plugs into PC 6300, IBM PC bus compatible; includes Communications Manager software
BIZCOMP CORP.							**Circle 578**
532 Mercury Dr., Sunnyvale, CA 94086, (408) 733-7800							
2110	300, 1200	FSK, PSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	449(Q1); 225(Q100)	Bell 212, Hayes compatible; plugs into IBM PC or compatible
4120	300, 1200	FSK, PSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	499(Q1); 249(Q100)	Bell 212, Hayes compatible
4124	300, 1200, 2400	FSK, PSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	599(Q1); 349(Q100)	Bell 212, CCITT V.22 bis compatible
BYTCOM INC.							**Circle 579**
2169 Francisco Blvd., San Rafael, CA 94901, (415) 485-0700							
24/12 CONTAC PLUS	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	389(Q1)	Bell 103, 113, 212, CCITT V.22 bis compatible; plugs into IBM PC or compatible
24/72 FASTLINK	300, 1200, 2400, 7200	FSK, PSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	899(Q1)	Bell 103, 113, 212, CCITT V.22 bis compatible
212PC CONTAC	300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	299(Q1)	Bell 103, 113, 212 compatible; plugs into IBM PC or compatible
CERMETEK MICROELECTRONICS INC.							**Circle 580**
1308 Borregas Ave., Sunnyvale, CA 94088-3565, (408) 752-5000							
1200SM	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	595(Q1)	Bell 103, 212A compatible
1200SPC	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	345(Q1)	Bell 103, 212A compatible; includes software
2400 SPC	300, 1200, 2400	FSK, PSK, QAM	full duplex	asynch	auto dial/ auto answer	445(Q1)	Bell 103, 212A compatible; includes software

VOICE GRADE DDD MODEMS

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Price $ (quantity)	Notes, features
CODEX CORP.							**Circle 581**
Maresfield Farm, 7 Blue Hill River Rd., Canton, MA 02021-1097, (800) 426-1212							
224 Series	300, 1200, 2400	QAM	full duplex	asynch, synch	auto dial/ auto answer		Bell 103, 212, CCITT V.22, V.25 compatible
2300 Series	4800, 9600	QAM	full duplex	synch			
2600 Series	4800-19.2K	QAM, TCM	full duplex	synch	auto dial/ auto answer		CCITT V.27 bis, V.29 compatible; point-to-point
COMDATA CORP.							**Circle 582**
7900 N. Nagle Ave., Morton Grove, IL 60053, (312) 470-9600							
212E2-32	1200	PSK	full duplex	asynch	manual orig./ manual answer		Bell 212A compatible
224	300, 1200, 2400	FSK, PSK	full duplex	asynch	auto dial/ auto answer		Bell 103, 212A, CCITT V.22 bis compatible
1200	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer		Bell 103, 212A compatible
COMPUTER COMMUNICATIONS SPECIALISTS INC.							**Circle 583**
6683 Jimmy Carter Blvd., Norcross, GA 30071, (404) 441-3114							
Audiomodem Audiomodem II	1200	FSK	half duplex	asynch	auto dial/ auto answer		Bell 202 compatible, verbal response to inputs from touch-tone phone or hand-held terminal
CONCORD DATA SYSTEMS							**Circle 584**
397 Williams St., Marlborough, MA 01752, (617) 460-0808							
224 Autodial	1200, 2400	DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	450(Q1)	Bell 212, CCITT V.22, V.22 bis compatible
224 Series II	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	695(Q1)	Bell 103, 212, CCITT V.22, V.22 bis compatible; MNP error correction
V.32 Trellis	4800, 9600	QAM	full duplex	asynch, synch	auto dial/ auto answer	3,495(Q1)	CCITT V.32 compatible
CTS FABRI-TEK INC. (DATACOMM PRODUCTS DIV.)							**Circle 585**
6900 Shady Oak Rd., Eden Prairie, MN 55344, (612) 941-9100							
2424ADH	110, 300, 600, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	395(Q1)	Bell 103, 113, 212A, CCITT V.22 bis, V.22 AIB, Hayes compatible
2424AMH	110, 300, 600, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	495(Q1)	Bell 103, 113, 212A, CCITT V.22 bis, V.22 AIB, Hayes compatible
Half-Pak #24	110, 300, 600, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	395(Q1)	Bell 103, 113, 212A, CCITT V.22 bis, V.22 AIB compatible; plugs into IBM PC/AT/XT, Portable
DATA RACE INC.							**Circle 586**
12758 Cimarron Path, San Antonio, TX 78249, (512) 692-3909							
RACE I & II	1200-19.2K	FSK, PSK	full duplex	asynch	auto dial/ auto answer	1,495/1,695(Q1)	Bell 103 compatible
RACE I & II AF	1200-19.2K	FSK, PSK	full duplex	asynch	auto dial/ auto answer	1,645/1,845(Q1)	Bell 103, 212A compatible
RACE-BMX	1200-19.2K	PSK	half duplex	asynch	auto dial/ auto answer	1,195(Q1)	
DATAGRAM CORP.							**Circle 587**
11 Main St., East Greenwich, RI 02818, (800) 235-5030							
DCE-224	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	695(Q1)	Bell 103, 202, 212A, 224, CCITT V.21, V.22, V.22 bis, V.23 compatible; plugs into IBM PC
DCE-9600	4800, 7200, 9600	QAM	full duplex	synch		1,495(Q1)	CCITT V.29 compatible
DCE-14400T	4800, 7200, 9600, 14.4K	QAM	full duplex	synch		4,995(Q1)	CCITT V.29 compatible
DATALINK READY INC. (ARK ELECTRONIC PRODUCTS)							**Circle 588**
P.O. Box 2169, Melbourne, FL 32902-2169, (305) 676-0500							
DLR9.6/208B	4800, 9600	DPSK, QAM	half duplex	synch	auto dial/ auto answer	2,160(Q1); 1,620(Q100)	Bell 208B compatible, rackmount
DLR12,000 DIAL	9600, 12K	QAM	half duplex	synch	auto dial/ auto answer	2,900(Q1); 2,175(Q100)	rackmount
24K Plus	1200, 2400	DPSK	half duplex	synch	auto dial/ auto answer	545-595(Q1); 409-446(Q100)	Bell 103, 212A compatible, plugs into IBM PC or rackmount
DECATEK INC.							**Circle 589**
4754C N. Royal Atlanta Dr., Tucker, GA 30084, (404) 493-7273							
ZIPmodem/MF	9600	QAM	half duplex	synch	auto dial/ auto answer	1,995(Q1)	CCITT V.27, V.29 compatible
ZIPmodem/PC	9600	QAM	half duplex	synch	auto dial/ auto answer	2,995(Q1)	CCITT V.27, V.29 compatible; plugs into IBM PC/AT/XT
DIGITAL COMMMUNICATIONS ASSOCIATES INC. (DCA)							**Circle 590**
1000 Alderman Dr., Alpharetta, GA 30201-4199, (404) 442-4000							
DCA 932	9600	QAM	full duplex	synch		2,695(Q1)	CCITT V.29 compatible, multipoint

VOICE GRADE DDD MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Price $ (quantity)	Notes, features
DCA 940	14.4K	QAM	full duplex	synch		4,995(Q1)	CCITT V.29 compatible, built-in multiplexer
IRMA's FASTLINK	18K	FSK, DPSK, DAMQAM	half, full duplex	asynch	auto dial/ auto answer	1,995-2,395(Q1)	Bell 103, 212A, CCITT V.22, V.22 bis compatible; plugs into IBM PC or standalone; includes CROSSTALK software
DOWTY INFORMATION SYSTEMS (DIV. OF DOWTY RFL INDUSTRIES INC.)							**Circle 591**
Powerville Rd., Boonton, NJ 07005-0239, (201) 334-3100							
Quattro	2400	FSK, DPSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	695(Q1)	Bell 103, 202S, 212A, CCITT V.21, V.22, V.22 bis, V.23 compatible; plugs into IBM PC
ELECTRONIC VAULTS INC.							**Circle 592**
12347-E Sunrise Valley Dr., Reston, VA 22091, (703) 620-3900							
upta 96/I	4800, 7200, 9600	FSK, DPSK		asynch	auto dial/ auto answer	895(Q1)	CCITT V.29 compatible, plugs into IBM PC or compatible, error detection/correction
upta 96/S	4800, 7200, 9600	FSK, DPSK		asynch	auto dial/ auto answer	995(Q1)	CCITT V.29 compatible, standalone, error detection/correction
EVEREX SYSTEMS INC.							**Circle 593**
48431 Milmont Dr., Fremont, CA 94538, (415) 498-1111							
Evercom II EV-920	300, 1200	FSK, DPSK	full duplex	asynch	auto dial/ auto answer	249(Q1)	Bell 212A compatible; plugs into IBM PC/AT/XT; includes Bitcom software
Evercom 24 EV-940	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch	auto dial/ auto answer	289(Q1)	Bell 212A, CCITT V.22 bis compatible; plugs into IBM PC/AT/XT; includes Bitcom software
FASTCOMM DATA CORP.							**Circle 594**
12347-E Sunrise Valley Dr., Reston, VA 22091, (703) 620-3900, (800) 521-2496							
FASTCOMM 2400	300, 1200, 2400	FSK, DPSK		asynch	auto dial/ auto answer	599-619(Q1); 389-402(Q100)	Bell 103, 212A, CCITT V.22 bis, Hayes compatible; plugs into IBM PC
FASTCOMM 2496	300, 1200, 2400, 4800, 7200, 9600	FSK, DPSK		asynch	auto dial/ auto answer	979-999(Q1); 636-649(Q100)	Bell 103, 212A, CCITT V.22 bis, V.29 compatible; plugs into IBM PC
FASTCOMM 9600	4800, 7200, 9600	QAM		asynch	auto dial/ auto answer	899-919(Q1); 584-597(Q100)	CCITT V.29 compatible, plugs into IBM PC, error detection/correction
FUJITSU AMERICA INC.							**Circle 595**
3055 Orchard Dr., San Jose, CA 95134, (408) 946-8777							
M192IL	9600	QAM	full duplex	asynch	manual orig./ manual answer		CCITT V.29 compatible
M1923L	9600	QAM	full duplex	synch	manual orig./ manual answer		CCITT V.29 compatible
M1926L	14.4K	QAM	full duplex	synch	manual orig./ manual answer		CCITT V.29 compatible
GAMMALINK							**Circle 596**
2452 Embarcadero Way, Palo Alto, CA 94303, (415) 856-7421							
GammaComm	4800, 7200, 9600	QAM	half duplex	synch	auto dial/ auto answer	1,395(Q1); 1,046(Q100)	CCITT V.27, V.29 compatible; plugs into IBM PC/AT/XT
GammaFax	2400, 4800, 7200, 9600	QAM	half duplex	synch	auto dial/ auto answer	995(Q1); 746(Q100)	CCITT Group III Facsimilie compatible, plugs into IBM PC/AT/XT; PC-FAX dial-up product
GammaModem	4800, 7200, 9600	QAM	half duplex	synch	auto dial/ auto answer	1,495(Q1); 1,121(Q100)	CCITT V.27, V.29 compatible; standalone
GANDALF DATA INC.							**Circle 597**
1020 S. Noel Ave., Wheeling, IL 60090, (312) 459-6630							
ACCESS Series 12S	300, 1200	FSK, DPSK	full duplex	asynch, synch	auto dial/ auto answer	495(Q1)	Bell 103, 113, 212A compatible
ACCESS Series 24S	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	595(Q1)	Bell 103, 212A, CCITT V.22, V.22 bis compatible
SAM 201	2400	DPSK	half, full duplex	asynch, synch	auto dial/ auto answer	725(Q1)	Bell 201C, CCITT V.26 compatible
GENERAL DATACOMM INDUSTRIES INC.							**Circle 598**
Rt. 63, Middlebury, CT 06762, (203) 574-1118							
DC 208B/A	4800	DPSK	half, full duplex	synch	auto dial/ auto answer	1,545(Q1)	Bell 208 compatible
Multiport 9600	9600	QAM	full duplex	aysnch, synch	auto dial/ auto answer	2,495(Q1)	CCITT V.29 compatible, integral 4-channel multiplexer
Multiport 14400	14.4K	QAM	full duplex	asynch, synch	auto dial/ auto answer	5,490(Q1)	CCITT V.29 compatible, integral 6-channel multiplexer
HAYES MICROCOMPUTER PRODUCTS INC.							**Circle 599**
P.O. Box 105203, Atlanta, GA 30348, (404) 449-8791							
Smartmodem 1200	300, 1200	PSK	half, full duplex	asynch	auto answer	599(Q1)	Bell 103, 212A, CCITT V.22 compatible
Smartmodem	300, 1200,	FSK, DPSK,	half, full	asynch,	auto answer	899(Q1)	Bell, CCITT V.22, V.22 bis compatible

VOICE GRADE DDD MODEMS

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Price $ (quantity)	Notes, features
2400	2400	QAM	duplex	synch			
Smartmodem 2400B	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch, synch	auto answer	739(Q1)	Bell, CCITT V.22, V.22 bis compatible; plugs into IBM PC or compatible
IDEASSOCIATES INC.							**Circle 600**
29 Dunham Rd., Billerica, MA 0l821, (617) 663-6878							
IDEAcomm 1200	300, 1200	DPSK	half, full duplex	asynch	auto dial/ auto answer	495(Q1)	Bell 103, 212 compatible; plugs into IBM PC/AT/XT; includes IDEAcomm software
IDEAcomm 2400	300, 1200, 2400	QAM	half, full duplex	asynch	auto dial/ auto answer	695(Q1)	Bell 103, 212, CCITT V.22 bis compatible; plugs into IBM PC/AT/XT; includes IDEAcomm software
INCOMM DATA SYSTEMS							**Circle 601**
115 N. Wolf Rd., Wheeling, IL 60090, (312) 459-8881							
Rainbow 2400 PC	300, 600, 1200, 2400	FSK, QAM, QDPSK	full duplex	asynch	auto dial/ auto answer		Bell 103, 212, CCITT V.22, V.22 bis compatible; plugs into IBM PC/AT/XT or compatible; includes Quick Link software
Turbo 2400	300, 600, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer		Bell 103, 212, CCITT V.22, V.22 bis compatible; includes Quick Link software
Turbo 4800	300, 600, 1200, 2400, 4800	FSK, DPSK, QAM	full duplex	asynch	auto dial/ auto answer		Bell 103, 212, CCITT V.22, V.22 bis compatible
INFINET INC.							**Circle 602**
40 High St., North Andover, MA 01845, (617) 681-0600							
224 Dial Modem	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	795(Q1); 715(Q100)	Bell 103, 212A, CCITT V.22, V.22 bis compatible; MNP error correction
IDM 144	9600, 12K, 14.4K	QAM, TCM	full duplex	synch	auto dial/ auto answer	6,100(Q1); 5,400(Q100)	CCITT V.33 compatible, private line, error correction
INMAC (DATACOM DIV.)							**Circle 603**
2350 Zanker Rd., San Jose, CA 95131, (408) 435-1700							
Clear Signal 2400	300, 1200, 2400	QAM	half, full duplex	asynch, synch	auto dial/ auto answer	459(Q1)	Bell 103, 212A, Hayes compatible
Clear Signal 4800	2400, 4800	QAM	half, full duplex	synch	manual orig./ manual answer	1,095(Q1)	CCITT V.27 compatible
Clear Signal 9600	4800, 7200, 9600	QAM	full duplex	synch	manual orig./ manual answer	1,495(Q1)	CCITT V.29 compatible
LEADING EDGE HARDWARE PRODUCTS INC.							**Circle 604**
225 Turnpike St., Canton, MA 02021, (800) 343-6833							
Model "L"	1200	FSK, PSK, QAM	half, full duplex	asynch	auto dial/ auto answer	149(Q1)	Bell 103, 212A compatible; plugs into IBM PC or compatible; includes Bitcom software
Model "L"	2400	FSK, PSK, QAM	half, full duplex	asynch	auto dial/ auto answer	289(Q1)	Bell 103, 212A compatible; plugs into IBM PC/AT/XT or compatible; includes Bitcom software
MICOM SYSTEMS INC.							**Circle 605**
4100 Los Angeles Ave., Simi Valley, CA 93062, (805) 583-8600							
M3124EH-S1	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	549(Q1); 439(Q100)	Bell 103, 212A, CCITT V.22, V.22 bis compatible; MNP error correction
MULTI-TECH SYSTEMS INC.							**Circle 606**
82 Second Ave. S.E., New Brighton, MN 55112, (612) 631-3550, (800) 328-9717							
MT212AH2	300, 1200	FSK, PSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	399(Q1)	Bell, CCITT, Hayes compatible
MT224EC	300, 1200, 2400	FSK, PSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	699(Q1)	Bell, CCITT, Hayes compatible; plugs into IBM PC/AT or compatible; MNP error correction
MT224EH	300, 1200, 2400	FSK, PSK, DPSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	749(Q1)	Bell, CCITT, Hayes compatible; MNP error correction
NCR COMTEN INC.							**Circle 607**
2700 Snelling Ave. North, St. Paul, MN 55113, (612) 638-7944							
7164	4800	QAM	full duplex	synch		2,995(Q1)	IBM 3864 compatible
7165	9600	QAM	full duplex	synch		3,995(Q1)	IBM 3865, CCITT V.29 compatible
7166	14.4K	TCM	full duplex	synch		3,995(Q1)	CCITT V.33 compatible
NOVATION INC.							**Circle 608**
20409 Prairie St., Chatsworth, CA 91311, (818) 996-5060							
1200XE	300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	299(Q1); 249(Q100)	Bell 103, 212 compatible
1200XE/HC		FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	199(Q1); 179(Q100)	Bell 103, 212 compatible; plugs into IBM PC
P2400	300, 1200, 2400	FSK, PSK, DPSK	half, full duplex	asynch, synch	auto dial/ auto answer	795(Q1); 495(Q100)	Bell 103, 212, 224, CCITT V.22 bis compatible; MNP error correction
PARADYNE CORP.							**Circle 609**
8550 Ulmerton Rd., Largo, FL 33540 (813) 530-2292							
FDX 2400 Plus	2400		full duplex	asynch, synch	auto dial/ auto answer	595(Q1); 565(Q100)	Bell 103, 113, 212A, CCITT V.22 bis compatible; plugs into IBM PC; MNP error correction

VOICE GRADE DDD MODEMS

Company / Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Price $ (quantity)	Notes, features
HDX 9600/208B	4800, 9600	QAM	half duplex	synch	auto dial/ auto answer	1,995(Q1); 1,495(Q100)	Bell 208B compatible
208A/B	4800	DPSK	half duplex	synch	auto dial/ auto answer	1,295(Q1); 1,095(Q100)	Bell 208A/B compatible, plugs into IBM PC
PENRIL DATACOMM							**Circle 610**
207 Perry Parkway, Gaithersburg, MD 20877-2197, (301) 921-8600							
Datalink 2400	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	synch	auto dial/ auto answer	695(Q1)	Bell 103, 212A, CCITT V.22 bis compatible
Datalink 4800	2400, 4800	DPSK	half, full duplex	synch	auto dial/ auto answer	1,395(Q1)	Bell 208A/B, CCITT V.27 bis/ter compatible
Datalink 9600	2400, 4800, 7200, 9600	QAM	half, full duplex	synch	auto dial/ auto answer	1,795(Q1)	CCITT V.27 bis/ter, V.29 compatible
PRENTICE CORP.							**Circle 611**
266 Caspian Dr., Sunnyvale, CA 94088, (408) 734-9810							
P-208A/B	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	1,295-1,395(Q1)	Bell 208A/B compatible, standalone or rackmount
P-2424	300, 1200, 2400	FSK, PSK, QAM	half duplex	asynch, synch	auto dial/ auto answer	595-695(Q1)	Bell 103, 212A, CCITT V.22 bis, Hayes compatible; standalone or rackmount
P-9600A/B	4800, 7200, 9600	QAM	half, full duplex	synch	manual orig./ auto answer	2,050-2,150(Q1)	CCITT V.29 compatible, standalone or rackmount
QUADRAM CORP.							**Circle 612**
One Quad Way, Norcross, GA 30093, (404) 923-6666							
Quadmodem II	110, 300, 1200, 2400	PSK	half, full duplex	asynch	auto dial/ auto answer	425-695(Q1)	Hayes compatible, plugs into IBM PC or compatible, includes CROSSTALK XVI software
RACAL-MILGO							**Circle 613**
1601 N. Harrison Parkway, Sunrise, FL 33323, (305) 476-5609							
9600VP	9600	QAM	half duplex	asynch, synch	auto dial/ auto answer	1,495(Q1); 1,271(Q100)	Bell 103, 212, CCITT V.29 compatible; MNP error correction
RM-1822D	18K	FSK, PSK, DPSK, QAM (multicarrier)	half duplex	asynch	auto dial/ auto answer	2,395(Q1); 2,036(Q100)	Bell 103, 212A, CCITT V.22, V.22 bis compatible; minimal fallback
RM-9632	4800, 9600	QAM, TCM	full duplex	synch	auto dial/ auto answer	3,500(Q1); 2,975(Q100)	CCITT V.32 compatible
RACAL-VADIC							**Circle 614**
1525 McCarthy Blvd., Milpitas, CA 95035, (408) 946-2227							
2400VP	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	595(Q1); 488(Q50)	Bell 103, 212, CCITT V.22 bis compatible; MNP error correction
4850PA	2400, 4800	DPSK	half duplex	synch	auto dial/ auto answer	1,295(Q1); 1,100(Q50)	Bell 208B, CCITT V.27 ter compatible
9600VP	300, 1200, 9600	FSK, DPSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	1,495(Q1); 1,270(Q50)	Bell 103, 212, Vadic compatible; MNP error correction
TEK-COM CORP.							**Circle 615**
120 Charcot Ave., San Jose, CA 95131, (408) 435-9515							
TC212AD	300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	359(Q1)	Bell 103A, 212A, Hayes compatible
TC2400 PC1	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch	auto dial/ auto answer	499(Q1); 374(Q100)	Bell 103A, 212A, CCITT V.22 bis compatible; plugs into IBM PC or compatible
TC2400 SA	300, 1200, 2400	FSK, PSK, QAM	half, full duplex	asynch, synch	auto dial/ auto answer	550(Q1); 412(Q100)	Bell 103A, 212A, CCITT V.22 bis, Hayes compatible
TELENETICS CORP.							**Circle 616**
895 E. Yorba Linda Blvd., Suite H, Placentia, CA 92670, (714) 524-5770							
24a	300, 1200, 2400	FSK, PSK, DPSK, QAM	full duplex	asynch	auto dial/ auto answer	495(Q1); 347(Q100)	Bell 212A, CCITT V.22 bis compatible
24i	300, 1200, 2400	FSK, PSK, DPSK, QAM	full duplex	asynch	auto dial/ auto answer	495(Q1); 347(Q100)	Bell 212A, CCITT V.22 bis compatible; plugs into IBM PC or compatible
24s	300, 1200, 2400	FSK, PSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	695(Q1); 487(Q100)	Bell 212A, CCITT V.22 bis compatible
TOUCHBASE SYSTEMS INC.							**Circle 617**
16 Green Acre Lane, Northport, NY 11768, (516) 261-0423							
WorldLink 1200	300, 1200	FSK, PSK	full duplex	asynch	auto dial/ auto answer	199(Q1)	Bell 103, 212A, CCITT V.21, V.22, Hayes compatible
TRANSEND CORP.							**Circle 618**
884 Portola Rd., Portola Valley, CA 94025, (415) 851-3402							
PCM 1200	300, 1200	DPSK	half, full duplex	asynch	auto dial/ auto answer	159(Q1); 140(Q100)	Bell 212A compatible, plugs into IBM PC
TRI-DATA							**Circle 619**
505 E. Middlefield Rd., Mountain View, CA 94043, (415) 969-3700							
OZ Guardian 533	110, 300, 1200	FSK, PSK	half, full duplex	asynch	auto dial/ auto answer	750(Q1)	Bell 103, 212A compatible

VOICE GRADE DDD MODEMS

Company Model	Data rate (bps)	Modulation method	Transmission mode	Synchronization	Calling mode	Price $ (quantity)	Notes, features
TYMNET (MCDONNELL DOUGLAS NETWORK SYSTEMS CO.)							**Circle 620**
2710 Orchard Parkway, San Jose, CA 95134, (408) 942-5254							
932	1200, 2400	DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	495(Q1); 455(Q100)	Bell 212A, CCITT V.22 bis compatible
933	1200, 2400	DPSK, QAM	full duplex	asynch	auto dial/ auto answer	795(Q1); 652(Q100)	Bell 212A, CCITT V.22 bis compatible; X.PC error correction
934	1200, 2400	DPSK, QAM	full duplex	asynch	auto dial/ auto answer	1,295(Q1); 1,115(Q100)	Bell 212A, CCITT V.22 bis compatible; X.PC error correction; supports up to 3 terminals or PCs over same dial-up line
UNIVERSAL DATA SYSTEMS							**Circle 621**
5000 Bradford Dr., Huntsville, AL 35805, (205) 721-8000							
208A/B	4800	DPSK	half, full duplex	synch	manual orig./ auto answer	1,295(Q1)	Bell 208A/B compatible
9600A/B	4800, 7200, 9600	QAM	half, full duplex	synch	manual orig./ auto answer	1,995(Q1)	Bell 208A/B, CCITT V.29 compatible; diagnostics
V.33	9600, 12K, 14.4K	QAM, TCM	full duplex	synch	manual orig./ auto answer	2,995(Q1)	CCITT V.29, V.33 compatible
US ROBOTICS INC.							**Circle 622**
8100 N. McCormick Blvd., Skokie, IL 60076, (312) 982-5001							
Courier 2400e	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	699(Q1)	Bell 103, 212A, CCITT V.22 bis compatible; MNP error correction
Courier HST	300, 1200, 2400, 9600	FSK, DPSK, QAM, TCM	half, full duplex	asynch	auto dial/ auto answer	995(Q1)	Bell 103, 212A, CCITT V.22 bis compatible
VARmodem 2400	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	499(Q1)	Bell 103, 212A, CCITT V.22 bis compatible; plugs into IBM PC bus
VEN-TEL INC.							**Circle 623**
2342 Walsh Ave., Santa Clara, CA 95051, (408) 727-5721							
2400 Plus	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	695(Q1)	Bell 103, 113, 212A, CCITT V.22, V.22 bis compatible
Half Card	300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	549(Q1)	Bell 103, 212A compatible; plugs into IBM PC/AT/XT or compatible; includes CROSSTALK XVI software
Half Card 24	300, 1200, 2400	FSK, DPSK, QAM	half, full duplex	asynch	auto dial/ auto answer	695(Q1)	Bell 103, 113, 212A, CCITT V.22, V.22 bis compatible; plugs into IBM PC/AT/XT or compatible; includes CROSSTALK XVI software
VISIONARY ELECTRONICS INC.							**Circle 624**
141 Parker Ave., San Francisco, CA 94118, (415) 751-8811							
Visionary 1200XT	300, 1200	FSK, PSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	495(Q1); 223(Q100)	Bell 212A, CCITT V.21, V.22, Hayes compatible
WESTERN DATACOM							**Circle 625**
5083 Market St., Youngstown, OH 44512, (216) 788-6583							
424 Error Free	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch, synch	auto dial/ auto answer	645(Q1); 419(Q100)	Bell 103, 113, 212, CCITT V.22 bis, Vadic compatible; MNP error correction
MESA424	300, 1200, 2400	FSK, DPSK, QAM	full duplex	asynch	auto dial/ auto answer	995(Q1); 646(Q100)	Bell 103, 113, 212, CCITT V.22 bis compatible
WorldCom 200	300, 1200	FSK, DPSK	half, full duplex	asynch	auto dial/ auto answer	495(Q1); 321(Q100)	Bell 103, 113, 202, CCITT V.21, V.23, Videotex compatible

ADVERTISERS INDEX

See P. 138-140 for Mini-Micro Marketplace

DEC DIRECTIONS ADVERTISERS

Be sure to send for more information about these DEC-compatible products, too:

The following advertisers in DEC DIRECTIONS invite you to send for more information about their DEC-compatible products. (DEC DIRECTIONS is a special MINI-MICRO SYSTEMS supplement appearing only in magazine copies sent to subscribers who have indicated involvement with DEC computers.)

Boston Business Computing Ltd. (PC/EDT software)	D4	153
TRW Inc. Customer Service Div. (diagnostic Software)	D3	152
Walker, Richer, & Quinn (terminal emulation software)	D2	151

DEC is a trademark of Digital Equipment Corp.

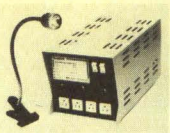
MINI-MICRO MARKETPLACE

ATTENTION: BUYERS AND SELLERS OF PRODUCTS AND SERVICES IN THE COMPUTER SYSTEMS INTEGRATION MARKETPLACE:

READERS: For additional information on the companies in this section, please circle reader service numbers on the Reader Inquiry card

AVOID COMPUTER DOWNTIME!

- 11-25 MINUTES BLACKOUT POWER
- FRONT PANEL TEST SWITCH



FREE CATALOG

- SineZUPS – NATURAL SINE WAVE UPS
- CONTINUOUS ON-LINE OPERATION
- ELIMINATE:
  - BLACKOUT • SPIKE/SURGE
  - BROWNOUT DAMAGE
  - EMI/RFI INTERFERENCE
- EXCLUSIVE LITE UPS ILLUMINATE WORK AREA WHEN LIGHTS GO OUT
- SINE-UPS, BATTERIES & LITE UPS

SU-250 250 WATT $1095.00
SU-500 500 WATT $1495.00

ESP Electronic Specialists, Inc.
171 SO. MAIN, NATICK, MA 01760
617-655-1532 TOLL FREE 800-225-4876
VISA, MASTERCARD, AMERICAN EXPRESS

CIRCLE NO. 206 ON INQUIRY CARD

Cut costs with

Offshore Manufacturing

Companies in Taiwan produce cast iron and aluminum parts, printed circuit boards, precision machined parts, product enclosures, custom cables and other components.

IBM, Boeing, Chrysler and other major firms use components produced in Asia. Costs for tooling, raw materials and labor can be significantly reduced.

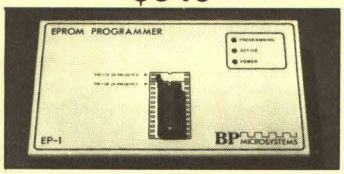
Through our permanent Taipei office we can
- Find reliable quality-conscious manufacturers.
- Help set up offshore production facilities.
- Inspect products, guarantee quality, and arrange shipment.

Call us today

SUNHILL-NIC
1000 ANDOVER PARK EAST
SEATTLE • WA • 98188
206/575-4131

CIRCLE NO. 207 ON INQUIRY CARD

EPROM PROGRAMMER $349



The EP-1 is a great value, here's why:

- IBM PC Software included or RS-232 to any computer
- ASCII Command driven operation; All intelligence in unit
- Reads, Programs, Copies over 150 types from 2716 to 27512
- Optional Intel microcontroller programming head
- Menu-driven Chip Selection; No Personality Modules
- Fast, Slow, Quick-Pulse Programming Algorithms
- Intel (8080 & 8086), Motorola, Tekhex, Straight Hex Files
- Splits Files by Base Address and Odd/Even (16 bit systems)
- Gold Textool ZIF IC socket
- Generate & Set Checksums
- Over-Current Protection
- 8 Baud Rates 300 to 38,400
- Full One-Year Warranty
- 5,12.5,21.25V Programming
- U.V. Erasers from $34.95
- Same Day Shipment

BP MICROSYSTEMS
10681 Haddington, #190 / Houston, TX 77043
(713) 461-9430 (800) 225-2102

CIRCLE NO. 208 ON INQUIRY CARD

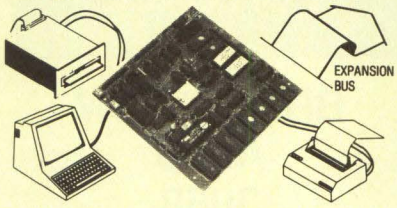
Get the whole story on graphics terminal emulation.

To find out more about software that lets your PC emulate TEKTRONIX™ 4105/6/7/9 and DEC VT100™ terminals, call or write:

GRAFPOINT
4340 Stevens Creeks Blvd., Suite 280,
San Jose, CA 95129 (408) 249-7951

CIRCLE NO. 209 ON INQUIRY CARD

OEM188 SBC DEVELOPMENT SYSTEM FOR PRODUCT APPLICATIONS



The OEM188 - designed to bring your product to market in the fastest possible time - through the most productive software development environment available & cost effective hardware.

- The OEM188 boots MS-DOS or CP/M-86. Write your program in Assembler, Forth, Basic, C, Fortran or Pascal.
- ROM your code. The EPROM programmer is onboard and fully integrated into the hardware and software.
- Develop your code quickly with Vesta's ROMmed languages designed for control tasks.

Size 8" x 8". FDC for 4 drives, Dual UART with RS-232, TTL and RS-422 I/O, Bus - IBM, Printer port, Watchdog, Battery backed real time clock and up to 256 K static RAM/ROM. Programmer interface - terminal. Various I/O boards available.

Prices starting as low as $329 each

VESTA TECHNOLOGY, INC. • 7100 W. 44th Ave. • Suite 101
Wheatridge, CO 80033 • (303)422-8088 • VISA & MC

CIRCLE NO. 210 ON INQUIRY CARD

A MUST for Computers

The Ideal Keyboard Cover!

Protect your computer and **eliminate** downtime caused by liquid spills, contaminants, environmental hazards, etc. with VIZIFLEX SEELS - the **only** keyboard cover that:

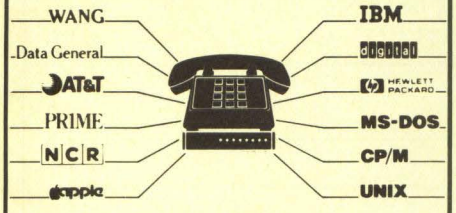
- **Remains securely in-place** during the operation of the keyboard and will not interfere with computer performance in any way.
- **Is designed to "form-fit"** to the exact contours of the keyboard to provide superior tactile sensitivity & feel for individual keys.
- **Consists of Ultraflex™ material, a transparent, flexible "film"** which allows all "markings" to be clearly visible.

VIZIFLEX SEELS are the **only** keyboard covers for your computer!

VIZIFLEX SEELS, INC.
16 E. Lafayette St., Hackensack, NJ 07601 (201) 487-8080

CIRCLE NO. 211 ON INQUIRY CARD

BLAST®



PC to MINI to MAINFRAME COMMUNICATIONS SOFTWARE

The low cost solution for linking hundreds of PCs with central systems!

• An Asynchronous Connectivity Tool • No Boards – Uses standard RS-232 ports • Provides distributed data management • Sends binary or text data or commands • Sends spreadsheets, programs, etc • 100% error-free data transfer • Links different operating systems • Uses phone lines, LANs packet nets • Connects multiple sites, unattended • Uses any low-cost modems, any speed

• **$250** / Micros • **$495-895** / Minis • **$2995** up / Mainframes

COMMUNICATIONS RESEARCH GROUP
5615 Corporate Blvd. Baton Rouge, LA 70808 (504) 923-0888
(800)-24-BLAST

CIRCLE NO. 212 ON INQUIRY CARD

Promote New Literature

at a LOW COST

If you've got catalogs or literature, distribute them at a low cost in the **MINI–MICRO MARKETPLACE.**

Call Carol Flanagan
(617) 964-3030

CIRCLE NO. 213 ON INQUIRY CARD

PC-AT BUS RACKMOUNT COMPUTER WITH BUILT-IN MONITOR FOR INDUSTRIAL AND LABORATORY APPLICATIONS

ST-1000 is a fully AT compatible computer with 10MHZ AT CPU plug-in Card with CMOS VLSI chips, and a passive backplane to provide serviceability and reliability.

The standard features are:

- 19" rack-mount or tabletop rugged light weight enclosure
- Built-in 9" amber high-res (720×348) monitor with graphics card
- 20MB shock mounted Hard disk, 1.2MB high density floppy drive
- 1MB RAM, Serial and Parallel ports
- Positive pressure cooling, replaceable air filter
- 200 watt power supply, 110/220V auto-switchable
- Designed to meet following environmental specifications: **Operating Temp**: 10 to 40 degrees C, **Humidity**: 10 to 90% non-condensing, **Vibration**: .01" double amplitude at 5-55HZ, 1.5G at 55-500HZ, **Shock**: 2G, at 10ms, operating; 20G, at 10ms, storage.
- Keylock ON/OFF switch for security, Keyboard rackmount shelf

Some of the optional features are: • 80386 enhancement • Color Monitor with CGA or EGA board • Sealed membrane Keyboard • Custom Configurations. For further details, contact **I.B.I. SYSTEMS, INC.**, 6842 NW 20 AVE, FT. LAUDERDALE, FL 33309, 305-978-9225, Telex: 529482 IBI SYSTEMS

CIRCLE NO. 214 ON INQUIRY CARD

Cartridge Tape Systems

Intelligent Stand Alone RS-232 or IEEE-488 Cartridge Tape System

Replacement for Tandberg, Columbia 300 B, C, & D and European MFG Tape Drives

- Stores 5.3 Mbytes or 20 Mbytes of Binary or ASC II Data
- Power Fail Standard-Power Fail "NO DATA LOSS" Optional
- Auto Answer Standard
- Intelligent Search & Retrieval
- IEEE-488 and/or RS-232-C with data rates up to 2,500 characters/sec
- Large input buffer allows unit to accept data non-stop

APPLICATIONS: Data Logging, Control System, Archiving, Program Loading & Storage, Back-up, and Telephone Switch Monitoring. Auto-polled Remote Data Storage.

1200 5.3 Mbyte

1600 20 Mbyte

WE SERVICE COLUMBIA TAPE DRIVES
300B - 300C - 300D
Return Authorization Number Required

ALGO INCORPORATED

9198-C Red Branch Rd, Columbia, MD 21045 TX333405 ALGO COL
1-800-252-ALGO in MD:
(301) 730-7442

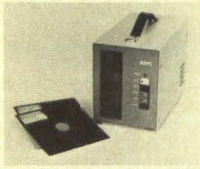
CIRCLE NO. 215 ON INQUIRY CARD

CONVENIENT FEATURES!

- 320 K memory, RAM and ROM, allocated between interchangeable cartridge and onboard memory.
- Direct-connect, Hayes function, onboard modem; 1200 baud, audo dial/auto answer, voice and data. Bell and CCITT compatible.
- Programmable in C and Forth. Powerful data entry application generator.
- Acoustic modem cups, 300 baud.
- 2 serial ports, RS232/422.
- Flexible, interchangeable battery system to satisfy any requirement.
- Compact, portable printers.
- Bar code reader.
- Weighs from 24 oz.
- (8½ x 3¾ x 2½) in.

CIRCLE NO. 216 ON INQUIRY CARD

IBM PC COMPATIBLE RS232 EASI-DISK 5¼" FLOPPY DATA STORAGE & TRANSFER SYSTEM



Information Transfer to/from Non IBM Compatible Systems to/from IBM PC; (Over RS232 Interface).

- Reads & Writes IBM PC DOS 5¼" Disks
- RS-232C I/O
- Rugged Portable Package
- ASCII or Full Binary Operation
- Baud Rates 110 to 19.2 K Baud
- Automatic Data Verification
- Price $995 in Singles - OEM Qtys. Less.

28 other systems with storage from 100K to 35 megabytes.

ADPI

ANALOG & DIGITAL PERIPHERALS, INC.
815 Diana Drive Troy, Ohio 45373
513/339-2241 TWX 810/450-2685

CIRCLE NO. 217 ON INQUIRY CARD

FOR SALE

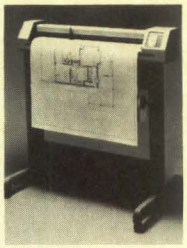
BRAND NEW ALTO 3068

2 meg ram, 65 meg disk drive
2, 10 port serial boards (20 ports)
Floppy drive, printer port, tape drive
7 units avail...$13,549.00
ALTOS BASE III also AVAILABLE
(617)-438-4700 (800)-343-4700

CIRCLE NO. 218 ON INQUIRY CARD

CREATE A BETTER IMAGE

Ioline Corporation introduces the **LP3700** large format line plotter: the high performance, professional quality instrument that maximizes value...with a orice that draws conclusions:
$4,195.



LP3700 Plotter

The LP3700 offers:

- **Versatility**
  - Lets you plot on any media at any size up through E (37½" × 81")
- **Precision**
  - .0025" Resolution & Repeatability
- **Buffering**
  - 14K to 512K
- **Speed**
  - Up to 10 ips (axial)
- **Reliability**
  - Rugged all metal frame
  - Endurance tested at over 60 million cycles
- **Value**
  - At $4,195, the LP3700 is in a class all by itself.

IOLINE CORPORATION

19417 36th AVENUE WEST, SUITE D1
LYNNWOOD, WA 98036
(206) 775-7861

CIRCLE NO. 219 ON INQUIRY CARD

ORDER FORM

Advertise in the **MINI-MICRO MARKETPLACE**
Please run my advertisement in the following issues: Jan Feb March April May June July Aug Sept Oct Nov Dec

EFFECTIVE JANUARY 1987

1x	3x	6x	12x	18x
$700	$630	$610	$595	$580

24x	48x
$555	$535

MATERIALS

1. Glossy photo with 50-75 words. We will typeset your ad at no charge.
2. Camera ready artwork.
3. Film negatives: right reading emulsion side down.

AD SIZE: 2¼" × 3½"

COMPANY

ADDRESS

CITY STATE ZIP

TELEPHONE

SIGNATURE

Space reservation by the first week of the month proceeding issue date.

☐ Materials enclosed ☐ Materials to come ☐ Please send information

Send to: Carol Flanagan, **MINI-MICRO SYSTEMS**
275 Washington St.
Newton, MA 02158

15% Agency commission to accredited agencies. Please specify agency.

THINK SMART.

Hundreds of leading edge organizations develop practical applications using Tek's Family of AI Workstations. The 4400 Series offers you excellent productivity for rapid prototyping, expert systems building and advanced software development.

This productivity results from Tek's commitment to practical research and development goals. Goals we can help you achieve with tools like Common Lisp and Prolog as well as object-oriented languages like Smalltalk. All optimized to run on Tek's low-cost, high-performance 32-bit workstations.

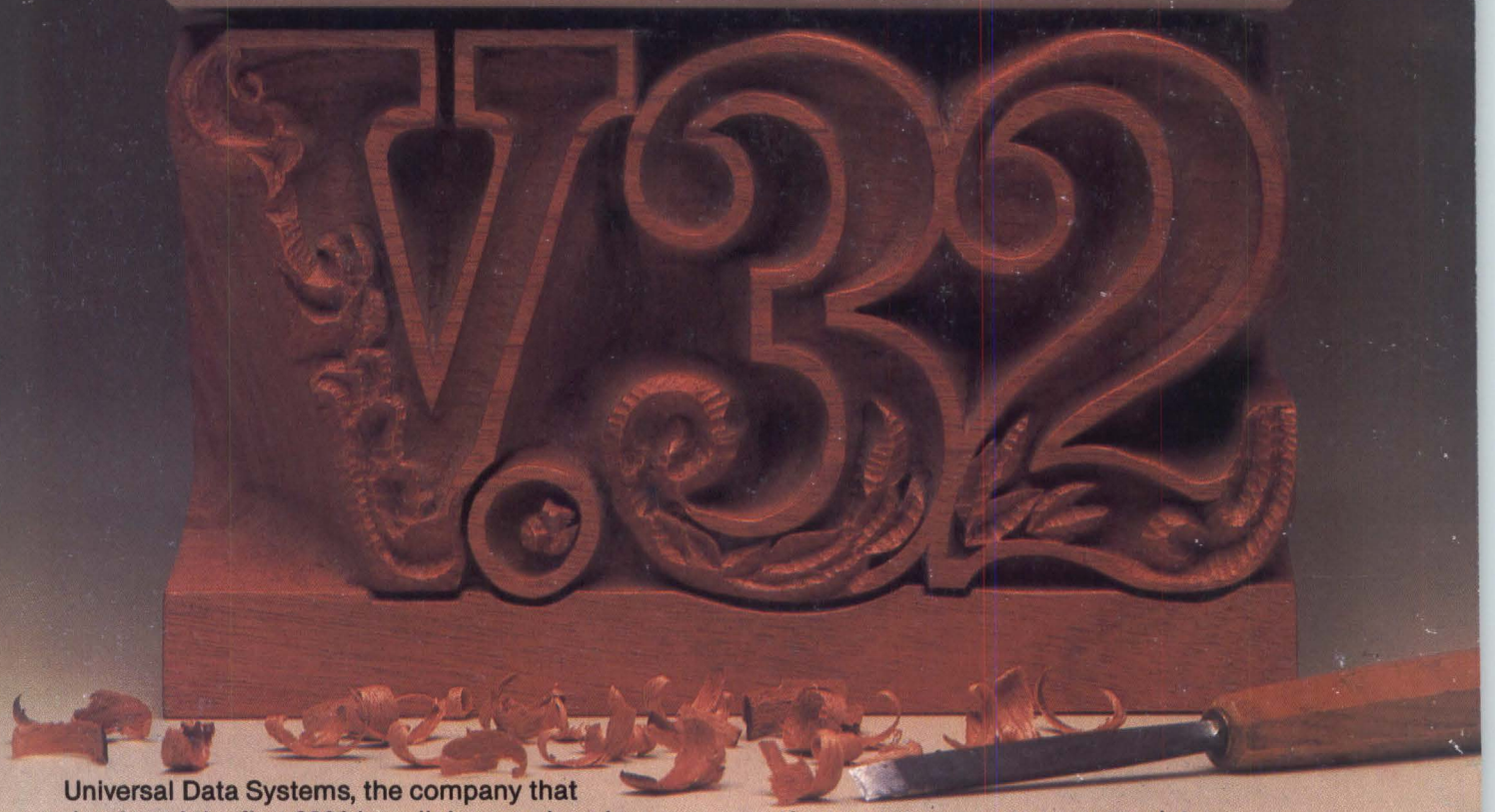
Add to this the outstanding training and support, and you know why more and more innovative developers are selecting Tek AI systems when they want to think smart.

For more information, circle the reader service card or write to: Tektronix, Inc., AI Marketing, P.O. Box 1000, M.S. 63-635, Wilsonville, OR 97070.

Tektronix®
COMMITTED TO EXCELLENCE

CIRCLE NO. 77 ON INQUIRY CARD

A special kind of craftsmanship



Universal Data Systems, the company that developed the first 9600 bps dial-up modem, has now applied its special brand of craftsmanship to the CCITT V.32 specification.

The result is a *full-duplex* 9600 bps device for the switched telephone network. When substandard line conditions are encountered, the device offers automatic fallback to 4800 bps, while maintaining the full-duplex communications capability.

As you expect from UDS, the device fully utilizes the latest in CMOS technology for low-noise performance and very low (less than 20W) power consumption. A new LCD control panel displays and configures modem set-up selections and displays outputs from the unit's comprehensive self-test regime. Auto-dial capability is also included.

If your system must accommodate periodic bursts of high-throughput, full-duplex communication, UDS craftsmanship and the V.32 standard provide a reliable, cost-effective solution. For complete technical details and quantity prices, contact Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 205/721-8000; Telex 752602 UDS HTV.

$2495.00
Quantity One

Universal Data Systems

MOTOROLA INC.
Information Systems Group

PREMIERING AT INTERFACE: BOOTH 1068!

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

CIRCLE NO. 78 ON INQUIRY CARD