

Mini-Micro Systems

A CAHNERS PUBLICATION

JULY 1983

COMPUTER GRAPHICS

465560UNIVA HLLR04/01
07002 11 2 F 3 JHI 5210
R HELLENTHAL ASSTPRO
UNIV. OF NOTRE DAME
BIOLOGY DEPT
NOTRE DAME IN 46556

Graphics workstations:
mid-range power

You've concluded that you need the performance and capacity that only an 8 inch Winchester drive can provide. Which one should you buy?

There are 109 different models available.

Of this 109, only 39 are 8 inch floppy form-factor compatible.

28 of these 109 perform an average seek in 30 milliseconds or less.

And of this 109, only 17 offer true SMD compatibility.

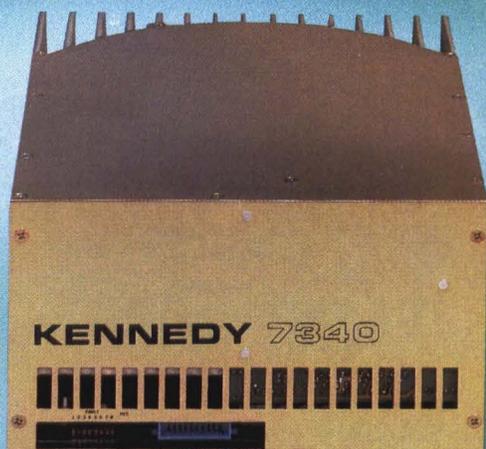
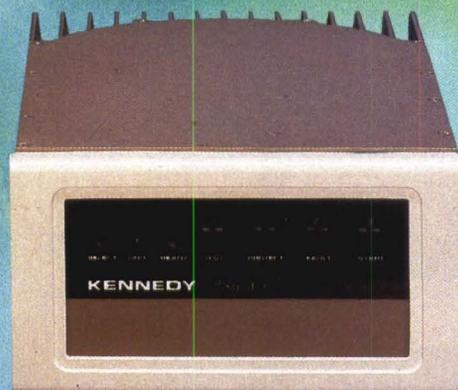
Puzzled?

Only one company provides a disk drive with all the features —

Kennedy and Model 7300

with the right size, the right interfaces and the right price.

Write or give us a call.



CIRCLE NO. 2 ON INQUIRY CARD

KENNEDY

An Allegheny International Company

1600 Shamrock Ave., Monrovia, CA. 91016

(213) 357-8831 TELEX 472-0116 KENNEDY

TWX 910-585-3249

SPECIFICATIONS:

- 41 and 82 MB Capacities
- Rotary Voice Coil 30 msec average seek
- SMD, ANSI or PICO BUS Interfaces
- 1209 KByte/sec. transfer rate
- Available 30-45 days ARO
- Q100: \$2,560/\$3,195

KENNEDY • QUALITY • COUNT ON IT

The new COMPAQ Portable Computer. IBM compatibility to go.

Simple, isn't it? The COMPAQ™ Portable Computer can do what the IBM® Personal Computer does. To go.

It runs all the popular programs written for the IBM. It works with the same printers and other peripherals. It even accepts the same optional expansion electronics that give it additional capabilities and functionality.

There's really only one big difference. The COMPAQ Computer is designed to travel.

Carry the COMPAQ Computer from office to office. Carry it home on the weekend. Or take it on business trips.

If you're a consultant, take it to your client's office.

If you use a portable typewriter, you can use the COMPAQ Computer as a portable word processor instead.

If your company already uses the IBM Personal Computer, add the COMPAQ

you'd probably need to buy an additional display screen because the built-in screen is too small for certain tasks, like word processing. The COMPAQ Computer's display screen is nine inches diagonally, big enough for any job, and it shows a full 80 characters across. And the built-in display offers high-resolution graphics and text characters on the same screen.

The bottom line is this. The COMPAQ Computer is the first uncompromising portable computer. It delivers all the advantages of portability

In the standard configuration, the COMPAQ Computer has three open slots for functional expansion electronics as your needs and applications grow. It accepts standard network and communications interfaces including ETHERNET™ and OMNINET™.

If you're considering a personal computer, there's a new question you need to ask yourself. Why buy a com-

puter that isn't portable?

For more information on the COMPAQ Portable Computer and the location of the Authorized Dealer nearest you, write us. COMPAQ Computer Corporation, 20333 FM149, Houston, Texas 77070. Or call 1-800-231-9966.

without trading off any computing power capability.

And what do those advantages cost?

Nothing.

The COMPAQ Portable sells for hundreds less than a comparably equipped IBM or APPLE® III. Standard features include 128K bytes of internal memory and a 320K-byte disk drive, both of which are extra-cost options on the IBM. Memory and additional disk drive upgrades are available options to double those capacities.

Portable as a mobile unit that can use the same programs, the same data disks, and even the same user manuals.

There are more programs available for the COMPAQ Computer than for any other portable. More, in fact, than for most non-portables. You can buy them in hundreds of computer stores nationwide, and they run as is, right off the shelf.

With most other portables



COMPAQ™

PORTABLE COMPUTER

The most computer you can carry

Mini-Micro Systems

MINI-MICRO WORLD

News

Competition heats up for commercial Ada compilers (p. 19) . . . Gould S.E.L. launches new division to market Convergent-based systems (p. 20) . . . New graphic advances to emerge at upcoming shows (p. 22) . . . Microsoft's retail XENIX will test commercial thirst for UNIX (p. 26) . . . Calcomp, Mannesman-Tally enter low-end plotter market (p. 28) . . . Maxtor ST-506 enhancement may force "interface off" in market for high-capacity, 5¼-in. drives (p. 34) . . . Naked Mini follows shifting market with 186-based microcomputer (p. 39) . . . Precision Visuals' mainframe graphics software migrates to 68000-based microcomputer (p. 46) . . . NEC broadens printer line with dot-matrix models for OEMs (p. 50) . . . Matsushita finds way to erase optical disks, Burroughs erases program (p. 54) . . . Intel, NCR collaborate on 1M-bps LAN (p. 59)

Corporate and Financial

DEC PC alumnus beefs up Franklin for possible IBM-compatible portable (p. 65) . . . Guest Forum: Electronic technical publishing—doing well by doing good (p. 70) . . . Corporate and financial briefs (p. 66)

International

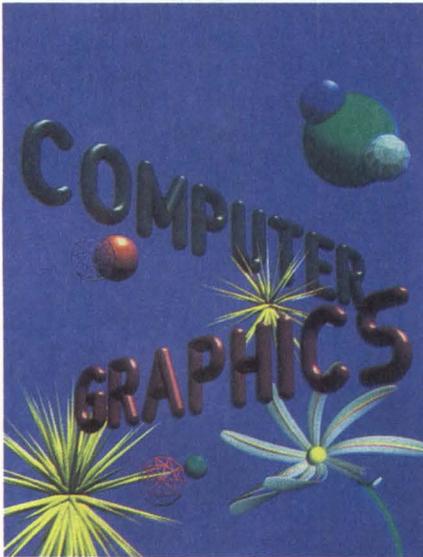
Europeans will join forces in fifth-generation research program (p. 81) . . . ISO's workstation ergonomics subcommittee progresses (p. 82) . . . British seek U.S. users for VAX/VMS AI software (p. 86) . . . Centronics-compatible fiber-optic modem supports parallel-to-serial conversion (p. 88)

INTERPRETER

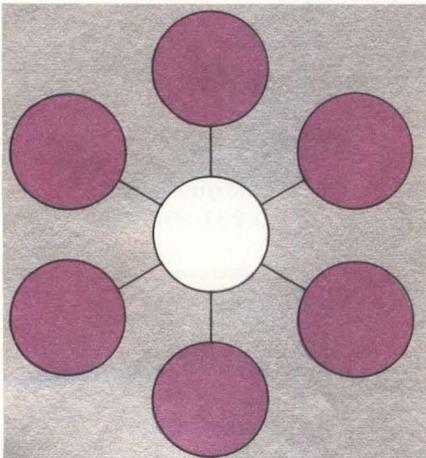
- 101 Committees, vendors chase elusive networking standards
- 115 Advanced CMOS technology overtakes established MOS applications
- 125 Pioneering university/industry venture explores VLSI frontiers

SYSTEMS IN MANUFACTURING

- 135 Value-added system integration plays key role in driving robot market
- 147 Control Automation robot works with any controller or programming language
- 151 Martin Marietta Data Systems expands manufacturing software line . . . Uniq introduces manufacturing system for DEC computers . . . HP adds quality-management software to MPN family



Cover produced by Olin Lathrop, flower by Al Barr, courtesy of Raster Technology. Art direction and design by Vicki Blake.



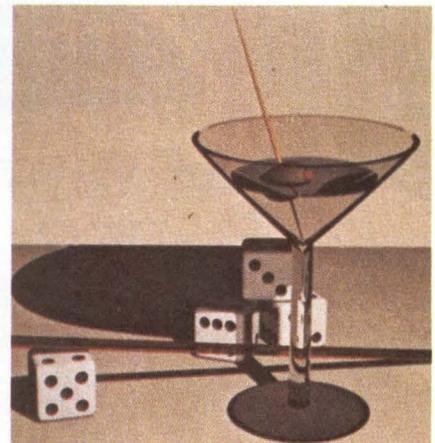
p. 125 Pooling boosts VLSI research



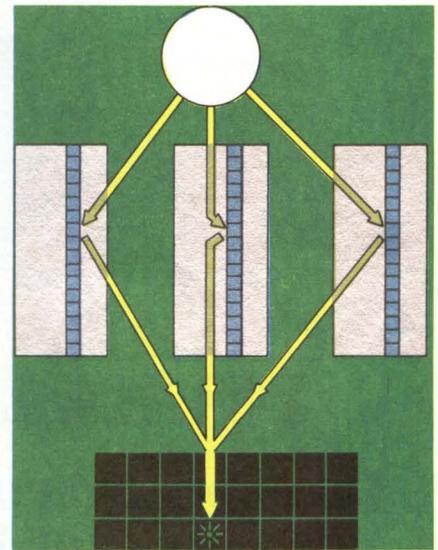
p. 147 Robot assembles precisely

FEATURES

- 159 **Feature Highlights**
- 165 **Product profile: graphics workstations . . .** this year's significant development involves mid-range units.
- 189 **Graphics compatibility . . .** software compatibility is a prerequisite for graphics-workstation success.
- 197 **Light valve brightens large-screen displays . . .** GE's single-gun projector generates 25-ft.-wide color images.
- 207 **Desk-top design station features multimode graphics . . .** micro provides efficient pixel manipulation.
- 214 **Terminal measures 3D objects . . .** Matra's Traster provides 3D measurements using stereo photographs and polarized light.
- 219 **Half-height minifloppy stores 3.3M bytes . . .** "SuperMinifloppy" offers a 500K-bit-per-sec. transfer rate.
- 231 **Law: the ultimate high-tech battleground . . .** courts face many lawsuits as companies try to preserve their competitive edge.
- 239 **Cellular radio gives rise to portable data communications . . .** new radio technologies take on-line computers on the road.



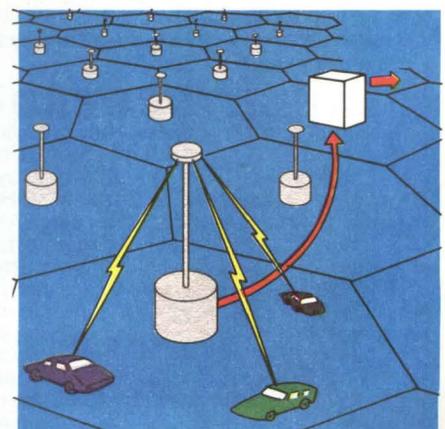
p. 189 Software must be compatible



p. 207 . . . Desk-top has multimode graphics

DEPARTMENTS

- | | |
|-------------------|----------------------------|
| 4 Editorial Staff | 251 New Products |
| 7 Breakpoints | 285 Mini-Micro Marketplace |
| 72 Box Score | 287 Classified Advertising |
| 246 Calendar | 288 Career Opportunities |
| | 292 Index to Advertisers |



p. 239 Taking computers on the road

MINI-MICRO SYSTEMS (ISSN 0364-9342) is published monthly (with additional issues in spring and fall) by Cahners Publishing Company, Division of Reed Holdings, Inc., 221 Columbus Avenue, Boston, MA 02116. Norman L. Cahners, Chairman; Saul Goldweitz, President; Ronald G. Segel, Financial Vice President and Treasurer. MINI-MICRO SYSTEMS is published by the Cahners Magazine Division: J. A. Sheehan, President; William Platt, Executive Vice President; H. Victor Drumm, Group 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 Europe based corporate and technical management, systems engineers, and other personnel who meet qualification procedures. Available to others at the rate of \$45.00 per year in the U.S.; \$50.00 in Canada and Mexico; \$65.00 surface mail in all other countries; \$100 foreign air mail (14 issues). Single issues \$4.00 in the U.S.; \$5.00 in Canada and Mexico; \$6.00 in all other countries.

©1983 by Cahners Publishing Company, Division of Reed Holdings, Inc. All rights reserved.



OEM DESIGNERS SAVE TIME & MONEY IN CONTROL PANELS, SERVICE & SET-UP APPLICATIONS

Termiflex hand-held control display terminals have been field proven in hundreds of standard and custom OEM applications. You don't have to do-it-yourself. Take advantage of our volume production prices. Don't reinvent the wheel.

Termiflex Corporation
18 Airport Rd., Nashua, N.H. 03603
Telephone: (603) 889-3883 TWX: 710-228-7545

Termiflex

CIRCLE NO. 5 ON INQUIRY CARD

OUR GUTS ... YOUR GLORY

INTRODUCING CUSTOM COMPUTERS FOR OEMS FROM DAVIDGE

We think you should get the glory. After all, who finds the customers, writes the applications software, answers all the questions and provides cheerful after-sales service? YOU do! So, why should your customers see anyone else's name on the enclosure?

YOU BE THE HERO We're not shy, but we'd rather spend time manufacturing our powerful little systems to your specifications. And we have plenty to be proud about. Our DS-4/6 line offers you systems built around the Davidge industry proven 4MHz or 6MHz Z-80 single board computer. Get 64K RAM, boot ROM, a hard disk port, parallel printer port, the disk controller, and up to 4 RS-232 ports (One is modem configured). Select single or double density 8" or 5 1/4" floppy drives, and hard disk drives, a CP/M* operating system, and now get ready for the fun part. You can have all of our system enclosures in whatever color you choose, silkscreened with your company name and logo, and we even custom print the system manuals to match.

WHY DO WE DO IT? Simple. Our glory is building them. That's what we do best. And once you see our prices you'll do what you do best. Sell them.

*Z80 is a registered trademark of Zilog. *CP/M is a registered trademark of Digital Research.

Davidge

Call Davidge today, (415) 964-9497
1951 Colony St. Suite X, Mountain View, CA 94043

CIRCLE NO. 6 ON INQUIRY CARD

STAFF

Vice President/Publisher
S. Henry Sacks

Managing Editor
George N. Bond III

Editorial Departments
Features

Executive editor: **Alan R. Kaplan**
Senior editor: **Patrick Kenealy**
Associate editor: **Roy R. Friedman**
Associate editor: **David R. Simpson**
New products editor: **Steven F. Frann**

Contributing editors:
Walter A. Levy, data communications;
Efrem Mallach, computer architecture;
John Murphy, office automation;
Steven Roberts, artificial intelligence;
Malcolm L. Stiefel, product profiles

Interpreter/Systems in Manufacturing

Senior editor: **Dwight B. Davis**
Associate editors:
Frank Catalano, Sarah Glazer

Mini-Micro World

Boston: **Lori Valigra**, senior editor, news; **David Bright**, reporter (617-536-7780)
San Jose: **Robert A. Sehr**, associate editor (408-243-8838)
Los Angeles: **Edward S. Foster**, associate editor (213-826-5818)
New York: **Geoff Lewis**, associate editor (212-949-4446)
Washington, D.C.: **Stephen J. Shaw**, contributing editor (202-320-2273)
London: **Keith Jones**, European editor (011-44-1-661-3040)

Editorial Production

Associate editor: **Frances T. Granville**
Production editor: **Mary Anne Weeks**
Copy editor: **Susan A. Hughes**
Word processing: **Elizabeth Kress**

Art Staff

Art director: **Vicki Blake**
Assistant art director: **Mark Fallon**
Artist: **James Wiley**

Editorial Services

Helen M. Benedict, Adrienne DeLeonardo, Laura Downey, Jeanne Howat, Frances C. Michalski, Robin Sheehan

Production Staff

Supervisor: **William Tomasselli**
Production services: **Noel Boulanger**
Composition: **Diane Malone**

Executive VP/Group Publisher
H. Victor Drumm

VP/Group Editorial Director
Roy Forsberg

Director of Graphics
Lee Addington

Vice President, Production
Wayne Hulitzky

Vice President, Research
Ira Siegel

Assistant to the Publisher
Linda L. Lovett

Group Circulation Manager
Sherri Gronli
(303) 388-4511

Marketing/Promotion Staff
Richard B. Dalrymple, Mktg. Director
Susan Rapaport, Promotion Director
Elizabeth Gotoff, Promotion Coordinator
Wendy Whittemore, Promotion Coordinator

Editorial Offices

Boston: 221 Columbus Ave., Boston, MA 02116.
Los Angeles: 12233 W. Olympic Blvd., Los Angeles, CA 90064. **San Jose:** 3031 Tisch Way, San Jose, CA 95128. **New York:** 205 E. 42nd St., New York, N.Y. 10017. **London:** IPC Business Press, Quadrant House, The Quadrant, Sutton Surrey, SM2 5AS, England.

Reprints of Mini-Micro Systems articles are available on a custom printing basis at reasonable prices in quantities of 500 or more. For an exact quote, contact Art Lehmann, Cahners Reprint Service, 5 S. Wabash, Chicago, IL 60603. Phone (312) 372-6880.

We just gave the computer industry something to reach for.

A new standard... performance/footprint.

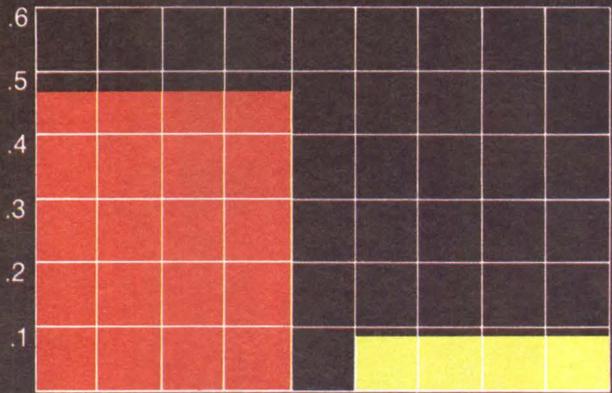
Introducing the Gould CONCEPT 32/67. Performance in a size as accommodating as its price.

From the 32-bit performance leader comes yet another minicomputer product line other suppliers can only hope to duplicate. The 2-MIPS-class, cost and space-saving CONCEPT 32/67.

We scrimped on size, but that's all. The 32/67 gives you top computational power in 1/5 to 1/3 the floor space of the competition. And it's packed with features. Performance up to 2.6 MIPS. Largest cache in a mini...32K byte two-way set associative with separate 16K banks for data and instructions. And, 16M byte task addressing in a base register mode. All at a price that matches its size.



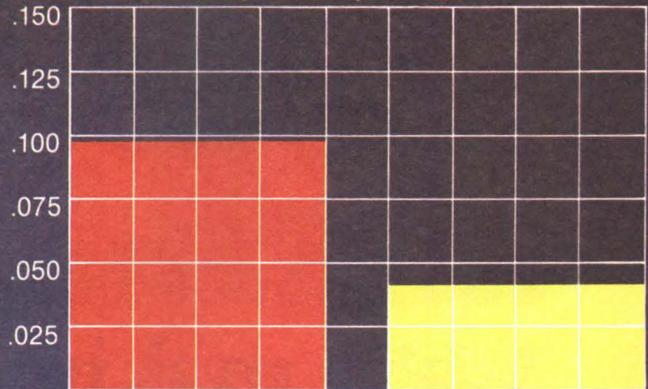
MIPS/SQ. FT.*



CONCEPT 32/6780

VAX 11/782

MIPS/\$10,000* (Equivalent System Price)



CONCEPT 32/6780

VAX 11/782

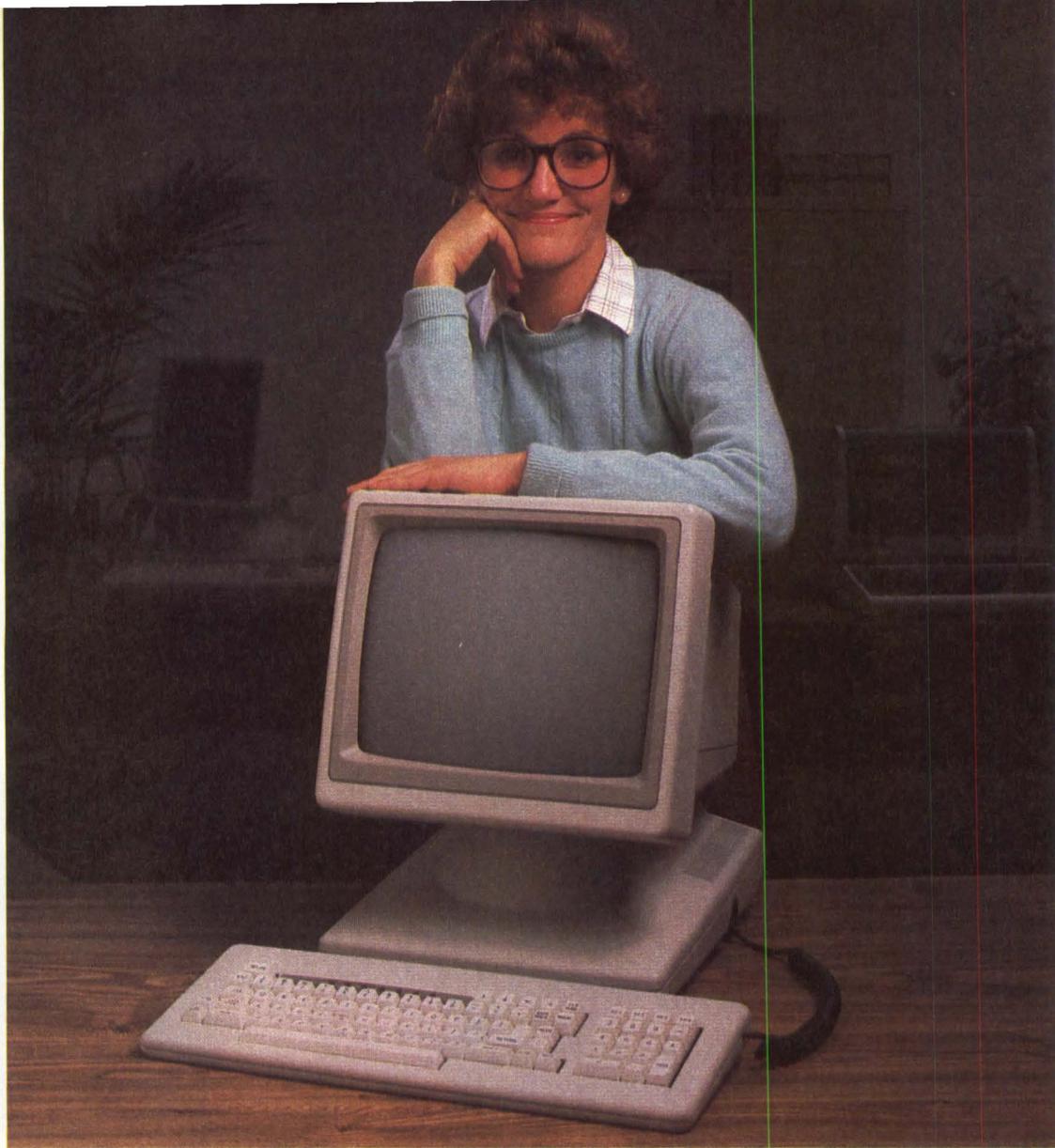
* All chart data from published competitive information.

For more information about the new standard of minis, call or write: **Gould Inc., S.E.L. Computer Systems Division**, 6901 West Sunrise Boulevard, Fort Lauderdale, Florida 33313. 1-800-327-9716.

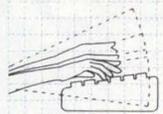
 **GOULD**
Electronics

VAX 11/782

CIRCLE NO. 7 ON INQUIRY CARD



We're making our terminals even more kind to mankind.



4010/4014 emulation. And more.

So you don't have to buy DEC after DEC to get all the features you want. You'll find them all in one CIT-101e.

How's that for kindness?

To learn more, just write or call.

We've done it again.

We've one-upped DEC® with a fully ergonomic version of our CIT-101.

It tilts. It swivels. It has a large 14-inch screen. The detachable keyboard is pure ergonomics right down to its matted key caps. It's the CIT-101e.

Actually, it makes us more than two-dozen features up on the DEC VT100. Because our CIT-101e has all the extras that DEC asks you buy extra terminals to get.

Features like Advanced Video. A bi-directional printer port. Tutorial soft setup mode. A graphics expansion card cage for full Tektronix®

CIE TERMINALS A new company of
C. ITOH ELECTRONICS, INC.

New headquarters and Southern California sales office: 2505 McCabe Way, Irvine, CA 92714-6297. (714) 660-1421.
Or call toll-free, 1-800-854-3322. Other regional sales offices: San Jose, CA (408) 247-2393; Cherry Hill, NJ (609) 983-5075;
Chicago, IL (312) 992-2346; Houston, TX (713) 777-1640; Atlanta, GA (404) 257-1814; Boston, MA (617) 935-5188;
Ontario, Canada (416) 848-1050; Denmark (02) 921100.

® DEC is a Registered Trademark of Digital Equipment Corporation. Tektronix is a Registered Trademark of Tektronix Corporation.

© CIE TERMINALS, INC. 1983

Breakpoints

TANDON, DEC, MEMOREX SAID TO BACK ½-IN. TAPE

Spurred by the efforts of the Quarter-Inch Cartridge standards groups—QIC-2 and QIC-24—an even weightier group may be mapping a strategy to manufacture a standard ½-in. tape cartridge. Sources say Tandon Corp., Digital Equipment Corp. and Memorex Corp. representatives have joined in an effort to reach a compromise before large volumes are manufactured. Tandon expects to begin production of its ½-in. tape drive (announced at this year's NCC) this summer at its MicroTech subsidiary in Campbell, Calif. DEC is reportedly working on a similar ½-in. tape drive with with a 5¼-in. form factor under the code name "Maya" in Springfield, Mass. With DEC and Memorex acting as second sources for the Tandon cartridge, a major roadblock to the drive's viability has been lifted.

PIXEL FOUNDER STARTS OVER WITH CADMUS

Bill Southworth, who left the Pixel division of financially troubled Instrumentation Laboratories after it became a spin-off in March, has launched Cadmus Computers. Like Pixel, Cadmus is introducing a Motorola MC68000/UNIX system. The company has set up shop in a Lowell, Mass., mill dating from 1831 and has recruited former Digital Equipment Corp. product manager Bill Kiesewetter as marketing and sales vice president. Cadmus hoped to close a \$3.5-million venture-capital offering led by Citibank last month. It is beginning to roll out a product line that will range from a \$9500 graphics workstation to a \$28,900 graphics cluster with four 1024 × 800 CRT workstations, dual 65M-byte, 5¼-in. Winchester disk drives and a 16M-byte streaming-tape drive. In addition to the graphics products, the company will offer single- and multi-user general-purpose UNIX boxes aimed at commercial OEMs. The Cadmus hardware, which will be manufactured in Lowell, is based on designs developed in Germany by consulting firm PCS, which has sold 140 of its own UNIX systems and which has consulted for Siemens Corp., Nixdorf Computer Corp. and Tandem Computers Inc. Kiesewetter says Cadmus is putting its marketing emphasis behind a distributed UNIX approach that will use Ethernet to cluster 50 or more nodes. One possible fly in the ointment is a threatened lawsuit from Pixel president Tom Rosse, who reportedly sees Cadmus as a violation of Southworth's employment contract at Instrumentation Laboratories.

SECOND SOURCE FOR IBM'S 4-IN. MICROFLOPPY SAID TO BE IMMINENT

The long wait for a second source for IBM Corp.'s 4-in. drive may be over. Atlas Ltd., a Hong Kong electronics manufacturer, reportedly will license the controversial drive and manufacture it through its U.S. floppy disk drive head subsidiary, Data Magnetics Co. Data Magnetics has reportedly been seeking financial assistance to ramp up production. IBM has made no public announcement about manufacturing plans since the drive was announced last spring, but rumors persist that the drive will be built into the company's forthcoming "Peanut" system.

PC-DOS-EMULATING CONCURRENT CP/M-86 DUE FROM DIGITAL RESEARCH

Digital Research Inc., which recently announced PC-DOS support with its high-level languages, is expected to step up its marketing thrust further by announcing a PC-DOS-emulating Concurrent CP/M-86 by the end of this month. Planned for release in December is a fully ANSI-77-compatible version of FORTRAN. DRI also says its Personal BASIC will soon incorporate graphics. DRI has been collaborating with DEC on a smaller version of the VMS operating system; results of that project may be seen late this year. In addition, DRI plans to attack what it considers to be the virgin territory of the home computer ROM-cartridge software market.

Breakpoints

ZILOG FILES COMPLAINT AGAINST NEC FOR IMPORTING Z80 LOOK-ALIKE

Zilog Inc. has filed a complaint with the International Trade Commission in Washington against Nippon Electric Corp. of Japan. The complaint asks that NEC be enjoined from importing a chip that Zilog claims is a Z80 look-alike. The action follows a suit for patent infringement filed against NEC this year by Zilog in U.S. District Court in San Francisco. The ITC has the power to bar import of the chip, regardless of the outcome of the lawsuit.

NIPPON TELEPHONE & TELEGRAPH EXPANDING PRINTER TECHNOLOGY

Nippon Telephone & Telegraph, the Ma Bell of Japan, is said to have developed a prototype of a color ink-jet printer based on a technology for controlling the ink spray with a cathode ray-type system. Reports indicate that the prototype can print as many as 10,000 dots per sec. and 180 x 180 dots per in. NT&T's computer division now produces equipment for internal use, but the organization may be interested in licensing its ink-jet technology to another Japanese concern.

COLUMBIA ADDS HARD DISK TO PC-COMPATIBLE PORTABLE

Columbia Data Products Inc. plans to add a 5M-byte hard disk drive to its IBM PC-compatible VP portable, probably in time for unveiling at this fall's Comdex show. The drive will fit into a space typically occupied by floppy disk storage slots. Columbia marketing vice president Jack White says the company may also switch from an aluminum to a plastic shell to lighten the machine. With two floppy disk drives, the VP weighs 32 lbs., 4 lbs. more than the COMPAQ. Columbia, Columbia, Md., projects 1983 sales of \$50 million and is expected to go public in 1984.

STAR MICRONICS TARGETS DAISY-WHEEL PRINTER MARKET

Star Micronics Inc. is said to be developing products for the low-end daisy-wheel market after success with its first product, the Gemenii 10 dot-matrix printer. The company is hoping to fill the price/performance windows in the daisy-wheel market for 20- to 30-character-per-sec. models priced at less than \$600 and 50- to 60-cps models priced at less than \$800. Star Micronics is the U.S. marketing arm of Star Manufacturing Group, Japan. It entered the printer market less than a year ago with the Gemenii 10 and ships nearly 15,000 units a month.

START-UP OFFERS DISK CACHE MEMORY BOARD

Origin Inc., Los Angeles, has begun delivering sample units of its first memory product, the OR-88C disk cache memory board for Intel MDS Series 2, Series 3 and 800 Development Stations. The disk cache board works with the development station's floppy disk controller to provide 480K bytes of cache memory, according to Origin tests. One potential customer for the product is Intel.

BYTEL ENHANCES PROGRAM GENERATORS

Bytel Corp.'s new release of its COGEN COBOL program generator is scheduled for third-quarter availability. The program generator features a data dictionary, the ability to alter permanently the way the system generates source code, data validation and generation of batch control programs. The package from the Berkeley, Calif., firm runs under PC-DOS, VAX/VMS and other systems and uses menus and prompts. Its five skeletal source-code modules—file maintenance, inquiry, report writing, initialization and batch processing—are open to modification. The entry-validation system allows as many as nine conditional statements. The batch programs read a master file and as many as 99 secondary files. COGEN 6.0 prices range from \$950 to \$7500.

NOBODY DELIVERS DEC CONTROLLERS LIKE PLESSEY.



Because nobody has the range of DEC-compatible controllers and mass storage subsystems that Plessey has.

Controllers, floppies, cartridges, disc packs, Winchester and magnetic tape, including a proven 1/4" streamer. All the storage you need for your LSI-11, PDP-11 or VAX computers. (Complete subsystems with savings of up to 50%, too).

Just check the chart, then check us out at (800) 992-8744.

We can also help your budgets and your systems with communications multiplexers. And with a huge selection of memories, typically 30% less expensive than the DEC equivalents. 32 kbytes to 1 Mbyte. ECC, parity and non-parity. MOS and non-volatile core. They're fully DEC-compatible, but run up to 30% faster, occupy less space and come with an extensive 1-year warranty.

And we'll back you up with our own worldwide network of factory-trained specialists. They can service products from a variety of vendors and answer all your questions about configuration, operation or software. You get the responsiveness of an in-house technician at a

fraction of the cost.

Nobody else even comes close.

For the rest of the story, contact: Plessey Peripheral Systems, Computer Products Division, 1674 McGaw Avenue, Irvine, CA 92714. Telephone (800) 992-8744 or (714) 540-9945.

CONTROLLER	EMULATION	COMPATIBLE DRIVES	FORMATTED CAPACITY
Q-BUS Floppy: PM-XCV21 PM-XCV31 Disc Cartridge/ SMD/MMD: PM-DCV06A PM-DCV02A	RX02 RX03 RK06 RM02 RM05	Shugart/NEC/Qume. Single or double-density Shugart/NEC/Qume. Double-sided/double-density CDC Phoenix CMD Drive or Ampex DFR9x Series (32, 64, or 96MB ea.) 80MB CDC 9762 SMD/80 CDC 9730-80 MMD/ 160MB CDC 9730-160 MMD 300MB CDC 9766 SMD/600MB CDC 9775 FMD/ (also any CDC-compatible SMD interface)	512KB per drive (x2) 1024KB per drive (x2) Min: 28MB (2 logical RK06) Max: 8 logical RK06; up to 2 physical drives Min: 67MB (1 logical RM02) Max: 2 physical drives/4 logical RM02 (268MB total) Min: 256MB (1 logical RM05) Max: 2 physical drives/4 logical RM05 (1024MB total)
Fixed (Winchester): PM-FCV21	RL01/02	Industry-standard, Seagate technology interfaced 5.25" Winchester drives with buffered seek	Min: 104MB (1 RL02 or 2 RL01) Max: 41.5MB (4 physical drives/4 logical RL02) or any combination of RL01/02 up to 4 logical drives
Tape: PM-CCV11A	N/A	Cipher 'Quarterback'	20MB per 450-ft. cartridge
UNIBUS Floppy: PM-XC21 PM-XC31 Disc Cartridge: PM-DC06A SMD (Removable)/ MMD (Fixed): PM-DC02A	RX02 RX03 RK06 RM02 RM05	Shugart/NEC/Qume. Single or double density Shugart/NEC/Qume. Double-sided/double-density CDC Phoenix CMD Drive or Ampex DFR932 Series (32, 64, or 96MB ea.) 80MB CDC 9762 SMD/80MB CDC 9730-80 MMD/ 160MB CDC 9730-160MMD 300MB CDC 9766 SMD/600MB CDC 9775 FMD/ (also any CDC-compatible SMD interface)	512KB per drive (x2) 1024KB per drive (x2) Min: 28MB (2 logical RK06) Max: 8 logical RK06 with up to 4 physical drives Min: 67MB (1 logical RM02) Max: 268MB (4 logical RM02) Min: 256MB (1 logical RM05) Max: 1024MB (4 logical RM05)
Tape: PM-TC11B	TM11	Kennedy or Perlec 1/2-inch, 9-track, reel-to-reel; 12.5 to 125ips; 800/1600bpi	4 Tape Transports per controller
VAX SMD (Removable) MMD (Fixed): PM-DCG03	RM03/ RM05/ RM80	80MB CDC 9762 SMD/160MB CDC 9730-160 MMD (2 logical RM03 or 1 logical RM80)/300MB CDC 9766 SMD (1 logical RM05)/ 474MB Fujitsu M2351 (3 logical RM80)/600MB CDC 9775 FMD (2 logical RM05)/(also any CDC-compatible, SMD interface)	Min: 67MB (1 logical RM03) Max: 2048MB (8 logical RM05) Supports up to 4 physical or 8 logical drives

 **PLESSEY. ASK ANYBODY.**

©Plessey Peripheral Systems 1983 DEC, LSI-11, PDP-11, VAX trademarks Digital Equipment Corp.

MINI-MICRO SYSTEMS/July 1983

CIRCLE NO. 9 ON INQUIRY CARD

9

History will record as a profound irony
that the most powerful word processing package
ever created for the IBM® Personal Computer
wasn't created by IBM.

LEADING EDGE.®

Leading Edge Products Inc., Fortune 1300 Division, 21 Highland Circle, Needham Heights, Mass. 02194 (800) 343-3436 (617) 449-6762
Headquarters and Retail Division, 225 Turnpike Street, Canton, Mass. 02021 (800) 343-6833 (617) 828-8150

*IBM is a registered trademark of International Business Machines Corporation.

CIRCLE NO. 10 ON INQUIRY CARD

Breakpoints

THE NEXT WAVE FROM TAIWAN: IBM PC-COMPATIBLES

Most Taiwan manufacturers are caught in a vise with the conflicting pressures of being behind in development and not being able to design their own computer systems while being accused of copying others. They are now looking at the IBM PC-compatible market as their next move after creating controversy in the Apple-compatible market. Apple Computer Inc. is suing about 11 companies in Taiwan, and about 100 Taiwanese companies are said to be making rip-offs of Apple products. But the Taiwan government is getting strict—closing down the imitators and not allowing them to export their products. A government source says, however, that it is difficult to control domestic Apple rip-offs. Those poised to enter the IBM PC-compatible world include large Taiwan concerns such as Taiwan Automation and MultiTech International. The IBM PC and Digital Equipment Corp. personal computer were announced in Taiwan in early June, and encouraged such development. Taiwan Automation, part of the large Mitac Group of companies, plans to have its IBM-compatible ready for introduction next month. The company believes the manufacturer that can control costs controls the IBM PC-compatible market. One of Taiwan's strengths has been low-cost manufacture because of an abbreviated product-design phase. The initial IBM PC-compatible release, including an 8088 chip, CP/M-86 or MS-DOS, 256K bytes of basic memory, a 1000- × 1000-dot, high-resolution display, a control board and both Winchester and floppy disk drives, is due next month. Forthcoming by year-end is a portable version using 5¼-in. floppy disk drives. The products will be key to Taiwan Automation's gaining market share in the U.S. Although about 60 percent of equipment sales were to Taiwan's domestic market this year, Taiwan Automation and Mitac's U.S. marketing branch are planning a major push into the U.S. next year. Included is a Taiwan Automation-designed microcomputer that will run Apple IIe software and aimed at the game and educational markets. If the company is successful, the Apple machine could sell as many as 150,000 units per year. Another company introducing an IBM-compatible is MultiTech International, a key manufacturer of Chinese-character microcomputers. The company is still in hot water with Apple over its MicroProfessor microcomputer. MultiTech is an IBM PC distributor in Taipei, but is planning a compatible version by year-end. Also on MultiTech's agenda is a plan to obtain a price difference of only \$100 between its Chinese and English versions of certain models of its personal computers. Historically, a Chinese version sells for three times more than its English counterpart.

Micro in-circuit emulator company Microtek Labs Inc. plans to enter the systems market next year with a model whose specifications are still being defined. One thing is clear, however: Microtek will avoid MS-DOS compatibility because of market competition. Instead, Microtek will probably employ CP/M-86 and aim the computer at vertical applications, but also use 8088 and 8087 co-processors.

TECHFILES: A quick look at industry developments

Printer files: Mannesmann Tally Corp. was scheduled late last month to introduce a low-end dot-matrix printer, the Spirit. Retail price for the printer will be less than \$400. Targeted at the personal-computer market, Spirit prints 80 cps and uses a print head with square hammers for better horizontal and vertical line definition. An undisclosed offshore supplier manufactures the printer.... **C. Itoh Electronics** will soon introduce a portable thermal transfer printer to be used with portable computers. The product is said to have been demonstrated in Japan and will likely be brought to market before the end of this summer.... **Data-Type Inc.**, a producer of intelligent terminals, is introducing a color dot-matrix printer at Siggraph. The company's first printer product is said to be based on the

Breakpoints

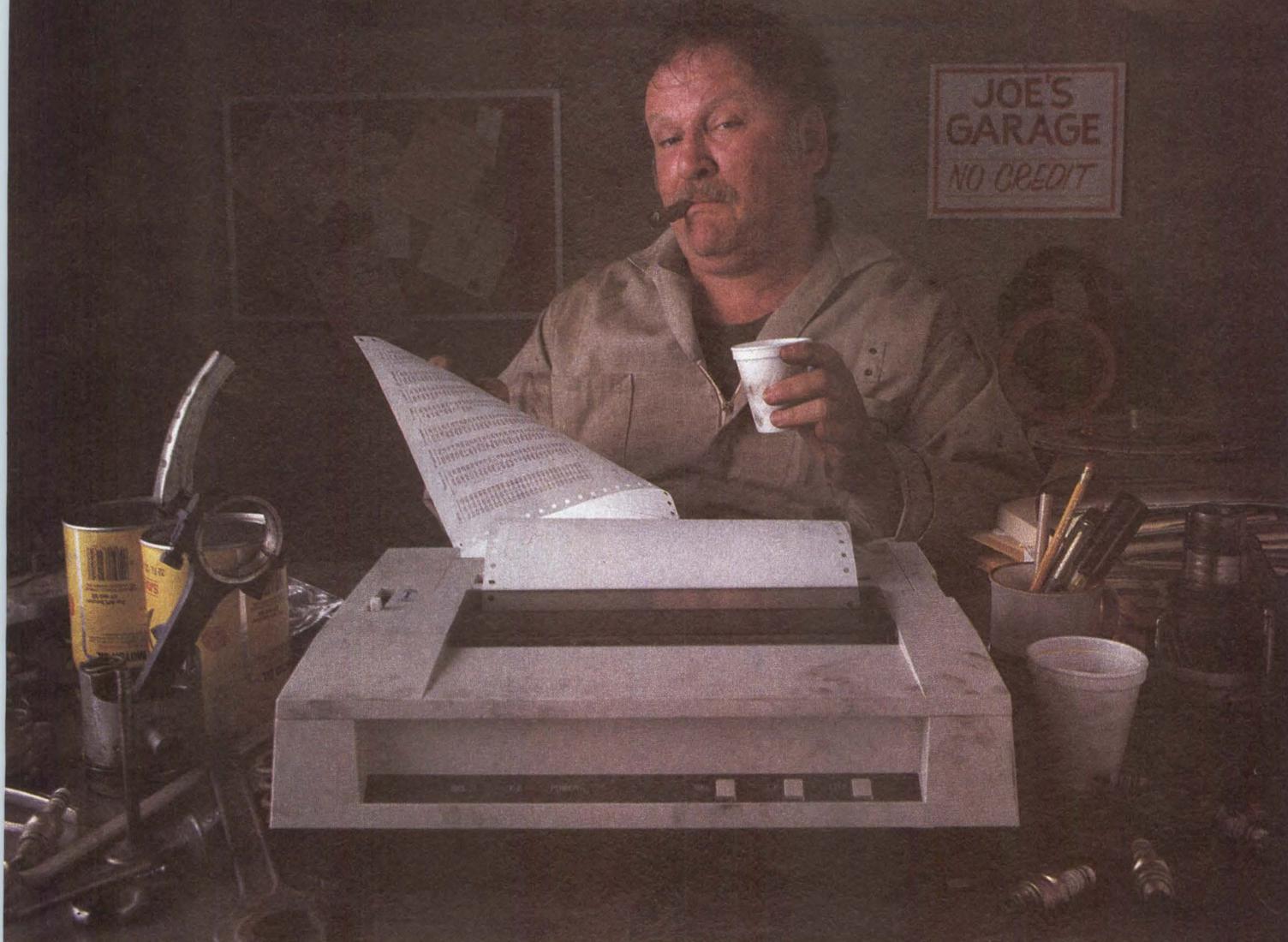
Infoscribe 1200 and to be aimed at the Tektronix-compatible market.... **Santec Corp.**, Amherst, N.H., has announced that it will receive a \$2-million investment from Nanjing Telecommunications Works, a government-owned manufacturing organization in the People's Republic of China. A joint venture between Santec and Nanjing is also planned to develop and produce printers. More than two-thirds of Santec's estimated 1982 sales of \$3.5 million were to overseas customers, partially because of the company's sophisticated dot-matrix technology, which allows for character sets of various languages.

Random disk files: Shugart Corp. will drop the SA1100 series of 8-in. Winchester drives from its line because the market window for the drives—announced in September, 1981—closed before any significant production began. The drive offered only 20M or 34M bytes on an 8-in. platter, which systems manufacturers no longer consider viable. Today's 5¼-in. drives offer 40M to 70M bytes of storage. Some announced drives have capacities of 380M bytes. Shugart shipped fewer than 1000 SA1100s after encountering production problems. Shugart's new president, Bill Bayer, has announced Shugart will concentrate in the meantime on 5¼-in. and smaller drives, leaving 8-in. development to its Xerox Corp. sister company, Century Data Systems. Shugart will continue to manufacture its SA1000 series of 8-in. drives, but will not add enhancements to any 8-in. drives.... **TeleVideo Systems Inc.** has become the first systems manufacturer to sign an exclusive contract for half-height 5¼-in. Winchester disk drives. The manufacturer of 16-bit personal computers estimates the value of the one-year contract with Miniscribe Corp. at \$20 million. TeleVideo declines to say what system will incorporate the new drive.... **Tandon Corp.** recently signed an \$80-million contract with Non-Linear Systems, manufacturer of the Kaypro portable computers, that will include some half-height drives, but also includes Tandon Corp.'s floppy and Winchester lines.

Micro files: Data Base Research Corp., Anaheim, Calif., hopes to announce a PC version of the CHAMPION accounting software this month. The system features an automatic crash-recovery program. The system size may be less than 270K bytes.... **Sord Computer of America Inc.** plans to announce a microcomputer that runs a version of UNIX 5.0 as well as Sord's proprietary operating systems in October. Sord may retain the Xerox store as a distributor.

Software files: Digital Research System Inc. has reached an agreement with VisiCorp to support Visi^{On} on CP/M systems. Under terms of the agreement, Digital Research will work with personal computer manufacturers to adapt the software to individual systems. Visi^{On} is an interactive, graphics-oriented package that displays applications in windows and uses a mouse for cursor movement. The IBM PC and the DEC Professional Computer also support Visi^{On}.... **Numerix Corp.**, Newton, Mass., claims its new 32-bit floating-point array processor is three times as fast as other array processors selling for less than \$100,000, including those from Floating Point Systems Inc. and CSP Inc. Numerix's MARS-432, one of the few array processors with a FORTRAN compiler, can be interfaced to Digital Equipment Corp. PDP-11s, VAX-11s, LSI-11s and Multibus-based host machines. Claimed overall computational speed is 30 million floating-point operations per sec. The system performs addition or multiplication in 100 nsec. and a 1024-point complex fast Fourier transform in 1.7 msec. Data memory physical address space is 16M words, and maximum physical memory is 64K words. DMA transfers occur at I/O bus rates of 20M bytes per sec. Data memory or write times are 100 nsec. The system provides seven-point decimal precision. Prices of a standard configuration with 64K words of data memory range from \$80,000 to \$100,000, depending on external interfaces and software options. OEM versions are available for around \$50,000.

SURVIVAL OF THE FITTEST.



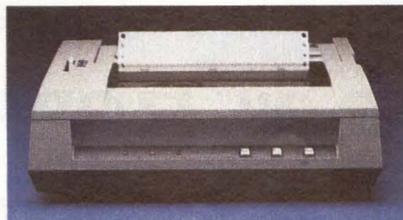
Ask major OEMS and they'll tell you that when it comes to reliable printers, the one they choose time and again is the C. Itoh 8510 Pro/Writer.

You see, many of today's printers achieve high speeds only by pushing their low-speed mechanisms to the limit of endurance. So what you seemingly gain in capabilities you lose in reliability.

C. Itoh's 8510 Pro/Writer, on the other hand, was designed from the very beginning to run at full speed (120 cps)—without breakdowns or noise. Its heavy duty stepper motor, base castings and synthetic-ruby print-head mechanism are built to take a lot of punishment. So you get superior print

quality throughout its 100 million-plus character life.

The 8510 also offers advanced paper handling features. You get bi-directional tractor and friction feed capability to handle paper widths from 4.5" to 10". Positive paper positioning for rapid bi-directional paper motion without short repetitive motions. Manual form alignment—even with power on. And a print line that can be easily



observed during printing.

Other features include built-in graphics with excellent resolution (144 x 160 dots per square inch). Five unique alphabets, eight character sizes. Mixed fonts during a single line pass bi-directionally. Variable form length, 6-channel electronic vertical formatting. The list goes on and on.

It's no wonder that so many major OEMs have selected the 8510 Pro/Writer design as their standard printer.

They know that in the real world, only the fittest survive.

For full details, contact C. Itoh Electronics, Inc., 5301 Beethoven Street, Los Angeles, CA 90066. (213) 306-6700.

CIRCLE NO. 11 ON INQUIRY CARD

C.ITOH ELECTRONICS

A world of Quality

OUR SMALLEST ACHIEVEMENT IS THE INDUSTRY'S BIGGEST SUCCESS.

The Tandon 8" and 3½" Floppy Company is the world's largest producer of 8" ThinLine™ drives.

And now we're ramping up for high volume production of single and double-sided 3½" drives.

When we introduced the half-height 8" floppy drive, we expected system designers to go wild over it.

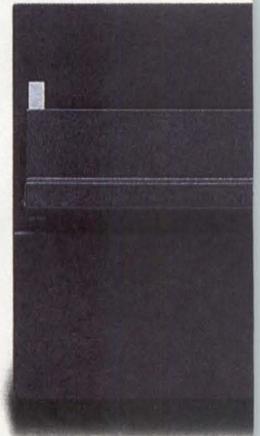
You did. Some of you stacked two of our drives to double system storage to as much as 3.2MB without increasing system size. Others took advantage of our small achievement to reduce system size instead.

Whatever you've done with our ThinLines, we want to thank you for having the confidence in them to give us an overwhelming lead in the half-height 8" market.

Now we're using our experience in making drives small to make them even smaller. Our new 3½" drives are now in

production in four versions. 500K byte single-sided and 1MB double-sided Tandon interface models. And Sony interface-compatible drives of the same capacities.

We plan on becoming the world's leader in 3½" the



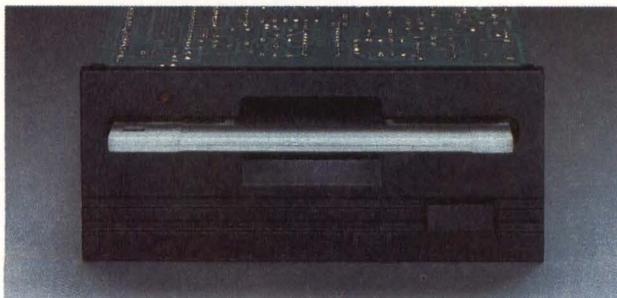
same way we became the world's leader in half-height 8". By focusing our energies on building more drives, better, at a lower cost than anyone else.

Like all Tandon companies, we start with a high degree of vertical integration. And an aggressive commitment to R&D no one can match.

We've also established ourselves in a brand-new facility with all the latest manufacturing and test equipment. So we can triple our current leading monthly production rate while ramping up to meet the burgeoning 3½" market.

Just because we've become a success by thinking small doesn't mean our plans are modest.

Tandon
THE MOST SUCCESSFUL DISK DRIVE
COMPANIES YOU EVER HEARD OF.



TANDON 8" AND 3½" FLOPPY COMPANY.

Tandon Corporation, 20320 Prairie, Chatsworth, CA 91311, (213) 993-6644, TWX: 910-494-1721, Telex: 194794. Regional Sales Offices: Boston (617) 938-1916 • New York (201) 449-7720 • Atlanta (404) 934-0620 • Chicago (312) 530-7401 • Dallas (214) 423-6260 • Irvine (714) 675-2928 • Sunnyvale (408) 745-6303 • Frankfurt, West Germany 6107-2091, Telex 411547 • London, England (0734) 664-676 Telex: 848411. Distributors: Hall-Mark, Kierulff, Schweber.



Dysan Diskettes Are Certified... Automatically

Because one thing
your diskettes don't need
is a personal touch.

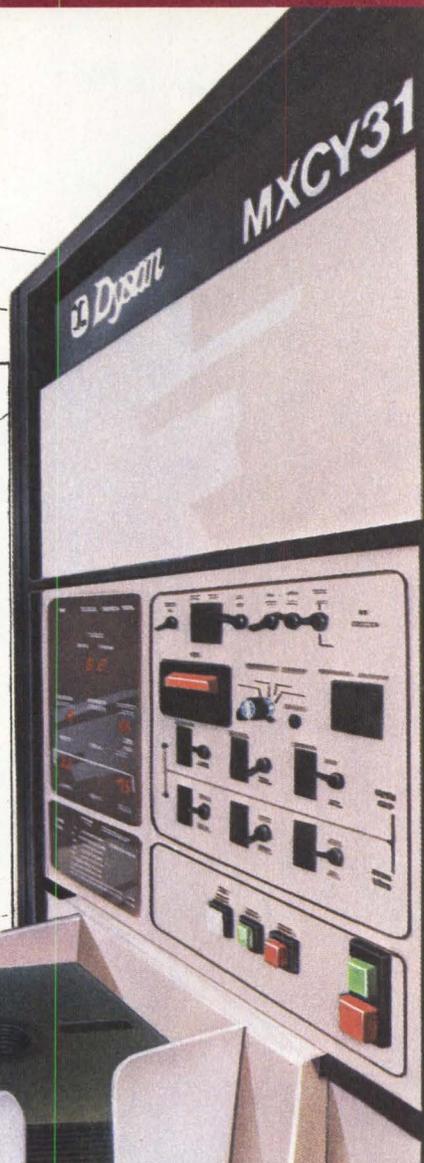
Auto-load certification enables critical testing of each and every diskette, ensuring each and every user 100% error-free diskette performance. This unique process is one more way that Dysan goes a bit further. Auto-load certification also eliminates any possibility of handling errors.

Background

Dysan does more to give you the assurance and quality you need. In fact, Dysan is the *only* diskette manufacturer using automatic, microprocessor-controlled certifiers to test and measure diskettes to parameters far beyond industry requirements. Dysan's exclusive "hands-off" method eliminates any possibility of handling errors and simplifies daily calibration routines. The result? Precision certification of each diskette. Exacting performance on your system. That's the Dysan difference.

Other Benefits

Dysan goes a bit further in the testing process, too, certifying that each diskette is 100% error-free both *on* and *between* the tracks: and more tested



surface means greater data integrity and unsurpassed performance. A proprietary DY¹⁰™ lubricant guards against surface abrasion and resonance, which can hinder effective read/write performance. Advanced burishing techniques provide optimum head-to-disc interface by flattening even the most microscopic surface peaks.

The true cost of a diskette equals the purchase price *plus* the time you spend to fully load the diskette. Reliability translates into cost savings. That's why Dysan goes a bit further to make diskettes which are the most reliable that money can buy. You can select from a complete line of premium 8" and 5¼" diskettes, in single or double densities, certified on one or both sides.



Three

Third in a Series

Auto-Load
Certification

DY¹⁰ is a trademark of Dysan Corporation

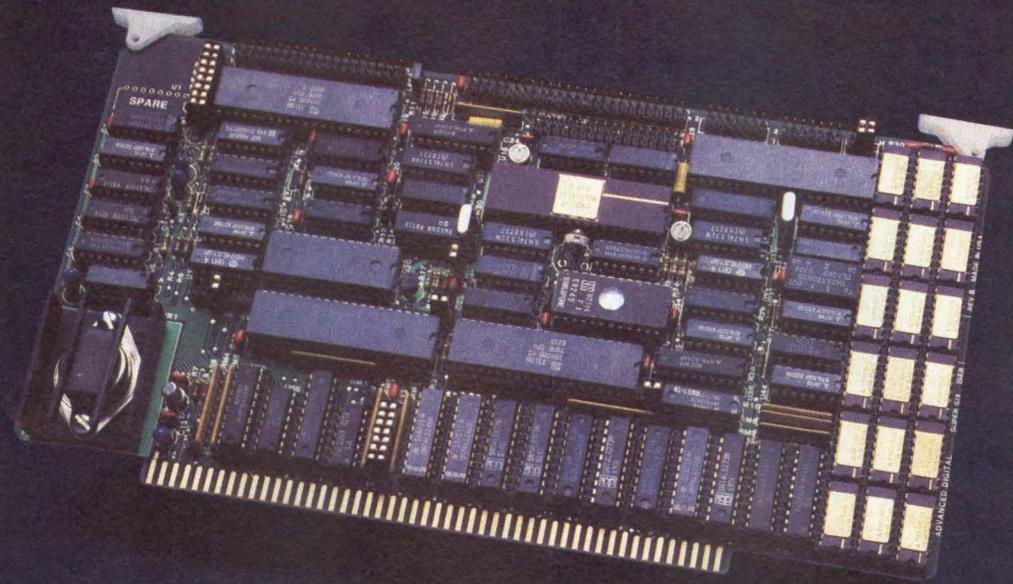
CIRCLE NO. 14 ON INQUIRY CARD

dysan **Dysan**
CORPORATION

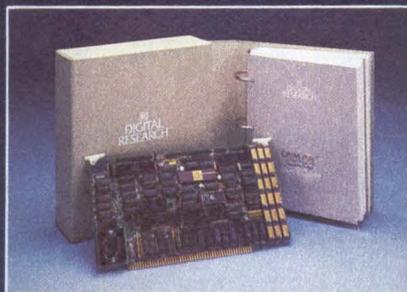
Corporate Headquarters
5201 Patrick Henry Drive
Santa Clara, CA 95050
(800) 551-9000

MINI-MICRO SYSTEMS/July 1983

SUPER SIX™



SUPER SIX, THE FIRST 6MHz S-100 SINGLE BOARD COMPUTER TO SUPPORT BANKED CP/M™ 3.0



SUPER SIX FEATURES:

- 128 KB of Bank — selectable RAM
- 6 MHz, Z-80B CPU
- DMA Controller
- 6 MHz, Z-80B DART (2 Serial RS-232 Ports)
- 6 MHz, Z-80B PIO (2 Parallel Ports)
- 6 MHz, Z-80B CTC (Clock Timer)
- Double/Single Density Floppy Disk Controller — Supports 8" and 5-1/4" Drives Simultaneously
- 2/4 KB of Monitor EPROM
- S-100, IEEE 696 Compatible

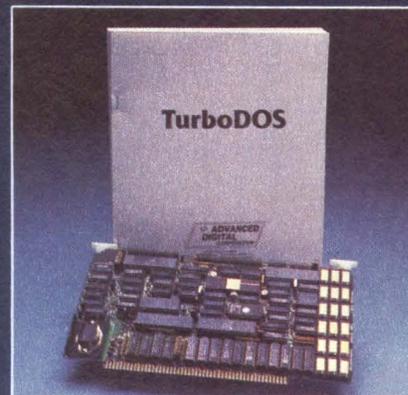
*CP/M is a trademark of Digital Research Corp.
TurboDOS is a trademark of Software 2000 Inc.
SUPER SIX and SUPER SLAVE are trademarks of Advanced Digital Corp.

SUPER SIX & CP/M™ 3.0 A PERFECT MATCH

Advanced Digital has found the perfect match to its powerful, high-speed SUPER SIX single board computer. It's Digital Research's new CP/M 3.0. Because of SUPER SIX's 128 KB of RAM, it is the only S-100 board to support CP/M 3.0 in the banked mode; or run CP/M 2.2 with 64 KB of extra buffer.

SUPER SIX & TurboDOS™ ANOTHER PERFECT MATCH

When you combine the TurboDOS multi-user operating system with the 6 MHz SUPER SIX, you'll find your system running 1-1/2 times faster than



before. Add the 4 MHz or 6 MHz SUPER SLAVE™ processor board(s) and you will have the fastest multi-user, multi-processor system available today.

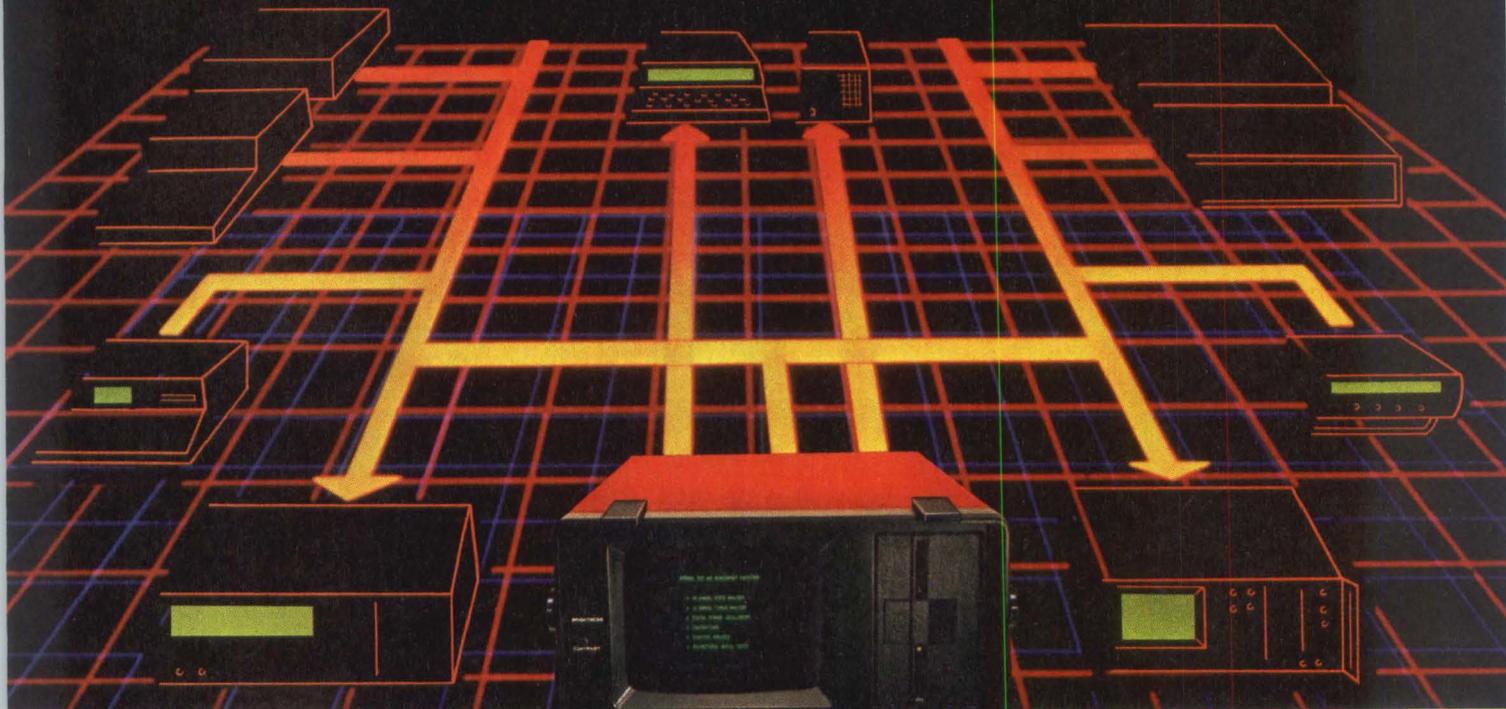
See the SUPER SIX at your quality computer dealer or contact:



12700-B Knott Street
Garden Grove, CA 92641
Phone: (714) 891-4004
Telex: 678401 tab irin

CIRCLE NO. 15 ON INQUIRY CARD

The Electronic Workbench



Now, a Logic Analysis System that puts a bench-full of instruments at your fingertips.

The NPC-764. It just makes good sense. When performing logic analysis and other measurement functions, you shouldn't have to face different sets of knobs, switches and dials. That's why we've developed the NPC-764, the Electronic Workbench. Now your analysis tasks are all done the same way—with a familiar ASCII keyboard and easy-to-use, self-prompting menus. Simple keystrokes are all it takes to run tests and record data on disk. And all logic analysis and other internal functions are ROM-based and ready to go on power up. No messy setups. No relearning of multiple instruments.

The NPC-764 includes a 48-channel State Analyzer and a 16-channel, high-speed Timing Analyzer. And, as optional plug-ins, a single-channel Digital Storage Oscilloscope, a 5-function Counter-Timer/Signature Analyzer, and bidirectional Serial Tester.

But the NPC-764 is more than just a multiple-function instrument. It also incorporates a GPIB controller and RS-232 MASTER/SLAVE capability. Standard. A common set of commands lets you control the internal analyzers and any GPIB- or RS-232-compatible devices you include in your setup—pattern generators, emulators, spectrum analyzers, PROM programmers . . .

And that's not all. The NPC-764 is a full desk-top computer, with floppy disk storage and a CP/M® operating system. Use it for

general-purpose computational tasks or the execution of commercially available CP/M programs.

The NPC-764, with all its internal measurement functions, requires less than *half* the investment of the equivalent instruments purchased separately. And the ASCII keyboard and menus are so user friendly it sets a new standard for the industry.

Not quite ready for all this capability? Start with our basic NPC-748. It provides exactly the same measurement functions, but 16 fewer state channels and no floppy disk drive. Upgrade easily to the NPC-764 at any time.

There's a whole lot more we'd like to tell you about the Electronic Workbench. For additional information, applications assistance or a personal demonstration, just give us a call: **(800)-NICOLET, (415) 490-8300** (Calif); TWX: **910-381-7030**. Nicolet Paratronics Corporation, 201 Fourier Avenue, Fremont, CA 94539.

*CP/M is a registered trademark of Digital Research.

CIRCLE NO. 16 ON INQUIRY CARD

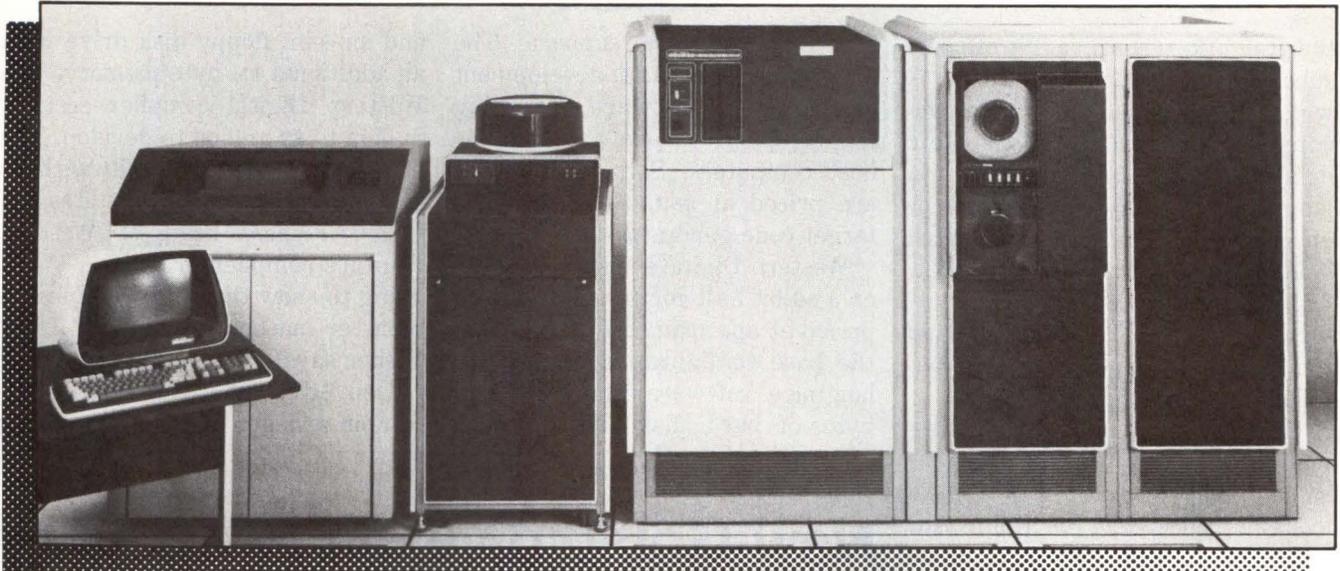
Leading The Way In Analysis Technology.



Nicolet
Paratronics Corporation

Mini-Micro World

NEWS



The Ada Work Center system above, to be marketed by both Data General and Rolm, includes DG's MV/8000 superminicomputer, Dasher system consoles and Rolm's Ada compiler. DG MV/4000 and MV/10000 models can also be used.

Competition heats up for commercial Ada compiler

Just as two commercial computer firms announced a joint Ada language compiler system developed entirely with \$8 million to \$10 million of internal funding, the U.S. Army was forced to rebid portions of its more-than-\$17-million contract with Softech Inc. to develop a cross-compiler for Ada-language applications in the Army's embedded computer systems.

Three of the five target computers that the Softech compiler was designed to work with—the Rolm 1602 B and 1666, and the VAX-11/780 (with no operating system)—were withdrawn from the contract after the Softech compiler failed Army validation tests late last year. The unsuccessful test effort was blamed on integration problems that resulted in unacceptable levels of data error. It has delayed the Army's program for approximately eight months and moved officials at the Center for Tactical Computer Sys-

tems (CENTACS), Fort Monmouth, N.J., to initiate monthly reviews of the progress of the cost-plus-award-fee contract with California-based Softech.

A Softech spokeswoman confirms that Softech's Ada contract with the Army had been modified to retarget development work on the VAX and military computer family systems, but she cannot detail the nature of the difficulties experienced during the validation tests.

Elimination of the three co-generator host computers will cost Softech \$3 million in future funding. That portion of the contract will be rebid competitively in 1985 or 1986. "We're trying to limit our risk—both ours and Softech's," comments Joseph Kernan, CENTACS chief of the Software Technical Development Division.

Meanwhile, Department of Defense validation testing of three Ada compiler systems began in April at

the Ada Joint Project Office. The first system, an Ada language interpreter from New York University's Courant Institute, was the first to pass the 2000 validation tests. NYU's Ada/Ed, characterized as a prototype system, was funded jointly by CENTACS and DOD's AJPO.

An Ada software-development system developed by Rolm Corp. and hosted on the new Data General Corp. MV/10000 supermini began validation testing in early May and is expected to be the first production system to be certified after a month-long series of tests and evaluations. Western Digital Corp. claims to have had a compiler in production since December. The company started AJPO tests in June, says an AJPO official.

Western Digital was the first company to formally apply for validation testing. But an 18-week delay in receiving the American National Standards Institute's Ada standard caused a delay in the company's development schedule, according to Western Digital.

At a press conference to unveil

Mini-Micro World

NEWS

the Rolm/DG system, AJPO officials subtly needled Army counterparts while toasting the efforts of the commercial sector. "With their delays in developing their own Ada language, the Army will allow or encourage commercially validated Ada development," Air Force Lt. Col. Larry Druffel, AJPO director, wryly noted. "All I can do is applaud the efforts of these [Rolm and DG] folks."

Under a joint marketing agreement, Rolm and DG will offer the same family of Ada Work Center systems, consisting of Rolm Ada software to run on DG's 32-bit Eclipse series—MV/4000, MV/8000 and MV/10000. Ada applications can also be run on Rolm's 16- and 32-bit military specification MSE/800, MSE/14 and 1666B computers. Rolm's Ada Work Center system (MMS, January, p. 40) is designed as an Ada software-development facility that includes Ada development environment software, the compiler, as much as 8M-byte processor memory, a hard-copy console, a magnetic-tape unit, a disk drive and as many as eight terminal ports.

Rolm has long claimed that its development system will fully meet the recently completed ANSI 1815(A) 1983 specifications for the Ada compiler, and company executives are not timid in saying so. "We're the only fully compatible Ada system in the industry today," boasts Rolm vice president Dennis Paboojian. "DOD now has the Ada development capabilities that weren't anticipated until late 1984 or early 1985."

Rolm has conducted beta testing of its work center at Lockheed Corp. in California during the past year, but no orders have been taken for a production unit.

Prices for the Rolm/DG systems range from \$158,965 to \$409,665 for the basic work center, including

first-year software support. The license for the Ada development environment software, including the compiler, is available for the host computers. Software licenses are priced at \$82,800 and include target code generators.

Western Digital's system is based on a 16-bit host computer. It will be priced at approximately \$20,000 for the base configuration of the Ada language software, the CPU, 10M bytes of hard disk drive storage

and an 8-in. floppy disk drive with an additional 1M-byte memory. The Western Digital compiler cost \$1 million to \$2 million to develop. The effort was funded internally without any government moneys, states Dr. Gerry Fisher, head of Western Digital's compiler program. "We're going to show that you don't need a monster machine to support Ada," Fisher says.

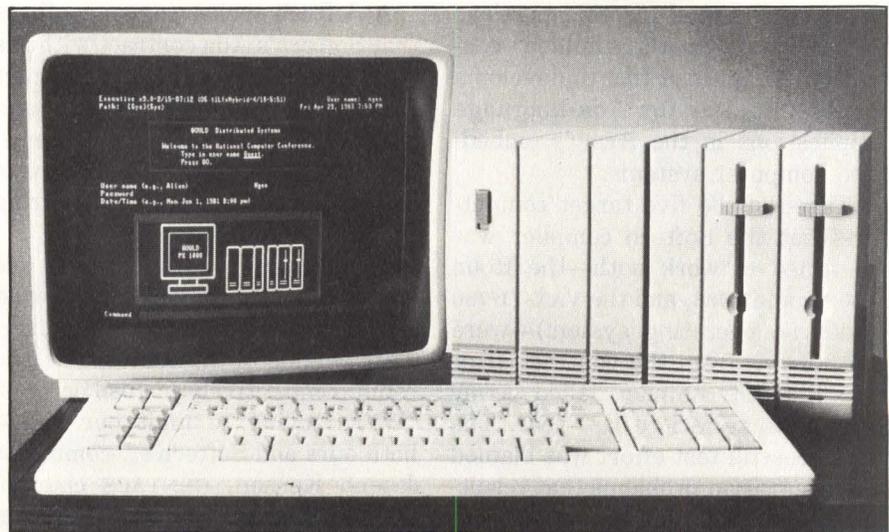
Deliveries of Western Digital compilers began last year, according

New Gould division to market Convergent-based systems

Gould S.E.L. has begun its drive into the fertile computer-aided engineering market with a new organization assembled like an entrepreneurial start-up and a product line that relies heavily on OEM hardware provided by Convergent Technologies Inc. The new Distributed Systems business unit promises to be the first Gould operation to provide products span-

ning a range of requirements across the corporation's various electronics subsidiaries.

John Muczko, vice president for Distributed Systems, says, "We are literally a new venture. I drew up a business plan, and we had to get venture capital from the company to fund our development." The plan was drawn up last October, and Distributed Systems opened a shop



Gould S.E.L.'s Distributed Systems division will market the Power Series 1000 engineering workstation, which is based on Convergent hardware. Prices for the medium-resolution, bit-mapped display terminal will start at \$5700 in a dual-floppy disk drive version with 256K bytes of RAM and XENIX.

to the company. Customers using the compiler include the National Ocean Systems Center, the Center for Defense Analysis, Clemson University, Wright-Patterson Air Force Base, the University of Tokyo and a West Coast aerospace firm. Western Digital sees defense and space contractors as the largest market for the compiler in the near-term, says Fisher. But the company is eyeing process-control applications as the largest market.

"That's about three years off, though," he says.

The private-sector Ada development efforts are "exciting," comments AJPO's Druffel. Validation testing of compilers from Telesoft, Softech and others is not likely to begin until the second quarter of 1984. "They [Rolm, DG and Western Digital] have lapped the field," says Bob Mathis, AJPO technical director.

Following the test failure of the

Softech compiler, Army program management decided to concentrate development efforts on the Ada tool set and the compiler itself. The two remaining target computers are the VAX-11/780 with the VMS operating system and the Army's custom-designed military computer family with its NEBULA instruction set.

—Stephen J. Shaw

in January in a small office at a condominium project near S.E.L. headquarters in Fort Lauderdale, Fla.

The decision to approach computer-aided engineering is a strategic move that will take S.E.L. out of its real-time minicomputer niche for the first time in the company's 20-year history. It is also intended to bolster the parent corporation's position in the industrial-automation/factory-automation market. Timothy O. Gauhan, vice president of CAD/CAM industry service at Dataquest Inc., a Cupertino, Calif., market research firm, points out, "They [Gould] are eminently well postured to be a major force in the engineering automation market and a force in the engineering in particular. They have virtually all the parts General Electric has." With links to the Gould Modicon factory-automation subsidiary, the De Anza Systems Inc. image-processing subsidiary and the proposed acquisition of CAD/CAM supplier Graphics Technology, Distributed Systems is in a position to link systems for factory and engineering automation markets. Gauhan estimates the engineering workstation market alone will grow from \$21 million in shipments last year to \$448 million



John Muczko, vice president of Gould S.E.L.'s new Distributed Systems division, says, "We are literally a new venture. I drew up a business plan and we had to get venture capital from the company to fund our development."

by 1987, with S.E.L. competing against firms such as CAE Systems, Metheus Corp., Mentor Graphics and Daisy Systems.

Gould's entry into the engineering automation market revolves around an OEM agreement with Convergent Technologies that covers both the Convergent MegaFrame multiple-MC68010 supermicrocomputer and a new Convergent workstation based on the Intel 80186 and designated the Power Series 1000. Prices for the Power Series 1000 medium-

resolution, bit-mapped display terminal will start at \$5700 in a dual-floppy disk version with 256K bytes of RAM. The price includes the XENIX operating system. Gould plans to offer office-automation and personal-productivity packages under MS-DOS and CP/M-86 as well.

Gould S.E.L.'s 3000 series products are cluster controllers based on the MegaFrame. List price for an eight-user controller with an MC68010 CPU, an 80186 file processor and an 80186 application processor, 1M byte of main memory, a 50M-byte disk and floppy disk backup will be \$25,000, including UNIX.

Beyond the Convergent hardware, Gould will supply S.E.L. series 5000 processors and "power nodes," both of which will provide facilities for compute-intensive design applications. The 5000 is based on the Advanced Micro Devices 2901 bit-slice processor technology that S.E.L. implemented on the Concept 32/67 this year (MMS, June, p. 259). Unlike the 32/67, however, the 5000 has a dual-processor architecture with what Muczko calls "hints of redundant processing capabilities" and a demand paging scheme that provides 16M bytes of virtual-memory space in the basic 1M-byte version.

The 5000 will be offered in a design station configuration with a 19-in. color graphics CRT, an 80M-byte disk drive, a 1/4-in. streaming-tape drive, a keyboard and a tablet in a \$75,000 package. A similar 2901-based power node for back-end processing has a 2M-byte physical memory and can support Winchester disks with capacities as high as 600M bytes each. The power node will be custom configured, and prices are expected to start at about \$75,000, says a Gould spokesman. Other power nodes based on Gould processors will be available next year.

Muczko stresses that Distributed Systems will develop the CAE market as a separate business. "It appears to be a direct sales market. The products will be available to our existing customers, but not with the traditional OEM discounts," he explains. Gould plans to offer the system with a range of third-party engineering application software, including electrical, electronic and mechanical engineering and architecture packages. Muczko declines to identify which packages will be available when the systems start to be shipped early next year.

Muczko, who moved from his slot as vice president of marketing in February to devote all his energies to the new division, expects Distributed Systems to be a \$100-million business in 1986. He expects the rest of S.E.L. to grow to more than \$500 million in annual sales by 1986 from about \$200 million in 1982.

The division employs about 30 people in its headquarters and its Nashua, N.H., development facility. Muczko expects the staff to reach 50 by year-end, with 20 employees working on development and system integration in Nashua.

—Geoff Lewis

New graphics advances to emerge at upcoming shows

As forests grow from small trees, trends spring from individual product introductions, and several noteworthy products will sprout at upcoming graphics shows. At the shows, Ramtek Corp., Genisco Computers, Megatek Corp. and Zentec Corp., will introduce new products that promise to offer a glimpse of future graphics trends, such as very fast frame buffers for higher performance.

Ramtek hopes to introduce a color raster display system at the Association of Computing Machinery's SIGGRAPH show July 25-29, to be held in Detroit. "Our main charter on this terminal was to be the fastest frame buffer around," says Ramtek's new products manager Mike Tyler of the display system. Part of that speed is obtained by using 150-nsec. RAM. But write times for the display surpass even memory read times because the raster processor grabs memory words in parallel and shifts them serially with fast, custom logic. The result, claims Tyler, is an average pixel write time of less than 40 nsec., creating a display that's 60 percent faster than the Evans & Sutherland Strokewriter and 35 times faster than Ramtek's previous fastest display, the 9400.

The system is also state of the art in resolution, using some of the first available monitors with 1280 × 1024 resolution at 60 Hz noninterlaced. The system can handle as many as 16 planes of image memory, and Tyler says double buffering for animation is possible in such applications as medical imaging.

Ramtek calls its new color raster display The Time Machine. The system should be easy to customize

because all software for protocols is RAM resident, loaded out of a Sony 3 1/4-in. floppy disk drive. Further, there's room for a number of MC68000-based option boards on the system's VME bus, with an interrupt-driven communications scheme implemented via 64K bytes of memory on each board that is in the address space of all the other processors.

The first option to arrive will be a display list processor, and Ramtek is expected to introduce drawing and graphics/array co-processors in 1984. Thus configured, The Time Machine will handle most of the functions of a solids-modeling display locally, including 3D coordinate transformations with clipping, hidden-line removal and variable light-source shading, in nearly real time. The drawing board option will sell for about \$15,000, and list price for the frame-buffer terminal is \$20,000. Although Ramtek won't reveal the specifications of the solids-modeling version, the company expects it to be fast. "Nobody in the aircraft pilot training market can simulate a day view of a landing in 3D," says Tyler, adding, "we're going to be close."

Another high-end introduction is due from Genisco at the National Computer Graphics Association show, June 26-30, to be held in Chicago. Genisco has solved the mystery surrounding the introduction last year of the 6100, a \$34,000 terminal that emulated a \$15,000 Tektronix system. One clue to the mystery was that the original cost figures for the 6100 were based on components bought in 10-piece quantities instead of in volume, says product marketing manager Dan

Jones. Now that costs have been refigured, the price has fallen to \$21,950. That reduction, coupled with the introduction of Gencor terminal-resident software, which performs most 3D graphics-manipulation functions specified in SIGGRAPH's Core recommendation as well as supporting the GKS standard, make the 6100 more competitive. This year, Genisco is taking the wraps off of the similarly priced 6200 family—two higher performance, rack-mount versions of the 6100 that better serve Genisco's traditional customer base of system integrators, says Jones.

The 6210's resolution is 1392 × 1024, interlaced, while the 6220 offers 768 × 512, noninterlaced. Both include 512K bytes of display-list memory, expandable to 1M byte, a 19-in. monitor, a detachable keyboard with an adjustable-rate joystick, an asynchronous serial host interface, six additional interactive device ports, a full-screen interactive cursor and display of as many as 4096 colors out of a palette of 16 million. DMA interfaces at 3M words per sec. are available for Digital Equipment Corp., Data General Corp., Perkin-Elmer Corp. and Gould S.E.L. terminals. Prices for the 6200 start at \$23,950 in single units.

Megatek had planned to introduce its 1645, a 1280 × 980 resolution, black-and-white version of its 1650 desk-top engineering terminal, at the National Computer Conference. But it may have saved the more significant introduction for one of the two graphics shows. Megatek vice president Hiram French says he expects to take advantage of the recent porting of 3D color software from DEC's VAX to IBM's 4300 series with a 50K-baud interface. French says the interface gives Megatek terminals an edge, since IBM's 3250 terminals and its color raster



Genisco's new 6210 high-end graphics terminal features 1392 × 1024 interlaced resolution and can display as many as 4096 colors out of a possible 16 million on a 19-in. monitor. Maximum display list memory is 1M byte.

emulators are limited to 9600 baud. "IBM, with its new pricing on the 4300, seems to be going after the VAX market; which means there's a new, virgin host for 3D color software that will be ported to the 4300s from DEC's VAX," says French.

Meanwhile, in the low-end graphics game, OEM terminal manufacturer Zentec plans to jump in at the NCGA show to challenge the recently introduced 640 × 480 member of Tektronix's Unicorn family, the 4107 (MMS, April, p. 22). Zentec will offer its own less-than-\$7000, 640 × 480 resolution, eight-color raster terminal with independent alphanumeric overlay. The terminal is based on the Intel 8086 and an NEC graphics display controller. Marketing vice president Mason Killibrew says Zentec's orientation toward customizing terminals to OEMs' specifications will be an advantage, given

Tektronix's apparent intention to sell Unicorn terminals only in vanilla versions. He also says that Zentec performs extensive burn-ins at the component, board and system levels. He believes that, because Tektronix has put the burden of component quality assurance on vendors and skips burn-in of assembled terminals, Zentec may be able to compete in price.

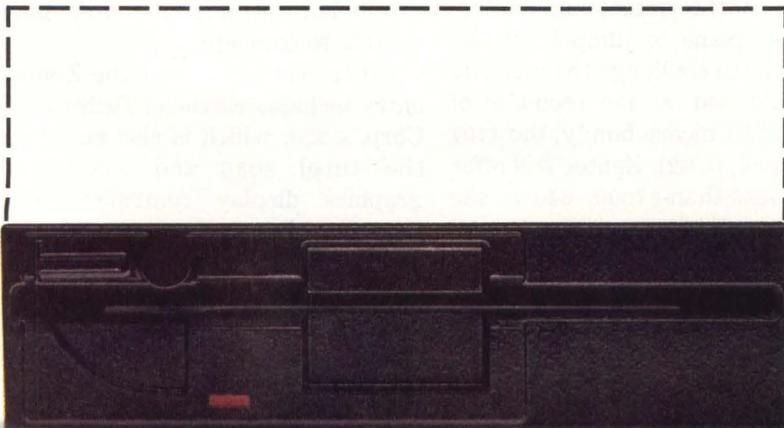
Other competition for the Zentec entry includes Envision Technology Corp.'s 220, which is also based on the Intel 8086 and NEC 7220 graphics display controller. But Zentec project manager Sue Vogtlin claims that write-control logic, which speeds the 7220's performance by allowing the chip to write simultaneously to several planes of memory, and an optional 8087 math co-processor give Zentec an edge.

—Kevin Strehlo

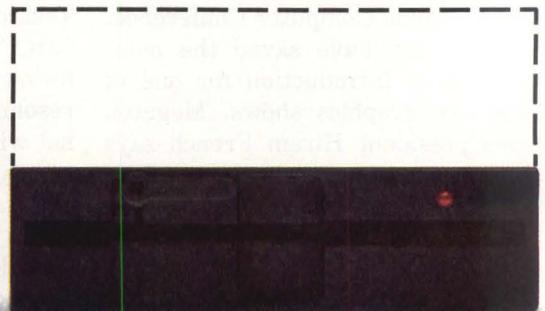
SHUGART DRIVES.

1/2 OFF

SA810



SA455



No, it's not a sale.

It's just a way of telling the world that Shugart now has a whole line of half-height floppy disk drives.

Half of which are our new 5.25" Mini-floppies. Or, if you will, mini Minifloppies.

The SA455/465 double-sided drives.

Both offer improved performance and reliability over conventional minis. And more design flexibility, because of a technology that demands only half as much space.

So you can create smaller, more competitive systems. Or build more storage capacity into existing designs by putting two drives in the space of one.

Moreover, both the 48tpi SA455 and 96tpi SA465 are compatible with their relatives, the industry standard SA400/405 and SA410/460. So there's no need for a major revamping of hardware or software.

And once they're in place, you'll find they use 45% less power than ordinary 5.25" drives. While delivering snappier access times (in the case of the SA465, 3 msec track-to-track). And even better reliability — an impressive 10,000-hour MTBF. A 25% improvement over most full-height drives.

Then there's the other half of the story. Our new 8" half-heights, the SA810 single-sided and SA860 double-sided floppies.

They too give you more performance and reliability out of a lot less hardware.

They too eliminate major redesign. Since the controller interface, mounting holes

and internationally recognized DC power supply requirements are fully compatible with the industry standard SA801 and SA851 8" drives.

The SA810/860 are also the only half-heights offering true electrical compatibility with the existing user base of over 4 million 8" disk drives.

And all our half-height drives feature rapid-start direct drive DC motors for better reliability, speed control and longer media life than any other floppy disk drive.

Of course, Shugart still offers the industry's most complete line of full-height floppy and Winchester drives. Plus an extra-economical 2/3-height Minifloppy,™ the entry level SA200.

And our newest small wonder, the SA300 3.5" microfloppy.

All backed by the largest and most experienced engineering, sales and service organizations in the business.

Which is our way of giving you more.

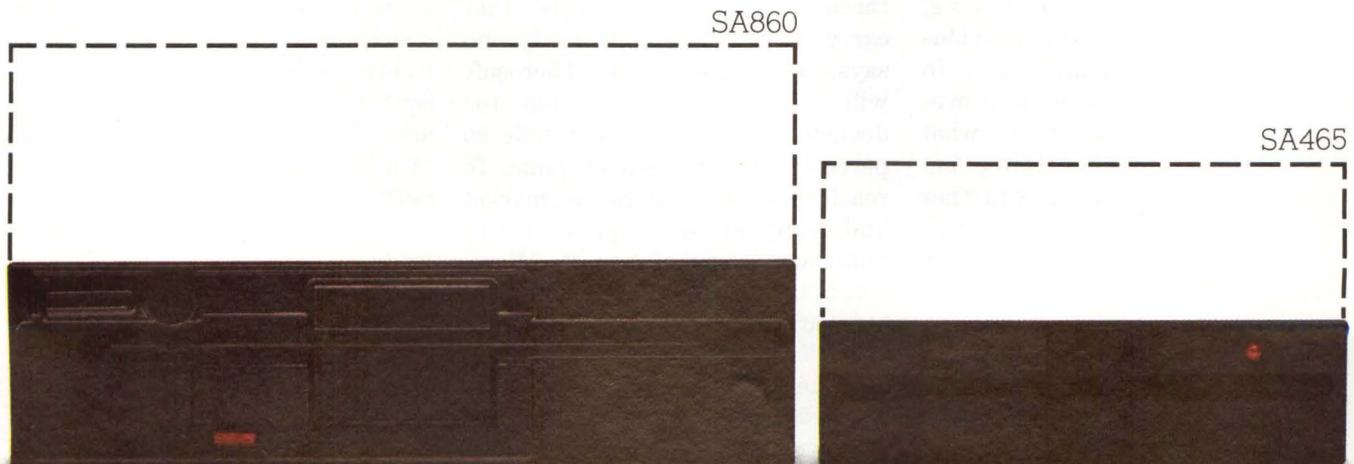
Even if it's only half as much.

For more information, contact Shugart Corporation, 475 Oakmead Parkway, Sunnyvale, CA 94086, 408/733-0100 (Hamilton/Avnet, authorized distributor).

Shugart

Right from the start.

Milpitas, CA 408/263-2600; Costa Mesa, CA 714/979-1935; Thousand Oaks, CA 805/496-5388; Minneapolis, MN 612/574-9750; Richardson, TX 214/234-3568; Framingham, MA 617/879-1700; Saddle Brook, NJ 201/368-8445; Atlanta, GA 404/955-8968; Toronto, ONT 416/475-2655; Paris, France (1) 687-31-41; Munich, West Germany 089-78-60-21; London, UK (44) 4862-24527.



CIRCLE NO. 17 ON INQUIRY CARD

Microsoft's retail XENIX will test commercial thirst for UNIX

Microsoft Corp. this month plans to start filling retail store racks with end-user editions of its version of UNIX. The products—XENIX 3.0 for Apple Lisa and IBM PC systems with hard disks—could be a major test of UNIX's viability in the commercial market. The new versions are the result of three years of effort directed at getting XENIX to run on the top-selling microprocessors and a two-year OEM marketing effort.

XENIX product marketing manager Mark Ursino projects "conservative" shipments of around 20,000 units through year-end. He says that number could triple if the end-user XENIX packages take off in the market.

XENIX 3.0 is based on AT&T's UNIX System III and is scheduled for release to end users this month. Both OEM and retail versions have been upgraded with a menu-based command shell shared with the recently updated Microsoft MS/DOS operating system. XENIX 3.0 also supports an improved electronic-mail function using an RS232 interconnection, improved disk-loading routines and record locking, which was added to the previous release about six months ago. In addition to the system improvements, Microsoft has made what Ursino calls "marketability improvements" to propel UNIX further into commercial microsystems environments and to try making XENIX the leading version of UNIX in the microcomputer arena.

To make the system more attractive to microcomputer users and more compact, Microsoft has divided XENIX 3.0 into time-sharing, software-development and text-editing modules so that end

users do not have to purchase the full 8.5M-byte XENIX system. Assuming use of 160K-byte floppies for IBM systems, Ursino says, the time-sharing module would require 10 diskettes for loading onto the hard disk. The retail version will be accompanied by consumer-oriented documentation. Microsoft also plans to distribute various books and manuals for business and end-user programming, Ursino says.

The \$395 text-processing module includes UNIX T-roff and N-roff as well as the Vi visual shell. The software-development module is priced at \$495 and also includes Vi. Single-user versions of XENIX 3.0 for the Apple Lisa and IBM PC are priced at \$395, and multiple-user upgrades are \$695. For the IBM PC, Microsoft provides a plug-in memory-management card with the multi-user upgrade. Users must purchase third-party communications cards to get the ports to support three additional users.

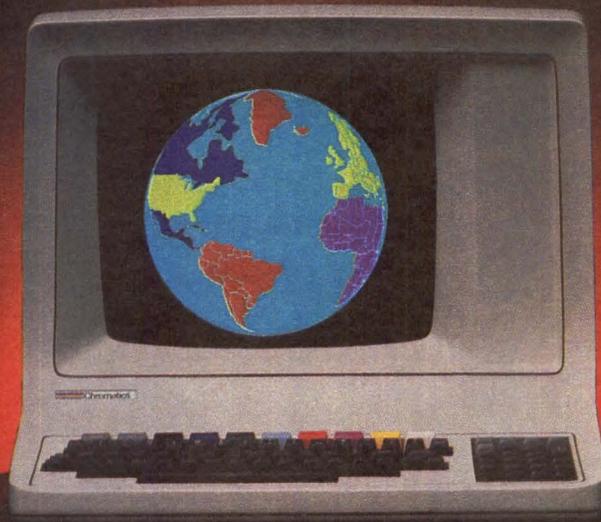
The end-user XENIX 3.0 package for Apple will be sold directly through Apple Computer Inc. major account sales representatives and through authorized dealers that carry Lisa this summer, Ursino says. In the IBM market, Microsoft will concentrate on the top 100 dealers that Ursino says handle 80 percent of the PC's sales volume. To reach them and dealers who market and support subsequent retail implementations of XENIX, Microsoft is negotiating a contract with a software-distribution start-up that specializes in UNIX products. Ursino declines to identify the new distributor, pending a public announcement by the principals, who are still employed at other companies.

With the retailing of XENIX and the addition of a common shell for it and the single-user MS/DOS operating system, Ursino sees Microsoft positioning itself as the leading purveyor of UNIX in the microcomputer market. Unisoft Corp. has implemented its UniPlus on a larger roster of 40 to 50 Motorola MC68000-based systems, including a version of the Lisa. But Ursino claims Microsoft has greater market penetration in terms of installations. The XENIX system, for example, was installed on approximately 5000 Tandy model 16 computers shipped in the first two months that XENIX was available on the MC68000, Tandy Corp. computer division vice president Jon Shirley says. The XENIX package reportedly is also being shipped on an estimated total of 500 Altos systems per month.

The IBM PC represents an even larger opportunity, Ursino points out. Unisoft president Jeff Schriebman concedes that the IBM PC and PC-compatible market may have more potential, but says Unisoft will maintain its lead in the MC68000-based systems market in which customers such as NCR Corp., Corvus Systems Inc., Callan Data Systems and Wicat Systems Inc. are expected to ship large numbers of multi-user systems. Schriebman declines to provide numbers, but asserts, "We are clearly the world leader in MC68000 ports." Unisoft also has a retail version of its UNIX package, which is marketed to Apple dealers through Unipress, East Hanover, N.J., a distributor specializing in UNIX products.

—Geoff Lewis

THE NEW CHROMATICS CT4200



WITH OUR 2 YEAR GUARANTEE
\$3995

NOBODY ELSE DELIVERS SO MUCH RELIABILITY FOR SO LITTLE MONEY.

- Best price/performance color terminal on the market.
- 512 x 512 x 4 Bitmap image, 512 x 384 viewable.
- No flicker 60 Hz refresh rate.
- 85 characters by 48 lines alphanumeric display.
- High resolution 13" precision in-line CRT.
- Optional 1024 x 1024 x 4 with 1024 x 768 viewable.
- 2 year limited warranty on all parts and factory service.
- Detachable 64-key keyboard. Optional 92-key keyboard shown.
- Supported by many popular graphics packages.
- Quantity discounts available.

Chromatics

For full product information on the best price/performance color terminal in the business, contact:
Chromatics, Inc./2558 Mountain Industrial Blvd./Tucker, Ga. 30084/Telephone: 404/493-7000/TWX: 810/766-8099.
Offices Worldwide

CIRCLE NO. 18 ON INQUIRY CARD

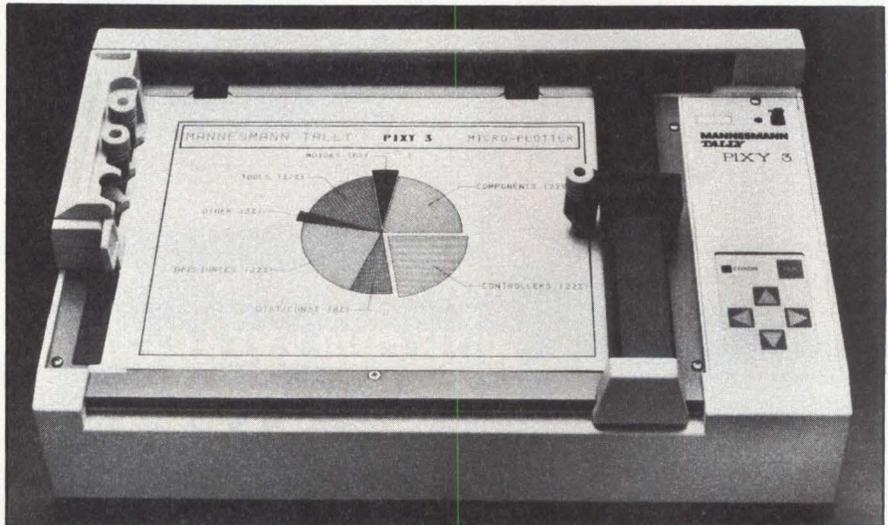
Mini-Micro World

NEWS

CalComp, Mannesmann Tally enter low-end plotter market

The growing demand for color business graphics hard copy continues to draw new players into the low-end pen plotter competition. California Computer Products Inc. (CalComp) and Mannesmann Tally Corp. have both recently entered the market with their first plotters targeted at personal computer users. Some observers expect the U.S. segment of that market to be worth as much as \$240 million in 1986.

The companies' introductions have little in common. CalComp, long a leading supplier of pen plotters for scientific and engineering applications, has chosen to make its first low-end introduction an eight-pen machine list priced at less than \$2000. Mannesmann Tally's product, the first plotter the printer manufacturer has produced, is a three-pen unit with a list price of



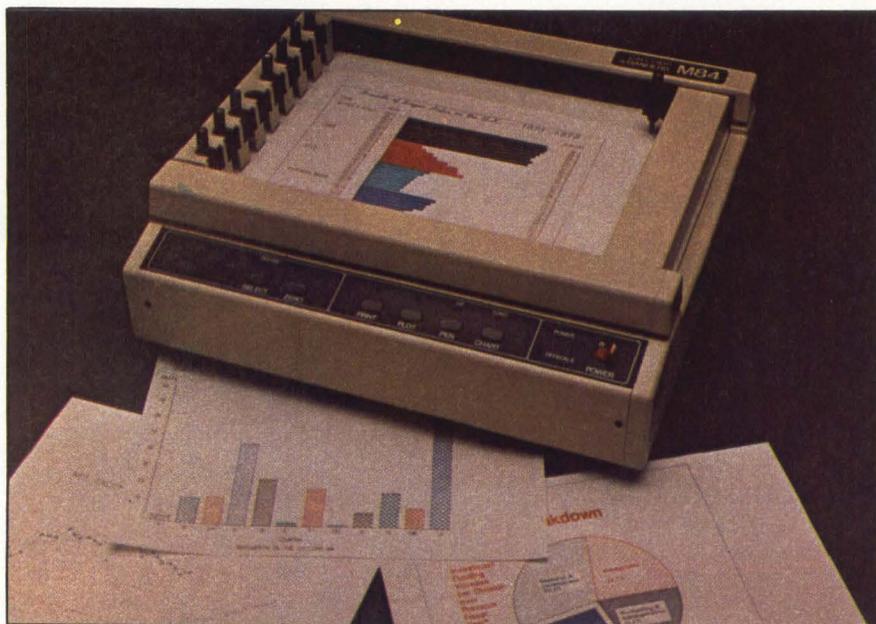
Mannesmann Tally Corp. officials believe their 3-pen Pixy plotter, priced at \$795, will be sufficient for most business graphics applications. The plotter, Mannesmann Tally's first, is manufactured by Watanabe.

\$795.

Ralph Kosoff, product sales manager at CalComp's Anaheim,

Calif., headquarters, says that the company's Model-84 is not targeted to compete with the lowest priced units, but instead to meet a need for high-quality graphics output at a price affordable to typical micro-computer systems users. "In a way, it's not much different from our approach to the CAD/CAM market," says Kosoff. "There too, you have vendors with less expensive product with which you give up a certain amount of quality, reliability and support. That is not the market we're looking at."

CalComp officials believe that the Model-84's eight pens will attract business graphics users. Company studies indicate that a typical chart or graph averages five colors. Kosoff says that one advantage CalComp expects in the crowded business graphics market will be established links to major software vendors. The Model-84 is supported by a number of software graphics



CalComp is entering the low-end pen-plotter market with the Model-84, an eight-pen unit with an end-user price of less than \$2000.

TIME-PROVEN PERFORMANCE



While new printers with impressive specifications are introduced on an almost daily basis, only time will tell the true quality of the product. Over the past 2 years our customers have continued to buy the DS180 printer, not only because of its impressive performance and competitive price, but also because of our outstanding track record for product reliability and customer support.

We have continually improved on the performance of the DS180 by incorporating such enhancements as dot addressable graphics, 6 user-selectable print sizes and a 2000 character buffer. These features coupled with 180 cps printing, parallel and serial interfaces, adjustable tractor feed and over 40 other programmable features, make the DS180 one of the most versatile matrix printers available today.

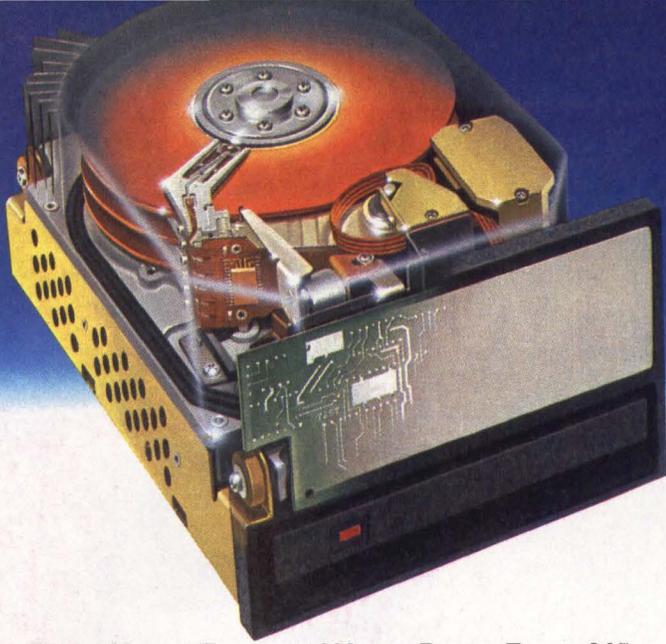
Before you select your next printer, why not take a look at a time-proven performer—the Datasouth DS180.

The DS180 printer is available nationwide through our network of sales/service distributors.

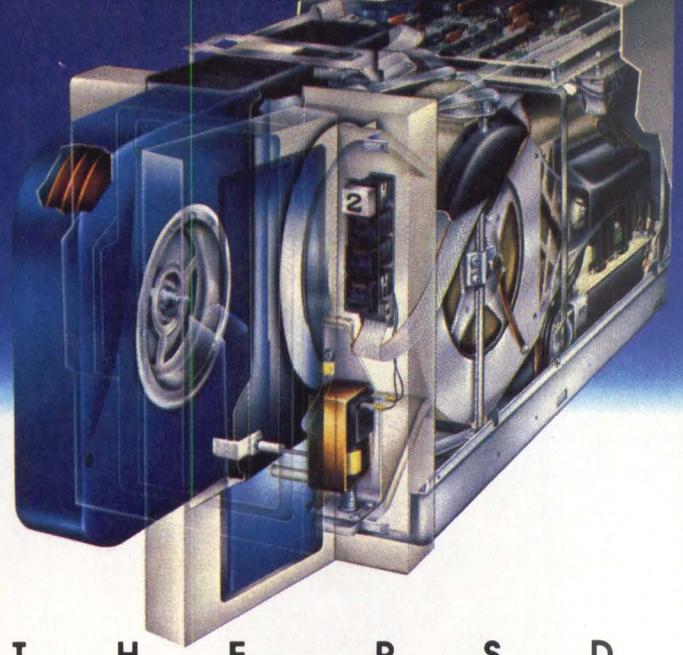
datasouth computer corporation

P.O. Box 240947 • Charlotte, NC 28224 • 704/523-8500

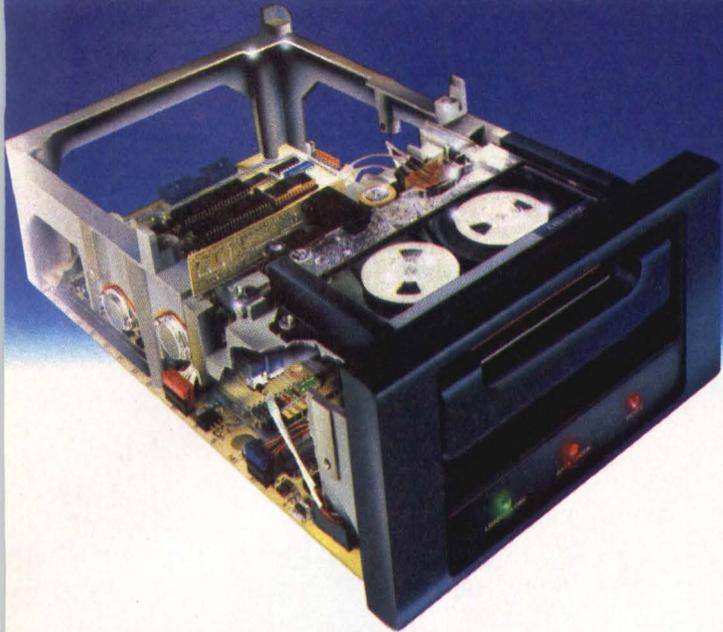
Telex: 6843018 DASOU UW CIRCLE NO. 19 ON INQUIRY CARD



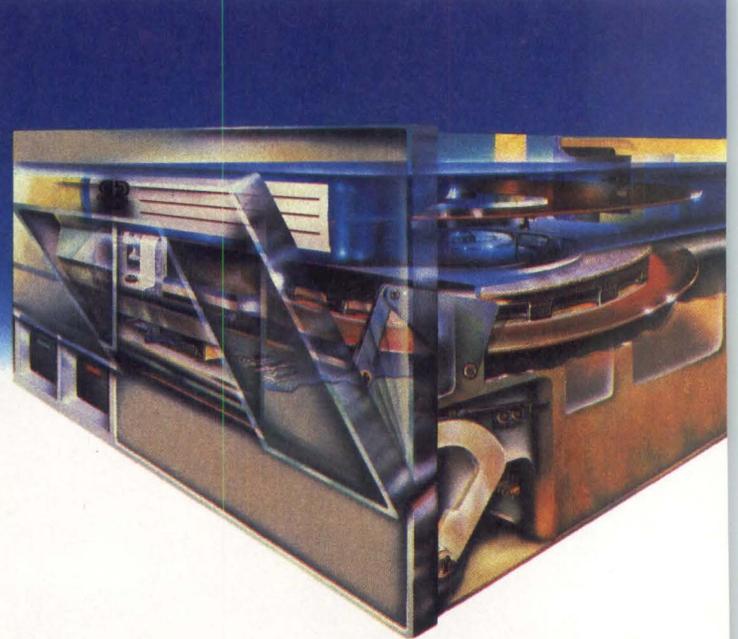
T H E W R E N™



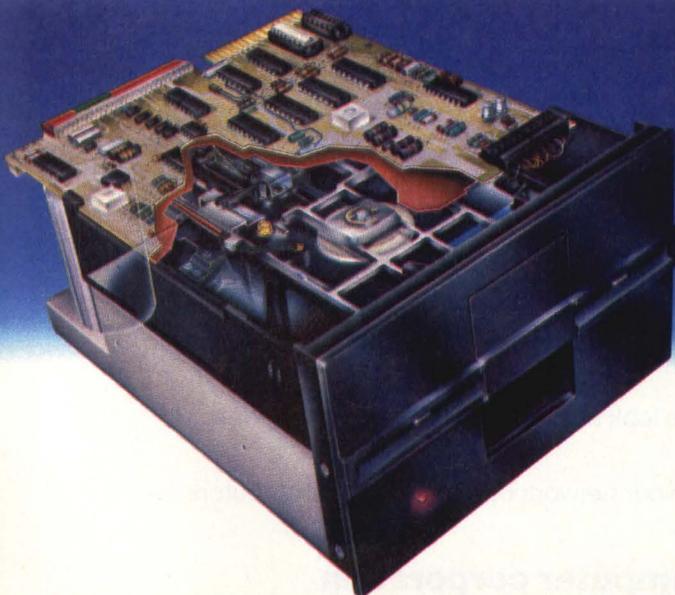
T H E R S D



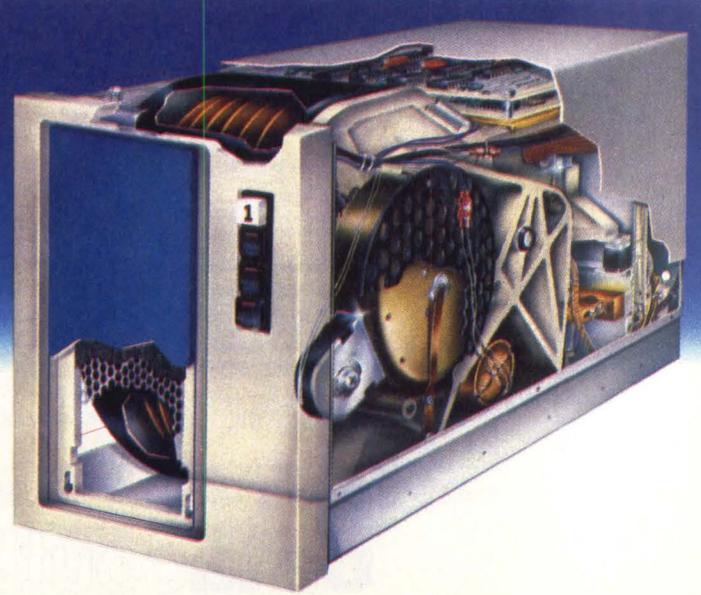
T H E S E N T I N E L



T H E L A R K™



T H E 5-1/4" F D D



T H E F S D

CONTROL DATA: AFTER 25 YEARS, STILL THE LEADER IN THE PERFORMING ARTS.

Designing peripherals with exceptional performance is as much an art as a science. We know. We've been doing it since 1962. From the beginning, we've been dedicated to giving you solutions to on-line and back-up storage needs. Example: the Storage Module Drive (SMD) we introduced became the industry standard for removable media disk drives. The SMD is just one of the high-performance products that helped make us the world's leading independent supplier of storage peripherals.

We're still adding star performers to our product family.

The LARK with a combined 50 Mbytes of fixed and removable media. The WREN high-performance 5-1/4" winchester drive. The Sentinel 1/4" cartridge streaming tape drive and the RSD that provides 80 Mbytes of removable media in a unit one-half the size of the original SMD.

Today there are more than 35 different products designed to help you meet any storage or back-up requirement, with maximum reliability and low cost of ownership built right in.

There's more—the direct support that Control Data offers.

We can deliver maintenance on everything we make. So wherever your customers are, Control Data peripherals can be counted on for less downtime and more productivity than unsupported products. Our spare parts programs help ensure that your reputation for excellent service with your customers is backed to the hilt, 24 hours a day, 365 days a year. In the United States and around the globe.

Add to this the commitment to research, to development and to manufacturing quality that a corporation the size of Control Data contributes, and you're looking at precisely the kind of performance that makes our OEM peripherals top-rated in independent preference studies year after year.

Every performance needs a program.

We'll send you one **free**: our new 48-page OEM products catalog. Write OEM Product Sales, Control Data Corporation, P.O. Box 0, HQN08H, Minneapolis, MN 55440.

MINI-MICRO SYSTEMS/July 1983



GD CONTROL DATA

CIRCLE NO. 21 ON INQUIRY CARD

A lineage to be reckoned with.



Aydin introduces their Patriot™ fast scan monitors.

The 8835 (19-inch) and the 8815 (13-inch) Patriot™ fast scan color monitors are the latest additions to Aydin's successful Patriot Series. These monitors are made by Aydin, in the U.S.A.

Patriot fast scan monitors, with a range of 25 to 38KHz, feature electronic linearity correction, low power consumption, and high contrast glass for easy reading.

Ideal for high resolution (1280 x 1024) applications, the monitors are versatile enough to be used in a variety of configurations.

Test it, and see the quality for yourself!

For further information contact Aydin's Marketing Department for the name of your regional sales representative.



Visit us at Siggraph, Booth #539

Aydin  Controls
Command Performance in Color Graphics

414 Commerce Drive, Fort Washington, PA 19034 (215) 542-7800
TWX: 510-661-0518 Telex: 6851057

CIRCLE NO. 22 ON INQUIRY CARD

Mini-Micro World

NEWS

packages such as Integrated Software Systems Corp.'s DISSPLA and TELL-A-GRAF, SAS/GRAPH and Digital Research's Graphics System Extension.

John Roberts, Mannesmann Tally's product manager for its new plotter, the Pixy, believes his company has made a significant price breakthrough in the low-end market. "To my knowledge, there is no other plotter on the market with three or more pens for under \$1000," he says. Mannesmann Tally's product designers settled on three pens, Roberts says, because their studies, unlike CalComp's, indicate that additional colors are not needed for most business graphics applications. "More than three colors tends to make a graph too complex, and the whole idea of graphics is to present information in such a way that it is simpler to digest," says Roberts. "Crosshatching and other patterns can be used when you have more than three variables. Our studies indicate such charts will be more aesthetic and effective than additional solid blocks of color."

Roberts realizes that many observers will wonder whether a printer company can produce a reliable plotter for such a low price. "Obviously we got some help," he says. "After we settled on our product specifications, we spent a great deal of time searching out the manufacturing expertise we needed in Japan." Roberts says plotter manufacturer Watanabe, which holds a dominant share of the Japanese market, proposed a design adapted from one of its x-y recorders. Mannesmann Tally has a worldwide exclusive on the Watanabe plotter, he says. The Pixy runs on graphics software packages including BPS Business Graphics, GraphTalk, Curve II and Transparent Data Systems.

While the marketing strategies of

MEASURING THE PLOTTERS

	Mannesmann Tally Pixy	CalComp Model-84
Pen positions	3	8
Resolution	0.004 in.	0.004 in.
Plot speed	200 mm. per sec.	420 mm. per sec.
Plotting area	7 x 9.7 in.	8 x 11.3 in.
Media size	A, A4	A, A4
Media	Paper, film	Paper, film
Interface	8-bit parallel, RS232 (\$85 extra)	8-bit parallel, RS232, IEEE - 488

CalComp and Mannesmann Tally differ, market projections indicate there may be room for many approaches. Deanne Iwanaga, CalComp's manager of market analysis, believes that the annual growth rate for tabletop plotters will be 11.1 percent, peaking in 1987 at \$250 million in worldwide sales. In comparison, Iwanaga projects the growth of large flatbed plotters during the same period to be -5 percent.

CalComp's projections of the total market for tabletop plotters is rather pessimistic compared to those of many industry observers. Neil Kleinman of the Pacific Technology Center of research firm International Data Corp., believes the U.S. market for tabletop plotters will total at least \$240 million by 1986. "That is a conservative estimate," Kleinman adds. "In terms of units, we expect almost tenfold growth by 1986 from the estimated 28,850 U.S. shipments in 1982."

Kleinman believes that the tabletop units introduced in the last year can take advantage of the business graphics market. "We suddenly have a graphic hard copy device priced reasonably in respect to the total workstation," he says. "With a

personal computer or desk-top system, it now makes sense for users to have a plotter. At the same time, we're seeing software developments that are making the graphics relatively easy for such users. That's why we are pretty bullish on the market."

Kleinman believes the real pioneer in the market is Hewlett-Packard Co.'s 7470. "It showed desk-top computer system users they could get quality plotting, two pens and color," he says. With that introduction the market has opened, with suppliers offering multi-pen units, A- or B-sized drawings and other features for less than \$2000, Kleinman says. He sees the plotter market opening new distribution channels to U.S. manufacturers.

Kosoff expects CalComp to make 60 to 70 percent of the Model-84's sales to OEMs and the rest to end users. He acknowledges that many OEM customers for the low-cost plotter are a new market for CalComp. "They are putting together business graphics systems, whereas our marketplace has been primarily in the scientific, CAD/CAM and engineering areas," he says.

Mannesmann Tally will market the Pixy through OEM and distributor channels. —Edward S. Foster

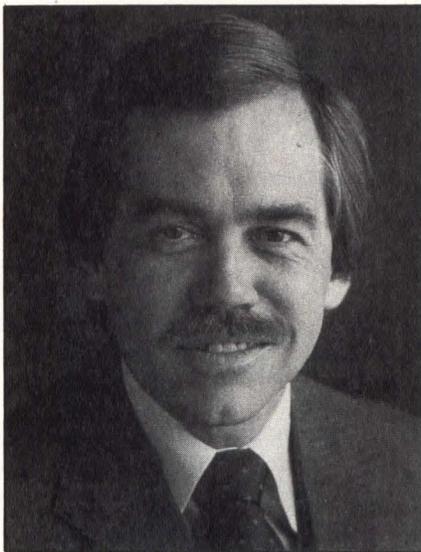
Maxtor ST-506 enhancement may force 'interface-off' in high-capacity, 5¼-in. drives

In contrast to the bloody battle to achieve an 8-in. Winchester disk drive interface standard, the ST-506 interface for 5¼-in. rigid drives has been about as controversial as a congressional resolution endorsing Mother's Day. However, a new generation of 5¼-in. Winchester drives, which break through restricted capacity and other limitations of the ST-506 interface, threaten to open a new controversy. The controversy may also signal the end of the need for separate controller boards and drive interfaces.

Maxtor Corp., a year-old start-up in Santa Clara, Calif., has taken the lead in organizing an industry-wide effort—with the added muscle of mighty Control Data Corp.—to establish a standard for high-performance drives. At last year's fall Comdex, Maxtor announced a 5¼-in. drive with a precedent-setting 140M-byte capacity, which strains the limitations of the ST-506 interface. A new standard is essential to the company's latest plans to market a family of products with capacities as high as 380M bytes. The new drives incorporate an enhanced version of the ST-506 that doubles the data-transfer rate of the ST-506 to 10M bits per sec. and switches to 2/7 run-length-limited recording codes.

Seagate Technology, which pioneered the 5¼-in. Winchester drive in 1980, had the foresight to distribute the ST-506 widely to other disk drive and controller manufacturers, preempting any other interface from emerging until now. More than 200,000 drives have been manufactured in the past three years with an ST-506 interface.

Most manufacturers agree that



"If the ANSI standard were that good, it would have been more widely accepted," says Maxtor's Skip Kilsdonk.

the ST-506 data-transfer rate of 5M bps is too low for drives that store more than 30M bytes. Most agree that for the best performance and cost efficiency, data separators—now built into controllers—must reside on the drive.

From there, the controversy ensues as manufacturers differ on which approach will best achieve the desired result. Although the Enhanced Small Disk Interface proposed by Maxtor has been endorsed by 25 additional companies, the support is unified.

The Small Disk Interface committee held four meetings beginning immediately after last fall's Comdex. Attendance dropped slightly after each meeting as some participants disagreed with the interface specifications, expressed doubts about giving Maxtor a public boost by supporting the interface or simply lost interest. "There are definite problems in getting any group of diverse individuals to

agree on something," one committee member says. "Remember that a camel is a horse designed by a committee."

Many significant market forces, including Tandon Corp., a major supplier of low-end 5¼-in. Winchesters, Xebec Systems, the largest supplier of controllers for 5¼-in. drives, and Seagate, are conspicuously absent from the list of 26 companies supporting the interface.

Xebec president Jim Torreson, the most vocal opponent of the ESDI, says because of the inherent performance limitations of the ST-506, there is little to be gained by simply enhancing the interface. He claims that when Seagate developed the ST-506, it wasn't interested in high performance, but instead in high volume and low cost. "They said, 'To hell with performance; give us low cost,'" he notes. "That's not anything against Seagate; they proved they could do really well with the ST-506 for their 5M- and 10M-byte drives."

Seagate admits to shortcomings in the ST-506 interface when used on high-performance drives. However, the company is not prepared to jump on the ESDI bandwagon. Instead, Seagate is reserving the right to update the ST-506 itself, join Torreson's opposition group or eventually endorse ESDI. "We are working with our on-board customers to establish what interface they want," says Seagate vice president of marketing Scott Holt. "We're not ruling anything out."

Despite the controversy, there is little argument that a new interface is needed. Even controller manufacturers admit that the data separator—not part of the controller—should be housed on the drive. However,

It's not Magic, it's NEC.



presto NEC peripherals turn into extra profits for you.

Put an NEC diskette drive, Winchester or printer into your product, and watch your profits multiply.

To configure a reliable system, you need reliable peripherals.

That's why NEC puts so much research, testing and manufacturing effort into our Winchesters, diskette drives, and printers, to make them the most reliable around.

NEC peripherals work from the instant you take them out of the box, and keep working for years thereafter. Our Spinwriter™ letter quality printers often go two years without a failure. NEC Winchesters and flexible disk

drives typically run more than five years problem-free.

We build one more thing into our peripherals: repairability. The rare failure that does occur can usually be fixed in less than 30 minutes.

At NEC, our own system designers won't tolerate system failure. And we've done everything we can to insure they don't have to. Because NEC knows you can't profit from other people's mistakes.

For information on NEC diskette drives, Winchesters, Spinwriter letter quality printers, and line printers, return the coupon to NEC Information Systems, Inc., 5 Militia Drive, Lexington, MA 02173.

CIRCLE NO. 23 ON INQUIRY CARD

NEC Information Systems, Inc.
5 Militia Drive, Lexington, MA 02173
 Have a representative call me.
 Send more information on NEC peripherals.

Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Telephone _____

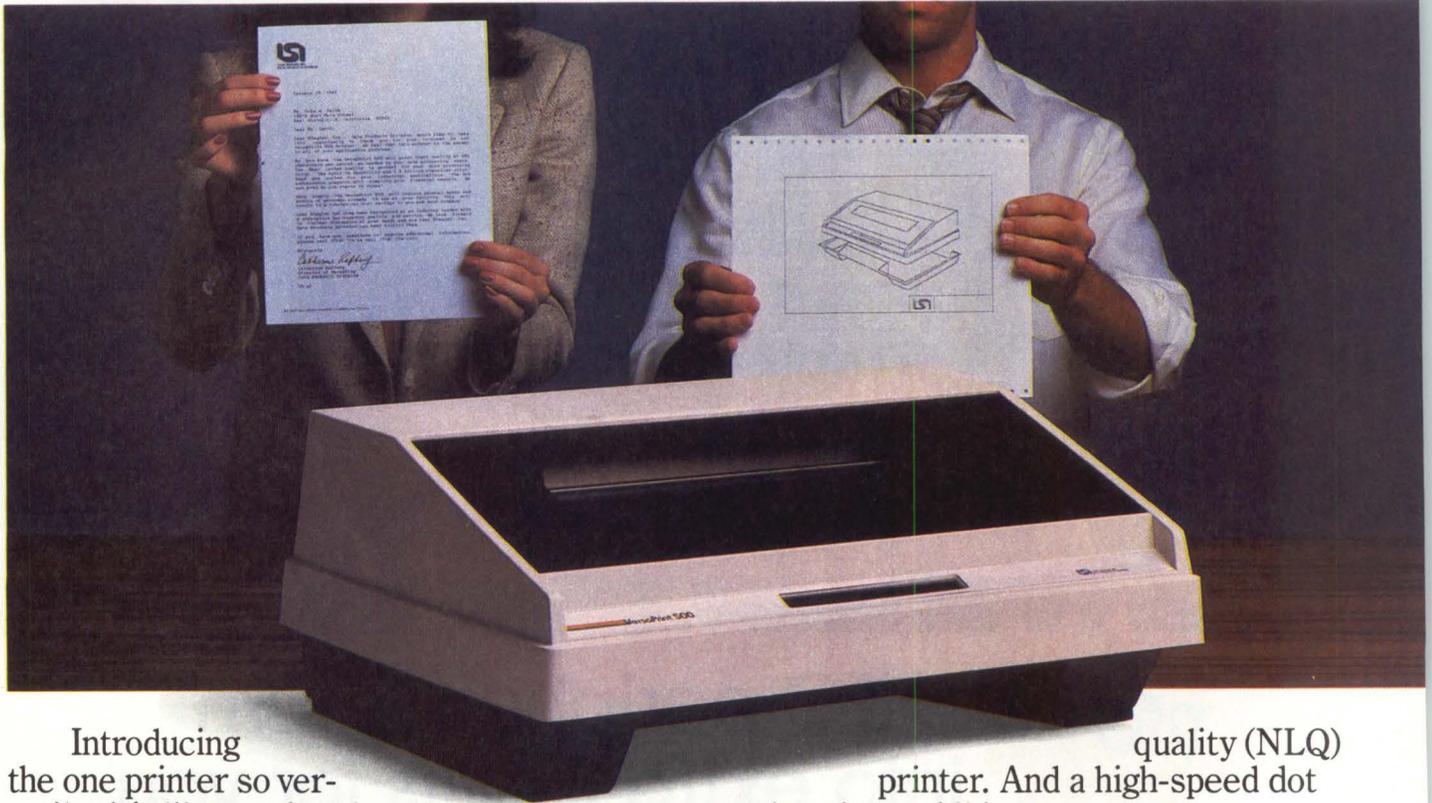
MMS0783

Spinwriter is a trademark of
NEC Corporation.

NEC

NEC Information Systems, Inc.

INTRODUCING V BUY ONE.



Introducing the one printer so versatile, it's like getting three. The VersaPrint 500™ Series printer is a full-color graphics printer. A near-letter-

quality (NLQ) printer. And a high-speed dot matrix printer. All in one.

It's the only printer you need. For office applications. Data processing applications. Or manufacturing applications.

That's because it's the only printer that offers all this:

NLQ printing.

Graphic capabilities. (72 x 72 and 144 x 144 dpi)

Quiet operation. (55dB)

Color printing.

Both tractor feed and friction-feed cut sheet handling.

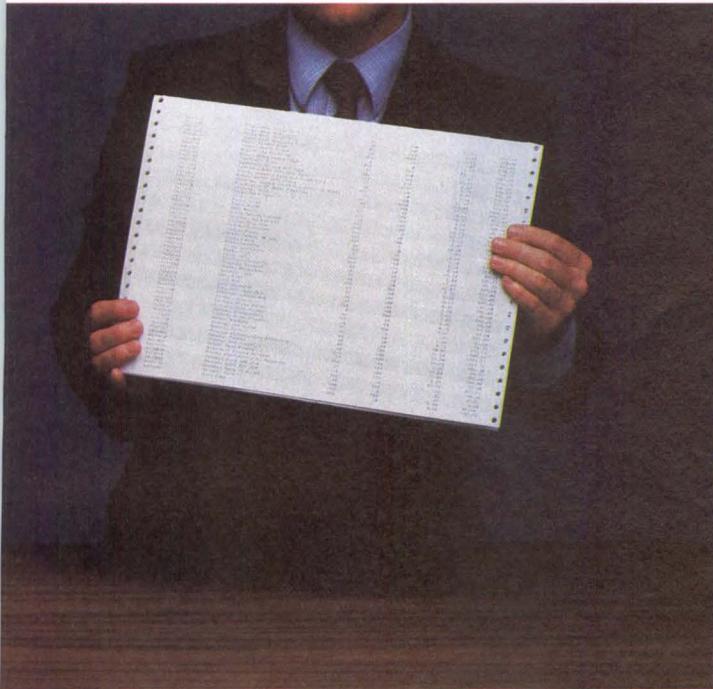
Now you can have graphics for design



Quieter than a typewriter.

Sales & Service: Boston (617) 456-8228 • Chicago (312) 279-7710 • Houston (713) 780-9440 • Los Angeles (714) 774-1010, Ext. 219 • Philadelphia (215) 245-4080
• San Francisco (415) 828-6941 • England (04867) 80666 • From the states of CT, DE, MA, MD, NJ, NY, RI, VA and WV (800) 523-5253.

VERSAPRINT 500.™ GET THREE.



applications on the same high throughput printer that gives you 136 columns for spreadsheets and reports. And all this on an NLQ printer that's actually more quiet than a typewriter.

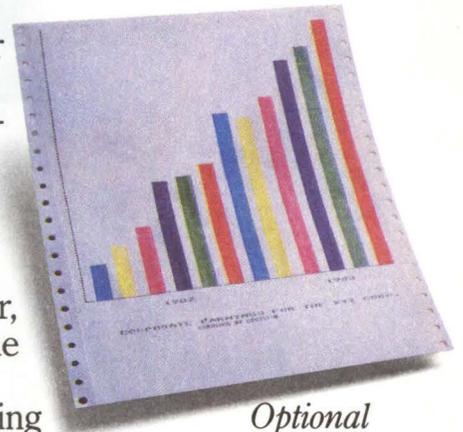
You can run it at 180, 90 or 45 cps, for draft, memo or NLQ quality. At any speed, with its 1.5 billion character printhead you know it's reliable.

VersaPrint 500™ is another innovative implementation of state-of-the-art technology from Lear Siegler, the world's favorite manufacturer of reliable, high quality terminals. It's backed by the

broadest network of full service centers anywhere, with walk-in Express Depot™ service, on-site service and extended warranty service in 3,000 cities nationwide.

Call 800-LEAR-DPD or 714-774-1010 for more information and the name of your nearest distributor.

Remember, there's only one printer that offers everything VersaPrint 500™ offers.



Optional full color printing.

The one printer versatile enough to replace three.

Please send me further information about the VersaPrint 500™ series. MM 7/83

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

ZIP _____ PHONE _____

Mail to: Lear Siegler Data Products Division
714 North Brookhurst St., Anaheim, CA 92803
Or Call: 800-LEAR-DPD (800-532-7373)

 **LEAR SIEGLER, INC.**
DATA PRODUCTS DIVISION

EVERYBODY MAKES PRINTERS. ONLY WE MAKE LEAR SIEGLERS.

OEM Sales: • Chicago (312) 279-5250 • Houston (713) 780-2585 • Los Angeles (714) 774-1010, ext. 582 • New York (516) 549-6941 • San Francisco (415) 828-6941
• England (04867) 80666 VersaPrint 500™ and Express Depot™ are trademarks of Lear Siegler, Inc.

CIRCLE NO. 24 ON INQUIRY CARD



Has been.



Will be.

The Tektronix 4027 Color Graphics Terminal has been understandably famous.

It features high-quality, dot-addressable graphics, and readily available application packages using Plot 10 software.

The Datamedia ColorScan has these features, too. (And what's more, it takes up less space, and its display is comfortably brighter.)

Indeed, the ColorScan emulates the 4027 in almost every respect except price. It costs up to 30 percent less – a distinction that will make the ColorScan very famous, very soon.

Write Datamedia Corporation, 7401 Central

Highway, Pennsauken, NJ 08109. Or call 1-800-DMC-CORP. (In New Jersey: 1-609-665-5400.)

DATAMEDIA



**Getting Business
Computing Together.**

MINI-MICRO SYSTEMS/July 1983

Mini-Micro World

NEWS

putting the separator on the drive would force manufacturers to recruit more highly skilled talent that was previously limited to controller houses. It would also cause controller manufacturers to suffer price erosion. But that is the least of the worries for controller manufacturers.

Evotek Corp., Fremont, Calif., a two-year-old manufacturer of high-performance Winchester drives, gave lukewarm endorsement to ESDI. The company plans to announce a drive at this year's fall Comdex with the entire drive controller on the drive, eliminating the need for both a controller board and a drive interface. "Those controller companies who recognize trends will begin to think about becoming chip makers rather than board companies," says Jose Ramos, director of marketing at Evotek. "Those who don't will find a rapidly declining market for their products."

However, Data Technology Corp. marketing vice president Mike Kirby points out that separate controller boards will still have a role, especially in applications in which a user needs various backup devices. In addition, the drive interface is less costly than the host interface to the CPU, which will still be required.

Seagate vice president of engineering Doug Mahon notes that drive manufacturers may have a difficult time finding the available real estate in a tight 5¼-in. form factor to house the four chips for the on-board controller. As a solution, Xebec's Torreson suggests reengineering the 8-in. ANSI interface for high-performance 5¼-in. drives. He has offered to redesign the ANSI 8-in. interface to fit the Maxtor drive and other high-performance drives. Such a redesign could be easily implemented "in a matter of

months," Torreson says, at a very low cost. "We have already paid our dues on the ANSI interface; it's just sitting there ready for us to use. For about \$5 in parts, we can adapt it to 5¼-in. drives," he says.

Torreson says Maxtor's ST-506 enhancement would strain future controllers and drives built to the interface. He says the ST-506 is working overtime to achieve a 5M-bit-per-sec. data-transfer rate, and pushing it to 10M bps as Maxtor proposes would prove disastrous. "As you start going up to 10M bps, you roll off a drastic increase in the bit error rate," he says.

Maxtor's marketing director, Skip Kilsdonk, disagrees. He says the ESDI has taken enough strain from the interface to allow it to accept the full 10M-bps transfer rate. He doesn't believe the ANSI interface is the answer either. "If the ANSI standard were that good, it would have been more widely accepted," he says. "I don't see that many ANSI interfaces around, even in the 8-in. market."

Torreson, however, believes he is on the right track and plans to organize a separate group of

companies—including some notable exclusions from the ESDI, such as IBM Corp., Digital Equipment Corp. and Hewlett-Packard Co. Torreson has suffered some defections from his ranks, however. Two companies believed to be in his camp—Priam Corp. and Micropolis Corp.—appeared on the list of 26 supporters of ESDI.

Priam's about-face resulted from its plans to reintroduce a high-performance 5¼-in. Winchester first announced at the 1982 National Computer Conference and later withdrawn. The redesigned drive is expected to have an increased capacity of more than 50M bytes and thus will require a high-performance interface. The ESDI is the only one available.

Micropolis, meanwhile, has also endorsed the ESDI as a "step in the right direction," says Bob Mortensen, application engineering manager at Micropolis. However, he adds, the company has no plans for a product made to the interface specification "unless there is an unexpected demand from our customers."

—Robert A. Sehr

Naked Mini 186-based micro follows shifting market

The introduction at the National Computer Conference by the Naked Mini Division of Computer Automation Inc. of the Intel 80186-based OMNIX 186 multi-user system emphasizes that the Irvine, Calif., division was named in a bygone era. The new product is neither "naked" nor "mini," yet it is to be the big gun in a campaign to gain and retain customers committed to CA's proprietary software. It will simultaneously make a play for the system house business going to companies

such as Altos Computer Systems that emphasize industry-standard operating systems.

The 80186-based CPU board at the heart of the OMNIX 186 is also expected to boost Naked Mini's more traditional board-level business when it is unbundled this year.

Since 1979, when Gordon Watson, then Naked Mini general manager, described CA's products as the "low-end spread" in the OEM minicomputer business, the performance gleaned from micro-

Expensive.



The new RCA APT expands your data communications

For business, professional and personal data communications, you'll find more user-friendly features and greater communications capabilities in the RCA APT than in other terminals selling for up to three times the price.

The new APT terminals are ideally suited to multi-data base time sharing and dedicated, direct computer-connected applications. They feature menu-controlled operation and a programmable "personality" to match specific communications requirements for your data bases.

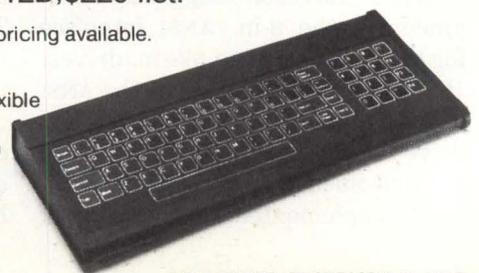
A single keypress can dial a stored number, send the log-on sequence to the host computer, and return terminal control to the user. Password protection prevents unauthor-

ized access to designated numbers. APT can also be used as an auto-dialer for voice communications.

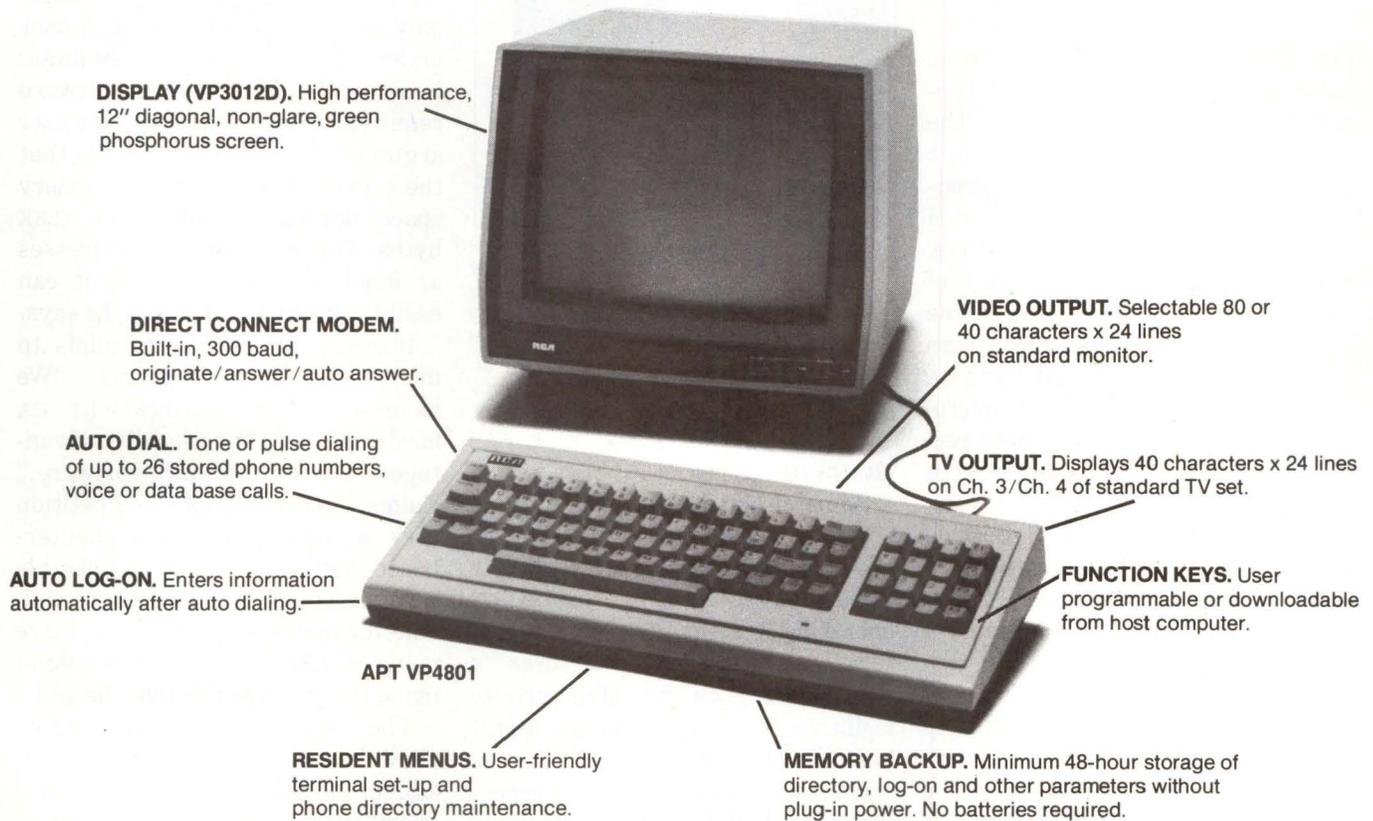
APT terminals list for \$399, in your choice of full stroke or membrane keyboard versions. Either style is also available with a display monitor for \$598 list. The data display monitor alone, VP3012D, \$229 list.

OEM and dealer pricing available.

APT VP3801. Flexible membrane keyboard version designed for travel and hostile environments.



Expansive.



(All Purpose Terminal) capabilities for a lot less money.

Quite simply, matching features with price, there is no other professional quality terminal available today that can do as much at such low cost.

For more information, just clip the coupon at right. The new RCA APT. Expansive. Not expensive.

OTHER FEATURES

RS232C port for direct computer connections at data rates to 9600 baud, or for connecting high speed modems and other accessories. Parallel printer port for hard copy. Numeric keypad, can dial phone numbers not in terminal directory. Built-in speaker with adjustable volume control for audio monitoring of phone line. Smooth scroll display. Automatic screen blanking to reduce possibility of burn. Briefcase size: 17" x 7" x 2". Weight: under 4 lbs.

To:
RCA MicroComputer Products
New Holland Avenue
Lancaster, PA 17604

Please send me the APT brochure with complete specifications.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

For more information or to order, call 800-233-0094. In Penna., call collect to 717-393-0446.

Mini-Micro World

NEWS

processors by the major semiconductor houses has swept microcomputers past low-end minis. The Intel 186, which CA rates as a 0.7-million-instruction-per-sec.

processor, outperforms the lower two-thirds of CA's mini-based processors, for example. And the "naked" in the division's name is a problem because board-level products, which held a minority share of the minicomputer business in 1979, now claim just a small sliver of the pie, says Skip Bushee, vice president of market research firm InfoCorp, Cupertino, Calif. "The CA announcement of a complete micro-processor-based system simply recognizes the reality of the market today," says Bushee.

A basic OMNIX 186 configuration includes 384K bytes of RAM, four serial ports, a 5M-byte, 5¼-in. Winchester disk drive and a 1M-byte floppy drive for a suggested single-unit list price of \$8990. The OMNIX 186 retains compatibility with the OMNIX workstation introduced last year as well as with the rest of Naked Mini's line of single-board computers. It runs CA's TRANS-BASIC language under the proprietary OPUS-1 operating system.

But Brian Middleditch, Naked Mini's manager of marketing for business systems, stresses the importance of the new system's ability to run CP/M-86, Concurrent CP/M-86 and MP/M-86 as well as MS/DOS (as a task under OPUS-1), giving CA its first product for OEM system packagers committed to industry-standard software. "We have a general business package running under OPUS-1," says Middleditch. "But the attraction of the 186 is that we can augment the application base so much faster by going with third-party MP/M programs than we can by developing applications ourselves using



Computer Automation's Naked Mini division is addressing the shifting computational performance range with a 186-based system multi-user system called OMNIX 186. The basic configuration includes 384K bytes of RAM, four serial ports, a 5M-byte, 5¼-in. Winchester disk drive and a 1M-byte floppy drive for a single-unit list price of \$8990.

TRANS-BASIC."

Some of Naked Mini's customers, however, are more interested in the less expensive horsepower suddenly available to run CA's OPUS-1 operating system. OPUS-1, like the Pick operating system, uses a multikeyed ISAM file structure to facilitate and speed writing compact business applications.

One such customer, Dave Ferren, vice president of software development for Distributor's Data Management Systems, Addison, Texas, thinks the OMNIX 186 will boost sales of a turnkey package he designed for wholesale office-supplies distributors. "CP/M offers no real advantage to us," Ferren says, explaining that the transportability of DDMS's software unchanged to the OMNIX 186 is the real attraction. "We figure our software will run about five times faster under the 186 than under the two Naked Mini 4/30 processors we use for our 20-terminal, five-printer system," he says.

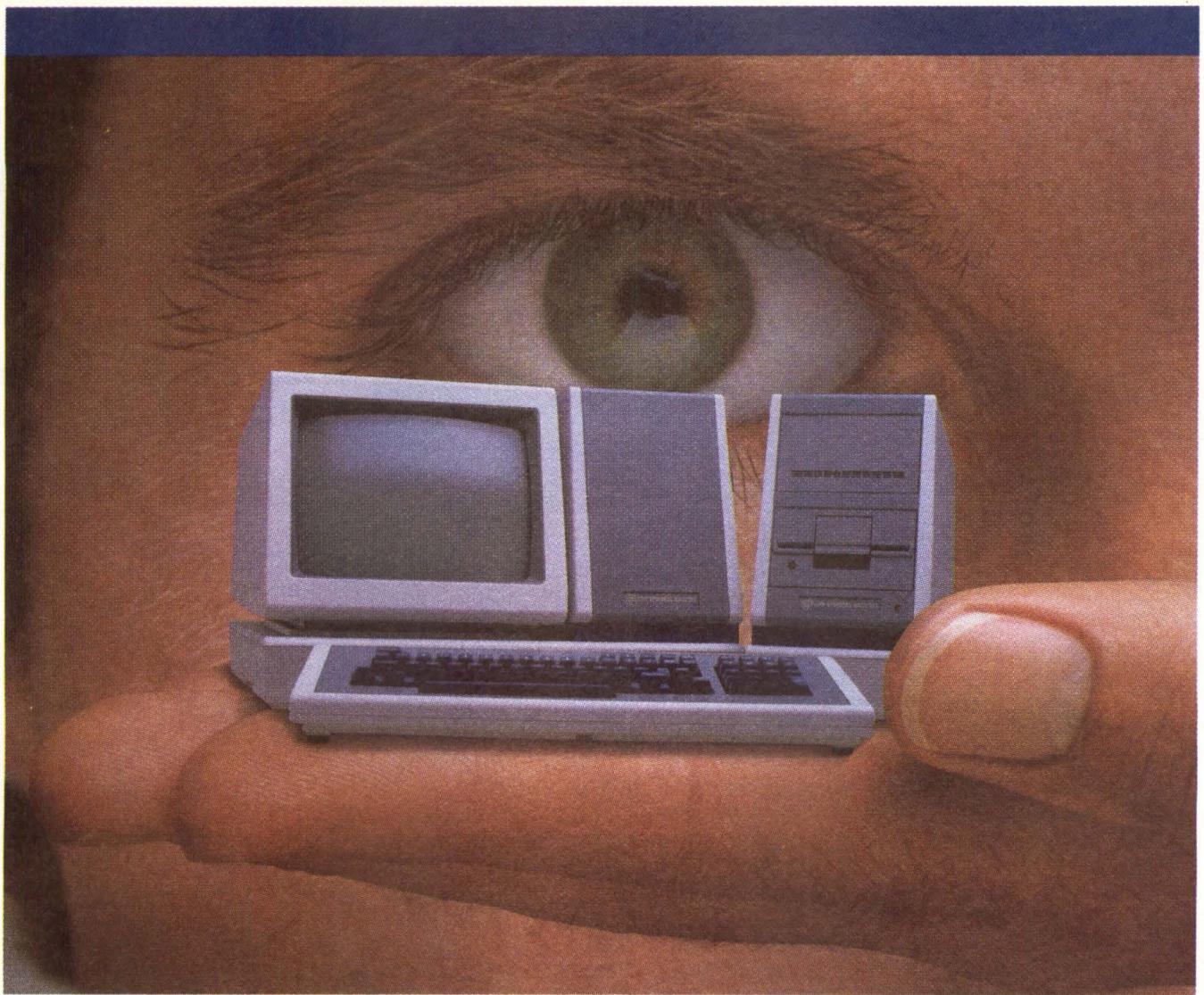
Ferren says most of the speed increase is the result of the Naked Mini architecture's use of only two registers for byte comparisons, compared to the 186's 10. "But the thing I like about the 186 more than

the speed is its memory capability," he says. Ferren is pleased with his current CA minicomputer-based system. He emphasizes that it takes only 8K bytes to support each user under OPUS-1 and TRANS-BASIC because the table-driven software requires storage space only for user argument strings. But he notes that the 4/30 quickly uses up its memory space because it addresses 128K bytes. The 186, however, addresses as much as 16M bytes, so it can easily support 40 terminals, he says.

DDMS is jumping from minis to micros to remain competitive. "We have a real price edge with CA hardware and a functionality advantage because of our software," claims Ferren. DDMS's competition uses a variety of minicomputer-based hardware. "But comparable software tools are becoming available for microcomputers, and we're going to lose that edge if we don't make the jump to the 186," he adds.

The OPUS-1 operating system allows a second CPU board to be added. CA has also included a board based on its proprietary 0.17-MIPS 4/04 microprocessor to handle I/O for as many as 16 terminals and printers. The Intel 8087 floating-point co-processor is optional. Although usually added to systems aimed at scientific applications, the 8087 also significantly speeds some TRANS-BASIC applications.

The 8-MHZ version of the 8087 to work with the 8-MHZ 186 part is not due in quantity from Intel Corp. until the year-end, however. That means a 186-based board-level product will probably wait in the wings until then because of the importance of the 8-MHZ version's extra number-crunching power to Naked Mini's engineering customers. Also probable by year-end, says Middleditch, is a version of the OMNIX 186 that OEMs can unbundle down to the chassis. —Kevin Strehlo



CIES 680 Business Computer

THE NEW GIANT IN MICROS

If other computer makers call their micros "state of the art," then CIE Systems gives the term a whole new meaning.

The multi-user, CIES 680 Business Computer Systems are a unique blend of advanced 32/16-bit 68000 microprocessor architecture with the latest in software technology.

Capacities range from one to 20 terminals, 10 to 300 Mbytes of disk, and 256KB to one Mbyte of memory.

Processing takes place so fast that many people can use

MINI-MICRO SYSTEMS/July 1983

the system from separate terminals *simultaneously* with virtually no delays.

To complement the highly advanced 680 architecture is PRO-IV.[™] This unique applications software processor allows you to easily and quickly develop customized applications without programming or code generation.

Also available are prewritten applications that cover a wide variety of business operations, ranging from general accounting modules to financial modeling and word processing systems.

The complete and totally modular CIES 680s are a giant step forward in quality, versatility and performance. They're U.S.-designed and manufactured abroad by one of the world's largest electronics firms.

CIRCLE NO. 27 ON INQUIRY CARD

No computer maker has ever had greater manufacturing support or financial backing. Behind CIE Systems are the gigantic resources of a world-wide corporation with well over \$50 billion in sales.

For more information on the new giant in micros, just call or write CIE Systems, Inc., 2515 McCabe Way, Irvine, CA 92713-6579 (714) 660-1800. Call toll free, 1 800 854-5959. In California call 1 800 432-3687.

CIE SYSTEMS
A CITICORP ELECTRONICS COMPANY

TM PRO-IV is a Trademark of Data Technical Analysts, Inc.



What's Megateknology?

Everybody else claims to make state-of-the-art computer graphics systems. We don't. At Megatek, we're making history out of state-of-the-art. In fact, we're turning it into state-of-the-past. It's what we call Megateknology.

Meet Our Family.

Meet our family of Whizzards. One graphics miracle after another. Innovative, sophisticated systems that set industry standards others can only try to match. Tomorrow's design solutions today. In short, graphics Whizzardry.

The 7600 System. Power and Performance.

Our top of the line Whizzard.[®] The powerful 7600 perhaps provides the greatest range of operator interaction of any system today. Dual-bus architecture supports both high resolution stroke refresh and color raster displays. Up to two. Real time dynamics on color raster displays make frame updates at stroke refresh speeds for both 3D, wireframe and solid surface objects.

State-of-the-art doesn't even come close to the 7600.

The Whizzard 7200. Graphics Excellence.

Customize your own system to meet specific design needs. The 7200 offers unprecedented flexibility and speed. Modular architecture supports both high resolution stroke and real time dynamic color raster displays providing powerful, economical system configurations. Working in 2D or 3D, this Whizzard provides solid solutions for any design application, today or tomorrow.

Our 6200. Economical graphics terminals.

Whizzard 6200 graphics terminals are completely self-contained with their own desk, display monitors and interactive devices. They combine the high vector density of a raster terminal with the 12-bit virtual addressability and dynamics of a vector refresh system. And, our 6200 can display real time data and static overlays simultaneously. Efficient, effective and economical design tools that minimize host computer burden and reduce communications through local display list architecture.

That's Meg



The Whizzard 1600s. Desktop miracles abound.

Then, consider our 1600s for creating graphics miracles right on your desk. With all the features of our more powerful, expensive Whizzards but in a compact, highly efficient 2D design station, right at your fingertips. Everything an engineer or designer could ever want in desktop computer graphics. Color or monochrome. High quality and resolution. VT-100™ compatibility. Greatly increased productivity thanks to ergonomic design. Megateknology, pure and simple.

Graphics Software is Megateknology, too.

The Whizzard's WAND™ Upward and downward compatibility throughout our graphics family. It lets you write applications programs that run on either vector refresh or color raster systems for both 16- and 32-bit computers.

Or take TEMPLATE® Computer and device independent software support for 32-bit or larger mainframes. 2D and 3D dynamic or static applications in batch or interactive modes. Creates, displays, modifies or stores graphics for a myriad of applications.

That's Megatek.

Everything you could want in graphics hardware and software. Examples of innovative pioneering in computer graphics technology. Power, greatly increased productivity, multi-functionality, versatility, simple design excellence and solutions.

But then, there's state-of-the-art. Or by comparison, state-of-the-past. Why choose it when you can put Megateknology to work solving your graphics problems? It'll make miracles for you, too.

See us at SIGGRAPH,
Booth 527, July 26-28, Detroit, MI.

VT-100 is a trademark of Digital Equipment Corporation.

Making History out of
State-of-the-Art.



ateknology™

World Headquarters • 3985 Sorrento Valley Blvd. • San Diego, California 92121 • 619/455-5590 • TWX: 910-337-1270
European Headquarters • 34 avenue du Tribunal-Fédéral • CH-1005 Lausanne, Switzerland • Telephone: 41/21/20 70 55 • Telex: 25 037 mega ch

Precision Visuals' mainframe graphics software migrates to MC68000-based micro

A mainframe software package from Precision Visuals Inc. is being made available on an MC68000-based, Multibus microcomputer running UNIX. The DI-3000 package is a library of 160 FORTRAN subroutines that implement the Siggraph Core recommendation for device-independent graphics; it also is a tool box for graphics-application development that supports 3D transformations, interactive selection of color and such CAD/CAM essentials as a pick function and segment support. The porting of the package to an MC68000-based computer indicates that such a machine has the computing power and, more significantly, the software tools, to make large-scale sophisticated microcomputer applications feasible.

Precision Visuals chose to implement the package on a microcomputer then in prototype form to test its software. The microcomputer chosen is Cosmos Computer Inc.'s Lyra, which, in a minimum configuration includes a 20M-byte Winchester drive, 0.5M bytes of main memory, an 8-in. floppy disk drive

for backup and a full UNIX operating system including the Berkeley enhancements. That configuration sells for \$16,500. A monitor is not included in the price. To run the system, a user must purchase Silicon Valley Software's FORTRAN 77 compiler for \$600. The DI-3000 is priced at \$2275, including two days of training at Precision Visuals in Boulder, Colo.

Microcomputer access to mainframe-quality graphics is already available through Integrated Software Systems Corp. (ISSCO) and Graphics Software Systems software that allows microcomputers with an integrated display, such as IBM Corp.'s Personal Computer, to emulate a low-resolution graphics terminal. ISSCO has also ported its device-independent Disspla and Tel-A-Graf presentation-graphics software to run stand alone on the MC68000-based Apollo Domain. Apollo itself markets and supports a FORTRAN subroutine library based on George Washington University's public domain Core graphics package that runs under Apollo's

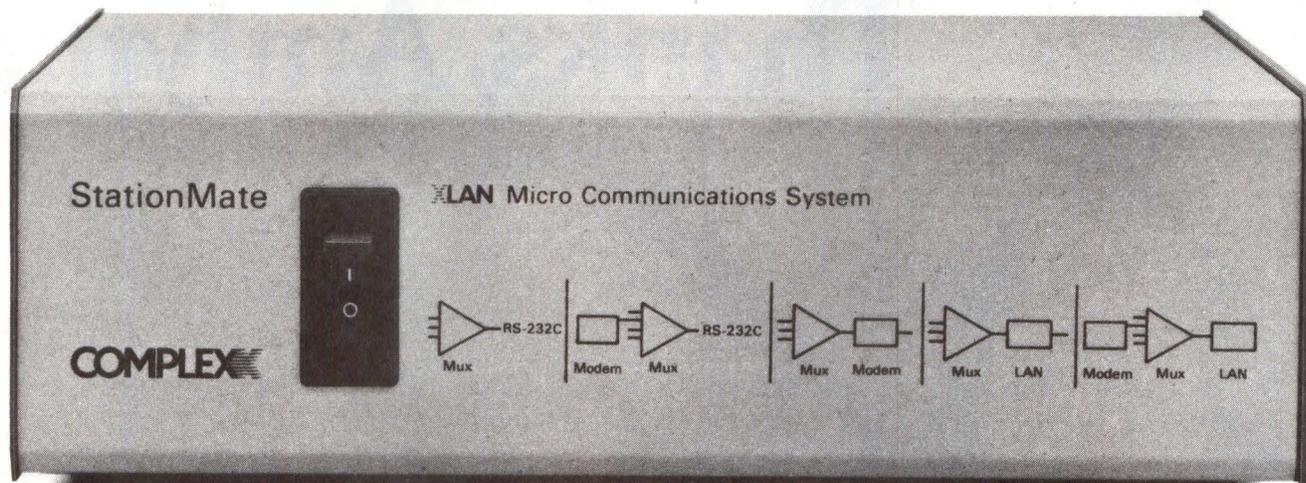
proprietary Aegis operating system. "The key for us," says Precision Visuals' president, Jim Warner, "was a robust, FORTRAN 77 compiler that really worked, a linking loader that could handle enough subroutines and strong development utilities, such as a symbolic debugger." Silicon Valley Software's FORTRAN fit the ANSI-77 bill, while Unisoft's Uniplus+ operating system, a subset of UNIX System III, provided an adequate linking loader and solid utilities.

Paul Inman, Precision Visuals' software engineer who transported the package to an early Cosmos prototype, says the choice of Beta-site hardware and software conditions for the initial move to micros was intentional, a study in worst-case feasibility. "Ports to mature MC68000-based machines with decent FORTRAN compilers should be a cinch," he says. The several machine-dependent routine in DI-3000 have been rewritten in C, and Inman says they will require only fine tuning to run on the 68000-based UNIX machines Precision Visuals is considering. Precision Visuals' OEM agreement with Cosmos involved an up-front licensing fee and royalties in the three figures per CPU instead of the five figures Precision charges for the software on a mainframe. But the agreement leverages the firm's sales and support through Cosmos. There will be no direct contact between Precision Visuals' and Cosmos's customers. "We've always prided ourselves on end-user support," says Warner, "but we have to adjust to this new market. By 1985, we expect 20 percent of our revenues will come from microcomputer annuities."



Precision Visuals Inc.'s graphics package for MC68000-based microcomputers is compatible with more than 40 output devices. The library of 160 FORTRAN routines allows such functions as 3D transformations, interactive selection of color, a pick function and segments support to be performed.

SIMPLE.



It unifies a switching statistical multiplexer, a local area network (LAN) interface, and a modem/dialer into one operating system. It's StationMate.™

Subtle. Strong. Singular. The first XLAN™ product from Complexx. An innovative idea for powerful networking with micro and mini computers. Simply, StationMate.

With it you can construct a LAN with up to 64 nodes having 3 ports each. And you can create a remote workstation or provide access to the LAN on a dial-up line. All it takes is just a simple phone call.

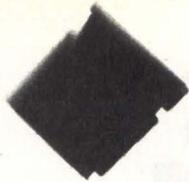
User interface is simple, too. You can configure or establish local or remote ports, nodes, and networks through menu-driven terminal commands from any port. *There are no cryptic DIP switches.* But the biggest surprise is the suggested retail price: \$1450.00. StationMate won't take a byte out of your budget.

If you didn't see StationMate at the spring Interface and Comdex shows, call or write for application information and specifications. Complexx Systems, Inc., 4930 Research Drive, Huntsville, AL 35805, 205/830-4310.

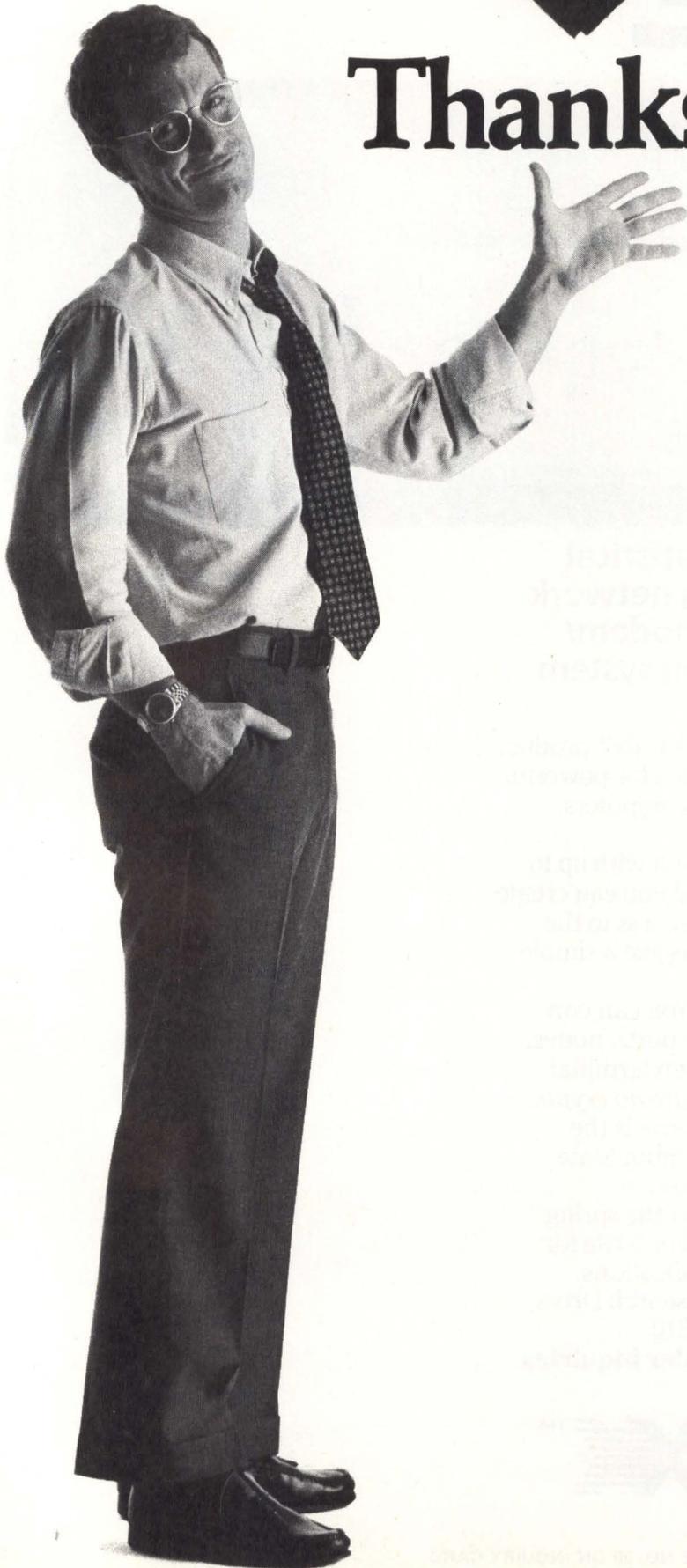
OEM, Distributor, and Dealer inquiries invited.

COMPLEX™

CIRCLE NO. 29 ON INQUIRY CARD



Thanks, Amlyn...



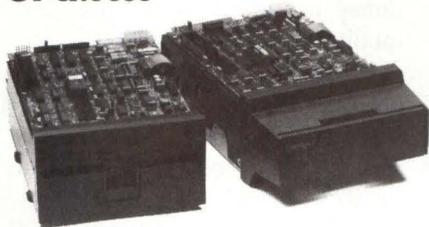
[Faint, mirrored text from the reverse side of the page, including the word 'COMPLEX' at the bottom.]

Who needs removable Winchester?

Nobody. Here's a low-cost solution that works in any format.

Let's face it. There's no workable, reliable Winchester system with removable media that can take the beating of typical, unsophisticated personal and portable computer users. What you've been wanting is Winchester that acts like floppy. Well, we turned the tables and made floppy act like Winchester.

So whether you need primary storage or Winchester back-up, Amlyn delivers. Our double-sided minifloppy provides 3.3 Mbytes per diskette. Or choose



our MiniPac drive which provides 8 Mbytes of dynamic data storage in a five-diskette removable cartridge.

Closed loop servo. Our heads never need alignment. With our system, each diskette is its own alignment diskette. But we don't mix positioning information with the data. And we position the read/write head over the center of each track — regardless of variations in track positioning due to temperature and humidity. Your user faces no special handling requirements and a dramatic reduction in soft read errors.

Interchangeable media. We don't care if the track density is 48, 96 or 100 tpi



(or any other density, for that matter). We don't care if you're reading industry-standard UHR II high density diskettes. With an Amlyn disk drive, you can work in *any* format. This saves end-users time and money since they don't have to use multiple drives or convert their existing data to a new format.

Proven technology. We have 1000's of these 5 1/4-inch drives in use throughout the world... Working as primary storage and Winchester back-up... Making some innovative OEMs a ton of money.

Since you don't need removable Winchester storage, why don't you contact us today for an evaluation unit?

amlyn
...advancing floppy
technology

Amlyn Corporation
2450 Autumnvale Drive
San Jose, CA 95131
(408) 946-8616
TWX 910-379-0029/
TLX 171627 Amlyn
In Europe (Brussels),
phone (32) (2) 513 87 94

CIRCLE NO. 30 ON INQUIRY CARD

Mini-Micro World

NEWS

Most of the company's \$8 million in annual revenues now comes from large companies. Bell Laboratories uses DI-3000 in all its computing centers, for example, and all of AT&T's documentation is produced on a film recorder output device using DI-3000 as the software base. Warner thinks the new portability of DI-3000 application source code

from mainframes to microcomputers is an edge for both Precision Visuals and microcomputers that run DI-3000. He says MIS managers in large organizations appreciate the fact that mainframe graphics applications can run on the workstations that are creeping into the department level.

Precision Visuals marketing vice

president Don Van Dyken believes the company's Core graphics will be a strong marketing tool for vendors of MC68000-based microcomputers. "It's tough to tell all those look-alike boxes apart," he says. "Manufacturers that incorporate powerful graphics will have a marketing edge."

—Kevin Strehlo

NEC broadens printer line with dot-matrix models for OEMs

NEC Information Systems Inc., a major competitor in the fully formed character printer arena, has entered the U.S. OEM market with a series of 18-pin dot-matrix machines priced to compete with nine-pin printers.

NEC's Pinwriter dot-matrix printer family was launched with the announcement of the P1 model. Scheduled for production deliveries in June, the P1 offers 180-cps printing in draft mode, 90-cps in high-density mode, 80 print columns and a Centronics-type interface.

Evaluation units of two additional models, the P2 and P3, were to be available in June, with full production quantities expected by the fourth quarter of this year. The P2 will add a 35-cps near-letter-quality mode and an IBM PC interface to the standard Pinwriter features, and the P3 will offer the same features plus 136 print columns. End-user, single-unit prices for the P1 and P2 are \$799 each, and price of the P3 is \$1250.

All three models employ 18-pin print heads. Bruce Thatcher, NEC director of peripherals marketing, believes the P1 is the first 18-pin-head dot-matrix printer priced at less than \$1000. "The design is a proven technology that NEC has been using in Japan for



NEC's Pinwriter, the company's first dot-matrix printer in the U.S., is part of a series from Japan that parallels NEC's fully formed character thimble printers.

years," he says. "The greatest benefit in having an 18-wire head comes in the throughput it offers, although that may not show up when measuring characters per sec." He claims that, with the 2 x 9 staggered pin array, the printer can produce densities in one pass for which other printers (1 x 9 pins) would require a dual-pass mode.

NEC previously marketed dot-matrix printers only with the company's microcomputer systems. The company hesitated to commit to the crowded market for low-end dot-matrix printers, but Thatcher believes the Pinwriter is priced for the high-end personal computer market. He claims that the Pinwriter offers a solution to personal computer OEMs, system

integrators and end users that need high speed, high quality and business graphics. "With the multiple printing modes, users can obtain the speed and performance for higher volume printing requirements such as data processing, high-density output and nearly unlimited font flexibility for graphics applications in one low-cost multifunction printer," says Thatcher.

All three Pinwriter models include 10-pitch pica, 12-pitch elite, and 17-pitch condensed printing; proportional spacing; international characters; and graphics symbols. The printers produce a 7 x 9 matrix character in high-speed mode and a 13 x 9 character for high density. The P2 and P3 produce characters as dense as 26 x 18 for near-letter-quality requirements.

Historically, NEC has concentrated on vertical integration of its product line, and NEC Corp. in Japan has long had dot-matrix printer models corresponding to each daisy-wheel printer series that the company has introduced in the U.S. The company will broaden its dot-matrix line, Thatcher says. "This is the low end of the spectrum. The requirements for future products will be for higher speed, greater density and smaller

INTRODUCING

THE TRANSTERM[®] 3 BATTERY POWERED TERMINAL

LIQUID CRYSTAL DISPLAY

Two lines with 40 characters each, 5x7 dot matrix font, 4.8 mm character height, upper and lower case ASCII character set, with an underscore cursor symbol.

KEYBOARD

68 keys, membrane with raise graphics and audible key-click for tactile feedback, On-line and Off-line modes with EDITing functions.

BATTERY POWERED

NiCd batteries inside the terminal supply power for up to eight hours of operation and for long-term retention of text and set-up parameters with automatic power shut-down (charger included).

OPTIONAL PRINTER

Forty column printer/plotter uses standard 2.25" wide adding machine rolled paper and a ball point pen stylus.



BUFFER MEMORY

1,920 character buffer memory organized in 24x80 or 48x40 format. Data retained by battery.

SET-UP MODE FEATURE SELECTION

- Half/Full Duplex Operation
- Eight Baud Rates (110-9600)
- Parity Bit State (even, odd, mark, space)
- Buffer Format (40/80 Characters/line)
- Page/Line Mode selection
- X-on/X-off protocol
- Auto Line Wrap
- Auto Key Repeat
- Auto New Line
- Upper/Lower case
- Protected data fields

OPTIONAL MODEM

300 baud built-in modem with auto-answer and auto-dial features in either direct-connect or acoustic coupler versions.

COMMUNICATIONS INTERFACE

RS-232C compatible serial asynchronous ASCII. Eight baud rates and parity are user selectable. Current loop and RS422 I/O are available as options.

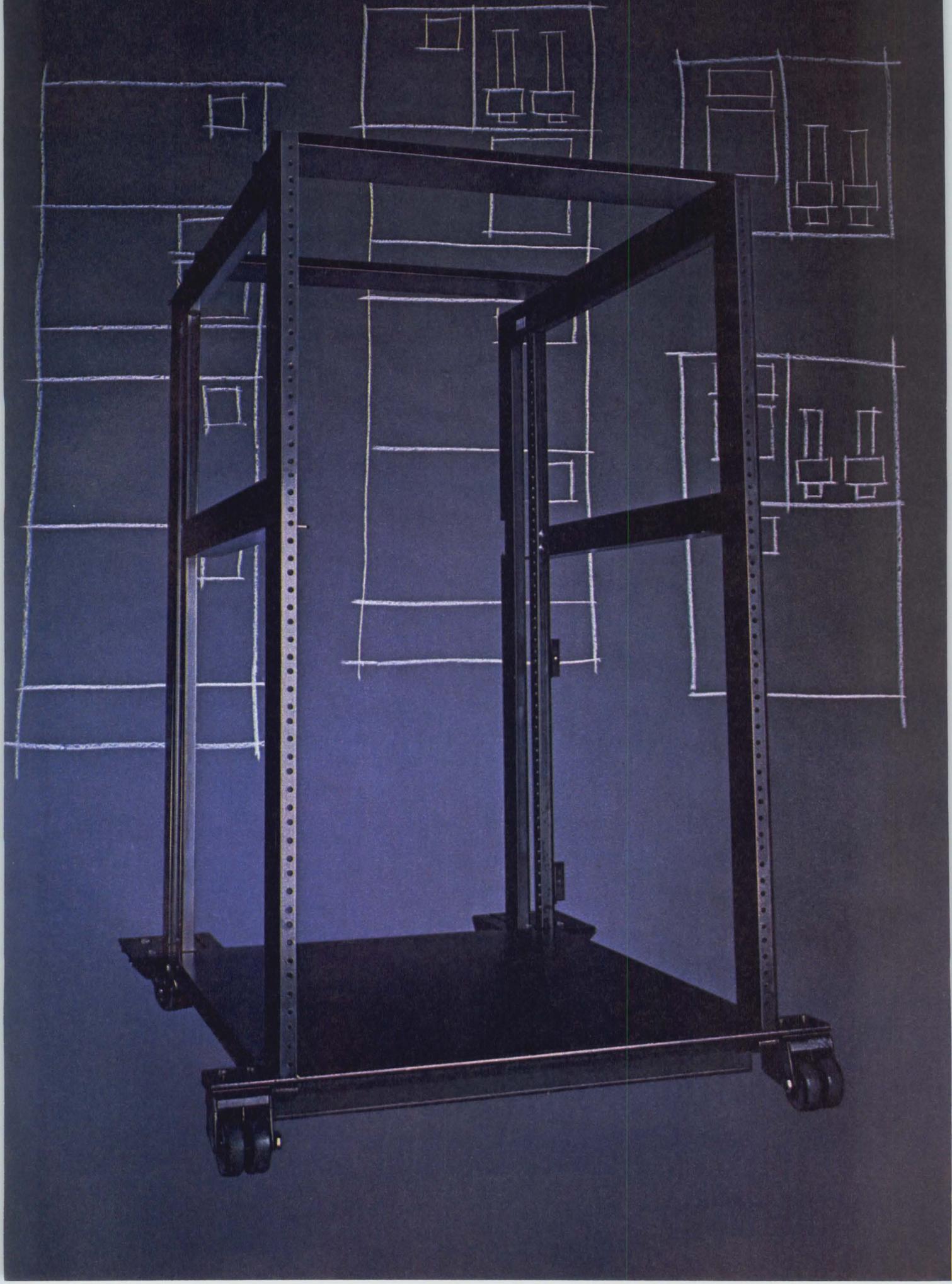
At last, the perfect answer to your portable communications requirement. It's the TransTerm 3—a compact, light weight, ASCII data terminal which will fit right into your briefcase for easy carry-around convenience. Domestic price under \$500.

COMPUTERWISE, INC.

4006 East 137th Terrace • Grandview, Missouri 64030 • 816/765-3330

TELEX 4991141 (ITT)

CIRCLE NO. 31 ON INQUIRY CARD



With the open architecture of the IBM Series/1

You configure it out for yourself.

With an IBM Series/1 you get exactly what you need. When you need it. Where you need it. No more. No less. Thanks to the open architecture design of the Series/1, IBM can work with you to match the right configuration to the job you want to do. And what that means to you is the best value for your data processing dollar.

But whatever you configure, with the Series/1 you can feel secure in knowing that you can add to the system without sacrificing any of your initial investment. As your needs change or grow, you can add more memory, more storage, a larger processor, work stations and I/O devices. Almost everything can be mounted in convenient 19-inch racks. A fully expanded system can take up to 96 transmission lines, which can connect to both IBM and non-IBM hardware.

With the open architecture of the Series/1, you can benefit from new IBM enhancements simply by plugging them in, eliminating the expense and time of installing a totally new computer. And as your configurations change, you don't have to change programs, thanks again to the open architecture.

The IBM Series/1 proves its mettle in multiples, where larger organizations can benefit from its low price, strong communications capability, easy installation and its tailorability.

The great price/performance story of the Series/1 and its technical superiority go a long way toward explaining its popularity across the country, in everything from stand-alone data processing on Main Street, to distributed processing nodes in peer or host-attached networks, to communication controllers for local networks.

When you add on IBM service and support nationwide, it's easy to see why so many customers become more and more attached to their Series/1s every day.

To learn more, send us the coupon today.



IBM
DRM, Dept. 003/96
400 Parson's Pond Drive
Franklin Lakes, NJ 07417

7-83

Please send me more information on the price/performance and technical superiority of the IBM Series/1.

Name

Title Phone

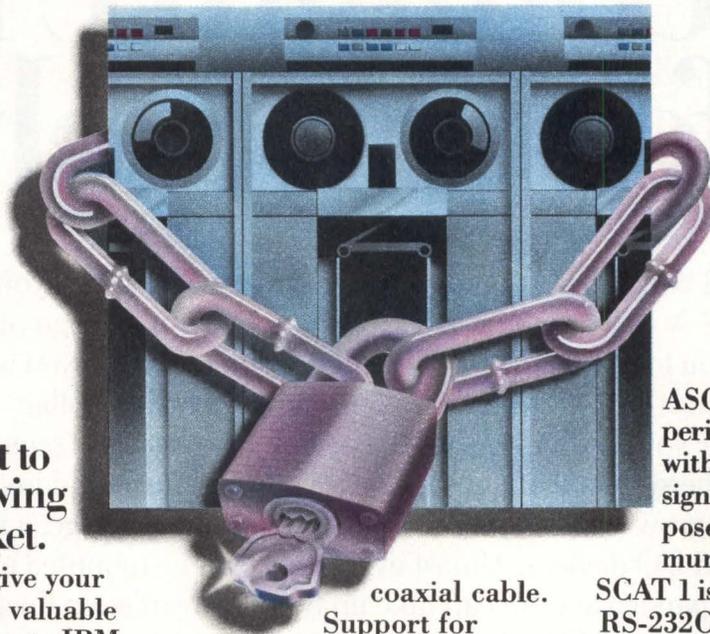
Company

Address

City State Zip

GREAT MOMENTS IN PERIPHERAL TECHNOLOGY

Finding the key to the 3270 world.



Good news for OEM's who want to unlock the growing BSC/SNA market.

Our products give your ASCII peripherals a valuable new capability: access to IBM 3270 environments. While margins on async equipment continue to shrink, the 3270 market is growing at upwards of 20% per year. So talk to Peripheral Technology — and get your share.

Our SCAT systems make your equipment IBM-compatible.

We manufacture a full line of protocol converters and terminal controllers, in both standalone and add-on configurations. Used in conjunction with your ASCII CRT's and other peripherals, they let you offer features and functions not available on IBM or other plug-compatible machines. The economy of using dial-up instead of dedicated phone lines between remote and host locations. Elimination of

coaxial cable. Support for multiple hosts, both sync and async. And much more.

SCAT 2 is more than a "black box" solution.

Our versatile SCAT 2 is a multi-host terminal controller

designed to meet the needs of growing networks. Menu-driven from any ASCII peripheral and expandable from 1 to 25 ports, SCAT 2 is a very cost-effective single-host, multi-host or cluster controller that satisfies all BSC/SNA communications requirements.

SCAT 1 means value-added versatility.

This compact, reliable 3270 BSC/SNA emulation board that can be installed in most

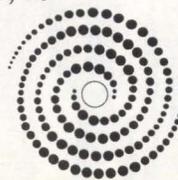
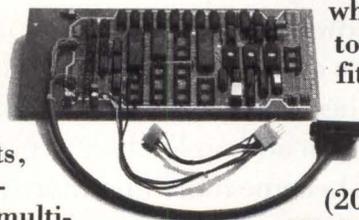
ASCII terminals or peripheral devices, usually without soldering. Designed as a general purpose programmable communications controller,

SCAT 1 is available with RS-232C interfaces, compatible with dial-up or dedicated links and transmission speeds up to 9600 bps — full or half duplex. Operation is menu-driven, and two levels of password security are provided.

1-800-822-2208

That's the number to call when you're ready to unlock the profit potential of the 3270 BSC/SNA marketplace (206-881-6691 in Washington State).

We know protocol conversion from the boards up, and offer fast delivery backed by nationwide service and support. Peripheral Technology, Inc., 14784 NE 95th, Redmond, WA 98052.



Peripheral Technology, Inc

Mini-Micro World

NEWS

dots," he says. Thatcher says NEC will not use less than 18 pins, but is considering using 24 pins for some applications.

Thatcher is not certain that

dot-matrix printers offer the best long-term solution to color hard-copy requirements, but he does expect the NEC dot-matrix line to offer color soon. "Other technolog-

ies like ink-jet and thermal transfer may still be a little too exotic for the marketplace," Thatcher adds.

—Edward S. Foster

Matsushita finds way to erase optical disks; Burroughs erases program

Matsushita Electric Industrial Co. Ltd. has given optical-disk-system technology a major boost with its announcement of the first erasable optical-disk recorder system.

Meanwhile, Burroughs Corp. has tossed out its \$20-million investment in optical-disk technology by shutting down its development program just as it was on the verge of manufacturing its first products. "We have concluded that an optical-disk system cannot be manufactured at a reasonable cost at this time," says a Burroughs spokesman. "That is not to say we have abandoned the technology; we will continue our research efforts."

Industry sources say Burroughs could have manufactured an optical-disk peripheral at a reasonable cost. What it apparently cannot do is to commit \$30 million more to selling the peripheral.

A commitment of \$30 million may not seem like much to a \$4-billion company, especially after that company had invested \$20 million in the technology. However, Burroughs posted a loss in earnings for its fourth quarter of 1982, and 1982 profits were marginal. As a result, it had a cash-flow problem.

In addition, it was faced with the embarrassment of not having a system or an interface to hook up to the optical disk after five years of effort. However, Memorex Corp., a Burroughs subsidiary, had a number of systems in the IBM plug-

compatible market to which Burroughs' prototype optical disk would interface. Memorex officials were eager to acquire optical disks for the company's oil-exploration customers that required the disks' multi-gigabytes of archival storage.

Faced with the embarrassment of manufacturing a peripheral that could be hooked only to systems of its number one rival—IBM Corp.—Burroughs opted to shut down the program. As a result, Storage Technology Corp. will be the only manufacturer of optical disks for the IBM plug-compatible market. "This gives STC a clear shot at the PCM market, since they are the only one other than Burroughs close to a product," says Ed Rothchild, a consultant and editor of *Optical Memory Newsletter*, San Francisco.

Rothchild says Burroughs could have raised the money to keep the program despite its financial difficulties. The company had the option of forming an R&D partnership or getting venture capital to keep the optical program going as an outside start-up.

Instead, Burroughs closed the Westlake Village, Calif., plant where the optical disks were being made and fired 50 of its 70 employees. Of the 20 staff members left, 10 were key engineers and technicians who will continue research in optical media. That program is likely to be merged into Memorex in Santa Clara, Calif. The other 10 employees were offered

jobs elsewhere in Burroughs. It did not take long for word to reach recruiters from other companies. RCA Systems Division, Cherry Hill, N.J., for example, made offers to 10 Burroughs engineers the next morning.

Left behind in Westlake Village was a new clean room and a business plan that called for the Optical Memory division to more than repay its investment within six years. The plan estimated that, by 1990, the Optical Memory division would bring \$4 billion in additional revenues, doubling Burroughs's current revenues. "It figures," says one disgruntled ex-employee. "Burroughs used to be the number-one supplier of microcomputers until it abandoned the program in 1979. That was the year personal computers began to take off."

Meanwhile, STC, CDC-Phillips, and Shugart Associates' Optimem programs are forging ahead. The companies are hoping to make product announcements by year-end. The Shugart Optimem product with its 12-in. platter is the lowest priced of the group. It is expected to sell for around \$6000 in large quantities.

CDC-Phillips also plans to sell a low-end optical-storage product, slightly above the Optimem price range. At the high end, RCA Systems plans a double-sided, 16-in. platter storing 9.3G bytes. Eastman Kodak Corp. is working on a 16-in. platter with 5.6G bytes on each side

Mini-Micro World

NEWS

of a two-sided platter. In comparison, the STC product to be introduced this year is expected to store about 4G bytes.

Matsushita introduced one of the more promising products to emerge from optical-storage technology. Until the introduction of

Matsushita's product, all optical-storage systems had been write-once/read-many-times products, unlike magnetic media, which allows continuous erasures and re-recording. Like nonerasable optical disks, the Matsushita product uses tellurium suboxide and two semi-

conductor lasers with one focusing lens. The lasers can simultaneously erase and record.

A few submetals, such as germanium, indium and lead, are mixed into the tellurium suboxide. This allows the recording materials to become reversible between the crystalline and the amorphous phases as the laser beam burns through the metal. In the recording and playback, the crystalline phase with high reflectivity converts itself into the amorphous phase of low reflectivity.

Most observers, however, are skeptical, believing that the Matsushita announcement is little more than a technology rather than an actual product. Matsushita does not estimate when computer links will be available, when delivery dates will be or what prices will be for the optical recorders. But the company does expect cartridges for the recorder to sell for about \$20.

Rothchild of *Optical Memory Newsletter*, however, notes that nonerasable optical cartridges sell for around \$20 and predicts that prices for erasable cartridges are more likely to begin at \$750 until production quantities are available. In addition, erasability has not been a prime requirement of optical disks. Many customers requiring large amounts of archival storage, such as banks and government agencies, prefer nonerasable disks.

Ultimately, the recorders will compete at the low end with CDC-Phillips, Optimem and Japanese manufacturers such as Toshiba Corp. and Sony Corp. Sony is said to be preparing an erasable product for announcement this summer.

The test for the recorders will be in the consumer market, in which optical-disk recorders, with their superior resolution and media durability, will compete against videotape recorders.

—Robert A. Sehr

UNIX & C™

HANDS-ON TRAINING

A complete Curriculum for:
End Users Management Applications Staff Technical Support

COURSES	WASHINGTON, D.C.	BOSTON	SAN FRANCISCO	CHICAGO	NEW YORK/TORONTO	TUITION	SEQUENCE TUITION†
UNIX Overview	Aug 9 Sep 27 Nov 8	Aug 9 Sep 27 Nov 1	Aug 23 Oct 11 Nov 15	Jul 5 Sep 6 Oct 18 Dec 6	Jul 5	\$ 225	\$ 860
UNIX Fundamentals for Non-Programmers*	Aug 10-12 Sep 28-30 Nov 9-11	Aug 10-12 Sept 28-30 Nov 2-4	Aug 24-26 Oct 12-14 Nov 16-18	Jul 6-8 Sep 7-9 Oct 19-21 Dec 7-9	Jul 6-8	\$ 735	
UNIX Fundamentals for Programmers*	Aug 15-17 Oct 3-5 Nov 14-16	Aug 15-17 Oct 3-5 Nov 7-9	Aug 29-31 Oct 17-19 Nov 28-30	Jul 18-20 Sep 12-14 Oct 24-26 Dec 12-14	Jul 18-20	\$ 735	\$1125
Shell as a Command Language*	Aug 18-19 Oct 6-7 Nov 17-18	Aug 18-19 Oct 6-7 Nov 10-11	Sep 1-2 Oct 20-21 Dec 1-2	Jul 21-22 Sep 15-16 Oct 27-28 Dec 15-16	Jul 21-22	\$ 490	
'C' Language Programming*	Aug 22-26 Oct 10-14 Nov 28- Dec 2	Aug 22-26 Oct 10-14 Nov 14-18	Sep 12-16 Oct 24-28 Dec 5-9	Jul 25-29 Sep 19-23 Oct 31- Nov 4	Jul 25-29	\$1225	\$1125
Shell Programming*	Aug 29-30 Oct 24-25 Dec 5-6	Aug 29-30 Oct 17-18 Nov 28-29	Sep 19-20 Oct 31- Nov 1 Dec 12-13	Sep 26-27 Nov 7-8	Aug 1-2	\$ 490	
Using Advanced UNIX Commands*	Aug 31- Sep 2 Oct 26-28 Dec 7-9	Aug 31- Sep 2 Oct 19-21 Nov 30- Dec 2	Sep 21-23 Nov 2-4 Dec 14-16	Sep 28-30 Nov 9-11	Aug 3-5	\$ 735	
UNIX Internals	Sep 12-16 Oct 31- Nov 4 Dec 12-16	Sep 12-16 Oct 24-28 Dec 5-9	Aug 15-19 Sep 26-30 Nov 7-11	Oct 3-7 Nov 14-18	Aug 8-12	\$1375	

*Including hands-on training workshops **UNIX is a trademark of Bell Laboratories

†Savings for consecutive seminar dates

CALL FOR DETAILS ON: • VIDEO-BASED COURSES
• IN-HOUSE SEMINARS

To reserve your seminar space now or for additional information, call:
(800) 621-3155 or in Illinois (312) 987-4000 8:30-5:00 central time.

Computer Technology Group UNIX seminars are presented by experts experienced in teaching UNIX as well as in designing and implementing UNIX-based systems.

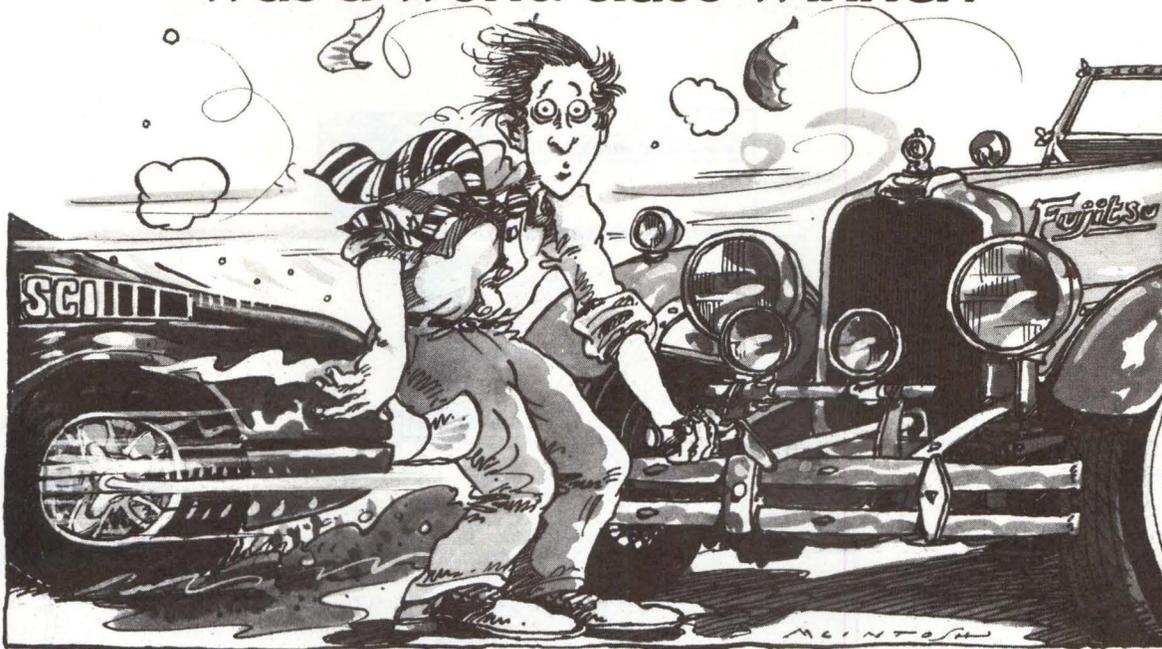
COMPUTER TECHNOLOGY GROUP
Our business is UNIX training.

**COMPUTER
TECHNOLOGY
GROUP**
Telemedia, Inc.

310 S. Michigan Ave., Chicago, IL 60604

CIRCLE NO. 34 ON INQUIRY CARD

Remember when the Fujitsu 80 MB Winchester was a world class winner?



No more.

Because now there's the SC80W. The remarkable new 8", 80 MB Winchester disc drive that leaves the Fujitsu M2312K and its brethren standing still.

For starters, the SC80W gives you an average access time of 18 MS. Not bad compared to Fujitsu's 20.

Maximum access is equally terrific. 35 MS compared with their 40.

And we're just getting started. Listen to this.

The SC80W exactly emulates the popular 14" Control Data 9762 80 MB removable pack drive.

Moreover, its reliability record is three times Fujitsu's. That's so good we'll give you a 30-month parts and labor warranty to their twelve.

Our drive runs a great deal cooler. Therefore, the SC80W does not require an external fan.

Plus there are some really nice design features. Like front locking spindle and carriage and a much easier way to access motor electronics.

On top of all that, depending on the quantity you need, we just may be able to give you a lower price.

It's no race anymore on 80 MB Winchesters. But there's one thing. We're in volume production July 1 and already the crunch is starting.

So race to the phone and let's talk some more.

We don't want you to get caught standing still too.

COMPARE FOR YOURSELF

	SCI SC80W	Fujitsu M2312K
AV. Access (MS)	18	20
Max. Access (MS)	35	40
67MB Cache Cartridge™ Backup with 1/2" Pertec Emulation	Available	N/A
MTBF (Hrs.)	30K	10K
Warranty (Mo.)	30	12
CDC 9762 Emulation	yes	no



Masters of Innovation®
SCIENCE & COMMUNICATIONS, INC.

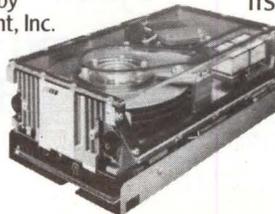
Distributed exclusively by
Peripherals Management, Inc.
A subsidiary of SCI.

64 Broadway,
Norwood, MA 02062

(617) 769-8640
Telex 924473

WHILE YOU'RE AT IT, ASK US ABOUT THE IDEAL BACKUP SYSTEM, OUR 1/4", 67MB FORMATTED CACHE CARTRIDGE DRIVE™ WITH 1/2" PERTEC EMULATION (NRZI/PE).

ITS 48KB CACHE AND FOR 500Kb/s PEAK DATA TRANSFER RATE MAKE IT THE HOTTEST PERFORMING 1/4" DRIVE IN ITS CLASS.



Mini-Micro World

NEWS

Intel, NCR collaborate on 1M-bps LAN

Intel Corp. and NCR Corp. have disclosed an 18-month joint development effort that has produced a low-speed local-area networking technique using data grade twisted-pair wiring. The network is expected to sell for about one-fifth the price of the 10M-bps Ethernet system. MIRLAN (mid-range local-area network) is scheduled to make its first commercial appearance on "soon to be announced" NCR products, probably CRT terminal clusters, says NCR president and chief executive Charles E. Exley Jr.

Operating at speeds as high as 1M bps over twisted-pair or CATV coaxial cable, MIRLAN is aimed at workstation clusters, bank terminal systems and other installations in which multi-drop wiring has been too slow and too complex. It is not aimed at personal-computer networks and will not be offered on NCR's DecisionMate in the near future. "OmniNet [from Corvus Systems] is satisfactory for personal computers, but for transaction processing, we see collision detection as an essential requirement," Exley says. Because the network is similar to Ethernet, Exley says, NCR expects MIRLAN to be used in departments that are hooked into larger local-area networks via a 10M-bps Ethernet "backbone."

Exley says NCR hopes to propose MIRLAN as a candidate for the IEEE 802 standard at the 1M-bps level. MIRLAN has many features of the Ethernet-based standard, which the IEEE committee has adopted at the 10M-bps level including CSMA/CD media access, baseband transmission and Manchester encoding. MIRLAN specifications call for connections of as many as 40 devices per segment, with each segment as

long as 4000 ft. Repeaters can be used to extend a single network to 12,000 ft.

Intel will initially offer MIRLAN interface components, which include

the Intel 82586 controller chip currently offered in the Ethernet market and the 82501 serial interface chip. Intel vice chairman Robert N. Noyce says that the MIRLAN design will enable Intel eventually to produce a single-chip controller/interface. —Geoff Lewis



GRAPHIC CONTROLLER MLZ-VDC

Heurikon unveils a graphic solution for your microcomputer application.

On-Card Feature Summary

CPU Section:

Z80A CPU
Z80A DMA
Up to 32K bytes of EPROM/ROM
Up to 16K bytes of RAM
One iSBX module module
132 byte bi-directional FIFO Buffer
Multibus™ Multimaster or Slave mode
24 bit address bus
Memory mapping RAM
Hardware and software selectable bus maps

Video Section:

NEC 7220 graphics controller chip
512K bytes of video memory, arranged as 4 overlapping planes
1024 by 1024 pixels
640x480 display format standard
16 Color programmable look-up table
4096 color palette
Light Pen I/F
Interlaced video
Non-interlaced video
Composite SYNC
Separate SYNC
BNC or MOLEX connectors on card, for the video

HEURIKON CORP.

3001 Latham Dr. Madison, WI 53713 • Telex 469532

Call Heurikon Direct 1 800 356-9602 In Wisconsin 1 608 271-8700



TELEVIDEO PRODUCTS

MODEL	DESCRIPTION	LIST PRICE
TV-100	TELEVIDEO MONITOR	100.00
TV-200	TELEVIDEO SYSTEMS INC.	200.00
TV-300	TELEVIDEO KEYBOARD	300.00
TV-400	TELEVIDEO MOUSE	400.00
TV-500	TELEVIDEO TRACKBALL	500.00
TV-600	TELEVIDEO TRACKPOINT	600.00
TV-700	TELEVIDEO TRACKMOUSE	700.00
TV-800	TELEVIDEO TRACKPOINT	800.00
TV-900	TELEVIDEO TRACKMOUSE	900.00

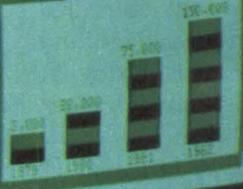
FOR MORE INFORMATION CONTACT

TELEVIDEO SYSTEMS INC.
1170 MORSE AVENUE
SUNNYVALE, CA. 94086
PHONE # 408-745-7760
TWX # 910-330-7633

TELEVIDEO SYS. INC. SHIPMENTS



UNITS INSTALLED



TeleVideo

Model 934

Brand new terminal.

Same old story.

If you're looking for the best terminal value, look to a familiar name: TeleVideo. The story of our new 924 is the same story you've heard for the last four years. We've combined the best innovations in technology, design, and quality manufacturing to give you everything you want in an advanced terminal. And we've done it at a price that can't be beaten.

The 924 is comfortable, with a tilt and swivel non-glare screen. Its lightweight, low profile keyboard fits your fingers naturally. Our 32 programmable, non-volatile function keys turn often used instructions into simple one-button commands. The 924 provides extra display features, including full screen editing, character and block graphics, definable scrolling regions for multiple window operation, plus 32 character-by-character visual attributes.

The 924 has the intelligence you need too, with logical attributes to define protected and unprotected regions. And, with standard one page or optional four page memory, there's plenty of room to work.

If you don't need all the power of the 924, try our 915. It has all the design advantages of the 924, and is the superior terminal in its class. It just costs less.

The 924 and 915 mark a great new chapter in the TeleVideo story. And, like all TeleVideo terminals, they're reliable performers, backed nationwide by General Electric Instrumentation and Computer Service Centers. Contact us today about the 924 and 915 story and you'll enjoy the happy ending. Call 800-538-8725 (in California call (408) 745-7760), or send us this coupon.

TeleVideo Systems, Inc.
Dept. 216N
1170 Morse Avenue, Sunnyvale, CA 94086

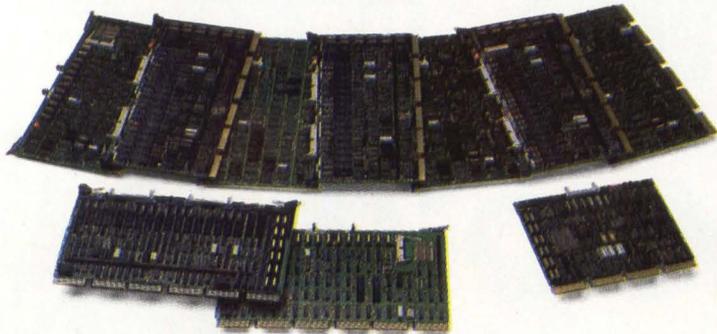
Yes, I'd like to know more about
TeleVideo's new 924 and 915 terminals.

Name _____
Address _____
City _____
State _____ Zip _____
Telephone (_____) _____

Santa Ana/California, 714-557-6095
Sunnyvale/California, 408-745-7760
Atlanta/Georgia, 404-399-6464
Dallas/Texas, 214-980-9978
Chicago/Illinois, 312-351-9350
Boston/Massachusetts, 617-668-6891
New Jersey/New York, 201-267-8805
Woking, Surrey/United Kingdom, 44-9905-6464

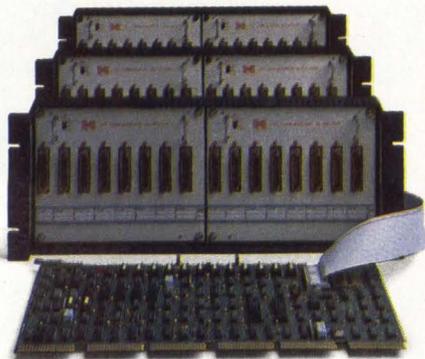
 **TeleVideo Systems, Inc.**

Five reasons why DEC users should buy Emulex communications controllers.



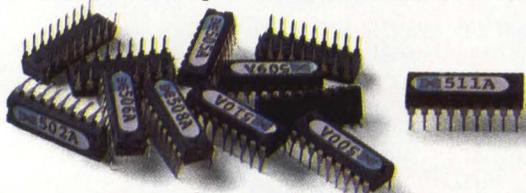
Broad product line featuring our new DMF-32 emulation.

Nobody covers LSI-11, PDP-11, and VAX-11 users' needs like Emulex. More than 15 software-transparent controllers emulating DH11, DZ11, DV11 and DMF-32. All deliver improved line-handling capabilities, in a smaller package, at lower costs.



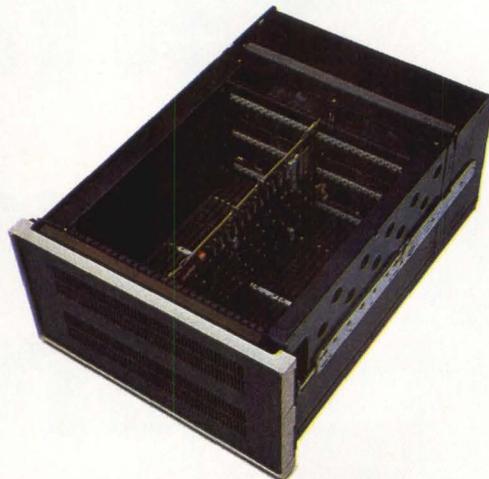
More channels.

Emulex's new DMF-32 emulation is typical. One controller board handles up to 64 lines, vs. only eight per DEC module. And Emulex offers *all* lines with modem control, not just two. For even more lines, Emulex's Statcon Series is the answer. We simply add a low-cost port concentrator, so that with one controller board you can connect up to 256 remote *and* local terminals.



Easy growth path.

As your system grows, upgrading is simple with Emulex controllers. Just change PROM sets. Example: DH to DMF for \$350. In addition, Emulex's advanced microprocessor architecture is consistent throughout the product line. Think of the inventory savings.



Fewer backplane slots.

Emulex communications controllers pack so much capability onto each board that fewer boards are needed. Take a 64-line DH11 emulation. Emulex does on one board what it takes DEC to do on 36. Think of the savings in rack space, to say nothing of price.



Lower prices.

For instance, a DEC DH11 controller lists at \$8,950 per 16 lines, with expansion chassis costing \$3,000 or more. Compare that to Emulex's CS11/H at \$4,500 for the first 16 lines and \$3,000 for each additional 16 lines. At 64 lines, you suddenly have savings of about \$23,000 and a lot of extra slots to boot.

Don't speculate with your communications controller dollars. Invest in Emulex. Phone toll free: (800) 854-7112. In California: (714) 662-5600. Or write: Emulex Corporation, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626.



The genuine alternative.

DELTA'S MAPPED OUT A WAY TO HANDLE YOUR TOP PRIORITY SHIPMENTS



Delta Air Express guarantees shipment to over 10,000 communities in more than 90 cities — on the flight you specify.

Few shipments are too large and none are too small. If your shipment does not get on the flight specified, rates will be adjusted to that of regular air freight. Local pick-up and delivery available.

Delta can ship anywhere in the U.S. or the world, via interline connections. Delta Air Express rates compare favorably with other air express services.

Also ask about Delta DASH®—same-day delivery on packages up to 70

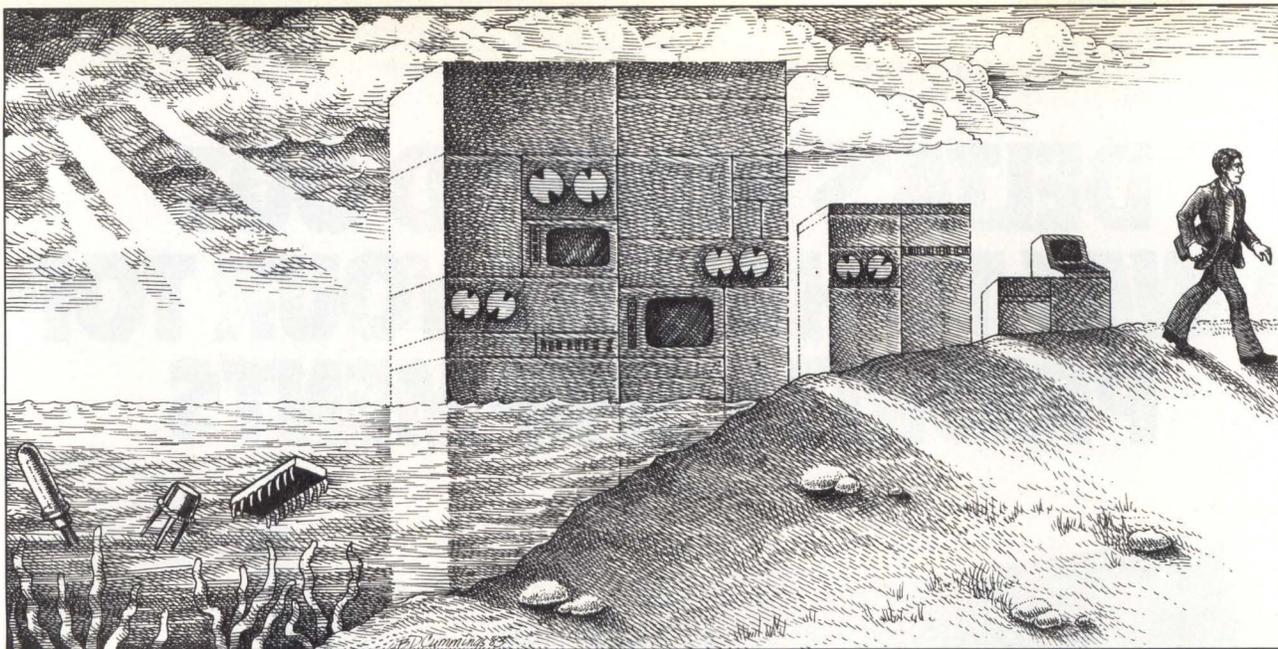
pounds. And Delta 3-D™ Air Freight—40% off regular freight rates on high-density shipments.

For details, call the Delta Marketing Office in the city nearest you.

DELTA
The airline run by professionals.



DELTA AIR CARGO. READY ALL-AROUND



COMPUTERS MUST CHANGE.

The evolution from vacuum tubes to transistors to microchips has spawned a series of stunning successes for computers—from the mainframe to the mini to the micro. Not since the introduction of the telephone has a piece of equipment made such a positive impact on the workings of business.

Yet, in today's business, a substantial workforce has been largely overlooked by the computer industry: the mobile professional.

They are the executives, salespeople and field-support personnel that spend many of their workdays doing battle against the competition away from their desks—far from the comforts, conveniences and computing aids of the home office.

THE HAZARDS OF THE ROAD.

The mobile professional spends hours on planes, trains and in taxis traveling to business meetings.

Only to have to return at a later date with the typed contract. Or mail in the revised report. Or call back with the final numbers.

Office automation simply hasn't moved fast enough for the mobile professional.

Between paper, pencils, pens, files, triplicate carbon copy order pads, calculators, dictation recorders, appointment diaries, phone books and a picture of the twins, the mobile professional charges off dragging half an office across thousands of miles of territory every year.

SOMETHING, INDEED, MUST CHANGE.

Clearly, what's needed is a viable alternative. A mobile computer designed specifically for the rigors of the road.

Taking the thinking professional's approach, we believe a mobile computer has to be a powerful and complete ultraportable. One that fits easily inside a briefcase. And

runs on rechargeable, self-contained batteries for use en route as well as in the office or at home.

It stands to reason that it must have an adequately large display screen, a full-sized keyboard, a correspondence-quality 8½" x 11" or legal page printer and microfloppy disk drives for memory.

Necessity would also suggest an integrated modem, for two-way data communication via standard telephone lines.

All in a package that weighs in at less than 14 pounds.

THE HARDEST PART IS THE SOFTWARE.

But by far, the most important feature of a truly useful mobile computer is its software. It has to be fully confusion-proof, using familiar graphic symbols, rather than complicated computer-talk, to guide the user through each step.

It also has to offer a full complement of practical application programs, including a personal secretary, word processing and financial planning. Developed precisely for the professional demands of the mobile professional.

These are the criteria by which we've designed the Gavilan™ mobile computer. In fact, Gavilan

is committed exclusively to taking the computer evolution to its next logical step.

Because, yes, computers have come a long way. But change they must.

Gavilan Computer Corp.
P.O. Box 5004
Campbell, CA 95008
(800) 528-6050, Ext. 1191
Telex 4991278 GVLN US



Gavilan is a trademark of Gavilan Computer Corporation.

Mini-Micro World

CORPORATE AND FINANCIAL

DEC PC alumnus beefs up Franklin for possible IBM-compatible portable

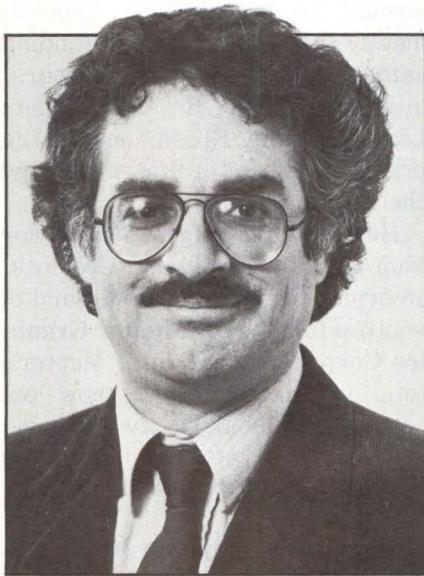
Franklin Computer Corp., once considered just another Apple Computer Inc. clone, is being closely monitored by the personal computer industry as it begins to move away from Apple's shadow. With the hiring last spring of several key research and development personnel, Franklin has indicated that it intends to become a major independent personal computer supplier.

Franklin's first big move was hiring Avram Miller, former manager of Digital Equipment Corp.'s Professional computer program, as executive vice president of manufacturing and engineering. A month after Miller arrived, he lured William L. Sydnes away from his position as development manager for the Personal Computer at IBM Corp. Sydnes was rumored to be working on the low-end Peanut model. He assumes the post of vice president of engineering at Franklin. Miller is confident that Sydnes will build an engineering organization at Franklin that will be "second to none." He says Sydnes has a proven track record in developing superior products on tight schedules.

Apple has inadvertently helped boost Franklin into the market. Apple's requests for a preliminary injunction barring Franklin from producing and selling the ACE series of Apple II- and IIe-compatible computers had at presstime been unsuccessful and have only resulted in tremendous free advertising for the Cherry Hill, N.J. company. As of last fall, Franklin's annual sales rate was less than \$10 million, but now it projects sales in excess of \$60 million for fiscal year 1983. The



William L. Sydnes, Franklin's new vice president of engineering, was development manager for IBM's Personal Computer and was rumored to be working on the Peanut low-end model.



Avram Miller, Franklin's executive vice president of manufacturing and engineering, was formerly manager of DEC's Professional computer program. He has been recruiting high-priced engineers to Franklin and beefing up its production capacity.

number of employees since last fall has grown from less than 100 to more than 400. Further, the two-year-old firm, which has received \$8 million in two rounds of private venture-capital funding, is expected to go public soon.

Many industry analysts are impressed by Franklin's rapid rise. "Franklin has been growing like crazy," remarks Egil Juliussen, of Future Computing Inc., Richardson, Texas. Juliussen expects Franklin to capitalize on its popularity by developing an Apple II- or IBM PC-compatible portable computer. "Since IBM doesn't have one, it's a very good idea," he says. Producing Apple-compatible computers is "a sound business decision," notes Aaron Goldberg, an analyst with International Data Corp., a Framingham, Mass., market research firm. "But getting Avram Miller is a coup. He's a very bright and intensely dynamic man."

Miller says he accomplished his goals in his 2½ years managing DEC's Professional program, and it was time for a change. He makes no secret of the fact that his next goal is to control a major computer-manufacturing company. But at DEC, he says, "There was no way to have it all. [DEC president] Ken Olsen wasn't going to give me his job."

At Franklin, Miller has surrounded himself with proven, high-priced talent from DEC, IBM and other top companies, and is gearing up for very large-scale production.

A few weeks before hiring vice president of engineering Sydnes, Miller recruited Vahram Erdekian, from DEC, where he had been responsible for the strategy and

Mini-Micro World

CORPORATE AND FINANCIAL

implementation of DEC's personal computer manufacturing program. Erdekian becomes Franklin's vice president of manufacturing.

Franklin has also hired a technical director from IBM, and Miller says he has added several people from IBM to Franklin's staff. He plans to continue to bolster the 40-member engineering staff with the best available talent.

Franklin's manufacturing operations will be consolidated this summer into a 134,000-sq.-ft. facility, and a 44,000-sq.-ft. administrative building has also been built. Franklin recently purchased a VAX-11/780 for CAD/CAM. Plans call for the company to open a manufacturing plant in Europe this summer.

Last summer, Franklin shipped 1000 units per month and projected that number to jump to 3500 by this March. Miller says shipments far exceed that projection. To handle the large inventory, an HP 3000 running an ASK Systems materials-requirement-planning system has been installed.

Apple compatibility will not be Franklin's main focus. "We did not come here to copy someone else's product," Miller maintains. New Franklin products may include portable computers, networking and clustering products and software. Marketing manager Ed Golderer hints that Franklin's next offering, due by early 1984, will be IBM compatible as well as Apple- and CP/M-compatible like the ACE 1200. "We want to be the company having the greatest mass software appeal," Golderer says. Miller says developments will happen quickly because he has mapped out his game plan.

—David A. Bright

In transition

Instrumentation Laboratory Inc.'s **Pixel Division** will become a separate corporation that is expected to go public this month. Instrumentation Laboratory shareholders of record as of Jan. 28 will receive shares in Pixel after registration is completed. Thomas A. Rosse, president of Instrumentation Laboratory, will provide additional financing. The capital will be used to expand Pixel's sales organization and for research and development. Pixel was acquired by Instrumentation Laboratory in June, 1980, and shipped its first MC68000-based microcomputer a year ago. Instrumentation Laboratory, in turn, has been acquired by Allied Corp.

Financings

COMPAQ Computer Corp.'s recent \$20-million third round of venture financing brings the total amount to \$30 million. Approximately \$8 million of the new funding came from previous investors, including Sevin Rosen Partners Ltd. Benjamin Rosen, one of the principals of Sevin Rosen, is now chairman of COMPAQ.

Headed by original investor Venrock, Sutter Hill and Greylock, 15 firms provided the third round of venture funding for **Mentor Graphics Corp.**, Portland, Ore. Mentor's total investment capital now exceeds \$10 million. The two-year-old CAD/CAM workstation OEM uses Apollo Computers Inc. distributed systems.

Synapse Computer Corp., a Milpitas, Calif., manufacturer of fault-tolerant minicomputers has completed a \$12-million private placement of convertible preferred stock. The funding was the company's fourth in its three-year history.

Investors include Sevin Rosen Partners and the IBM Corp. and Kodak pension funds.

Distribution/service deals

3Com Corp., Mountain View, Calif., has signed at least 25 retail stores to distribute its EtherSeries networking products for the IBM PC. Businessland, FuturByte of Montreal and independent ComputerLand stores are among the distributors.

Wet ink

Alphacom's multi-year contract to provide Timex Computer Corp. with thermal printers is worth an estimated total of \$54 million, with the first year valued at approximately \$15 million.... **Momentum Computer Systems International** will purchase more than \$4 million worth of 5¼-in. Winchester disk drives from **Atasi Corp.**, San Jose, Calif. The drives will be used with Momentum's MC68000-based microcomputers.... **MPI** has been awarded a two-year contract to deliver more than \$20 million worth of its 5¼-in. floppy disk drives to Rana Systems, Chatsworth, Calif. Rana offers the drives as add-on peripherals for Apple, Atari and other personal computers.... In its largest commercial order to date, **Wang Laboratories Inc.** has committed to supply General Electric Co. with more than \$20 million in office-automation equipment. The one-year contract covers Wang OIS, VS and personal computer systems. GE previously had more than \$30 million worth of Wang equipment installed.

Quarterly report

Digital Equipment Corp. says

Text continues on page 72



DISCOVER BRIDGE COMMUNICATIONS.

The High-Performance LAN Source.

Information and computer equipment. Two of your most valuable resources. But even more important is making those resources available to the people who need them most.

We're Bridge Communications. And we've developed the first commercially available 68000-based Ethernet local area network systems to make that goal a reality.

Simply and efficiently.

Take our CS/1, for example. This high-performance communications computer can be configured to support a comprehensive, resource-sharing, local area network. Its multiple 68000 microprocessor architecture provides unmatched performance levels (up to 200 packets/s). And CS/1 software fully implements Xerox Network System high-level protocols.

In complex multivendor environments, each CS/1 can network up to 32 of the most common RS-232 equipped computing and communications devices, including printers, terminals, personal computers, modems, disk systems, minicomputers and mainframes.

Even if they were never designed to be networked.

The CS/1 can also function as a front-end processor linking multiple host systems. As a terminal concentrator. Or as a peripheral cluster controller.

But that's just the beginning. At Bridge, we're continually discovering new ways to improve information management. For more information on the CS/1, or any of our other high-performance Ethernet systems, call us at (408) 446-2981.



Bridge Communications Inc.
10440 Bubb Road
Cupertino, CA 95014
Tel: (408) 446-2981
Telex: 176 544
Boston (617) 890-6122
Washington D.C. (202) 429-2042

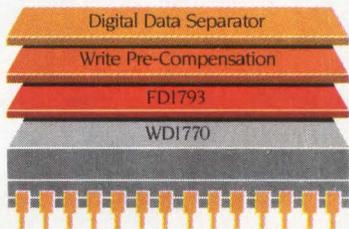


MAKING THE LEADING EDGE WORK FOR YOU

Introducing the Munchkin,[™] the lower cost solution to 5¼" floppy disk control.

Looking for a lower cost solution to interfacing 5¼" floppy disk drives to your system? Let our new WD1770 show you the way. We call it the Munchkin. You'll call it the economical solution you need in today's price sensitive systems market.

The WD1770 is a diminutive one-chip controller/formatter that masters both single and double density 5¼" floppies. It gives you all the features of our FDI793. Plus Digital Data Separation and Write Precompensation. On one chip. With just 28 pins. Component count is reduced, too. Which saves beaucoup board space. And on-chip digital data separation eliminates the manufacturing cost of tweaking PLL data separation.



A single read line is the only input required to recover serial FM or MFM data from the disk. Data rates are selectable. So are sector lengths. And a new programmable Motor On feature pre-enables the spindle motor. Stepping rates are compatible with the FDI793. Or, for rates of 2, 3, 5 or 6 msec, specify the WD1772 version.

Why wait? Call our Controller Hotline at 714/966-7827 for immediate information. Or write Kathy Braun on your letterhead for a free sample. Then find out for yourself why we say the Munchkin is such a big deal.

[™]Munchkin is a trademark of Western Digital Corporation

Components Group, 2445 McCabe Way, Irvine, CA 92714, (714) 557-3550

WESTERN DIGITAL
C O R P O R A T I O N



MAKING THE LEADING EDGE WORK FOR YOU

Ding, dong, the "Which" is dead. Our newest low price Winchester disk controller lowers the boom.

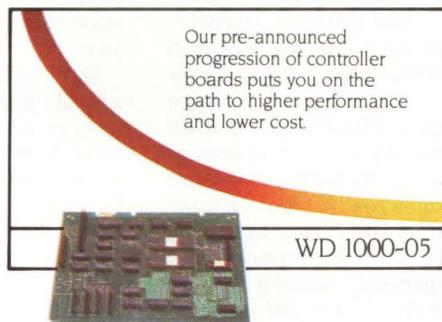
If, by any chance, you've been uncertain which company has the lowest price, highest value Winchester disk controllers, our new WD1000-05 will lay that "which" to rest.

Simply put, the WD1000-05 is the new price leader in hard disk controllers. How much a price leader? Our one-piece price, if you care to order an evaluation unit, is just \$150. Can you imagine what we must be selling these for in OEM quantities!

The WD1000-05 is designed for those systems builders who a) want to offer a hard-disk based system to stay competitive and, b) who recognize that shaving \$100 or more from their manufacturing costs could be the key to success.

Our new WD1000-05 is no stripped-down model, either. It includes our remarkable VLSI WD1010 Winchester Disk Controller, and WD1100-II Support Device. There is on-board sector buffering, data separation, write precompensation and error-checking, too. All on one board, designed to mount atop a 5 1/4" drive.

Call our Controller Hotline, 714/966-7827, for up-to-date details. Or send us your company PO or check for \$150 and we'll send you an WD1000-05 board for evaluation. It's our way of keeping you on top of things.



Our pre-announced progression of controller boards puts you on the path to higher performance and lower cost.

WD 1000-05

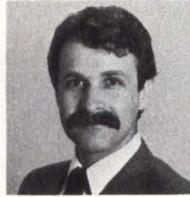
Components Group, 2445 McCabe Way, Irvine, CA 92714, (714) 557-3550

MINI-MICRO SYSTEMS/July 1983

WESTERN DIGITAL
C O R P O R A T I O N

GUEST FORUM

A column for guest experts to speak out



David Henry Goodstein is director of Inter/Consult, a Cambridge, Mass., consulting firm specializing in traditional and emerging information and media industries. He is the principal author of the recently released study: "Electronic Technical Publishing, Technologies and Markets to 1989."

Electronic technical publishing— doing well by doing good

By David Henry Goodstein
Inter/Consult

What's black and white and grows 500,000 pages a minute? The world's supply of technical documentation, according to a study by Bell Laboratories almost a decade ago. Technical documentation—the step-child of the computer industry—is about to come of age.

Documentation is a tedious, expensive affair. In the 1960s, my programming peers used to recommend a good IBM/360 Theory of Operations manual in lieu of sleeping pills for restless nights. Indeed, they were monuments to bad taste, reproductions of output from line printers with tiny drawings pasted in. Our local service center had a full-time staff of three experts whose job was to interpret the cryptic contents of these mighty tomes. Monthly packages of looseleaf technical updates sat in piles or boxes.

The discrepancy between state of the art and state of the documentation was occasionally infuriating, mostly just irritating and on rare occasions amusing. However, there are more serious implications. A major study by an Armed Forces group several years back showed that as much as 25 percent of pages of repair documentation for weapons systems were out of date at any given moment. This means that when it's time to fix the nuclear warhead, there may be a 1 in 4 chance that a manual has outdated data.

New technology for creating and manipulating text and image data in electronic form is about to come to the rescue. Once-mundane technical documents will be created on a Lisa/Star-like workstation that shows text in typographic font images. Line

art, business graphics and even pictures will be summoned off of smart databases or created on the same terminal.

Spot color will be a part of everyday documents. Page images will be transmitted as high-quality electronic mail. If hard copy is needed, it will be laser-printer output. The same files can, if necessary, be sent to phototypesetters or high-resolution printing plate recorders. Documentation will even take the form of a self-contained database located inside the equipment it describes. Service personnel will plug in multiterminal briefcase workstations and be prompted through diagnostics and repairs that include animated instructional sequences on how to use unfamiliar tools. The database will be perennially correct, since engineering updates will be automatically incorporated.

Sound futuristic? All this is possible with the new integrated systems for electronic technical publishing. The cresting wave of high-powered 16- and 32-bit chips has been washing exciting products ashore for some time.

Consider Apollo Computer Inc.'s Domain, a hyper-powered workstation that has been turning heads in the CAD world. Now, \$5000 extra adds the SCRIBE software package from Unilogic, Pittsburgh. SCRIBE takes as input separate databases of text and images. Its output is a set of formatted pages ready to go to a laser printer such as the Xerox 2700 or a high-quality Camex Supersetter, which transparently outputs to both 240 line-per-in. Canon LBP-10s and 1000-lpi Monotype Lasercomp engines. Suddenly, the Apollo has become a full-fledged documentation workstation. It will be joined by

others soon.

A half-dozen well-underwritten start-ups have emerged in ETP in the last half-year. Names such as Impress, Textet, Xyvision, Imagitex or Qubix are not household words. But the founders' former companies, including Applicon Inc., Compugraphic Corp. and Itek, certainly are in the big leagues. These new companies will be joined by large ones (perhaps even AT&T) in developing efficient ways to create, merge and manipulate usable documents out of the vast domains of information created daily by installed systems.

It behooves companies to be aware of ETP both as a significant potential improvement in their operations and as a major growth market. Recent studies by our clients indicate that the life cost of a single page of technical documentation can be as high as \$400 per page! For some companies, documentation is the largest single expenditure outside of personnel. One software company found they spent 10 percent of their annual revenues on the books that explain the software packages' mysteries. A new system using a \$50,000 pagination package will save them several hundred thousand dollars a year.

Our studies indicate there could be a total market as high as \$7 billion for integrated document systems by 1989. Exciting? We think so. Certainly those companies that are involved in processing words or images should be aware that they are offering solutions to one node on the total network of needs. They should probably be giving careful consideration to the strategic implications of the total process, as companies such as Xerox Corp., IBM Corp. and Apple Computer Inc. are doing.

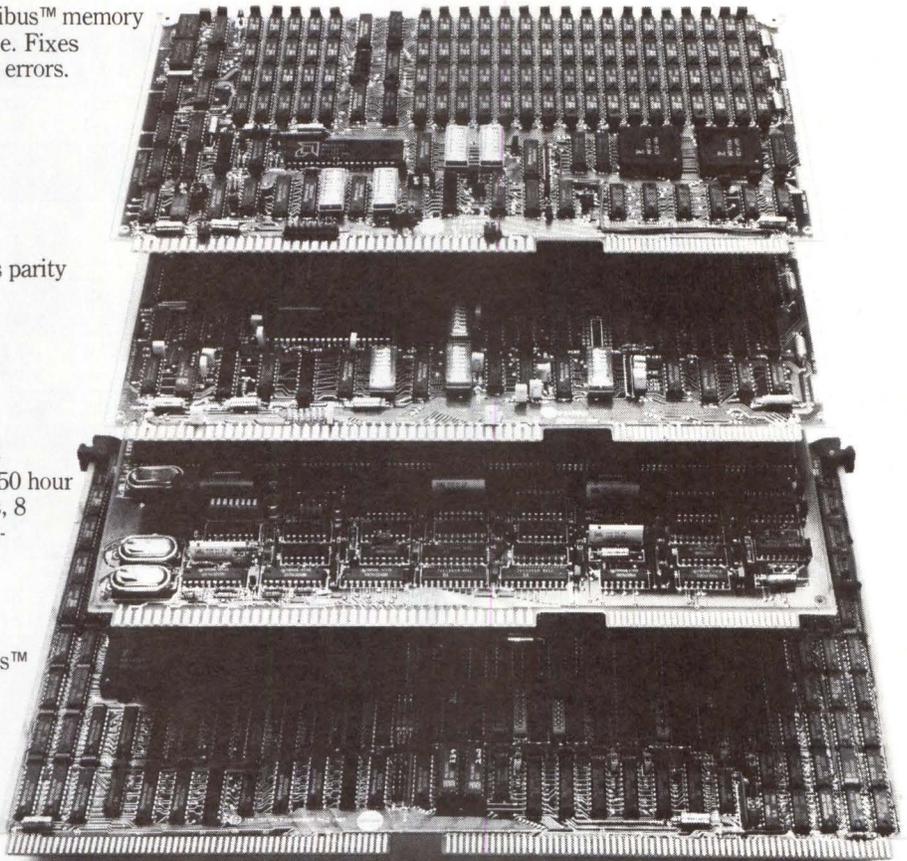
THE BUS STOCKS HERE:

PSM-512A: 512 kbyte Multibus™ memory with ECC, 275 nsec access time. Fixes single-bit errors, flags multi-bit errors.

PSM-512P: 512 kbyte Multibus parity memory, 240 nsec access time. Very economical.

PSM6463: 64 kbyte non-volatile CMOS Multibus memory, 200 nsec access time. 350 hour standby with on-board rechargeable NiCd's, 8 years with lithium. For process control, telecommunications, other critical applications.

NEW PSM1VA: 1 megabyte VERSAbus™ memory with ECC, 300 nsec access time. Lots faster and much less expensive than Motorola and IBM equivalents. Full 32-bit VERSAbus compatibility.



If you're on board the Multibus or VERSAbus, we've got the memories you need to get where you're going faster, for less. ECC, parity and non-volatile CMOS. All in stock now, all with one thing in common. Their first name is Plessey.

And since Plessey makes them all, they all have high reliability, a one year warranty and Plessey support worldwide.

For more information, just contact Plessey

Microsystems, 451 Hungerford Drive, Rockville, MD 20850. (301) 279-2892, TWX 710-828-9815. Irvine, CA: (714) 540-9931.

In Europe, contact: Towcester, UK: (0327)50312, Telex 31628. Paris: 776 41 06. Noordwijk: (01719) 19207. Munich: (089)2362226. Rome: (06) 350189.

Or get on board fast by calling (800) 368-2738 today. Your bus ought to be going our way.

Multibus is a trademark of Intel
VERSAbus is a trademark of Motorola

 **PLESSEY**

Mini-Micro World

CORPORATE AND FINANCIAL

Text continues from page 66

that manufacturing start-up delays in its personal computer line were part of the cause for lower than expected revenues for the quarter that ended April 2. Revenues for the quarter were \$1.1 billion, about even with the \$1 billion of the same period a year earlier. Nine-month revenues increased to \$3 billion from \$2.8 billion. Net income for the quarter dropped to \$79.8 million, or \$1.40 per share, from \$107.5 million, or \$1.94 per share, a year earlier. Net income for the nine-month period plummeted to \$197.6 million, or \$3.50 per share, from \$295.4 million, or \$5.33 per share, a year earlier. The company says lower than anticipated equipment sales, manufacturing costs that were not offset by product sales, price reductions and high research and engineering expenses adversely affected earnings.

Personalities

Digital Research Inc. chief operating officer **John Rowley** has been promoted to president, succeeding founder Gary Kildall, who remains chairman and chief executive officer. Kildall will continue his involvement in the company's research and development efforts.

Industry monitor

Digital Equipment Corp., the world's second-largest computer manufacturer, has broken into the *Fortune* 100 listing for total revenues. DEC's sales of \$3.9 billion for the fiscal year ended July 3, 1982, ranked it number 95, up 42 places from fiscal 1981, when it recorded revenues of \$3.2 billion. DEC ranked number 32 in net income at \$417.2 million, and number 8 in earnings-per-share growth, 31.2 percent, over the 10-year period.

BOX SCORE OF EARNINGS

This monthly table lists the revenues, net earnings and earnings per share in the periods indicated for companies in the computer and computer-related industries. Parentheses denote losses. Comments are from corporate summaries unless otherwise noted.

Company	Period	Revenues	Earnings	EpS
Altos Computer Systems	9 mos 3/26/83	53,568,000	5,652,000	.43
	9 mos 3/26/82	36,201,000	4,312,000	.38
Aydin Corp.	3 mos. 4/2/83	37,394,000	3,312,000	.70
	3 mos. 3/28/82	23,532,000	1,401,000	.30
Centronics Data Computer Corp.	3 mos 4/31/83	43,700,000	204,000	.02
	3 mos 3/28/82	26,328,000	(2,083,000)	(.33)
Emulex Corp.	9 mos. 3/27/83	21,015,186	3,585,312	.64
	9 mos. 3/28/82	10,788,511	1,523,137	.33
Fortune Systems Corp.	3 mos 4/1/83	20,766,832	3,340,182	.17
	3 mos 4/2/82	20,861	(2,030,151)	(.14)
General Datacomm Industries Inc.	6 mos 3/31/83	38,848,000	535,000	.08
	6 mos 3/31/82	25,258,000	(1,274,000)	(.19)
Genisco Technology Corp.	6 mos. 3/31/83	15,047,033	481,080	.21
	6 mos 3/31/82	13,126,126	514,160	.26
Harris Corp.	9 mos. 4/1/83	1,051,337,000	44,167,000	1.40
	9 mos 3/26/82	953,701,000	61,161,000	1.96
Hazeltine Corp.	3 mos. 3/31/83	28,693,000	1,855,000	.30
	3 mos. 3/31/82	27,086,000	1,225,000	.20
Honeywell Inc.	3 mos 4/3/83	1,324,000,000	22,200,000	.98
	3 mos 4/4/82	1,261,000,000	55,500,000	2.48
Lexidata Corp.	6 mos 3/31/83	11,248,500	(372,000)	(.07)
	6 mos 3/31/82	13,804,200	1,634,100	.32
Lundy Electronic & Systems Inc.	9 mos. 3/31/83	24,357,000	1,171,000	.69
	9 mos. 3/31/82	19,554,000	750,000	.65
NCR Corp.	3 mos. 3/31/83	781,352,000	34,073,000	1.25
	3 mos. 3/31/82	753,554,000	30,780,000	1.15
Prime Computer Inc.	3 mos. 4/3/83	120,504,000	8,540,000	.27
	3 mos 4/4/82	103,222,000	10,635,000	.35
Prodigy Systems Inc.	3 mos. 3/31/83	2,750,000	85,000	.07
	3 mos. 3/31/82	1,595,000	58,000	.05
Ramtek Corp.	9 mos. 3/31/83	32,510,000	1,457,000	.52
	9 mos. 3/31/82	33,428,000	1,908,000	.72
Solid State Scientific Inc.	3 mos. 4/1/83	7,824,000	(1,141,000)	(.55)
	3 mos. 4/4/82	9,182,000	(1,508,000)	(.73)
Texas Instruments Inc.	3 mos. 3/31/83	1,174,000,000	7,100,000	.50
	3 mos. 3/31/82	1,078,500,000	27,700,000	1.17

Comments: **Altos Computer Systems'** third-quarter sales rose 62 percent to \$20.5 million from \$12.6 million for the same quarter of the previous year. Earnings for the quarter rose 73 percent to \$2.3 million, or 16¢ per share, from \$1.3 million, or 12¢ per share, a year earlier. The company attributed the sales gain to healthy production deliveries of its new MC68000-based microcomputer, which was introduced last fall. **Fortune Systems Corp.'s** earnings included an extraordinary credit of \$1.3 million, or 7¢ per share, for the tax benefit relating to 1982 operating losses. **Fortune**, which manufactures MC68000-based systems, says it has eliminated short-term debt and has working capital in excess of \$100 million, including \$90 million from the company's

initial public offering. The company also says it has a \$20-million line of credit from the Bank of America and will invest more money than had been planned in research and development this year. Raster graphics display manufacturer **Lexidata Corp.** rebounded from a poor first quarter to show a profit of \$149,000 or 3¢ per share, in its second quarter. Earnings were still down, however, from \$937,000, or 16¢ per share, a year earlier. Sales for the period were \$6.7 million, as opposed to \$7.3 million a year earlier. While **Harris Corp.'s** orders in its Information Systems, Communications, and Semiconductor sectors increased slightly, Government Systems' nine-month orders were up more than 40 percent over the same period last year, the company says.

**How can
you develop one
system and offer
your customers
a choice of
three?**

Develop it around HP's new three-in-one microsystem.

Now you don't have to redesign your system to offer your customers a range of performance. Because the entire power range of HP's new A-Series computers fits into the same small, convenient package. At a slimmed-down starting price of \$7445*

So you can offer 1 MIPS performance. Or floating point hardware and microprogramming in either a 1 MIPS or 3 MIPS computer. Whichever one your customer chooses, you can fit it easily into the same space in your system.

Identical software keeps it simple.

When you change processors, you don't have to go back to the drawing board with your programs. Because, in addition to compatible hardware, these computers run identical software. That's the best kind of compatibility you can buy.

Our A-Series family consists of the Micro 26, Micro 27 and Micro 29. The Micro 26 comes with integrated 9.4 Mb

mini-Winchester disc and microfloppy. And it has 8 I/O slots, giving you plenty of room for our wide selection of I/O cards for instruments, measurement and control, and datacommunications, to name just a few.

The Micro 27 adds floating point hardware and microprogramming. And, for jobs needing up to three times the power, our 3 MIPS Micro 29 has got what it takes.

Our brand new operating system really performs.

That's one secret of our success. The new, full-function RTE-A real-time operating system provides the performance you need for your real-time automation applications. Ranging from dedicated machine control to monitoring instruments to supervising a whole network of computers.

This power, speed and I/O capacity also make our

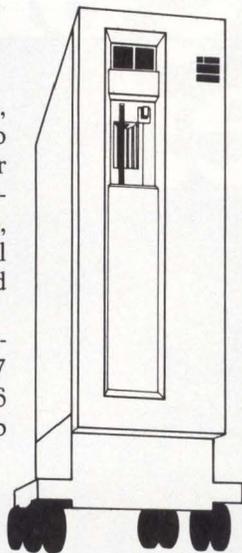
A-Series systems ideal for multi-user, multi-tasking environments.

Of course, these compact new computers are part of our newly expanded OEM program. This includes higher discounts and credits, extended warranties and free training. So you'll make more when you get your product to market. And you'll also get there faster with our new operating system and newly packaged microsystems.

If you'd like micro, mini or maxi performance in one micro package, call your local HP sales office listed in the white pages of your phone book. Ask for a technical computer representative. Or write for more information to: Hewlett-Packard, Attn. Greg Gillen, Dept. 08171, 11000 Wolfe Road, Cupertino, CA 95014. In Europe, write to Henk van Lammeren, Hewlett-Packard, Dept. 08171, P.O. Box 529, 1180 AM Amstelveen, The Netherlands.

*A600+ microsystem component, 128Kb memory, box, Winchester disc.

Prices are U.S.A. list in OEM quantities of 100 and include integrated peripherals, one interface card, RTE-A execute and 512Kb of memory for Micro 26 and Micro 27. Micro 29 includes 768Kb of memory.



Our new microsystems
also come in this floor-mount
or bench-top models.



Micro:

1 MIPS for
\$7445

Maxi:

3 MIPS, plus floating
point hardware and
microprogramming, for
\$16,350

Mini:

1 MIPS, plus floating
point hardware and
microprogramming, for
\$13,140



Whatever the level of performance you pick, it fits in this little 7" x 19" x 25.5" package.

**YOU CAN FIND A LOT OF
COMPANIES WHEN YOU WANT
TO BUY A MONITOR...**



...BUT HOW MANY CAN YOU FIND WHEN YOU WANT TO SERVICE IT?

There's one you won't have to search for. Conrac.

We're committed to giving OEMs the service and support you need—when you need it and where you need it. We're implementing an extensive network of regional and local technical centers throughout the country, and that means service and replacement parts along with sales support nearby, where you need it. And with our ongoing training program, the skills that our people can offer your people are constantly being polished and upgraded.

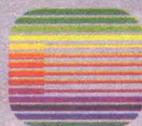
When you look at the total picture—our 36 years of expe-

rience, the broadest range of products in the industry, high quality, performance, reliability, serviceability, availability and responsive engineering and customer service—it's easy to see why Conrac is the first choice in OEM markets. You know that once you buy from us—you won't have to search for us.

For more details on Conrac's complete line of monitors, and our schedule of training programs, call or write:

Conrac Division, Conrac Corporation, 600 N. Rimsdale Ave., Covina, CA 91722.

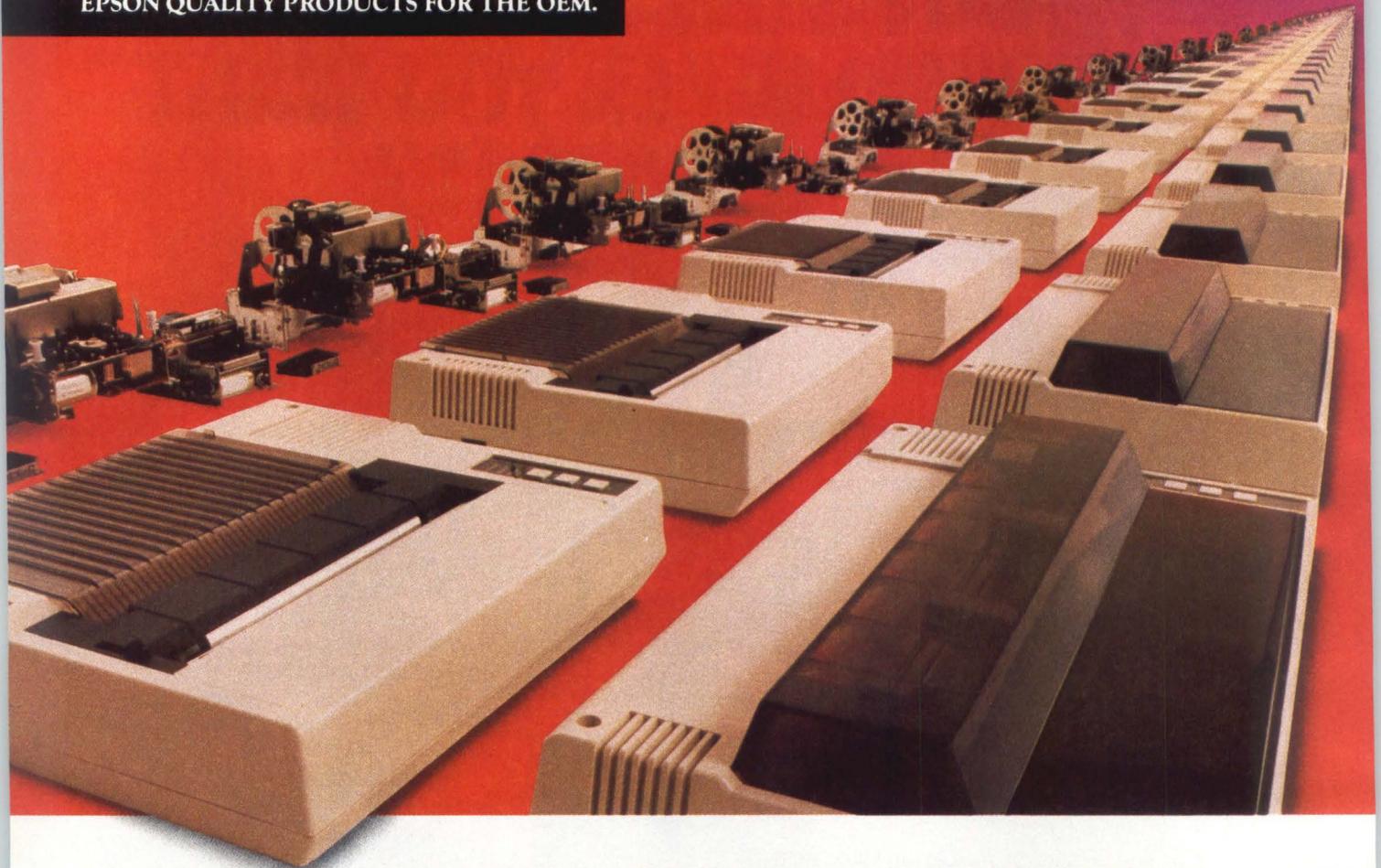
Regional Offices:
Western (213) 966-3511,
Mid West (312) 833-3310,
Eastern (203) 348-2100,
New England (617) 272-6720.



CONRAC

CIRCLE NO. 45 ON INQUIRY CARD

EPSON QUALITY PRODUCTS FOR THE OEM.



DESIGN EPSON PRINTER RELIABILITY INTO YOUR SYSTEM. AND GET SOMETHING EXTRA.

With our new serial dot matrix printers, for instance, you can choose features such as 160 cps print speed, *correspondence quality*, pica, elite and over 60 character weights and sizes; 7 dot addressable graphic modes including 1 to 1 aspect ratio; user-defined character sets, and more.

But you get something extra whenever you design Epson OEM products into your system. You get confidence. Confidence because you're dealing with the #1 OEM manufacturer of serial dot matrix printers and mechanisms on the planet — we shipped over 7 million this year. Confidence because of the exceptional reliability designed into each unit — out of box failure rate is measured in tenths of a percent. And confidence because of our dedication to quality that has made that record possible.

You get value, too. Epson printers give you the lowest total cost of ownership in the industry. And they can be customized from the inside out to meet your unique system requirements.

We simply don't have room to tell you all the Epson extras. But if you call or write we'll fill you in on all the details. Do it today.

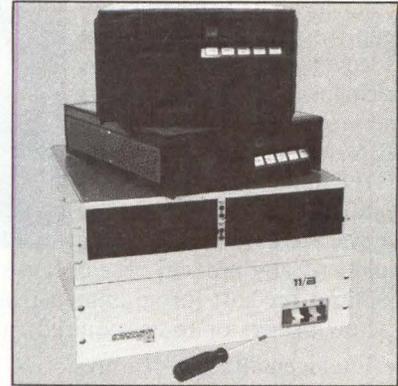
EPSON
EPSON AMERICA, INC.
OEM Products Division
Printer Group
3415 Kashiwa Street, Torrance,
CA 90505 (213) 534-0360
TELEX 182412

SW Region (714) 751-1919 • NW Region (408) 985-8828 • SE Region (404) 458-9666 NE Region (617) 245-8007
• CENTRAL Region (815) 455-2570

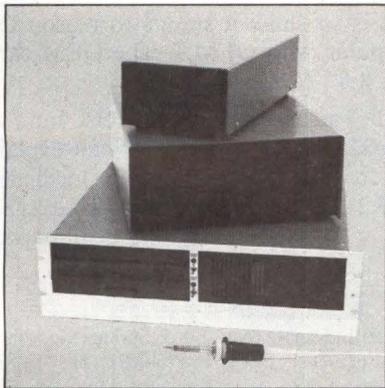
AT ANY LEVEL: DEC LSI-11 COMPATIBILITY

COMPLETE COMPUTERS

Using LSI-11/2 or LSI-11/23
Winchester Disk Storage to 140 Mbytes
Compact Packages as small as 13"W x 4"H x 15"D
Floppy Disk backup in 5¼" or 8" sizes, or
Streaming Magnetic Tape—industry standard



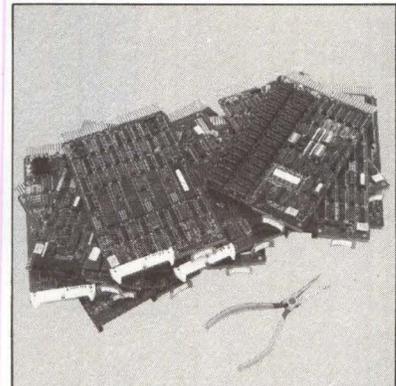
MASS STORAGE SUBSYSTEMS



Up to 140 Mbytes of mass storage
Emulation of RK05, RL01, RL02, or RP02
5¼" or 8" Floppy Disk option for incremental
backup and data interchange
Single Andromeda Controller for both
Winchester and Floppy Disk drives

CONTROLLERS AND INTERFACES

5¼" and 8" Winchester Disk Controllers
5¼" and 8" Floppy Disk Controllers
Multichannel Serial Interface
Line Printer Interface
Add-on Memory
Video Display Controller
Data Acquisition: analog I/O, programmable
clock, parallel digital I/O
... plus others



COMPATIBLE SOFTWARE AND ACCESSORIES, TOO

FROM ANDROMEDA SYSTEMS, INC.

For more information, call or write:

ANDROMEDA[®]
SYSTEMS
INC. 

9000 ETON AVENUE
CANOGA PARK, CALIFORNIA 91304 U.S.A.
(213) 709-7600 TWX: 910-494-1248

DEC, LSI-11, RK05, RL01/02, and RP02 are trademarks of the Digital Equipment Corp.

The New Rixon Intelligent R212A Modem...

The Intelligent R212A has literally leap-frogged the competition and revolutionized the 212A modem market. All beta site customers report that the Intelligent R212A is the most amazing 1200 BPS full duplex modem with an integral automatic dialer they have ever seen. Installation is the simplest of any modem ever because all options are soft (programmed from the keyboard)—no screw drivers or tools required, just plug it in.

The Intelligent R212A features:

- Automatic log on to databases with a single key stroke
- User friendly HELP list menu
- Store up to 10 numbers and alpha descriptions
- Automatically sets parity
- Automatically selects tone or pulse dial
- Dial stored numbers with a single key stroke or other numbers from the keyboard



- Initiate modem tests from the keyboard and review results on the CRT screen
- Battery backup protects all memory
- Link to another number if first number busy
- Redial selected numbers 1 to 99 times
- An unprecedented low price of \$499.00

The Intelligent R212A continuously monitors the progress of each call and reports its status by displaying — “Dialing Number”, “Waiting”, “Ringing”, “Busy”, “No Answer”, “Linking” and “On Line”.

The Intelligent R212A is so small it stands to reason the circuit card is very popular with OEM's. The OEM card is .5" x 5.4" x 8.8" (47 sq. inches).

Call Bill Vance today, at RIXON Inc., at (301) 622-2121, ext. 431. Bill can explain to you how the RIXON Intelligent R212A has revolutionized the 212A modem market.

SANGAMO WESTON
Schlumberger

RIXON INC.

2120 Industrial Pky., Silver Spring, Md. 20904
301-622-2121 TWX 710-825-0071 TLX 89-8347



3044A ©RIXON INC., 1983

Mini-Micro World

INTERNATIONAL

Europeans will join forces in fifth-generation research program

Those who still think that the evolving fifth-generation computer technology is strictly for academics may change their viewpoints dramatically by this October. That's when European Community governments are expected to give the green light to a \$1.5-billion research program for fifth-generation technology called ESPRIT (European Strategic Program of Research and Development in Information Technology). The program's goal is to unite European computer companies in the face of a common threat from Japan, which has also initiated a fifth-generation research program (MMS, October, 1982, p. 141). The European Community is contributing one-half of the \$1.5-billion, and participating companies are expected to fund the remaining half.

The European Commission, the European Community's main administrative body in Brussels is organizing ESPRIT. Commission officials say the Council of Ministers, the decision-making group comprising senior government ministers from each member country of the community, will vote on the project in October. The council's approval is likely since ESPRIT is the result of a council meeting in June, 1982, during which information technology was called "an urgent subject for increased action."

Total expenditure of the project could substantially exceed \$1.5 billion, the sum for the first five years. ESPRIT, like Japan's fifth-generation program, is intended to run for a decade.

The European Community's com-

mitment to fifth-generation work is more solid financially than that of the Japanese government, which has agreed to contribute only \$50 million for the first three years. However, MITI, Japan's trade and industry department, is pressing the Japanese government for at least \$500 million. The European Community hopes that Europe's main weakness—the fragmentation of its industry and markets—will not hinder pan-European cooperation because of the "pre-competitive" nature of the research work.

ESPRIT's five main research areas are software, advanced information processing, office automation, computer-integrated manufacturing and advanced microelectronics.

The software projects include the development of portable tools and a

BRITISH \$500-MILLION RESEARCH PROGRAM WILL COMPLEMENT ESPRIT

While the European Community's ESPRIT research program for fifth-generation technology awaits lift-off, the British government has given the go-ahead for its own \$500-million advanced computer research program. The Alvey program closely resembles ESPRIT in structure, although government officials say it is designed to complement the European Community's scheme. This assurance should alleviate community officials' anxieties that efforts to encourage pan-European computer research have been hindered by member countries that prefer to support their own national programs.

Alvey participants will receive government funds totaling \$300 million, but the participants are expected to contribute as much as 50 percent of the cost of each project.

The four main technologies Alvey will study are VLSI, software engineering, the man/machine interface and

intelligent knowledge-based systems. The largest chunk of the Alvey expenditure, about \$140 million, is for VLSI research.

A short-term aim of the more-than-\$100-million software-engineering program involves the UNIX operating system, a product not in ESPRIT's plans. Alvey plans enhanced database and communications facilities for UNIX, which will ultimately lead to the Information Systems Factory. The ISF will be a computer system, including both hardware and software, with an integrated set of tools for system development. It will include subsystems for prototyping, life-cycle programming support, accessing databases of reusable hardware and software components and communications over local- and wide-area networks.

The man/machine interface program, for which as much as \$70 million has been allocated, will include

development of flat-panel displays, also an important part of ESPRIT's research. Alvey plans to produce a color display with a resolution of 240 pixels per sq. in. within five years.

One difference between Alvey and both the Japanese and the ESPRIT programs is that Alvey places less emphasis on intelligent knowledge-based systems. Funding for that program is less than \$40 million. Its main thrust is toward improving a technology emerging from research laboratories—expert systems.

Despite the enthusiasm for Anglo-Japanese fifth-generation research expressed by Kenneth Baker, Britain's information technology minister, there will be no active cooperation between Alvey and the Japanese program, says a spokeswoman for the British government's department of industry.

Mini-Micro World

INTERNATIONAL

standard program-writing workstation designed to interface with local and wide-area networks. Also planned are validation and enhancement techniques covering the lifetime of a program and a software-production and maintenance-management system.

In the advanced information-processing area, the Europeans will look at advanced speech- and image-recognition systems, including advanced parallel architectures and very-large-scale-integration circuitry. The Europeans will also give much attention to expert systems. They plan to develop workstations for nonprocedural languages, such as Prolog and LISP. Plans also include work on "knowledge information-management systems," including a prototype machine for processing imprecise non-numeric information and languages for representing and manipulating knowledge rather than precise numeric information.

Like the Japanese, the Europeans will investigate and develop five categories of innovative computer architecture. The categories are database machines employing new architectures, "ultracomputers" with thousands of interconnected elements, machines designed to host data-flow program structures, highly parallel nonprogrammable specialist processors and inference machines for "deductive" operations—a key fifth-generation concept. Research on query languages for non-specialists is another target in the advanced information-processing research.

The office-automation program goals include establishing a standard European system, including communications protocols and specialized integrated circuitry, for integrating and processing voice, data, text, graphics and video. Other projects are planned for

hardware technologies such as multifunctional flat-panel displays, hard-copy printers and high-capacity, rewritable, optical-disk storage systems.

Work on filing systems will include content addressability and accessing loosely structured information with data, text, graphics and other media.

Computer-integrated manufacturing embraces computer-aided design, manufacturing and testing. The European Community sees it as the most urgent area for action. One of the program's main goals is to develop a chip set for robot control comprising three integrated circuits—for axis interpolation, axis control and servo interfacing. The project will also work on new operating systems for robot applications.

Imaging systems for feeding manufacturing control equipment is another important research topic. Work is expected on processing tactile, thermal and acoustic "images" as well as visual information and

on processing 3D images. Another aim is to establish "advanced development centers" for collaboration between industry and the academic community.

The advanced microelectronics program will emphasize development of design and production tools for ICs with submicron geometries. One project will study how to achieve four layers of metal interconnect patterns on a chip. Another will work on advanced CAD techniques to produce tools to enable a device with 10,000 gates to be custom designed in only five days. Further work could lead to the development of 50,000-gate devices in the same amount of time.

The advanced microelectronics area, like the office-automation sector, will study flat-panel-displays. The aim of the study is to produce displays ranging in size from 3 × 5 cm. (about 1.2 × 2 in.) to 1m. × 1.5m. (about 39 × 59 in.).

—Keith Jones

ISO's workstation ergonomics subcommittee progresses

The International Standards Organization, under the auspices of West Germany's Deutsches Institut für Normung (DIN) and the British Standards Institution, has progressed further toward universal ergonomics standards by asking one of its subcommittees to formulate rules for computer workstations. The SC4 subcommittee of ISO's TC159 international technical committee held its first worldwide meeting this June in Manchester, England.

Peter Crabbe, a technical officer at BSI and organizer of the June meeting, notes that it discussed mainly administrative arrange-

ments. Information about the meeting can be obtained from the American National Standards Institute in New York. "After the June meeting, there may not be another full meeting for two or three years," says Crabbe, "but individual working groups will meet quite often at locations that could be anywhere in the world."

Asked about the relevance of the existing DIN 66234 workstation standards to the proposed ISO rulings, Crabbe says that DIN is regarded as "a possible model." But he notes that standards bodies in other parts of Europe are not entirely in agreement with all

Introducing the first removable Whitney technology disk drive for OEMs.

Cartridge convenience with fixed media performance and reliability in an 8-inch, fixed/removable drive.



- **50 Mbytes Total Storage**
- **25 Mbyte ANSI Standard Cartridge**
- **35 msec average access**
- **CDC Lark™ compatible SMD interface**
- **8-inch floppy envelope**

Now there's a disk drive with the combination of speed, capacity, reliability and packaging efficiency to complement your high-performance mini- or microcomputer based system.

It's the Arapahoe 7110 from Amcodyne.

Arapahoe features advanced Whitney head suspension and read/write technologies derived from the latest generation of mainframe disk drives. Improved aerodynamic stability, superior head/disk compliance and higher signal-to-noise ratio result in data reliability that is substantially better than that attainable with Winchester technology.

Arapahoe incorporates a microprocessor-controlled/embedded-servo system to eliminate the head/disk alignment problems which handicapped early cartridge disk drives. The microprocessor directs all head-movement operations and computes the runout profile for each cartridge. The result is fast, accurate seeks and absolute tracking accuracy for cartridge interchangeability.

Reliability is further assured by Arapahoe's proprietary head-loading mechanism and positive-pressure clean-air system. When a cartridge is loaded, Arapahoe's heads are held off the disk until the cartridge is purged to a fixed-media cleanliness level. Only then are the heads lowered into flying position. Together, these features mean you can employ Arapahoe with confidence in a wide variety of office, laboratory or industrial environments.

For Arapahoe product specifications and a free monograph on Whitney, the technology that's replacing Winchester in high performance disk, contact Amcodyne.

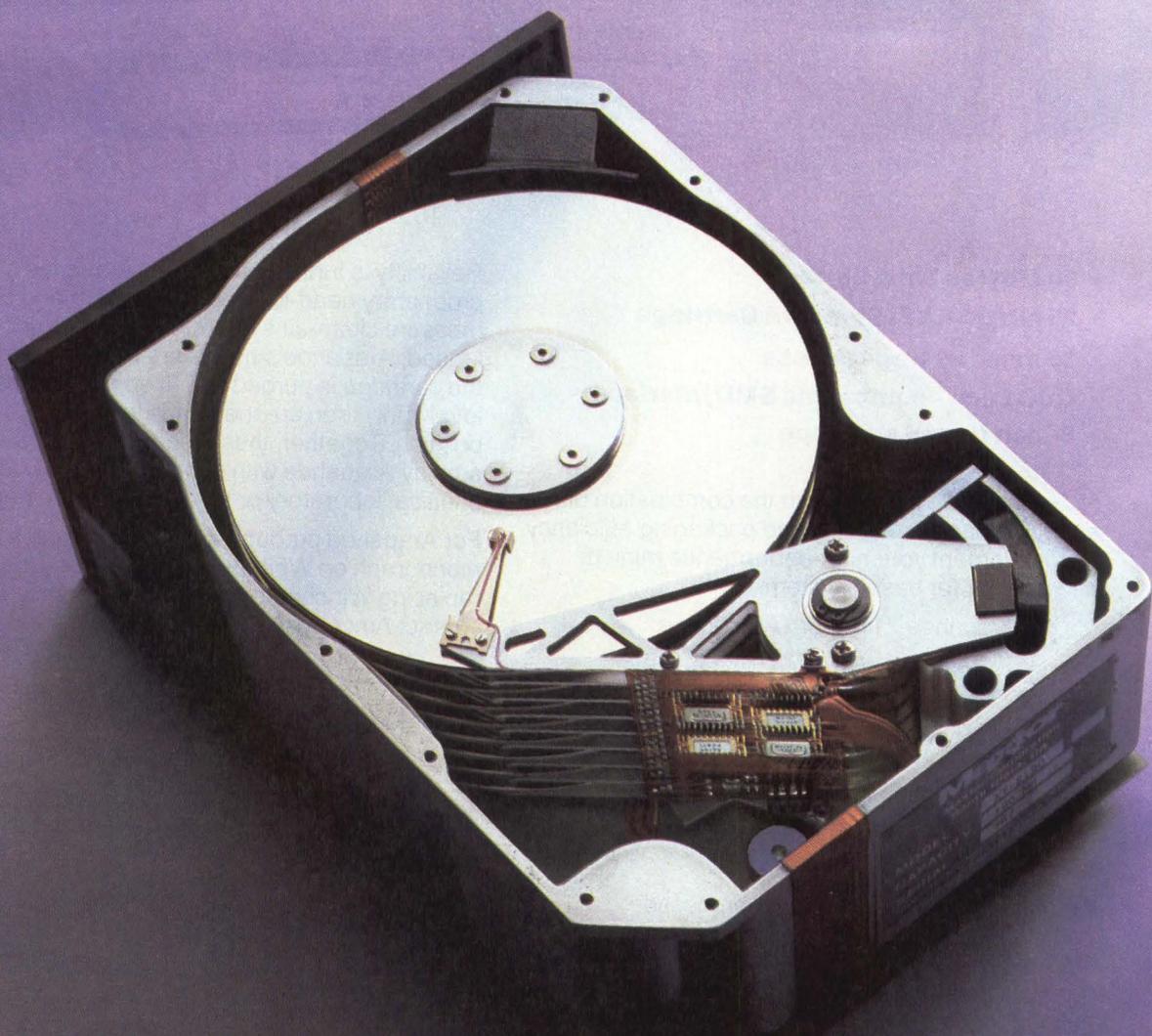


Amcodyne

Amcodyne Inc.
1301 South Sunset Street
Longmont, Colorado 80501
(303) 772-2601

We've taken
the 5¼" Winchester
from 140 to 380 MB
in six months flat.

And it's only
the beginning.



Since Maxtor introduced OEMs to the first eight-platter, 140 MB 5¼" drive a few months ago, the phones haven't stopped ringing.

Now we're at it again. Using innovative packaging and proven technology to introduce even more industry firsts.

Like our new XT-2000™ family of 5¼" drives. With 85 to 190 MB of storage capacity.

Or the Maxtor EXT-4000™ line. The highest capacity 5¼" drives on the market. With storage capacity from 75 to 380 MB. And a transfer rate of 10.0 Mbit/second.

EXT-4000 drives feature the new industry standard, ESDI (Enhanced Small Disk Interface). The high-performance alternative to the ST506/412 interface. Permitting up to 100% more storage capacity. And twice the transfer rate.

XT-1000.™ XT-2000. EXT-4000. Take your pick. One of our 5¼" drives is bound to fit your current or future product plans.

If not, give us a few months. We're working on it.

Our doors are always open to OEMs. Let's talk. Call Leon Malmed at (408) 942-1700. TELEX: 171074. Maxtor Corporation, 61 East Daggett Drive, San Jose, California 95134.

*XT-1000, XT-2000 and EXT-4000 are trademarks of Maxtor Corporation.
©Maxtor Corporation 1983

Maxtor

CIRCLE NO. 49 ON INQUIRY CARD

Mini-Micro World

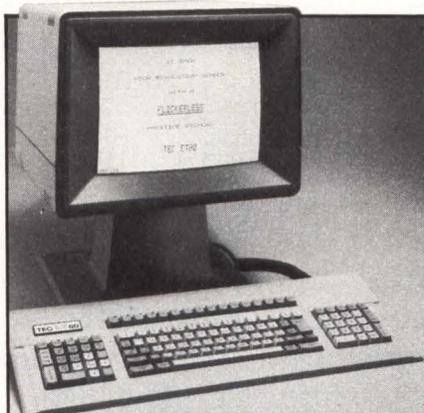
INTERNATIONAL

aspects of DIN. (DIN, the German version of ANSI, is generally regarded as the most advanced organization in the formulation of precise human-factors specifications.)

Human factors consultant Tom Stewart of office systems consultancy Systems Concepts Ltd., London, reinforces Crabbe's point. He notes that standards formers in France, for example, do not like DIN's rulings on the dimensions of workstation desks. Stewart says the DIN rulings in general are considered too strict and precise, citing its rulings on character shapes as an example.

Crabbe at BSI adds that some aspects of the DIN standard are still in the draft stage, including those relating to character perceptibility and the workstation lighting and positioning in an office environment. Those that have passed the draft stage and are published cover character shapes, the grouping and formatting of data and the coding of information. Information coding embraces factors such as contrast, screen colors, symbol size and the frequency of flashing elements on the screen.

DIN's rulings favor a positive display with dark characters on a light background. One U.S. CRT manufacturer already following this



A dark-on-light display, such as the one (shown) on TEC's ET80, is favored by Deutsche Institut für Normung standards. A 70-Hz refresh rate is employed to reduce flicker on the ET80.

specification is TEC Inc., Tucson, Ariz., whose ET80 display shows black characters on a white background. Company product planner Hans Daniel claims this feature (reverse video) can improve operator productivity as much as 90 percent by reducing reflection. To reduce flicker, TEC uses a 70-Hz refresh rate on the ET80, compared with the 30 to 60 Hz on CRTs using light characters on a dark background.

ISO is not the only international standards group interested in human-factors standards. The European Computer Manufacturers Association also has a technical committee, TC 28, drafting human-factors proposals. ECMA secretary

general Dara Hekimi says ECMA will publish a technical report on ergonomics guidelines by the end of this year. He stresses that ECMA is interested in setting guidelines, rather than standards, but expects ISO to use the report in its standards work. The guidelines will cover areas such as keyboard dimensions, screen luminescence, character size and screen movability. Hekimi notes that TC 28 includes representatives from U.S.-based ECMA members as well as Europe-based members.

Although little workstation ergonomics legislation has been passed in Europe, the Hamburg, West Germany injury insurers association, Verwaltungs-Berufsgenossenschaften, has had its DIN-related rules added to the West German equipment safety laws. A copy of the rules is available from V-B for about \$20.

Some parts of the DIN workstation standard 66234 can be obtained in the U.S. from Ann Boles at publisher Heyden and Son Inc., Philadelphia. They are available only in German and include three parts, which sell for \$15 each and cover character shapes, character perceptibility and character grouping, respectively. Another part sells for \$19.50 and covers information coding. —Keith Jones

British seek U.S. users for VAX/VMS AI software

It is not surprising that the computer industry is looking to academia for software to support a technology still strongly influenced by academic institutions—artificial intelligence. One AI-oriented software package, POPLOG, which was developed at the University of Sussex, Brighton, England, for use

on Digital Equipment Corp. VAX/VMS minicomputers, is aimed at U.S. users. POPLOG combines the POP-11, LISP and Prolog languages with a powerful editor called VED. POPLOG is being used on VAXs at several European companies. Applications include constructing expert systems and image-recognition software for

military and robotics products.

POPLOG's group leader at Sussex, Dr. Aaron Sloman, describes POP-11—a virtually unknown language in the U.S.—as more verbose but easier to use than the much more familiar LISP. He notes that LISP is being used by POPLOG users only for teaching, but sees no serious obstacles to LISP applications being developed with POPLOG. He believes that LISP and POP-11 comple-

Match the 68000 Competition with UNIX™ operating systems.

Beat it with UniFLEX™.

W

e can't keep a good thing secret. Our new UniFLEX Operating System for the 68000 is better than the competition's UNIX operating systems or like offerings. Better in several ways. A whole new generation of users can now enjoy the efficiency, flexibility, and reliability that built our reputation.

Want the full story? Call us. Or watch for more details.

There *is* a superior alternative.



Technical Systems Consultants, Inc.
111 Providence Road
Chapel Hill, NC 27514 USA

Telephone: (919) 493-1451
Telex II: 510-920-0540

Mini-Micro World

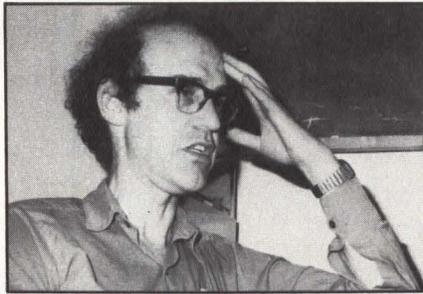
INTERNATIONAL

ment the third POPLOG language—Prolog. “POP-11 and LISP can be used for manipulating lists and arrays,” Sloman says, “while Prolog can handle the higher level parts of an application.” He cites Prolog’s ability to derive inferences from relationships.

Sloman explains that all three languages are incrementally compiled into one intermediate language, which is then compiled into instructions for the host machine. Although the VAX/VMS operating system is the only host environment, Sloman says a Berkeley 4.2 UNIX implementation on VAX and a 4.2 version on an MC68000-based microcomputer will be available soon. The machine on which the implementations will be made has not been selected. Sloman says VED exploits the incremental nature of the compiler to allow a user to make compilations without leaving the editor. The user can indicate the language to be compiled by extending the name of the program with the suffixes “.P”, “.LSP” or “.PL”.

Users support Sloman’s claims about VED. David Connah, picture analysis project leader of the research laboratories of NV Philips, Redhill, England, says, since VED is written in POP-11, its facilities can be modified by a user, and its features can be added to application programs written in POP-11. Connah’s group is using POPLOG in stored-model picture-analysis work for robotics applications.

Brian Dougherty of missile builder British Aerospace, Hatfield, England, points to VED’s ability to edit many files simultaneously as a strength. Connah says POP-11 is like Pascal, but has all the features of an AI language without the “unnatural-looking” syntax of LISP. “LISP has too many square brackets,” Connah remarks, adding that Philips is unlikely to use LISP. The Prolog



Dr. Aaron Sloman, POPLOG group leader at the University of Sussex, Brighton, England, believes the POPLOG artificial-intelligence package for the VAX/VMS computer is sufficiently debugged and safe for installation by U.S. users.

part of POPLOG probably will be used later, he adds.

Martin Merry, AI section head at Marconi Research, Chelmsford, England, says POPLOG was selected because Prolog is needed for the expert-system shells his team is developing for use by various divisions within Marconi’s parent, General Electric Co. Ltd. Merry’s team is also using the POP-11 part of POPLOG, despite the fact that the team has no previous experience with the language. “It took us about a week to get to a level of familiarity

similar to Pascal,” Merry says. “We have yet to use other POP-11 facilities such as pattern matching. POP-11 is definitely good for processing arrays.”

British Aerospace also lacked POP-11 experience, says Dougherty. He says the POP-11 self-teaching facilities have been beneficial, and his team is beginning to “get into Prolog.” Details of the team’s work are secret, but they involve software development for tank and airplane recognition.

Sloman is confident that U.S. users can install POP-11 without help from a local support group. He points to the system’s extensive teaching and help files and the availability of source code to end users. Sloman says plans are in the works to strengthen POPLOG’s appeal to nonacademic users. Those plans include a handbook to complement the on-line teach and help files and maintenance documentation for end users. The U.S. price for POPLOG will be the same as in the U.K.—about \$5000 for the complete system. —Keith Jones

Fiber-optic modem supports parallel-to-serial conversion

The large, diverse population of system integrators that use Centronics 600 series-compatible printers and terminals are potential users of a fiber-optic modem designed to handle Centronics parallel interface protocols. The product is being offered to the U.S. market by Systems Production Ltd., Farnborough, Hampshire, England, which is supplying—on an OEM basis—a unit conceptually similar to one offered by Versatec Inc.

Called the 5008 parallel data modem, the product is aimed

primarily at remote printing applications demanding immunity from electromagnetic interference, which is one advantage of fiber-optic technology. The 5008 also lifts speed limitations. It employs multiplexing techniques to convert 8-bit Centronics data and handshaking signals, such as busy and acknowledge, to serial bit stream for transmission over a single fiber-optic duplex cable. An identical transmitter/receiver at the other end of the line converts the bit stream back to parallel signals, rendering the link transparent to

Computer OEMs: Now's the time to team with Altos.



As an OEM, you're aware there's a lot of 16-bit computers on the market. But what you may not be aware of are the many advantages to doing business with ALTOS® Computer Systems. Here's just a few:

- Altos currently offers the broadest range of cost-effective, single and multi-user 8086-based computer systems.
- Altos supports the most popular commercial operating systems (XENIX™, MP/M-86™, MS™-DOS, OASIS-16™ and PICK) plus most high-level languages.
- Altos microcomputers can run more existing applications software than any other computer in the world.
- Altos offers a large selection of utilities and compilers for converting existing Z80™ and mini-computer applications, such as those written in DEC's® DIBOL.™
- Altos provides full communications support; both local networking and remote communications.
- Altos provides the widest range of 5¼" and 8" storage options, including floppy, Winchester disk and mag tape backup.
- Since 1977, Altos has delivered more than 35,000 multi-user systems and peripherals to satisfied customers throughout the world.

- Altos backs its computers with responsive, world-wide service and support. (Customer Service Division of TRW, Inc. in the U.S.)

If you're an OEM looking to remain on top, now's the time to team with Altos. Call, write or clip the coupon today.

- Please send me more information on Altos' single and multi-user 8086-based computer systems.
- My application is _____
- _____
- Please have an Altos representative contact me.
- Name _____ Title _____
- Company _____
- Address _____
- City/State/Zip _____
- Phone (____) _____

Mail to: Altos Computer Systems, Attn: Marketing Services,
2641 Orchard Park Way, San Jose, CA 95134, Telex 470642 ALTO UI
or 3718648 ALTO UI MMS-7

800-538-7872 (In Calif., 800-662-6265)



Packed with more value for OEMs

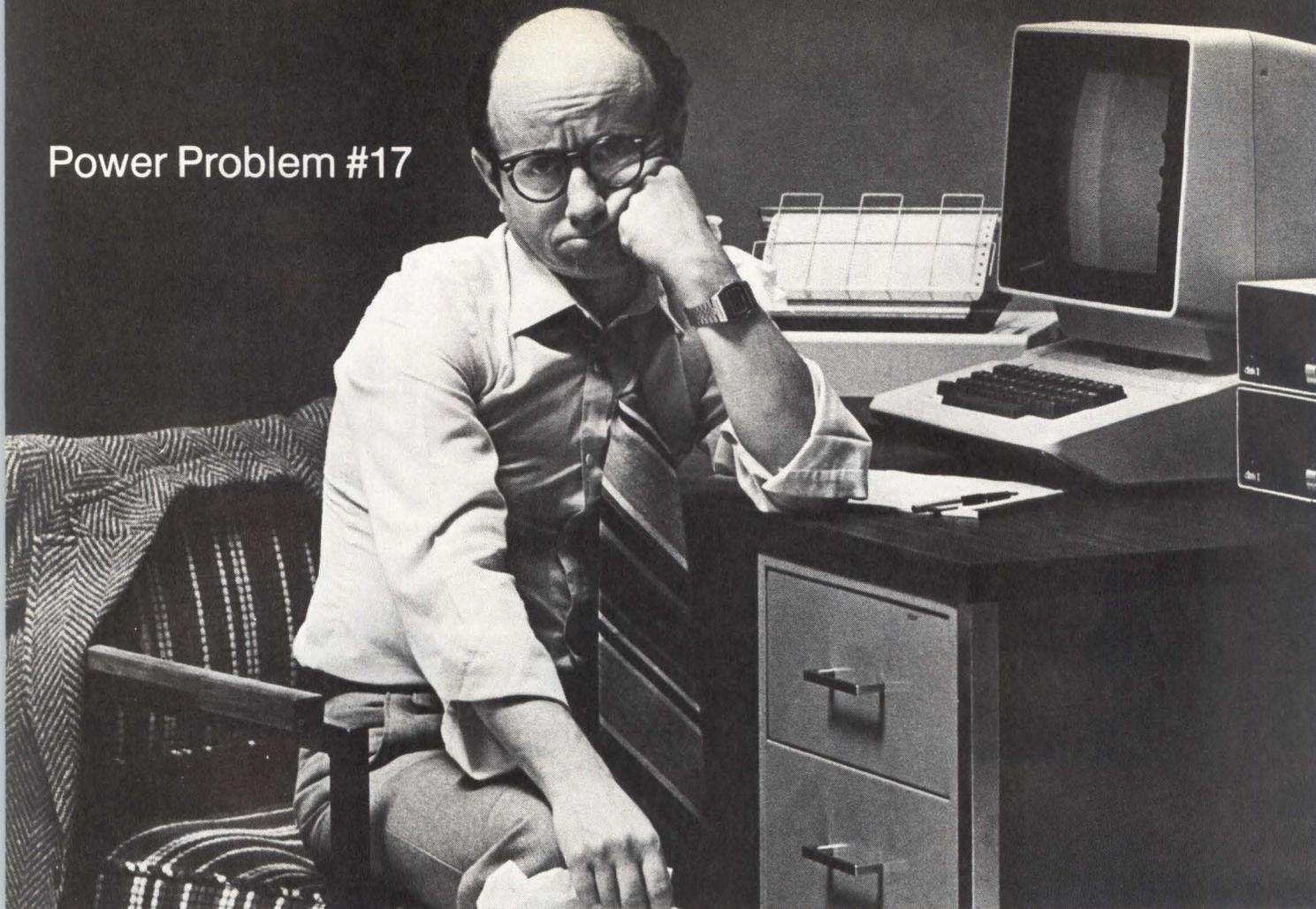
ALTOS is a registered trademark of Altos Computer Systems. 8086 is a product of Intel Corporation. Z80 is a trademark and product of Zilog, Inc. XENIX and MS are trademarks of Microsoft Corporation. XENIX is a microcomputer implementation of the UNIX operating system. UNIX is a trademark of Bell Laboratories. MP/M-86 is a trademark of Digital Research, Inc. OASIS-16 is a trademark of Phase One Systems, Inc. PICK is a product of Pick & Associates and Pick Computer Works. DEC is a registered trademark and DIBOL is a trademark of Digital Equipment Corporation.

©1983 Altos Computer Systems

MINI-MICRO SYSTEMS/July 1983

CIRCLE NO. 51 ON INQUIRY CARD

Power Problem #17



HOW DO YOU STOP BLACKOUTS FROM LEAVING BAD MEMORIES?

Answer: With a Topaz Source 2® Standby Power System.

Power failures can cause real problems for computers. Your word processor shuts down mid-sentence without a word of warning. Your intelligent terminal loses data and draws a blank. Worst of all, you spend hours trying to replace the data that was lost.

And blackouts aren't the only problem. A momentary dip in voltage or a brownout can put small business computers out of business.

But there is a bright side. Now you can put a Topaz Source 2 between your computer and your power problems. The moment AC voltage drops below normal, Source 2 takes over to deliver smooth,

sine-wave power to keep your computer up and running. Even during a total blackout you'll have plenty of backup power to save memory contents — and plenty of time to shut down the system in a businesslike manner.

If you rely on a computer to keep your business going, don't stop short. Give your equipment Topaz protection. Order your Source 2 Standby Power System today.

For more information, return this ad with your name and address, mark the reader service card, or call us:

Topaz Electronics Division
3855 Ruffin Road
San Diego, CA 92123-1165
(619) 279-0831 —
TWX 910-335-1526



TOPAZ
SOLUTIONS TO POWER PROBLEMS™

CIRCLE NO. 52 ON INQUIRY CARD



A FULL CAST OF STAR PERFORMERS

The Esprit product line has the right performer for every terminal role. It begins with *Esprit I*, an editing terminal at a conversational price. This basic Esprit presents crisp, clear video in comfortable green phosphor on a 12" diagonal screen. The integral typewriter keyboard has a 14-key numeric pad with alternate function key modes. *Esprit II* delivers additional editing features, plus the convenience of a detached keyboard; enhancements you'll appreciate in data entry. *Esprit III* meets a wide range of terminal applications. It costs much less than a TVI 925, but gives a significantly stronger performance including line drawing graphics, a broad repertoire of video attributes and editing commands, 22 user definable function keys and an optional 4-page display memory. *Esprit III COLOR* delivers the full Esprit III performance in eight brilliant colors.

There's an Esprit that's ready to star in all your terminal roles. Auditions are being held by your Esprit dealer right now.

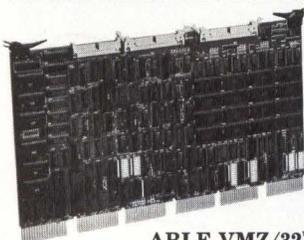
Esprit Systems, Inc., Hazeltine Terminals Division, 100 Marcus Drive, Melville, NY 11747 (516) 293-5600

Esprit Systems, Inc.
Hazeltine Terminals Division

If you're in the market for communications modules, make the ABLE connection now. And join the thousands who already have.

We are known as the innovators. Most of our products are industry "firsts" which become popular quickly, then settle into a stage of steady long-term acceptance. These four DEC-compatible, communications devices fit the pattern perfectly. They are ABLE originals. They achieved instant success worldwide. They provide top performance. And they are very reliable. Read on to find the one for you.

INCREASED VAX THROUGHPUT.



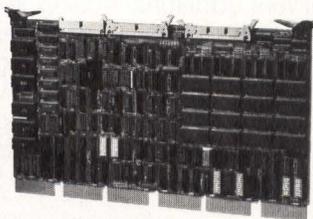
ABLE VMZ/32™
16-line DMF/32 subset

Here's an asynchronous microcontroller with programmable DMA, fully transparent to VAX/VMS as two 8-line DMF 32's and contained on a single board. Priced

below the DZ11-E, it outperforms DZ or DH devices under VMS v.3, has interrupt-driven modem control on every line, and includes an output throttle which lets peripheral devices optimize their own data rate.

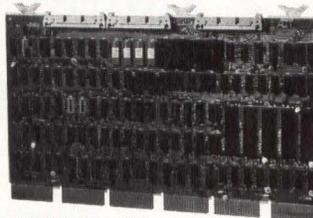
#1 UNIBUS DMA.

Then there's our DH/DM, the original multiplexer which puts 16 lines with modem control on a single board. This popular device meets UNIX VAX system needs for DMA communications requirements, serves UNIBUS systems equally well, and beats them all for MTBF, throughput and



ABLE DH/DM™
16-line combination DH11 & DM11 replacement

price. Other features include on-board diagnostics, modem control on all lines, superior on-board silo depth and variable prom-set. **SYNC/ASYNC FLEXIBILITY.**



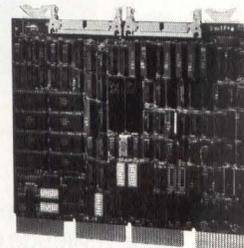
ABLE DV/16
16-line DV11 replacement

A controller for the PDP-11 user, the DV/16 contributes microprocessor-derived flexibility, which permits mixing of sync and async lines in combinations

of 4 or 8 lines with modem control and full system software compatibility. It takes less than half the space of a DV11 and uses word transfer instead of byte DMA to gain a 2 to 1 speed advantage or permit operation in half the bandwidth required for data transfers.

Q-BUS DMA.

The Q/DH is an asynchronous controller which makes DH-class performance possible on PDP-11/23 and LSI-11/23 Q-BUS systems. It connects the standard Q-BUS to as many as 16 async lines with DMA output capabilities and allows optimum Q-BUS utilization. Features include software compatibility with RSTS/E and RSX operating systems, large input silo, modem control on all lines.



ABLE Q/DH™
8 or 16-line DH/DM for Q-BUS

Write for details on our complete line of DEC-compatible products. Be on the lookout for exciting new ABLE communications products soon to come.

For Immediate, Toll-Free Information, Dial 800 332 ABLE.



CORPORATE OFFICES
ABLE COMPUTER
1732 Reynolds Avenue
Irvine, CA 92714 • (714) 979-7030

NATIONAL OFFICES
Burlington, MA (617) 272-1330
Rumson, NJ (201) 842-2009

INTERNATIONAL OFFICES
Canada (Toronto) (416) 270-8086
England (Newbury) (0635) 32125
W. Germany (Munich) 089/463080

DEC, PDP, UNIBUS, Q-BUS, LSI, VAX and VMS are trademarks of Digital Equipment Corporation.

Mini-Micro World

INTERNATIONAL

the host computer and the terminal and eliminating the need for an RS232 interface.

One observer of the fiber-optic market, Don Gooding, senior analyst at The Yankee Group, Boston, notes that a number of U.S. companies are selling fiber-optic data modems at lower prices than that of the 5008. But he knows of no other product offering parallel-to-serial conversion. There are modems that provide parallel-to-serial conversion for conventional twisted-pair links, but they do not offer the data-security advantages inherent in fiber optics, such as immunity from line tapping.

Canoga Data Systems, Canoga Park, Calif., quotes \$495 as the price for its CSA 100 modem, which comes with one RS232 interface. It supports full-duplex communications at speeds as high as 100K bits per sec. Phalo Optical Systems,

Chatsworth, Calif., charges \$525 for the rack-mounted version of its lowest priced modem, the ODS 201.

Gavin Dyer, a manager at Systems Production, says his company's U.S. marketing plans will probably include OEM deals with manufacturers of Centronics-compatible printers. Under the agreement with Versatec, Systems Production is supplying a modem that Versatec will sell as the Fiber Optic Link. The modem is designed to handle Versatec protocols, but employs multiplexing techniques that are fundamentally similar to the 5008's for parallel-to-serial and serial-to-parallel conversion. Matt Warner, a support specialist with Versatec, Santa Clara, Calif., says the Fiber Optic Link will be available this or next month.

Versatec could not find a U.S. manufacturer with a modem accepting parallel input, Warner says.

ENGLISH FIRM OFFERS OPTICAL DATACOMM DEVICE

European firm E.E.L., East Cowes, Isle of Wight, England, is attacking the U.S. market with an optical data-communications device. A subsidiary of Westland Helicopters Ltd., E.E.L. plans to sell the Data Link in the U.S. initially through Western Technologies Inc., Winston Salem, N.C., a Westland marketing subsidiary. E.E.L. offers a laser system called the Data Link, which comprises two identical full-duplex transmit/receive units priced at less than \$5000 each. The product is targeted at applications in which one data source is moving and could thus stretch or break a physical cable link. Maximum data rate for the Data Link is 19.2K baud.

E.E.L. manager Steve Tutton acknowledges that some U.S. manufacturers offer laser data-communications equipment with higher speeds. But he notes that the Data Link conforms with eye safety regulations specified by the British Standards Institutions. Those regulations render the product safe even if

its beam shines directly into a user's eyes.

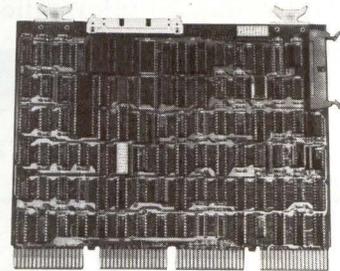
Data Link is equipped with a 20-mA current-loop interface. Tutton says the Data Link was developed for internal use in collecting test data from models of prototype Hovercraft on towing tanks.



E.E.L.'s Data Link laser system combines two identical full-duplex transmit/receive units, each less than 1 ft. high. The link is useful in applications in which one data source is moving, and eliminates the possibility of a physical line's stretching and breaking.

Another Famous First
from ABLE

DMA Line Printer Controller Gives VAX Users a High Performance Alternative to the DMF/32.



The ABLE VMZ/LP™ Beats Everything in its Class

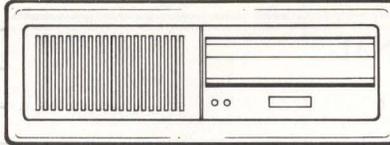
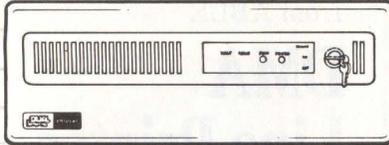
Features:

- Larger size character buffer (256 characters)
- DMA transfers
- Expanded formatting capabilities
- On-board diagnostics, LED display
- System software capability
- Ease of installation
- User friendly

VMZ/LP™, one of the most advanced line printer controllers on the market, is available now. Find out more about it and the rest of our full line of DEC-compatible modules. Write for details.

**ABLE
COMPUTER**

ABLE COMPUTER
1732 Reynolds Avenue
Irvine, CA 92714
(714) 979-7030



SYSTEM 83

What's your problem?

Software development; color graphics; high speed communications; industrial control & robotics (FORTH); word processing/document formatting; computer time-sharing; timing of Hawaiian marathon; farm management; CAD/CAM, laboratory control; CAT scan, dermatology graphics; medical analysis; pattern recognition (music/speech); relational database; telecommunications; mobile geophysical studies; data copying; automatic typesetting; data processing security...

What is your need? Let DUAL SYSTEMS be the solution. IEEE-696/S-100 based, 68000/UNIX,™ multi-user/multi-tasking, 20/80M byte. Call today for information!

DUAL

*UNIX is a trademark of Bell Laboratories

DUAL SYSTEMS CORPORATION

2530 San Pablo Avenue • Berkeley • CA 94702 • (415) 549-3854 • 172029 SPX

CIRCLE NO. 56 ON INQUIRY CARD

Mini-Micro World

INTERNATIONAL

"The Fiber Optic Link has been specifically designed to handle Versatec's parallel language," he says. Systems Production's Dyer notes that the agreement with Versatec prevents Systems Production from selling the unit to users of Versatec plotters or competing electrostatic plotters.

The 150K-byte-per-sec. speed of the Fiber Optic Link is an important feature. The speed approaches the speed of Versatec's plotters. The 5008 offers similar speed, but speed is less vital to vendors and users of Centronics-compatible units whose applications involve only alphanumeric printing. Dyer points to benefits other than error-free, secure communications, including the cost savings of using a single fiber-optic cable that can run several miles rather than using telephone lines or twisted-pair wires with repeaters every 1000 ft.

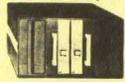
David Goddard, U.K. support manager with Versatec, worked with Systems Production on the development of the Fiber Optic Link. He estimates that using fiber-optic cable costs only one-third to one-fourth the cost of conventional twisted-pair wires. The major expense is the cost of the two 5008 units—about \$3000.

George Fritkin, marketing vice president of Canoga Data Systems, a leading fiber-optic modem manufacturer, says that his company offers no Centronics-compatible unit like the 5008. He says Canoga has no plans to offer such a product, and believes no substantial market exists for it. But Richard McCaskill of Phalo Optical Systems, another major vendor, says Phalo Optical is test marketing a unit like the 5008. Hinting at a possible deal with Systems Production, he says he would "like to talk" to Systems about its product.

—Keith Jones

Mini-Micro MARKETPLACE

Sprint 68 Microcomputer



CONTROL COMPUTER DEVELOPMENT SYSTEM
6800 MPU, serial I/O, 48K RAM, dual 8 drives, WIZO multiprocessing DOS, editor, assembler, 16K BASIC, all for \$3949

OPTIONS
C, P, W, PASCAL, FORTRAN, EBOM prog-
rammer, analog I/O, parallel I/O, 48K
RAM interface, CMOS RAM battery, power
fail detect, power on reset

WINTEK
185 South Street
Canaan, IN 47014
317-822-8422

The Mini-Micro MARKETPLACE is a low cost advertising section for selling hardware, software and services. Mini-Micro Systems'

readers are spending over 30 billion dollars a year on mini-computers, microcomputers, computer peripherals, data communication products, software and supplies.* Get their attention in the yellow pages of the Mini-Micro MARKETPLACE.

*from the 11th Annual Mini-Micro Computer Market Report

FORMAT

Ad Size: 2 1/4" X 3 1/16"

RATES

Frequency	Rate	Cost Per Program
1x	\$560	\$ 560
3x	540	1620
6x	520	3120
12x	500	6000
18x	480	8640

*Marketplace ads do not count towards frequency of regular display advertising. 15% commission to recognized agencies.

CLOSING DATE:

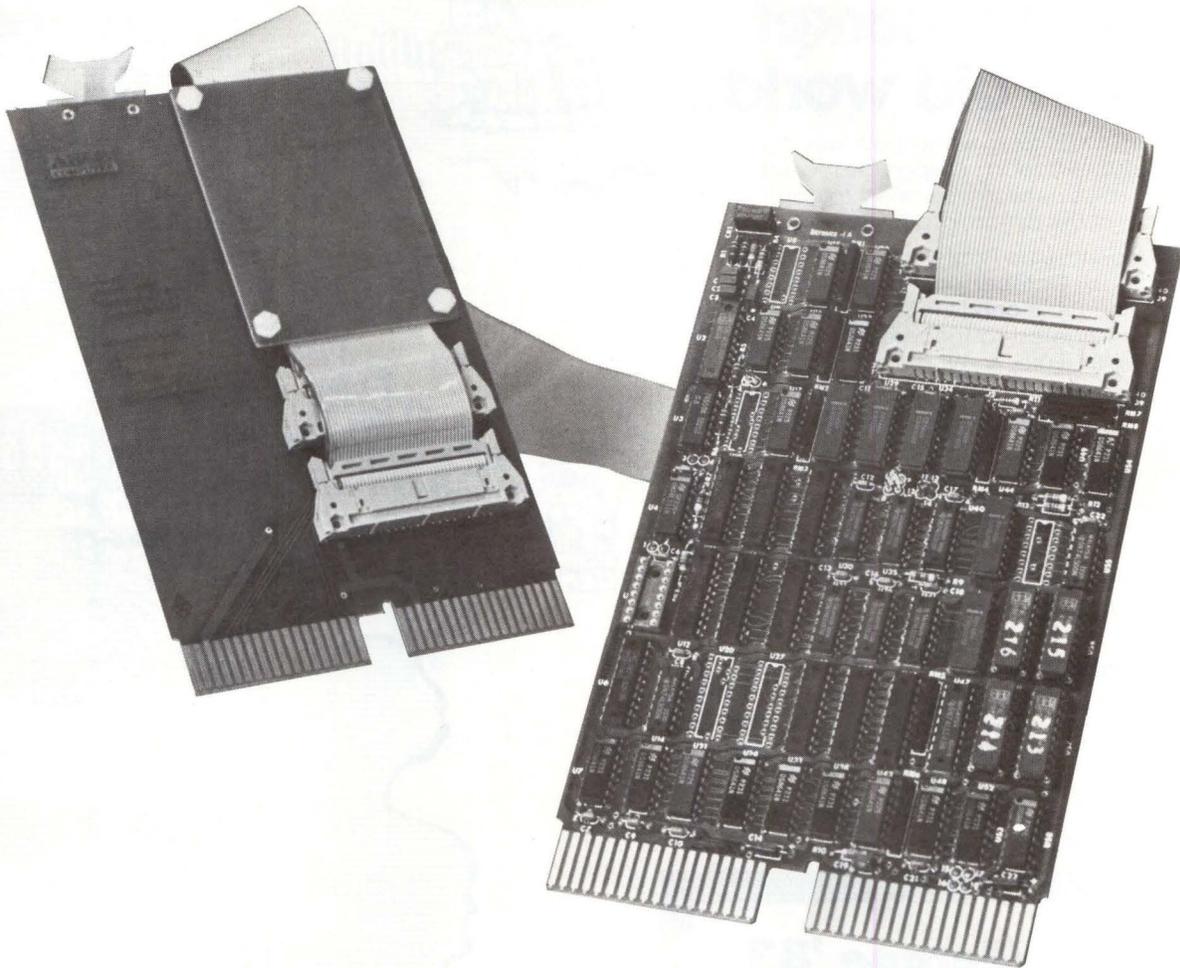
Publishes monthly, the first week of each month. Closing date for insertion orders and copy to be set are required by first of preceding month.

CONTACT

Lorraine Marden,
Sales Manager
Mini-Micro MARKETPLACE
221 Columbus Ave.
Boston, MA 02116
(617)536-7780

CIRCLE NO. 57 ON INQUIRY CARD

PDP-11/23 with 4 Megabytes of Q-BUS Memory. Impossible? Read On.



If you've outstripped your 256 kbyte addressing capability, if you want a reliable solution to your memory expansion needs, and if budget is a concern, we have the answer. We have made life on the Q-Bus a lot easier. QNIMAP™, another outstanding Q-Bus product from Able Computer, allows for full memory expansion up to 4 megabytes of main memory and the use of existing Q-Bus DMA devices. With QNIMAP™ you get system performance you never thought possible along with complete support from Able. The QNIMAP™ consists of two easy to install dual width boards and is software compatible with RSTS/E, RSX-11 and UNIX.

If you have other Q-Bus needs, Able has many exciting products:

- ABLE Q/DH™ – Direct memory access communications controller – gives you DH11 performance on your PDP-11/23 Q-Bus system.



- QNIVERTER™ – Bi-directional Q-Bus to Unibus/Unibus to Q-Bus signal converter for memory and peripheral devices.
- UNIMAP™ – Memory expansion to 4 megabytes on the PDP-11/23. Allows use of 18 bit Unibus devices.
- INTERLINK™ – DMA interprocessor link between two Unibus, two Q-Bus, or one Q-Bus and one Unibus system.

Find out more about QNIMAP™ and the rest of our Q-Bus products. Write or call for details. Able Computer, 1732 Reynolds Avenue, Irvine, California 92714. National offices: Irvine CA (714) 979-7030, Burlington MA (617) 272-1330, Rumson NJ (201) 842-2009. International offices: Canada (Toronto) (416) 270-8086, England (Newbury) (0635) 32125, W. Germany (Munich) (089) 463080. For immediate, toll-free information, dial (800) 332-ABLE.

Q-Bus, Unibus, RSTS/E, RSX/11 and PDP are trademarks of Digital Equipment Corporation. UNIX is a trademark of Bell Laboratories.

Explore a new market in an old world...

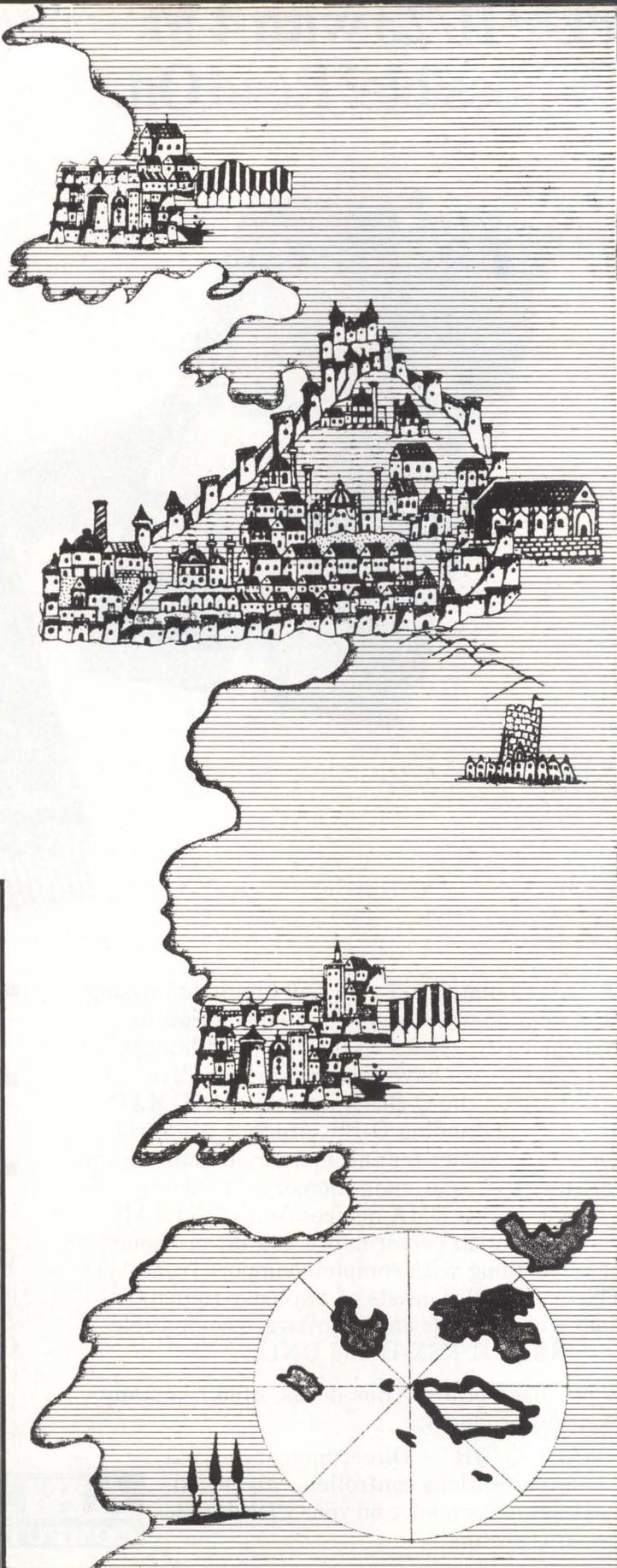
COMDEX/Europe is the best way for you to build... expand... or upgrade the distribution and sales network you need to capture **your** share of this dynamic, growth market.

Come with us to Amsterdam, The Netherlands, 24 to 27 October and explore new opportunities at the **only** European computer trade show targeted to the reseller marketplace—COMDEX/Europe. Where you can, with an exhibit at our second annual show, develop European distribution channels, easily and cost-effectively.

It's no secret that COMDEX is the place computer people do business. For five years COMDEX has meant opportunity in a reseller's marketplace in the United States. Now, there's a COMDEX targeted to meet the needs of Independent Sales Organizations (ISOs) and computer OEMs from all of Europe.

Take advantage of this unique opportunity. Call our Trade Show Sales Department today. Our toll-free number in the U.S. is 1-800-325-3330. In Massachusetts, please call (617) 449-6600. In Europe, call 31-20-460201.

This year take time to discover a new market in an old world!



COMDEX/Europe '83

24 to 27 October 1983

Amsterdam, The Netherlands

Yes, I want to explore a new market!

I want to meet Independent Sales Organizations (ISOs) who know how to best present my products to their European end-user customers! Please send me information on exhibiting at COMDEX/Europe '83.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

STATE OR COUNTRY _____

POSTAL CODE _____

MAIL TO: **COMDEX/Europe '83**

IN U.S.A.:
300 First Avenue
Needham, MA 02194
(617) 449-6600

IN EUROPE:
Amsteldijk 166
P.O. Box 7000
1007 MA
Amsterdam, The Netherlands
Tel. 31-20-460201



**THE
INTERFACE
GROUP, Inc.**

World's leading producer of computer conferences and expositions including COMDEX/Spring, COMDEX/Fall, COMDEX/Europe, INTERFACE, FEDERAL DP EXPO and the nationwide COMPUTER SHOWCASE EXPOS.



When Texas Instruments and Tektronix team up, brilliant ideas take shape.

- For high-resolution color graphics and lower costs, Tektronix uses TI's TMS4416 64K DRAM in its top-of-the-line graphics terminal (*Page 2*).
- TI's comprehensive choice for microprocessor-based systems: 64K DRAMs, static RAMs, controllers, and comparators (*Page 3*).
- First low-cost 64K DRAM chip carrier doubles the density of DIPs and provides all the advantages of TI plastic J-lead design (*Page 4*). ▶

TI's new memory

125 MHz pixel-rate performance. With memory part count cut by 75%. And cost savings more than 50%. The unique TMS4416 16K × 4 DRAM from Texas Instruments is the first 64K dynamic random-access memory (DRAM) in the world that could provide this performance at that price. And that's why it was chosen for the new, advanced Tektronix 4115B Computer Display Terminal.

Designed for the most demanding CAD/CAM applications, the Tektronix 4115B features a high-resolution color raster-scan display. This 60-Hz, non-interlaced, flicker-free display provides resolution of 1280 × 1024 pixels. Up to 256 colors can be displayed at one time from its palette of 16 million colors!

System-wide cost savings

By upgrading from four 16K devices per single in-line package to one TMS4416 ByFour* DRAM (see photo), Tektronix cut costs by more than 50% and memory part count by four times.

System costs also were lowered, due to fewer interconnects and support circuits. This reduced inventory, cut power requirements, and enhanced reliability.

Lower power, higher reliability

With one 5-V power supply at 130 mW per 64K, the TMS4416 significantly cut power consumption. This increased power supply margins and reduced noise. Plus, lower heat dissipation and fewer interconnects improved system reliability.

Equally important, TI met Tektronix's critical delivery schedule.

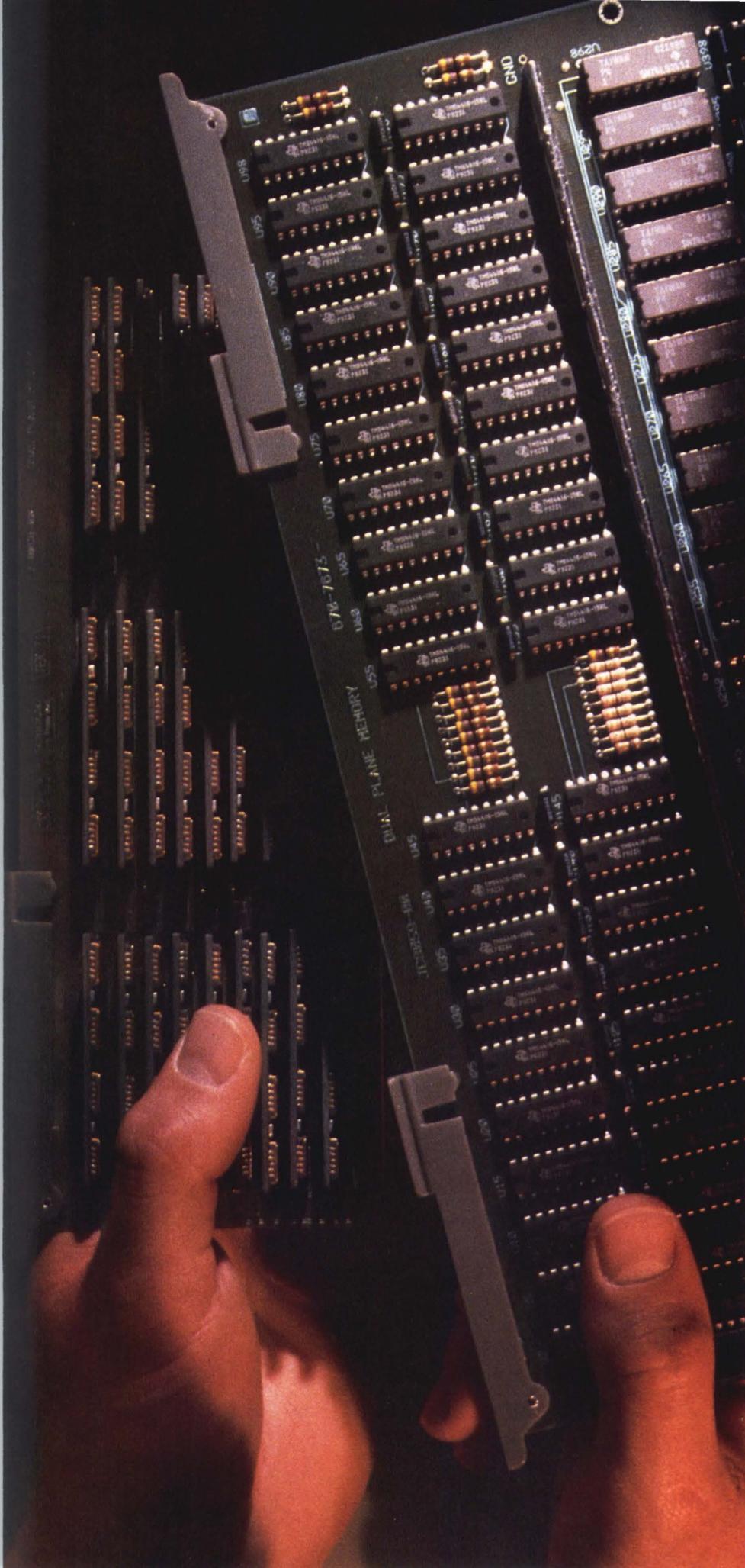
Meets many design needs

Where can the TMS4416 help you? In personal and small business computers. Intelligent terminals requiring 16K- and 32K-byte memory modularity. Single-board microcomputers. And more.

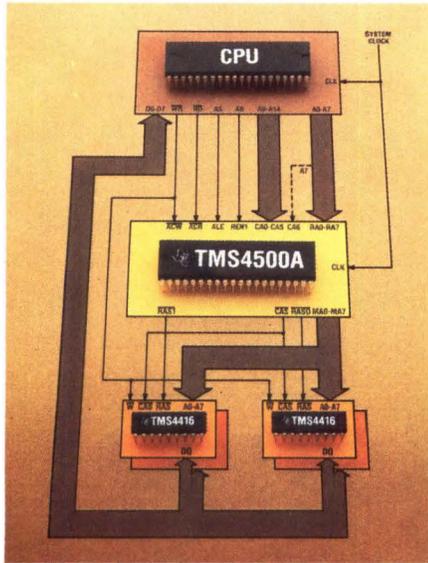
The output/enable feature makes interfacing the TMS4416 with microprocessors simple. ■

◀ **An exceptionally "clean solution,"** TI's TMS4416 16K × 4 DRAM enabled Tektronix to reduce memory component count by four in its new 4115B Computer Display Terminal. Each TMS4416 replaced four 16K devices mounted on a single in-line package.

*Trademark of Texas Instruments



16K x 4 DRAM cuts costs by 50% for Tektronix.



For a cost-effective, low-power memory system that uses minimum board space, combine the TMS4416 or the TMS4164 64K DRAM with the TMS4500A.

One TI chip links DRAMs with CPUs.

TI's TMS4500A DRAM controller saves design time and IC costs.

Easy to use, the TMS4500A supplies a reliable, single-chip interface between dynamic memory and the microprocessor.

The TMS4500A speeds and simplifies your design task by providing address multiplexing, cycle timing, arbitration logic, and refreshing—all on one chip. It saves substantial design time, circuitry, board space, and power. Plus replaces as many as 15 discrete support ICs.

Highly versatile, the TMS4500A interfaces with all popular microprocessors. And is compatible with DRAMs from 4K up—from any manufacturer.

Think of the board space and time savings and power reductions possible when you combine TMS4416 or TMS4164 64K DRAMs with a TMS4500A.

Using the TMS4500A, you can easily handle up to 256K bytes per controller with TMS4416s or TMS4164s. With additional decodes, you can go to 512K bytes and more.

For details on the TMS4500A, check number 1 on the next page. ■

TI's fast 64K DRAM just got faster.

Now, TI's pacesetter TMS4164 64K x 1 DRAM comes in a still speedier version. Our new TMS4164-12 provides 120-ns access time, 230-ns cycle time, and just 175-mW typical power consumption per device. Two other speeds also are available: 150 and 200 ns.

We've also taken another positive step. To increase board density and lower costs, the TMS4164 now can be yours in 0.285 in. x 0.425 in. plastic chip carriers.

Like the TMS4416, the TMS4164 requires only a single 5-V power supply. This—combined with fewer sense amplifiers—reduces power dissipation and increases system reliability.

In addition, both the TMS4164 and the TMS4416 employ interlocked internal clocks, which provide more precise timing sequences. This allows all chips to run at maximum speeds without the danger of race conditions. And these clocks reduce power consumption by ensuring that each clock is activated only as long as necessary.

When you need high-quality 64K DRAMs, rely on TI's two outstanding choices. For high speed and low power, select the TMS4164. For high bandwidth and modularity, choose the TMS4416. Both are cost effective. Easy to design with. And state of the art.

For more information on the TMS4416 and TMS4164, check number 2 on the coupon. ■

Fast, low-cost 16K static RAMs.

For an economical, high-density memory in smaller systems and peripherals, you can't do better than TI's TMS4016 static RAM.

Interchangeable with TI's TMS2516 and all other 16K, 5-V EPROMs, the TMS4016 makes board design simple and fast. This gives you flexibility to prototype and de-bug in RAM, then convert to EPROM or ROM for production. All in the same socket.

Just right for microprocessors, the TMS4016 features 2K-by-8 organization

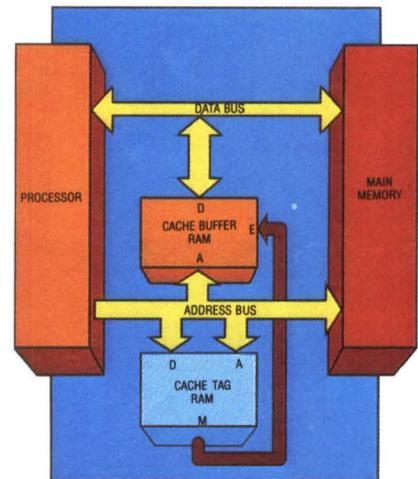
and single 5-V power supply. And operates at 120, 150, 200, or 250 ns with 385 mW maximum power dissipation.

For more facts on the low-cost TMS4016, check coupon number 3. ■

New cache-tag comparator speeds system throughput.

TI's new TMS2150 cache address comparator can improve high-performance microprocessor or bit-slice system throughput by up to three times. Plus reduce cache memory IC count, board area, power dissipation, and cost.

With the TMS2150, no wait states need to be implemented in microprocessor access cycles in response to slower-cycling DRAMs. The TMS2150,



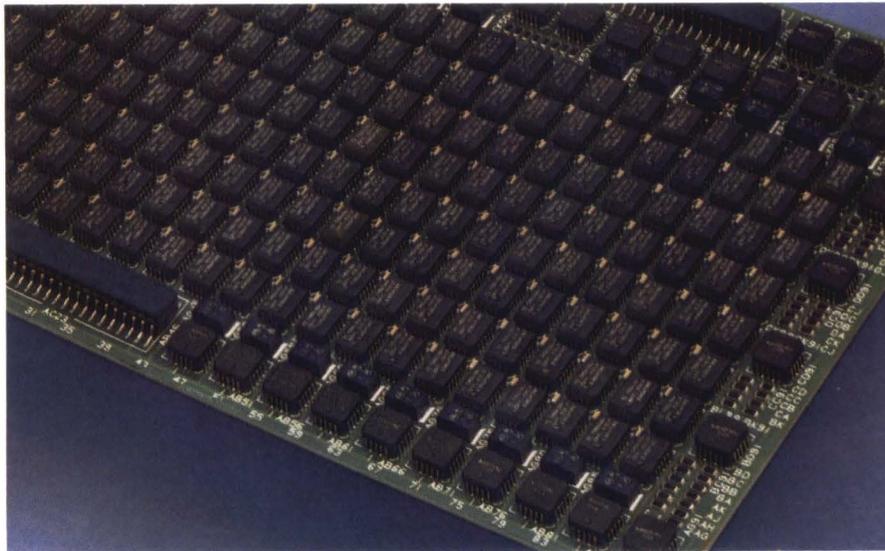
High-speed cache memory systems utilizing the TMS2150 will enable high-performance microprocessors to set new cost-performance standards with large, low-cost dynamic main memory.

in combination with high-speed static RAMs, completes an entire high-performance cache memory system. With a maximum 45-ns delay from address to match valid, the TMS2150 can provide TTL performance at one-tenth the part count and 10% the power.

Operating from a single +5-V power supply, the TMS2150 consists of a high-speed 512 x 9 static RAM array, parity generator and checker, and a 9-bit high-speed comparator.

For more specifics, check number 4 on the coupon. ■

TI's 64K DRAM chip carrier. More memory for less money.



Increased board density can be achieved economically with TI's exclusive plastic 64K DRAM chip carriers—an industry first.

Now you can pack even more memory into less space for less money. TI's unique plastic TMS4164 chip carrier gives you the high-density memory option you need. At a price you can afford.

Dramatic reductions in board size

TI's low-cost 64K DRAM chip carrier provides twice the density of the conventional DIP. System size can be substantially reduced. And significant cost savings realized.

Unlike conventional DIPs, TI's advanced TMS4164 in chip carriers can be surface mounted. As a result, the num-

ber of layers in the printed circuit board is greatly reduced, and fewer boards are required.

Ideal for SIPs

TI's 0.285 in. x 0.425 in. surface-mounted chip carriers are designed to meet the critical height requirement of single in-line modules (SIPs), as well as offer the necessary low power dissipation. And, now TI has in development single in-line module arrays in various organizations to meet your future system needs.

For more information on the world's first low-cost 64K DRAM chip carrier, check number 5 on the coupon. ■

Authorized TI Distributors

- ALABAMA:** Hall-Mark (205) 837-8700.
- ARIZONA:** Phoenix, Kierulff (602) 243-4101; Marshall (602) 968-6181; Wyle (602) 249-2232; Tucson, Kierulff (602) 624-9986.
- CALIFORNIA:** Los Angeles/Orange County, Arrow (213) 701-7500, (714) 851-8961; Kierulff (213) 725-0325, (714) 731-5711; Marshall (213) 999-5001, (213) 442-7204, (714) 556-6400; R. V. Weatherford (714) 634-9600, (213) 849-3451, (714) 623-1261; Wyle (213) 322-8100, (714) 641-1600, San Diego, Arrow (619) 565-4800; Kierulff (619) 278-2122; Marshall (619) 578-9600; R. V. Weatherford (619) 695-1700; Wyle (619) 565-9171; San Francisco Bay Area, Arrow (408) 745-6600; Kierulff (415) 968-6292; Marshall (408) 732-1100; Wyle (408) 727-2500; Santa Barbara, R. V. Weatherford (805) 965-8551.
- COLORADO:** Arrow (303) 758-2100; Kierulff (303) 790-4444; Wyle (303) 457-9953.
- CONNECTICUT:** Arrow (203) 265-7741; Diplomat (203) 797-9674; Kierulff (203) 265-1115; Marshall (203) 265-3822; Milgray (203) 795-0714.
- FLORIDA:** Ft. Lauderdale, Arrow (305) 776-7790; Diplomat (305) 971-7160; Hall-Mark (305) 971-9280; Kierulff (305) 652-6950; Orlando, Arrow (305) 725-1480; Diplomat (305) 725-4520; Hall-Mark (305) 855-4020; Milgray (305) 647-5747; Tampa, Diplomat (813) 443-4514; Hall-Mark (813) 576-8691; Kierulff (813) 576-1966.
- GEORGIA:** Arrow (404) 449-8252; Hall-Mark (404) 447-8000; Kierulff (404) 447-5252; Marshall (404) 923-5750.
- ILLINOIS:** Arrow (312) 397-3440; Diplomat (312) 595-1000; Hall-Mark (312) 860-3800; Kierulff (312) 640-0200; Newark (312) 638-4411.
- INDIANA:** Indianapolis, Arrow (317) 243-9353; Graham (317) 634-8202; Ft. Wayne, Graham (219) 423-3422.
- IOWA:** Arrow (319) 395-7230.
- KANSAS:** Kansas City, Component Specialties (913) 492-3555; Hall-Mark (913) 888-4747; Wichita, LCOMP (316) 265-9507.
- MARYLAND:** Arrow (301) 247-5200; Diplomat (301) 995-1226; Hall-Mark (301) 796-9300; Kierulff (301) 247-5020; Milgray (301) 468-6400.
- MASSACHUSETTS:** Arrow (617) 933-8130; Diplomat (617) 429-4120; Kierulff (617) 667-8331; Marshall (617) 272-8200; Time (617) 935-8080.
- MICHIGAN:** Detroit, Arrow (313) 971-8200; Newark (313) 967-0600; Grand Rapids, Arrow (616) 243-0912.
- MINNESOTA:** Arrow (612) 830-1800; Hall-Mark (612) 854-3223; Kierulff (612) 941-7500.
- MISSOURI:** Kansas City, LCOMP (816) 221-2400; St. Louis, Arrow (314) 567-6888; Hall-Mark (314) 291-5350; Kierulff (314) 739-0855.
- NEW HAMPSHIRE:** Arrow (603) 668-6968.
- NEW JERSEY:** Arrow (201) 575-5300, (609) 235-1900; Diplomat (201) 785-1830; General Radio (609) 964-8560; Hall-Mark (201) 575-4415, (609) 424-7300; JACO (201) 778-4722, (800) 645-5130; Kierulff (201) 575-6750; Marshall (201) 882-0320; Milgray (609) 983-5010, (800) 645-3956.
- NEW MEXICO:** Arrow (505) 243-4566; International Electronics (505) 345-8127.
- NEW YORK:** Long Island, Arrow (516) 231-1000; Diplomat (516) 454-6334; Hall-Mark (516) 737-0600; JACO (516) 273-5500; Marshall (516) 273-2424; Milgray (516) 546-5600, (800) 645-3986; Hall-Mark (516) 737-0600; Rochester, Arrow (716) 275-0300; Marshall (716) 235-7620; Rochester Radio Supply (716) 454-7800; Syracuse, Arrow (315) 652-1000; Diplomat (315) 652-5000; Marshall (607) 754-1570.
- NORTH CAROLINA:** Arrow (919) 876-3132, (919) 725-8711; Hall-Mark (919) 872-0712; Kierulff (919) 852-9440.
- OHIO:** Cincinnati, Graham (513) 772-1661; Hall-Mark (513) 563-5980; Cleveland, Arrow (216) 248-3990; Hall-Mark (216) 473-2907; Kierulff (216) 587-6558; Columbus, Hall-Mark (614) 891-4555; Dayton, Arrow (513) 435-5563; ESCO (513) 226-1133; Marshall (513) 236-8088.
- OKLAHOMA:** Arrow (918) 665-7700; Component Specialties (918) 664-2820; Hall-Mark (918) 665-3200; Kierulff (918) 252-7537.
- OREGON:** Kierulff (503) 641-9150; Wyle (503) 640-6000.
- PENNSYLVANIA:** Arrow (412) 856-7000, (215) 928-1800; General Radio (215) 922-7037; Hall-Mark (215) 355-7300.
- TEXAS:** Austin, Arrow (512) 835-4180; Component Specialties (512) 837-8922; Hall-Mark (512) 258-8848; Kierulff (512) 835-2090; Dallas, Arrow (214) 386-7500; Component Specialties (214) 357-6511; Hall-Mark (214) 341-1147; International Electronics (214) 233-9323; Kierulff (214) 343-2400; El Paso, International Electronics (915) 778-9761; Houston, Arrow (713) 491-4100; Component Specialties (713) 771-7237; Hall-Mark (713) 781-6100; Harrison Equipment (713) 879-2600; Kierulff (713) 530-7030.
- UTAH:** Diplomat (801) 486-4134; Kierulff (801) 973-6913; Wyle (801) 974-9953.
- VIRGINIA:** Arrow (804) 282-0413.
- WASHINGTON:** Arrow (206) 643-4800; Kierulff (206) 575-4420; Wyle (206) 453-8300.
- WISCONSIN:** Arrow (414) 764-6600; Hall-Mark (414) 761-3000; Kierulff (414) 784-8160.
- CANADA:** Calgary, Future (403) 259-6408; Varah (403) 230-1235; Hamilton, Varah (416) 561-9311; Montreal, CESCO (514) 735-5511; Future (514) 694-7710; Ottawa, CESCO (613) 226-6905; Future (613) 820-8313; Quebec City, CESCO (418) 687-4231; Toronto, CESCO (416) 661-0220; Future (416) 663-5563; Vancouver, Future (604) 438-5545; Varah (604) 873-3211; Winnipeg, Varah (204) 633-6190. BC

Texas Instruments

P.O. Box 401560
Dallas, Texas 75240

Please send me more information on:

- MC01 1. TMS4500A DRAM Controller
 MB01 2. TI 64K DRAMs
 MY01 3. TMS4016 Static RAM
 MT01 4. TMS2150 Cache Address Comparator
 MD02 5. TI 64K DRAM Chip Carrier (TMS4164 FPL) SMB013MY300C

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____

ZIP _____

AREA CODE _____

TELEPHONE _____

EXT. _____

©1983 TI

27-5071

TEXAS INSTRUMENTS
 Creating useful products
 and services for you.

Mini-Micro Interpreter

An analysis of news, issues and trends affecting the computer industry

Committees, vendors chase elusive networking standards

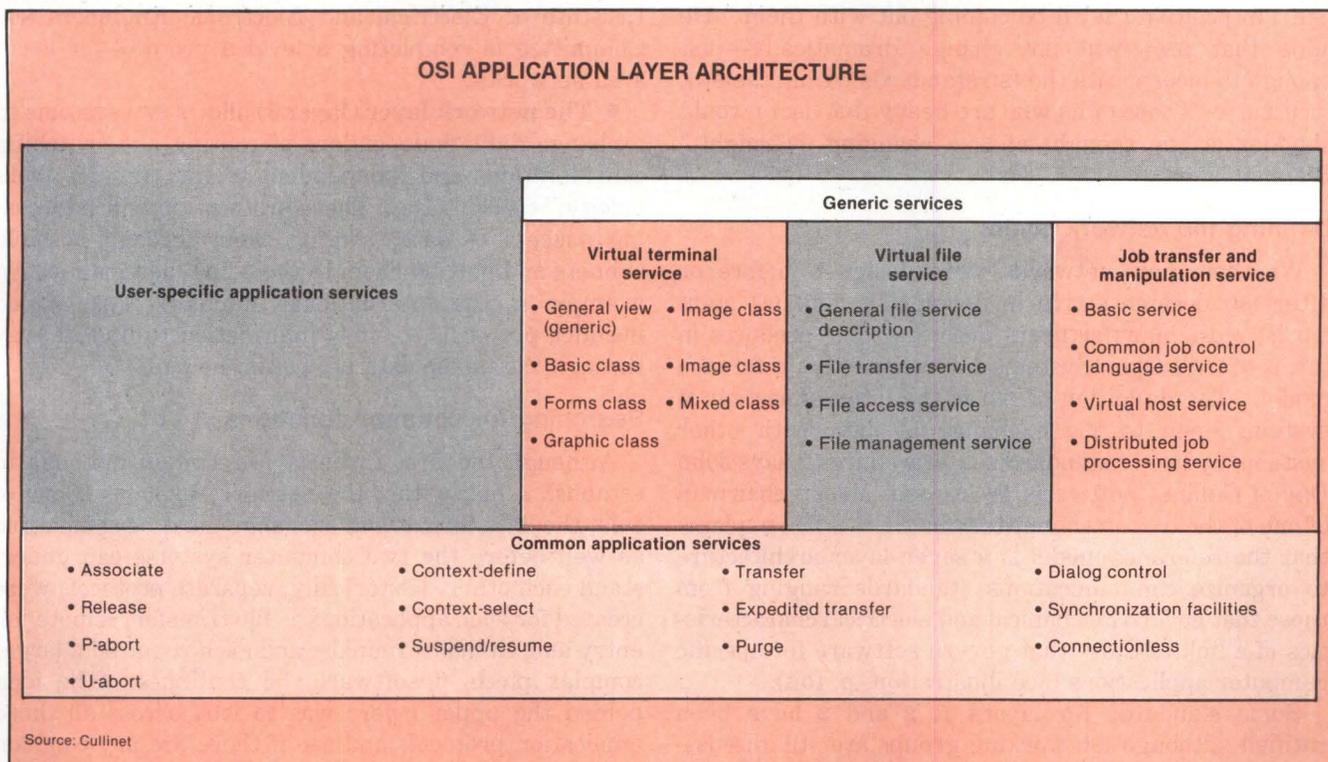
By Sarah Glazer

When two people talk, psychologists tell us, they depend as much on tone of voice, eye contact and other nonverbal cues to communicate as on words themselves. It's ritualized, learned behavior. And the most ordinary conversations can differ dramatically from culture to culture. So it is when computers talk to each other. The ritual of establishing a link, starting, stopping and verifying transmission must be followed exactly if communication is to take place. And as with human cultures, the entire process can differ dramatically from network to network.

Until very recently, a lack of communication between different manufacturers' networks was the rule. Significant differences in manufacturers' communications protocols kept their networks virtually incommunicado. As networking became more common and as increasing numbers of companies used equipment from more than one manufacturer, machine-to-machine communication

becomes even more complicated.

Various companies and groups have devised proprietary networks to satisfy specific communication requirements. Some of the more widely used networking schemes are IBM Corp.'s Systems Network Architecture, Digital Equipment Corp.'s DECnet, the Department of Defense's Arpanet and Xerox Corp.'s Xerox Network System, says Ralph Dement, manager of strategic planning for DEC's distributed systems group, Tewksbury, Mass. "Basically, the networks all provide the same services," he says. "However, each of us has taken a different tack as to how we wish to implement the services our products provide in a networking environment." Reflecting these differences, each type of network has its own protocols. "They all differ," Dement explains, "in the nature of the way the fields are set out, how big the fields are and what information is within a field." While this tailoring may give each kind of network a character well-suited for particular environments, it makes straightforward communica-



Historically, people developed protocols to facilitate communication among computer systems for different applications. These protocols are often large, complex pieces of software, and if a new system is brought in, a whole structure must be developed for it. The aim of the application layer, as of the three layers below it, is to reduce redundancy by pulling out common functions and making them standard.

◀ CIRCLE NO. 59 ON INQUIRY CARD

The Interpreter

tion among networks impossible.

Exactly how this incompatibility will be overcome is still unclear. Although most industry observers are confident that standards for network communications will appear soon, they are divided on the source of these standards: whether they will be released by the International Standards Organization or be de facto standards, determined by which computer company has the largest share of key markets.

In the de facto camp is Dale Kutnick, director of market research at The Yankee Group, Boston, a research firm specializing in communications. He says IBM's SNA is the predominant de facto standard and will remain so. Whereas SNA is a comprehensive architecture, other de facto standards may emerge for specific environments. "All the minicomputer vendors are announcing SNA products," he says, "and the market for independents will be in subnetworks to SNA."

Championing the ISO approach is Sheldon Blauman from Boeing Computer Service Co., Seattle. Blauman founded the Network Users Association, a nationwide group that deals with networking problems, and serves as head of the NUA's standards committee. "IBM has been one of the drivers of the standards process," he says. "They're heavily committed to the ISO protocols, and I'm positive they'll be coming out with them." He adds that SNA will not change dramatically—just enough to incorporate the ISO standards within the SNA structure. "Those of us who are heavy IBM users would shudder at the thought of SNA changing overnight," Blauman says.

Defining the network layers

Whether their networks were designed before or after ISO became active in developing network standards, most manufacturers describe their products in terms of ISO's Open Systems Interconnection reference model. "The definition of OSI is the interconnection of systems open to the exchange of data with other systems by use of standardized procedures," says John Day of Cullinet Software, Westwood, Mass., chairman of one of the OSI subcommittees in the U.S. He explains that the reference model is a seven-layer architecture to organize communications standards ranging from those that govern mechanical and electrical characteristics of a link to those that govern software for specific computer applications (see illustration, p. 106).

Some standards for layers 1, 2 and 3 have been ratified, although ISO working groups are still discussing additional proposals for these layers. Robert Blanc of the National Bureau of Standards, Washington, D.C., explains that the first three layers define the interface

between a host computer and the network. "They establish a link between one computer and another computer somewhere in the network," he says.

- **The physical layer (layer 1)** "provides mechanical, electrical, functional and procedural characteristics to establish, maintain and release physical connections," says Day of Cullinet. The physical layer covers the kind and number of wires, the kind of signals and the voltages that can be used. Day cites RS232 and V.28 as examples.

- **The data link layer (layer 2)** includes ensuring that data get from one computer to another. "We can send information in the 'send-and-pray' mode or can send it in a mode that gives some indication that the information has been delivered," says Paul D. Bartoli, a supervisor of international standards planning for American Bell, Lincroft, N.J. He notes that the earliest protocol in common use was binary synchronous, in which the receiver must acknowledge each packet of information before another can be sent.

An example of a more recent layer 2 protocol is High Level Data Link Control, says Day of Cullinet. Using HDLC, computers in a network can send information simultaneously, each sending a number of packets before waiting for acknowledgement. In the U.S., the Institute of Electrical and Electronic Engineers 802 Committee is completing a level 2 protocol for local-area networks.

- **The network layer (layer 3)** allows two systems to exchange data "independent of routing and switching considerations and independent of the transfer technology," explains Day. These protocols handle addressing packets of data, routing them through possible subnets and getting them to their final destination. An example is the international standard X.25, which includes protocols to allow information to find its way through the public data networks, he adds.

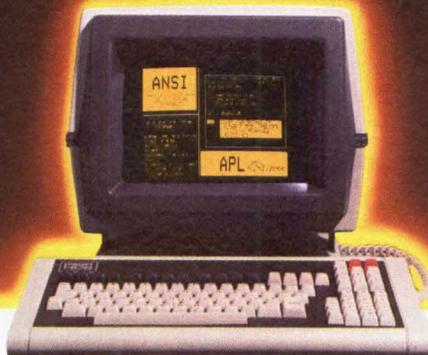
Searching for common functions

Although the first three layers contain methods to establish a link within the network, explains Blanc of NBS, the data format and exchange must be compatible as well before the two computer systems can understand each other. Historically, separate protocols were created for such applications as file transfer, remote job entry and virtual terminals, and each required a large, complex piece of software, he continues. "The idea behind the upper layers was to look across all those application protocols and see if there are any common functions that can be pulled out and defined so they don't have to be repeated," Blanc says.

- **The transfer layer (layer 4)** contains one such set

The CONCEPT AVT

Because VT100 users deserve more than just VT100 compatibility.



THE CONCEPT DISPLAY TERMINAL

VT100 compatibility is one thing, but eight pages of memory, programmable function keys, windowing, multiple computer capabilities, ANSI standard conformance...and VT100 compatibility is something else. Only from Human Designed Systems.

A good news/great news story from Human Designed Systems.

First the good news. The *concept* AVT display terminal gives you everything you need in an 80/132-column ANSI/VT100-compatible display terminal. And at a very competitive price.

Now the great news. The *concept* AVT display terminal provides an exciting, new set of capabilities that lets you do much more. Without changing the price.

It starts with ANSI standard conformance, DEC software compatibility, and 80/132-column capability, and extends that even further by offering eight pages of display memory to relieve the interactive user of the need to generate unnecessary hardcopy printouts and to provide the application developer with a powerful tool for applications requiring multiple formats and storage of large volumes of text; by enabling users to permanently configure a terminal for their needs or applications; by providing functionality

\$1295*

designed to improve the effectiveness of slow-speed applications; by enabling users to create true windows within display memory; by providing programmable function keys which transmit data and/or execute terminal commands; by providing up to three additional communications ports for connection to other peripherals and computers; by providing flexible user networking functionality for use in a wide range of different applications, including multiple computer connections; and by doing much more.

VT100 compatibility and ANSI standard conformance. Add it to the *concept* display terminal's 132-column performance, in ASCII or APL/ASCII models, with multiple computer capabilities, windowing, programmable function keys, multiple pages of memory, and much more, and you can see why Human Designed Systems has given terminals a new meaning...and that means true economy.

human designed systems, inc.

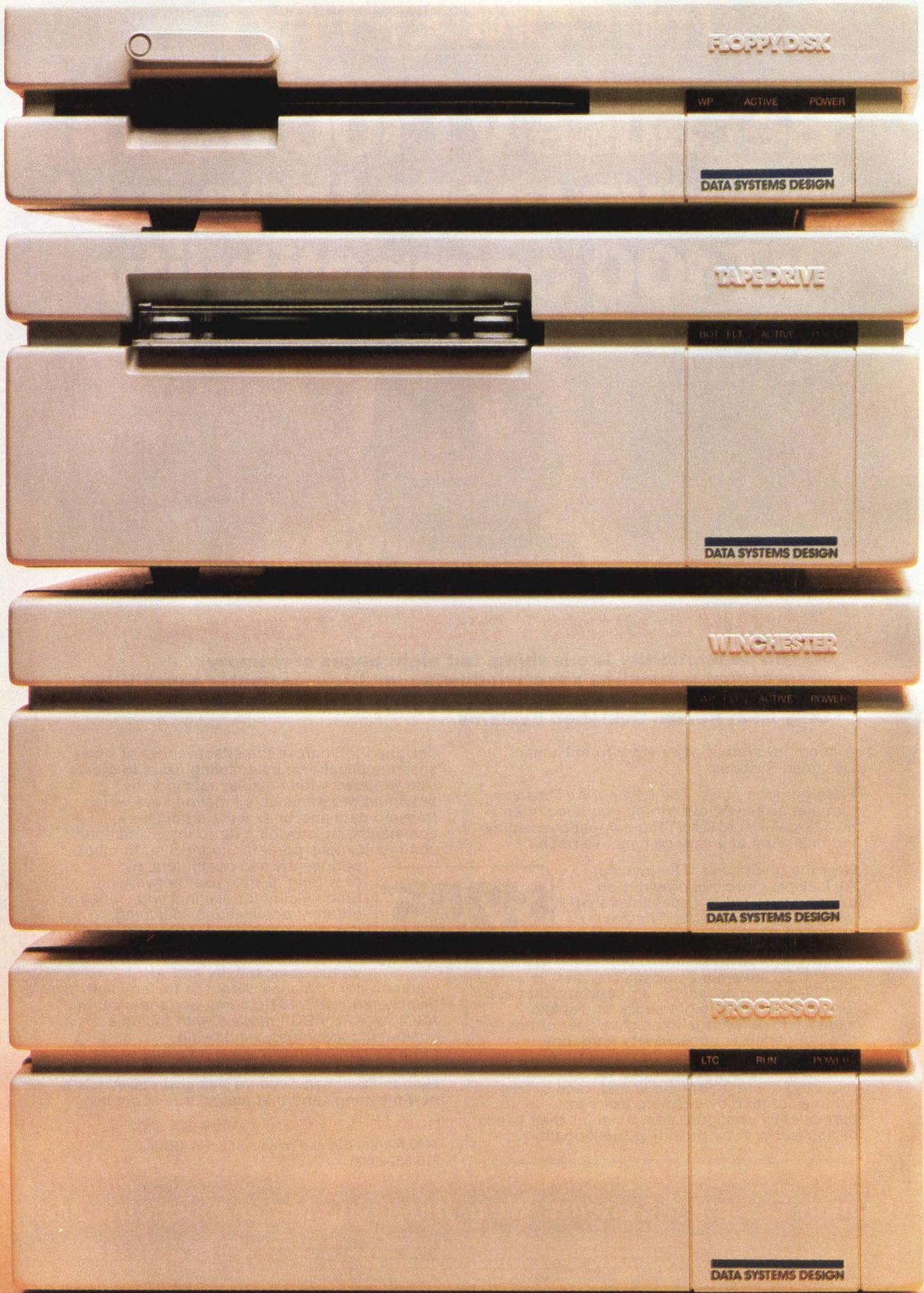
3440 Market Street, Philadelphia, PA 19104
215-382-5000

*Quantity one. DEC and VT are trademarks of Digital Equipment Corporation.

Human Designed Systems. We're redefining terminal performance.

Atlanta — (404) 391-9763; Boston — (617) 329-3510; Chicago — (312) 825-2960; Dallas — (214) 437-1888; Delaware — Infocon: (302) 239-2942; Hawaii — Gray Associates: (808) 261-3751; Los Angeles — (213) 410-9454; Northern New Jersey — Infocon: (201) 624-1372; New York City Area — Infocon: (212) 689-8833; New York State — Naco Electronics: Rochester: (716) 223-4490; Syracuse: (315) 699-2651; San Francisco — (415) 692-4184; Washington, DC — International Systems Marketing: (301) 279-5775; Australia — I. O. Peripherals Pty. Limited: (02) 427 3555; Belgium — BELCOMP: 091/25 22 88; Canada — CAIL Systems: Toronto: (416) 362-1063; Denmark — ADCOM Data Aps: 1-19 44 66; Finland — Modulsystem OY: 0-6926511; France — Walton: (1) 226.06.90; Singapore — DTS Singapore: (65) 33-88-566; Sweden — Allnovo Data AB: 08-37 25 15; Switzerland — Mitek ag: 02/461 22 52; United Kingdom — Shandell Systems Ltd.: 02407-2027; West Germany — COMKO Computersystemges, mbH: 0221-48 30 51. DISTRIBUTORSHIP INQUIRIES INVITED.

CIRCLE NO. 61 ON INQUIRY CARD



*StacPac, HyperDiagnostics, Rapid Module Exchange and HyperService are trademarks of Data Systems Design, Inc.
*DEC is a registered trademark of Digital Equipment Corporation. *Multibus is a registered trademark of Intel Corporation.

DSD STACKS THE DEC. AND THE MULTIBUS, TOO.

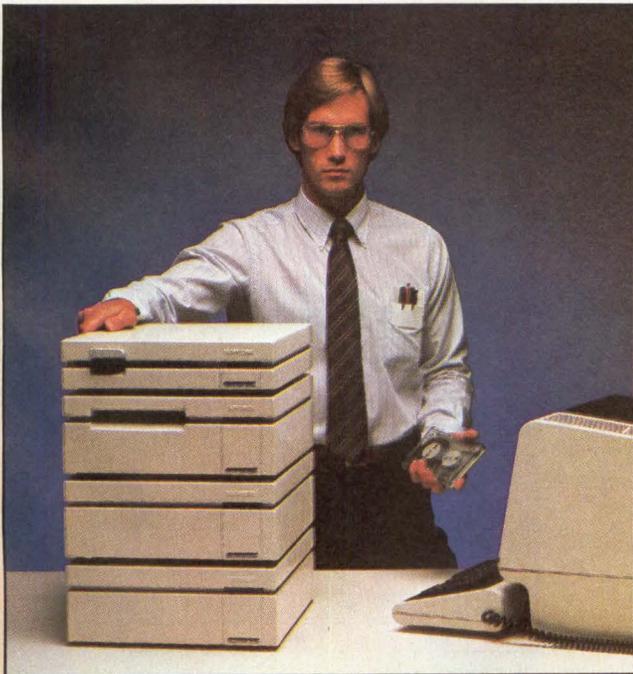
Presenting StacPac™ systems and modules.

This is a brand new deal for systems integrators. StacPac systems and modules. Modular storage and backplane units that stand alone or stack together to form the basis of a small but powerful tabletop computer.

They're available in either DEC®- or Multibus®-compatible versions. And there are lots of advantages to both.

On the DEC side, you can put a StacPac system in places a rack-mount just doesn't fit.

On the Multibus side, you can use our StacPac system to deliver serious minicomputer performance with microcomputer economy.



Either way you get greater flexibility to configure just the right system. And the easy upgradability to expand it whenever you like.

But perhaps one of the most important advantages is that you can protect your software investment—and your customers'—because inside, you're still selling the same system. You'd just never know it to look at it.

Which brings up another point.

Underneath that slick, compact exterior is the very latest in storage technology. 8" slimline floppy drives. High capacity, highly reliable 8" Winchester. Compact ¼" cartridge tape drives. And the best high performance controllers in the business. (Packaged systems are also available without controllers at your option.)

And if you're thinking about 5¼" storage, there's our 5¼" Winchester/floppy module. (Available in the Spring of 1983.)

Configuring an elegant system solution is a simple matter of picking out the storage option you want and adding your own CPU boards, I/O and memory to our uncommonly accommodating backplane units.

Naturally, we back it all up with HyperDiagnostics™, Rapid Module Exchange™ and HyperService™. Some of the most economical and intelligent service features ever devised.

And you can have more information about StacPac modules just by writing for our brochure.

But you just watch. You start marketing your systems in our StacPac modules and your competition will say you have an unfair advantage.

And you know something? They'll be right.

Corporate Headquarters: 2241 Lundy Avenue, San Jose, CA 95131. Eastern Region Sales and Service: Norwood, MA, (617) 769-7620. Central Region Sales and Service: Dallas, TX, (214) 980-4884. Western Region Sales: Santa Clara, CA, (408) 727-3163.

DATA SYSTEMS DESIGN

INTERNATIONAL SALES: Australia 03/544 3444; Belgium and Luxembourg 02/7209038; Canada 416/625 1907; Denmark 02/63 22 33; Finland 90/88 50 11; France 03/411 5454; Hong Kong and Peoples Republic of China 03/696231; Israel 52-52444; Italy 02/4047648; Japan, Osaka 06/323 1707, Tokyo 03/345 1411; Netherlands 02977-22456; New Zealand 04/693 008; Norway 02/78 94 60; Singapore, Malaysia, and Indonesia 2241077; Spain 01/433 2412; Sweden 08/38 03 70; Switzerland 01/741 41 11; United Kingdom 7073/34774; West Germany and Austria 089/1204-0; Yugoslavia 61/263 261

CIRCLE NO. 62 ON INQUIRY CARD

The Interpreter

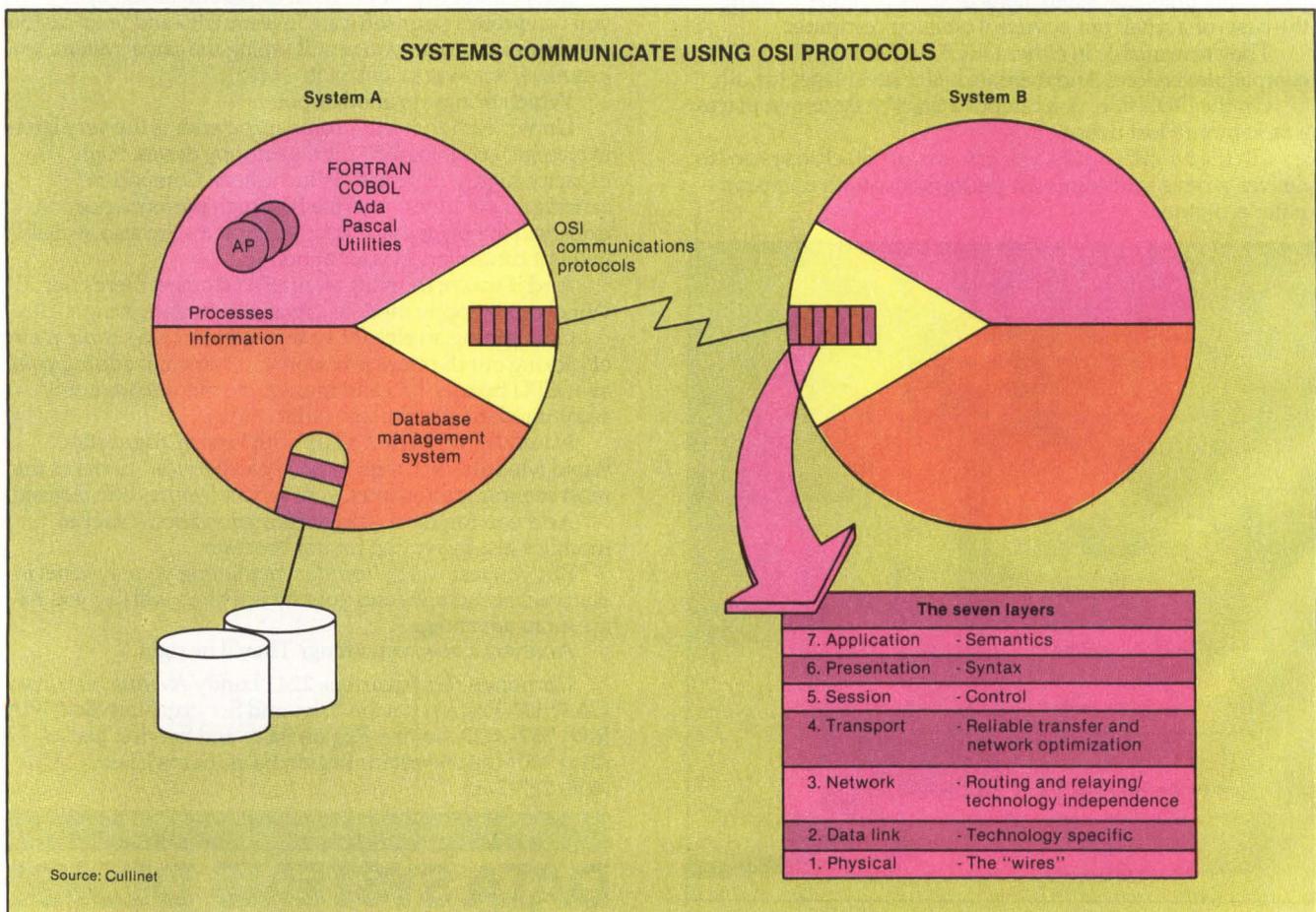
of functions—those for end-to-end error and flow control. “They make sure that the receiving end is ready to receive, that the sending end is ready to send, that the connection is established, that nothing has gone wrong during this process, that the connection is torn down and that both sides know it’s torn down at the same time,” Blanc explains.

Although standards are not yet released, voting on an ISO draft proposal for the transport layer should be complete by July. “You could pick up the draft transport document today and start looking at implementing it,” says Cullinet’s Day. In addition, the NBS is planning a demonstration of the transport level for the summer of 1984 that will include computer systems from a number of companies. Blanc says of the transport layer, “Agreements have been reached,” although he emphasizes that it was difficult because these protocols will have a major effect on how well the overall system works.

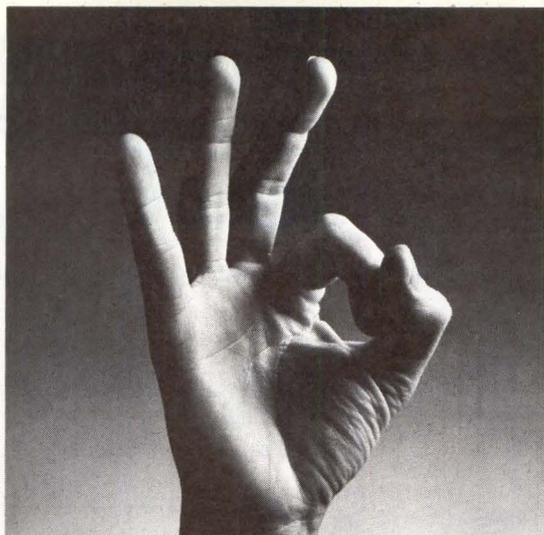
- **The session layer (layer 5)** synchronizes and structures the data exchange to augment services available from the transport layer, says Day. It orchestrates the session itself once the computers are ready to start. Day expects this standard to be final at about the same time as the one for layer 4. Voting on a draft proposal should also be complete by July.

Blanc characterizes these middle layers as the most complex from a standards maker’s point of view because they attempt to be the most universal. “At the lower layers, the protocols are technology dependent,” he says, “and at the highest layers, they might be more application dependent.”

- **The presentation layer (layer 6)** defines the form of data at its source, during transfer and at its destination. “Data is stored differently in different types of computer systems for different applications,” says Blanc. Each network must have a common format into which data can be translated for exchange.



Standardized communication protocols would allow computer systems to exchange information even if other software in the two systems is incompatible. Although there wouldn't necessarily be seven pieces of software to conform to the seven layers, says Paul Bartoli of American Bell, the system would have to be able to provide the communication services shown here.



Nice move, IBM.®

Well, IBM claims yet another first.

By offering the p-System™ on their Displaywriter and PC, it becomes the *only* operating system they market for both. They obviously know a good thing when they see it.

But then so did Apple®, Commodore, Corvus,™ TI, Digital, HP, Osborne,™ Philips, Sage®, Zenith, NEC, and Olivetti, for that matter.

And as a microcomputer manufacturer, you can see why. Applications sell hardware. But in the 16-bit marketplace, there just aren't enough applications available. Or are there?

Right now, there are hundreds of high-quality p-System applications. Like general business applications. Vertical applications for medicine, law, and real estate. And integrated professional productivity tools such as spreadsheets and word processing. The list goes on.

With the p-System, these applications can be running on your machine, too. Sooner than you thought possible.

And, with the p-System you can offer your customers the most complete set of microcomputer software development tools anywhere. Including compilers for UCSD Pascal,™ FORTRAN-77, and BASIC, a screen editor, 10 macro assemblers, a print spooler, graphics utilities, and a host of others.

The p-System, the Universal Operating System,™ makes it possible with real portability across *all* 8 and 16-bit micros. We can make it possible for you, too. Inexpensively. After all, IBM is offering it on the PC for just \$50.

So check into acquiring the world's only Universal Operating System yourself.

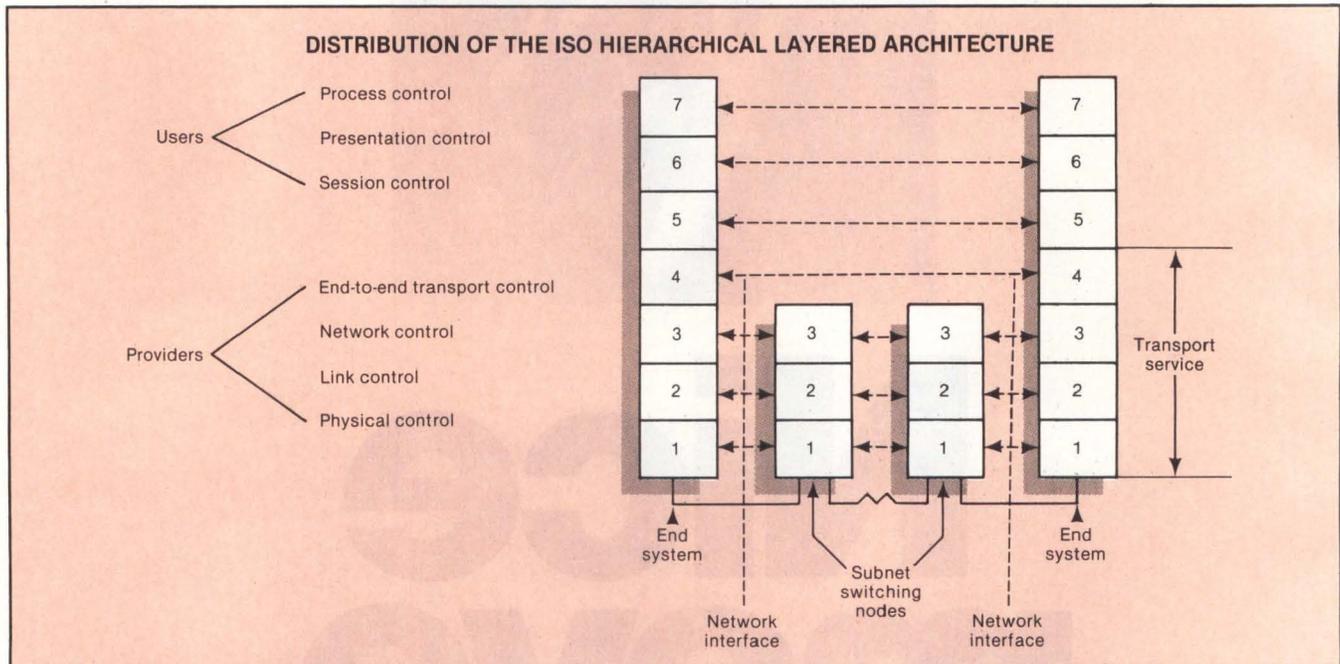
IBM did. And how often do *they* make a bad move?

SOFTech
MICROSYSTEMS
Finally, once is enough.

SofTech Microsystems • 16885 West Bernardo Drive • San Diego, CA. 92127 • (619) 451-1230

IBM is a registered trademark of International Business Machines Corporation. Apple is a registered trademark of Apple Computer, Inc. UCSD Pascal is a trademark of the Regents of the University of California. Universal Operating System and p-System are trademarks of SofTech Microsystems, Inc. Osborne is a trademark of Osborne Computer Corporation. Sage is a registered trademark of Sage Computer Technology. Corvus is a trademark of Corvus Systems, Inc.

The Interpreter



Only the lower layers of the OSI model deal with the actual routing of information through the network. At the upper levels, end users need protocols that will make their data understandable to the receiver at the data's final destination.

"Unfortunately," Blanc notes, "you can't define one such transformation for all applications." He believes there will be several presentation protocols. A standard for the presentation layer is not yet in the draft proposal stage, but Cullinet's Day believes it will be "technically stable" by early fall.

• **The application layer (layer 7)** provides those communication services directly available to a computer application, says Bartoli of American Bell. "There are some common elements available no matter what the application is," he notes, "for example, the ability to set up a connection into the network." In addition, there are several commonly used communication functions such as file transfer, remote job entry, graphics and virtual terminal. The aim of standardizing these functions is to reduce redundancy. "It won't be necessary for a particular application to define file transfer, for example, because it will be taken care of by common application services," Bartoli explains.

Cullinet's Day says draft proposals for application-layer protocols will start appearing by this fall. When the standards are ratified, the aggregate international market "will provide incentive to develop those standards and put them in off-the-shelf computer products," says Blanc of NBS.

The de facto standard

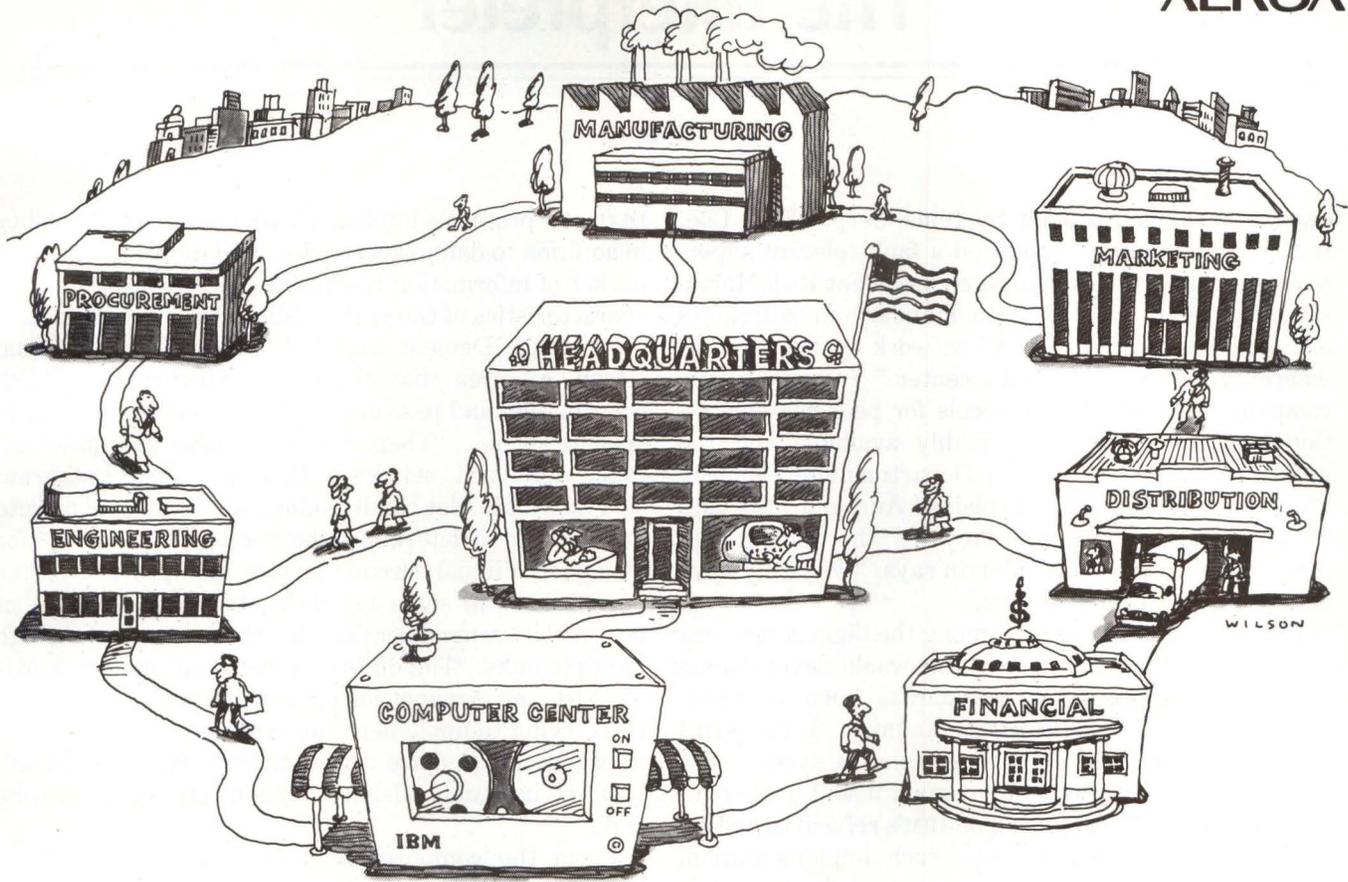
Although ISO activities are going full tilt, even their most enthusiastic supporters concede it will be more

than a year before upper-level OSI protocols will be available. "I think you're going to be able to buy these protocols starting in 1985," says Blauman.

"That's too late," says the Yankee Group's Kutnick of the OSI timetable. By 1985, he says, 55 to 60 percent of IBM's large customers will have networks under SNA. "OSI will have to get closer to SNA rather than vice versa," he says. Non-IBM networks, he predicts, will be "subnetworks to SNA," and he points to a proliferation of SNA-gateway products from other computer vendors as proof. Among these gateways are products from DEC, Data General Corp., Hewlett-Packard Co., Honeywell Information Systems Inc., Burroughs Corp. and Tandem Computers Inc.

Larry Twaits, product manager for DEC's SNA gateway, which became available as a DECnet product this spring, says the market for the gateway consists of DEC's largest customers. He says DEC tried but failed to integrate parts of its architecture directly with SNA. "The two networks are very, very different; they just don't do the same things," Twaits says. He calls the gateway "a function translator." The two architectures are so different, it's impossible to map layer into layer by simply translating DEC protocols into SNA protocols. Facing these problems fuels DEC's commitment to developing standards, he explains. "General interconnection is good for DEC and for our business," says Twaits.

Another company that has an SNA gateway out of its



Presenting a complete, unified software system for manufacturers.

Developing a manufacturing planning and control system takes skill and time. You can buy various parts from different vendors and build the interfaces yourself. Then test and implement the software.

Or you can have the Xerox Manufacturing System.

An advanced software architecture from Xerox has done all the work for you. Integrated applications, systems software, analytical tools, and personal computers joined in one complete, unified system.

Every department works with information from the same database. Closed-loop business applications help you plan and execute your priorities and manage costs at optimum levels. Master scheduling, MRP II, inventory, order entry, costing, production control, procurement, receivables, payables, and financial modules are combined in the most powerful operating management tool available today.

Plus, easy-to-use programs for inquiry, reporting, data manipulation, modeling, forecasting, and graphic display. And a personal computer link to your mainframe, the first practical application of its kind.

Xerox software is completely portable across all

IBM 4300, 370, and 3000 computers and operating systems. You can use it on your computer or, as an option, start with our timesharing service. Then, when you're ready, move the software and database in-house. In one weekend. Our systems run on Digital VAX minicomputers, too.

Implementation support, consulting, and education services are available nationwide. For more information, call toll-free (800) 323-2818, Operator 148. In Illinois, call (800) 942-1166. Or return this coupon.

Xerox Computer Services

c/o Ron Rich, 5310 Beethoven Street, Los Angeles, California 90066

Send me your *Xerox Manufacturing System* brochure.

I'm interested in your software for:

IBM 43XX IBM 370 IBM 30XX Digital VAX

MMS 7/83

Name/Title _____

Company _____

Street _____

City _____ State _____

Zip _____ Tel. () _____

XEROX® is a trademark of XEROX CORPORATION. VAX® is a trademark of Digital Equipment Corporation. IBM® is a trademark of International Business Machines Corporation.

The Interpreter

own network is Auragen Systems Corp., Fort Lee, N.J., which recently announced a fault-tolerant super-microcomputer system. Auragen president Rick Martin says that SNA is a de facto standard in Auragen's market because "our kind of network typically exists where there's one big data center." Internally, the company uses Arpanet protocols for peer communication because software is readily available and the protocols, developed for the Department of Defense, are not proprietary, he explains. Auragen also uses X.25 protocols if its system uses the public data network. But externally, Martin says, "We really have only to be able to talk to IBM."

Despite SNA's dominance among the biggest network users, some observers believe IBM would never use its weight to suppress OSI standards. "IBM is really pushing for OSI," says the NUA's Blauman. "It takes IBM longer because it's so much larger and its system is so much larger, but there's no question it will implement the standards." Commenting on IBM's refusal to make a public policy statement about such implementation, Blauman says, "IBM would never make a public announcement, but you don't need one."

Day of Cullinet has a more cynical view of IBM's voluntary implementation of OSI standards. "They say they'll make a seven-layer system to comply, but I guess they'll be dragged to it kicking and screaming," he says. He does believe, however, that IBM will eventually move toward OSI.

"Historically, IBM has been very active in standards issues," says Kenneth Bosomworth, president of International Research and Development Inc., Norwalk, Conn. They have opposed standards in some cases, he says, and sabotaged them in others. "Yet there are times," he adds, "when they've been against standards but have finally capitulated and gone along with them." He believes in this area that both SNA and the OSI model will be adjusted somewhat to reach a compromise.

The products—present and future

Because of the lack of standards, implementations of network software differs considerably. Most are closely tied to specific hardware, available either from computer manufacturers for their own networks or from manufacturers of network controllers.

The differences in software, says DEC's Dement, are less a matter of the kinds of services provided than of "how rich a family of services you have—whether you have options between two protocols." As an example, he compares DECnet's protocols with those for the Xerox Network System. The Xerox NS protocols provide a pure datagram service, he says, while

DECnet's protocols implement virtual circuit capability in addition to datagram service. In datagram service, a packet of information is sent into the network, and the characteristics of the path it follows are developed as it goes along, Dement explains. In contrast, a virtual circuit requires that the two participants establish coordination and pass data back and forth according to specific rules. "There are advantages and disadvantages for each service," Dement says. Datagram service avoids a lot handshaking, but requires elaborate mechanisms to determine whether a packet arrived, for example. Virtual circuit service can provide better performance in some networks, but requires a lot of internodal communication in those networks with multiple links. "The difference between DECnet, Xerox NS, SNA and Arpanet vary," says Dement. Because of this, trying to implement the same service in different networks may require very complex software, especially if one user depends on a certain class of service, he adds.

From the computer manufacturers, the need for interconnection grew out of their traditional business, but interconnection represents the primary business for other companies. One such company, Associated Computer Consultants, produces a variety of protocol processors to link DEC minicomputers with a number of manufacturers' mainframes. A new product described by ACC's Gary Krall is an "X.25 Ethernet bridge," which he says will allow several Ethernet local-area networks to communicate across the public data networks. "In doing this, we're following the OSI model in some respects," Krall says, "But we're also implementing the NS standards by Xerox, where they're used in the Ethernet environment." Krall adds that ACC is an active supporter of standards activities.

Blauman of the NUA anticipates a time when users will be able to obtain standard communication protocols from a variety of sources. He predicts that products conforming to OSI will be available within two years from "quite a few sources"—third-party manufacturers and mainframe manufacturers. Blanc from NBS notes that the lower level protocols such as Ethernet are being implemented on LSI chips, thus reducing the cost of network interfaces.

Higher level protocols won't be as simple to implement, says Blanc, but should also be available as off-the-shelf products. Kutnick of the Yankee Group agrees, but he predicts these packages won't first come from independent software vendors. Communications products, he says, will continue to come primarily from companies that supply hardware. □

Today, people are solving their back-up problems with this fast, reliable, 10 MB disk cartridge drive.

IOMEGA's 10 Megabyte cartridge drive outperforms most winchesters.

So you can back-up 10 Megabytes from your fixed disk in less than 30 seconds.

The easy to use cartridge sports the industry's lowest price tag, only \$30 each in OEM quantities.

IOMEGA's imbedded closed-loop servo guarantees interchangeability of cartridges between drives. And the standard interface is SCSI compatible.

Solve your backup problems with the fast, reliable IOMEGA 10 Megabyte cartridge drive.

Call IOMEGA for a personal demonstration. **And ask about our OEM Special Evaluation Offer.**

IOMEGA Corporate Headquarters, 4646 South 1500 West, Ogden, Utah 84403. 801/392-7581. San Jose, CA 408/263-4476. Coral Springs, FL 305/755-1060. Woburn, MA 617/933-2000. Dallas, TX 214/458-2534. Brookfield, WI 414/782-5229. Los Angeles, CA 714/855-1211. In Europe, Sparrow Corp. Slough, UK (0753)76533. Weisbaden, (6121)700862. Paris (1)3621010. Milano (2)718531. Brussels (2)7626200. Zurich (1) 814-3131.

IOMEGA™



PERFORMANCE
35 msec. average access time.
1.13 Mbyte per sec. data rate.

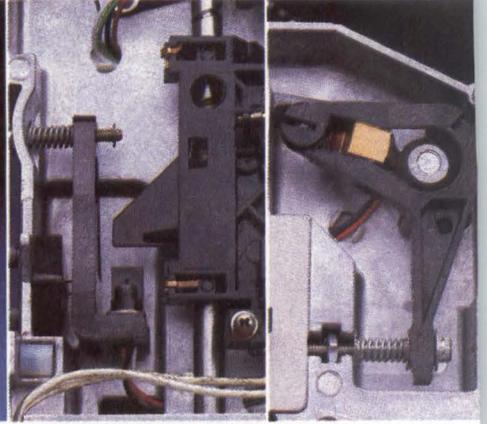
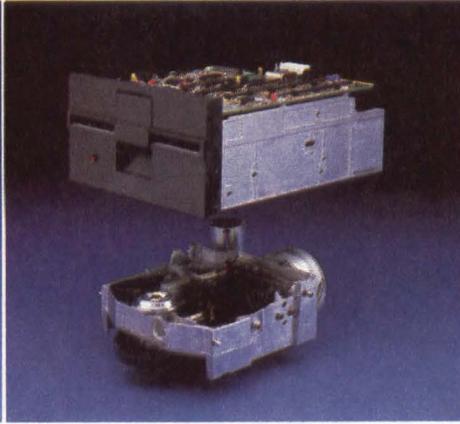
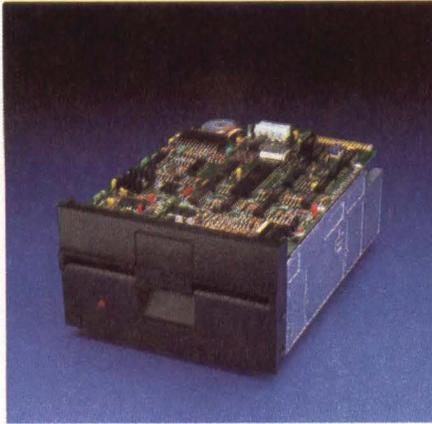
RELIABILITY
Error rates: Equal to winchesters.
MTBF: Drive 18,000 hrs. Controller 14,000 hrs.

Brushless D.C. motor
Rotary voice coil actuator

Only 2 moving parts during operation.

CIRCLE NO. 65 ON INQUIRY CARD

Copyright © IOMEGA 1983



When we designed our new 1100 Series 5 $\frac{1}{4}$ " 96 TPI floppy with up to 2Mbytes of storage, we set our standards high. High in reliability and high in performance. Naturally, we made it fully compatible with the industry—the same size, power, interface and bezel. It's even priced to compete with floppies that can't begin to match its performance. But

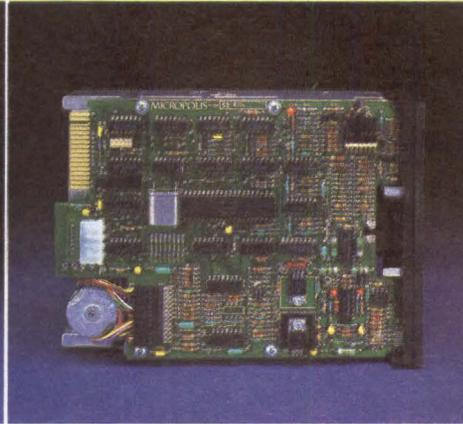
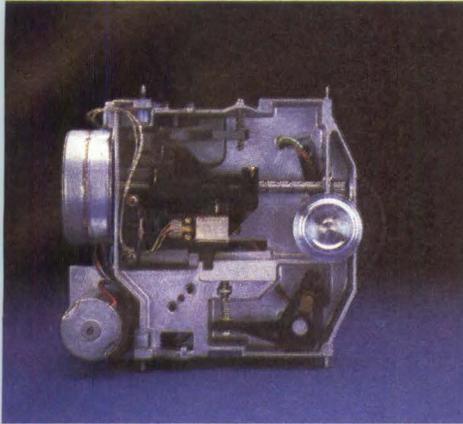
that's where the similarities stop.

To begin with, we developed the 1100 with a unique chassis-within-a-chassis design to provide unequaled alignment stability—assuring that the positioning mechanics are isolated from mounting and system handling stresses. At the same time, it provides unmatched electrical shielding and acoustic noise reduction.

And in order to make alignment simple, the 1100 has only three mechanical adjustments—all featuring stable, micrometer-quality precision. All easily accessible while operating the drive with the PCBA in place.

Then, we included our temperature compensating positioner-to-spindle referencing and precision diskette clamping techniques for pre-

The only thing over 5 $\frac{1}{4}$ " floppy



cise track positioning—every time. With our 1100 series, diskette interchangeability is guaranteed.

And if that weren't enough, we designed out all electrical adjustments—making board replacement a breeze. The microprocessor electronics precisely control the spindle motor at the spindle, eliminating speed drifts and wear

factors typically handled by pot settings. Nobody else can compete with that.

And because we've been building high performance floppies since 1977, nobody can mass produce them like we can. Nobody.

So if you want a high performance floppy for the same price you're now paying for low performance, give us a call.

At Micropolis, we don't believe you should have to pay more for the best.

Corporate Offices
21123 Nordhoff Street, Chatsworth,
CA 91311 • (213) 709-3300 • Telex: 651486

European Operations
210 Elgar Road, Reading, Berks. U.K.
RG20PJ • (734) 751-315 • Telex: 848591

Worried about our new price is its price.

MICROPOLIS™

Where lasting memories are made.



Net/One offers something unique in local area networking. A track record.

In fact, Net/One® offers a number of things unique in local area networking. True vendor independence. Media independence—baseband, broadband, fiber optics, or any combination thereof. Remote bridges and local bridges to interconnect separate Net/One systems—broadband or baseband—between buildings, or between cities, worldwide.

And all this uniqueness becomes even more so when you look at our track record. We not only talk a great network, we've actually been delivering Net/One since July of 1980. Hundreds of our systems are already out there moving information

for organizations like Control Data, Caltech, Fairchild, ITT, RCA, Boston University, U.S. Forest Service, and Ford Aerospace.

Let's talk about how to turn the equipment you have now—whatever it is—into the network you want, now, with a network you can have, now. And a network that can take you wherever you want to go from here. Net/One.

Ungermann-Bass, Inc., 2560 Mission College Boulevard, Santa Clara, California 95050.
Telephone (408) 496-0111.

Net/One from Ungermann-Bass 

The Interpreter

Advanced CMOS technology overtakes established NMOS applications

By Kevin Strehlo

The semiconductor industry is in the midst of switching its basic technology from NMOS (N-channel metal oxide semiconductors) to CMOS (complementary MOS). While this transition will not enhance computer systems to the same degree as earlier advances in circuit fabrication—the switch from tubes to transistors was revolutionary, for example—it will make possible computer systems that are smaller, more reliable, more powerful and truly portable.

CMOS was once considered a specialty technology whose usefulness was limited to such applications as digital watches, in which the need for low power consumption was overriding. CMOS offered the lowest power consumption available as well as high noise immunity, the ability to operate across the full range of temperatures required for military use and relative insensitivity to logic upsets caused by random alpha particles. However, compared to competing silicon technologies, CMOS was much slower, permitted fewer devices within a die area and sold for a premium.

The new high-speed generation of CMOS circuits is as fast and nearly as compact as other technologies and only slightly more expensive. The key to this performance improvement is the semiconductor industry's scaling down of design rules. At line widths less than 1.5 microns, the chip dimensions of CMOS will theoretically approach that of NMOS.

Because it generates less heat, CMOS will be a major factor in the next generation of microprocessors, which will cram huge numbers of circuits onto single slices of silicon. Use of more conventional NMOS technology for these dense chips would cause heat buildup and result in unacceptably low part reliability and possibly even meltdown of an ordinary package.

The lower heat generation of CMOS also makes it better suited than NMOS to the larger and more tightly packed memory boards of desk-top computers. While NMOS boards often need cooling fans, CMOS typically needs only convection cooling. In some cases, CMOS boards can be sealed, eliminating problems caused by the intrusion of dust or users. And the power supply, which occupies as much as 50 percent of the total system board in an NMOS/TTL system, takes up only 10 percent in a CMOS system.

CMOS has other ramifications for system power supplies. Because CMOS can tolerate a wide range of voltages, designers can use less regulated and therefore less expensive power supplies. And because CMOS can operate satisfactorily with a power supply voltage of 3V—the output of lithium batteries likely to be used in portable products—a report from Gnostic Concepts Inc., Menlo Park, Calif., predicts 3V will replace 5V as the industry standard in the mid-1980s.

An industry-wide trend

The movement to CMOS technology is broad based.

NMOS TO CMOS COMPARISON			
Parameter	Multibus	STD bus	Series/800
Technology	NMOS	NMOS	P ² CMOS TM /CMOS
Temperature range	0°C to 55°C (32°F to 131°F)	0°C to 55°C (32°F to 131°F)	-40°C to 85°C (-40°F to 185°F)
Board size (in. (cm.))	6.75 × 12.0 (17.21 × 30.5)	4.5 × 6.5 (11.4 × 16.5)	3.9 × 6.3 (10 × 16)
Supply voltage	+5VDC, ±12 VDC	+5VDC, ±12 VDC	10 VDC to 18 VDC
Power dissipation (watts)	20	7.5	.24
Speed	2 MHz to 5 MHz	2 MHz to 5 MHz	1 MHz to 4 MHz
Connector type	Card edge	Card edge	Positive contact

Source: National Semiconductor

The advantages of CMOS semiconductor technology, as compared to NMOS technology, include operation across wider temperature ranges, lower power consumption and, in the case of the National Semiconductor Series/800 implementation, greater compactness.

The Interpreter

Intel Corp., which reached its prominent position in the semiconductor industry via NMOS technology, plans to convert its products to CMOS within the next five years. Both National Semiconductor Corp. and start-up Integrated Device Technology predict CMOS will be the mainstream semiconductor workhorse during the rest of the '80s and into the '90s. Motorola Inc.'s first full 32-bit microprocessor, the MC68020, will be a CMOS processor. And Zilog Inc., an NMOS holdout that prides itself on conservatism, is developing a 2-micron CMOS technology for production of its Z80000 32-bit microprocessor by 1986.

Although the switch to CMOS will be nearly total, it will not be disruptive. This new generation of CMOS is NMOS to which chip designers have added a few carefully selected CMOS functions to achieve the best of both technologies.

CMOS is a blend of N-channel technology, which uses a negative electric field to control the flow of electrons in a transistor, and P-channel, which uses a positive electric field. Classic CMOS pairs equal numbers of N- and P-channel transistors to achieve a balanced circuit that draws power when the circuit is working but not when it is in a wait state. Power usage in classic CMOS is therefore less than one-sixth that of NMOS in a working state and 100 times less at rest.

But many chips dubbed CMOS use this P- versus N-channel balancing act for no more than 10 percent of the devices on the chip. Adding these few P-channel circuits is not difficult: the chips are produced on what are essentially NMOS processing lines, and the few additional steps needed for P devices don't significantly complicate the process, which already has almost a dozen steps.

An example of the quasi-CMOS chip is Motorola's full 32-bit member of the MC68000 microprocessor family, the MC68020. Scheduled to be sampled late this year or early next, the 68020 will be fabricated in what Motorola calls HC (high-density complementary) technology. P-channel devices will be used discriminately where most of the chip's power is consumed—the clocks, the memory-address decoders, the control store, the arithmetic-logic-unit and I/O ports, for example—but account for only 7 or 8 percent of the total devices on the chip. This is enough to solve the heat-dissipation problems in the more-than-300,000-device part without much additional expense for the larger dies necessary for true CMOS. "If we made the 68020 in true CMOS with a 50:50 P/N ratio, it would be too big to manufacture," says a Motorola spokesman.

Other 16- and 32-bit microprocessors are on the way from other suppliers. First to arrive will be chips from

Harris Corp.'s Semiconductor Products Division, Melbourne, Fla., which is scheduled to sample a CMOS version of Intel's 8086 this year and eventually a CMOS version of Digital Equipment Corp.'s J-11 microprocessor implementation of PDP-11 architecture. Cole Rada, director of marketing for National Semiconductor's NSC16000 family, says a CMOS version of the 16032 will be implemented in silicon this year, with initial production slated for the second half of 1984. Meanwhile, Intel will deliver CMOS iAPX 286s no later than 1985, says Pat Brooks, Intel's manager of new product introductions. Zilog, however, is not slated to produce a CMOS 32-bit Z80000 until 1986.

CMOS microprocessors using 8-bit words have been available for many years. The RCA classical-CMOS 1802 microprocessor was the first such product and is still in wide use, mainly for applications in extremely harsh environments. The 1802 has survived trips into boiling oil deep in oil wells at temperatures of 200° C and into space. It can be put to sleep and awakened; that is, unlike quasi-CMOS microprocessors, it is a static device. It also drains about 100 times less power in standby mode than quasi-CMOS devices do. The 1802 has an unusual architecture, however, and it is likely that more system designs will be won by CMOS versions of mainstream NMOS microprocessors.

One of the first available products of this new generation was National Semiconductor's NSC800 CMOS microprocessor. The NSC800 is not a true, static CMOS chip; the company used a 40:60 P-to-N transistor ratio to keep die size down. Yet the company claims that the NSC800 provides most of the low-power, high-temperature advantages of classical CMOS and that, for example, it operates over the military temperature range of -55° to +125° C. The NSC800 provides the speed and instruction set of the Z80A microprocessor, tied to the multiplexed address/data bus of the 8085, while dissipating only about 5 percent of the power consumed by either of those popular 8-bit processors. National Semiconductor suggests the NSC800 for rugged electrical environments, extended temperature ranges and applications in which a small package or the ability to run on battery backup power is required. The company has also introduced a board line based on the NCS800 called the Series/800 (see table, p.115).

Other available 8-bit CMOS microprocessors include Rockwell Corp.'s 6502, which uses 3-mm. geometry rather than its predecessor's 5-mm. design rules. It thus is smaller and operates faster than the original NMOS chip.

One of the first memory components to use the new approach to CMOS is Intel's prototype 64K-byte dynamic

SOMETIMES, THE BEST PLACE TO GET A DEC PDP-11 SYSTEM ISN'T DEC



When you buy DEC PDP-11 based System 58 from Cambridge Digital, it's ready to get to work as soon as you hook it up. Because at Cambridge Digital, we sell enhanced-performance DEC systems that are fully integrated with DEC-compatible products. Products you can't buy from DEC. So you spend your time working on your system, instead of just trying to make it work. It's part of the edge you get when you buy from Cambridge Digital.

Take our ready-to-run System 58. It features a DEC LSI-11/02, 21, or 23 with internal RAM memory of 32Kb, expandable to 1Mb. The 11/23 based system directly addresses up to 4Mb of memory. Plus you get an RLV12 compatible Winchester disk with your choice of 5, 10, 15 or 20Mb, and a floppy with usable capacity of 1.02Mb.

And, you get a full range of development tools from CDS, too. Like a fully-supported and enhanced operating system based upon UNIX* System III. Also TSX-Plus, RT-11, μ -power PASCAL, and RSX-11M.

It's all ready to run. Available for as little as \$7,350. Available in as little as 10 days. But it's *not* available from DEC, so call Cambridge Digital, instead, and get The Edge.

For more information on our System 58 and a copy of our DEC PDP-11 based system catalog, including a description of the seven guarantees you get when you get The Edge, call 1-800-343-5504 (in Massachusetts 1-617-491-2700), or send the coupon to Cambridge Digital Systems, Dept. 7401, P.O. Box 568, 65 Bent Street, Cambridge, Massachusetts 02139. Telex 92-1401/COMPUMART CAM

Cambridge Digital Systems is a division of Compumart Corp. *UNIX is a trademark of Bell Laboratories.

**I want The Edge: FOR FAST FACTS, CALL:
1-800-343-5504**

Name _____

Title _____

Organization _____

Address _____

City _____ State _____ Zip _____

Phone (_____) _____
(7401)

58

Cambridge
Digital
DIVISION OF COMPUMART

The Edge in System Integration

CIRCLE NO. 68 ON INQUIRY CARD

The Interpreter

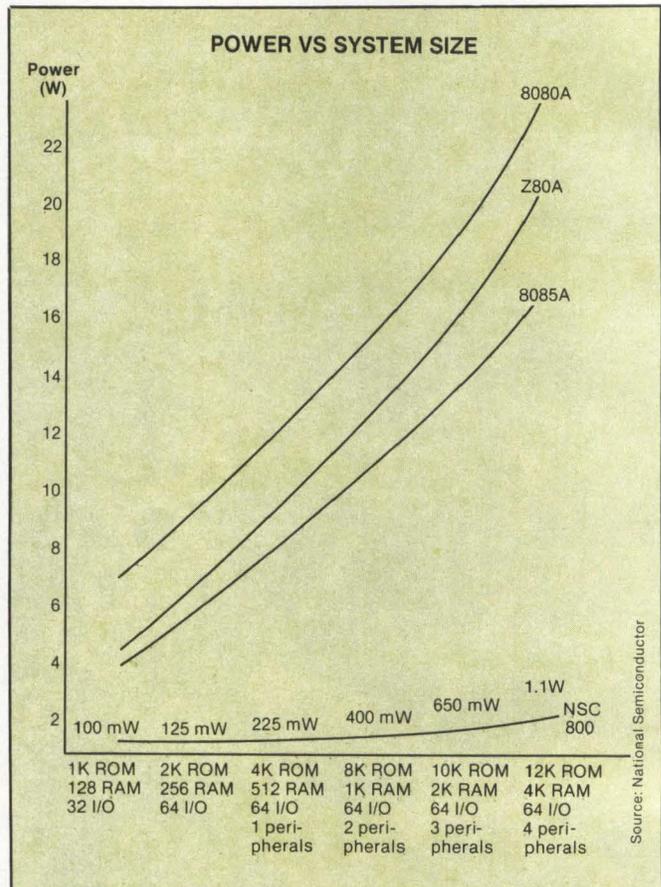
RAM. The prototype is based on Intel's CHMOS (complementary high-performance MOS) process, which leverages the company's long-term experience with NMOS, but adds P-channel devices in chip areas of high power consumption. The prototype is said to offer several advantages over earlier Intel 64K-byte dynamic RAMs built in HMOS. It runs at one-half the operating power and one-fifth the standby power of its HMOS equivalent, and its soft error rate is immensely improved. With this improvement, the 5500 hours between soft errors expected in a 1M-byte HMOS memory are extended to 250,000 hours by switching to CMOS.

Another improvement made possible by the reduced power consumption of CMOS is a data-access method Intel calls Ripplemode. "The use of CMOS allows us to keep the column address latches on all the time without burning the prohibitive amount of power that would be required to do that using NMOS," explains Intel's Brooks. "As a result, those column addresses flow right through, and we consequently get consecutive bits of data out at a rate of 40 nsec. per bit." Brooks says Ripplemode is similar to page-mode access on Intel's earlier 64K dynamic RAM. "But the best we can do with page mode is about 120 nsec. per bit," says Brooks. The 25-MHz bandwidth made possible by Ripplemode makes the new dynamic RAM attractive for applications and devices requiring high data-transfer rates, such as data logging and the frame buffers of graphics terminals.

But CMOS may have an even more dramatic impact on RAM. A study by Gnostic Concepts Inc. predicts that, by 1985, CMOS static RAMs will offer higher performance at a lower price than any dynamic RAMs. If true, it puts Integrated Device Technology, Santa Clara, Calif., in a very good position as manufacturer of the highest performance CMOS static RAM available. IDT produces a 16K-byte static RAM organized as $4K \times 4$ that is rated at a 45-nsec. access time. And because of the low power dissipation of CMOS parts, IDT began production this year of a 64K static RAM produced by combining four 16K static RAMs on a standard-sized package with JEDEC pinout.

Intel's Brooks says customers interested in designing Intel's iAPX 286 processor into high-performance engineering workstations are also interested in the new CMOS RAMs. He also cites interest in portable applications, and says that interest will intensify when full families of 16-bit processors and peripheral chips are available. Intel's director of corporate communication, Stu Sando, says, "If you have one chip in CMOS, that's fine, but you really begin to see the system-wide benefits when the rest of the solution is there too."

Microprocessors and RAMs aren't alone in going to



The advantages of CMOS semiconductor technology, as compared to NMOS technology, include operation across wider temperature ranges, lower power consumption and, in the case of the National Semiconductor Series/800 implementation, greater compactness.

CMOS. CMOS may have its most immediate impact in semicustom logic. Semicustom logic was once the province of large system manufacturers, such as IBM Corp. and Digital Equipment Corp., which used it in house, and small specialty IC makers, such as Interdesign, Exar and International Microcircuits Inc. More than 30 companies are now in the semicustom logic business, and projections of its eventual importance vary. Dataquest predicts that it will have a 20-percent market share by 1990, while Mackintosh International Ltd., Luton, Beds, England, predicts a 40-percent share of the semiconductor business by 1990.

The incentives for converting TTL circuits to ICs are lower fabrication costs in volume production, lower field-service costs due to increased reliability and reduced power and heat dissipation. Even small manufacturers of systems and boards can move to custom IC design. The move is the result of a new generation of CAD tools that reduces the time for an

EVERY TIME A DISK DRIVE FAILS, THE INNOCENT GET HAULED AWAY.

It was your system, your name,
your reputation ...

And somebody else's fault.

All the more reason to take a good
long look at your disk drive company.

Then take a good look at ours.

Shugart. We back up systems
builders with one of the lowest failure
rates in the industry.

Moreover, when we have a tech-
nological marvel on the drawing board,
we don't just hustle it to market — we
wait. Until we're sure it can be manufac-
tured reliably. In volume. On time.

We're also the one source that can
provide all the floppy and low end rigid
disk drives and controllers you need.

While sparing you the expensive burden
of qualifying numerous vendors. Or
wasting man-years on system redesign.

And another thing. With most low
end disk drive manufacturers, when you
need a field service call you get it by
phone. Whereas we'll send you a qualified
technician. From our applications team,
or our worldwide field engineering force.

In a nutshell, we're doing all we can
to protect the innocent.

So you can keep your good name,
and we can keep ours.

Shugart

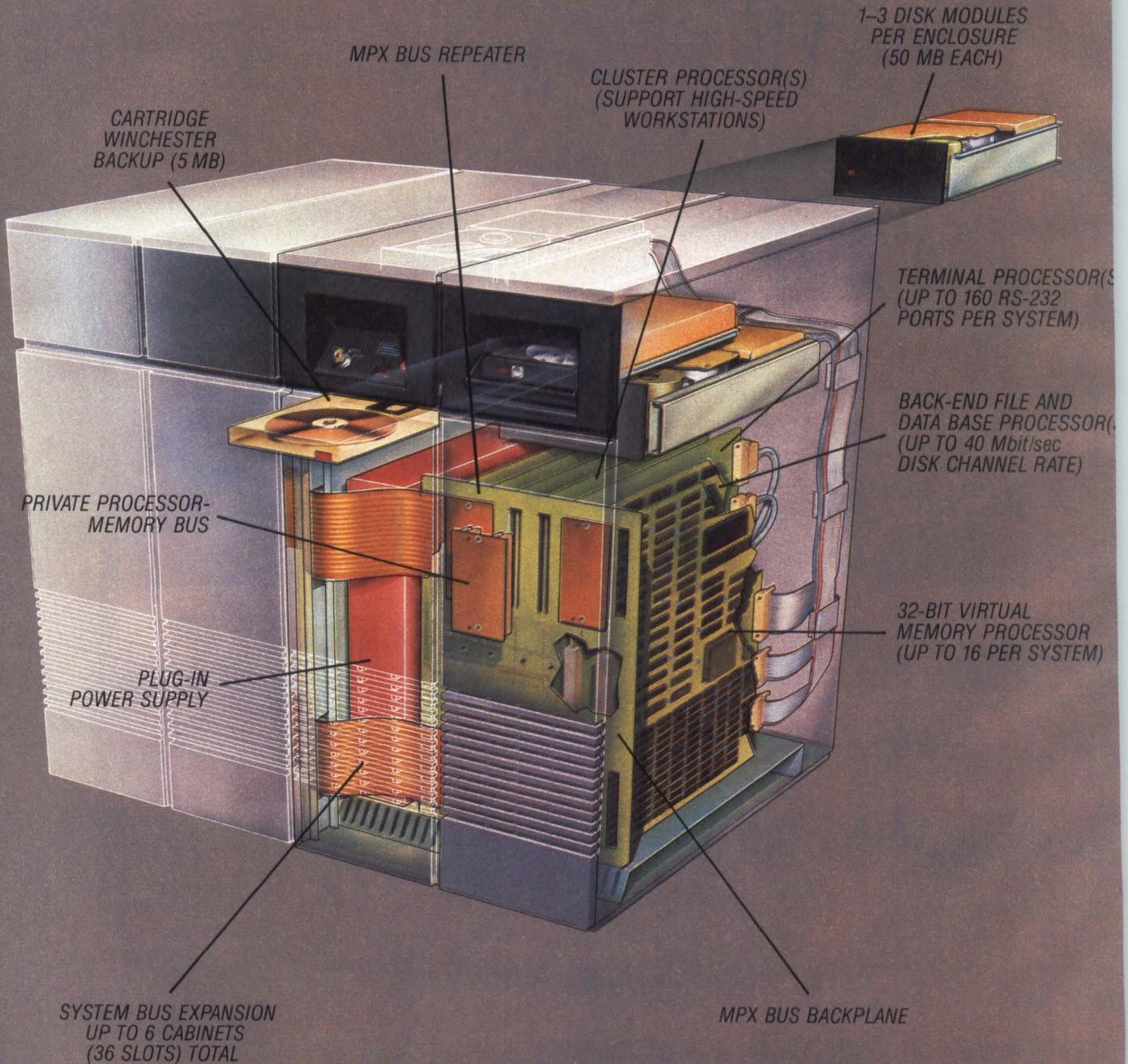
Right from the start.



475 Oakmead Parkway, Sunnyvale
CA 94086, Phone (408) 733-0100

MEGAFRAME™

Now you can let DEC, DG, and H-P
play catch-up with you.



□ **Supports multiple operating systems (including UNIX) simultaneously sharing files and resources.**

□ **Multiple specialized processors distribute the workload to achieve outstanding performance.**

Computer manufacturers and system builders face tough demands these days — demands that are just about impossible to meet with conventional hardware. So Convergent designed Megaframe: a highly unconventional new system. Its innovative architectural features solve with one stroke the major problems of multiuser system design.

The Distributed Mainframe: Multiple processors, multiple operating systems.

Programs in a Megaframe system run on up to sixteen virtual-memory Application Processors — each with a 32-bit CPU, private RAM, and UNIX operating system kernel. But when a program needs to access a disk, communications line, or other system resource, the request is sent to one of the specialized high-performance service processors. So the application's I/O overhead is reduced to virtually zero.

But that's only the beginning. You can add separate processors to the Megaframe to simultaneously run completely different operating systems — like CTOS,* which provides real-time multitasking and supports attached clusters of Convergent workstations.

The independent File Processors function as powerful back-end Data Base machines, providing relational DBMS, ISAM, and other disk-related services, with fully transparent file sharing by all operating systems.

Megaframe's dedicated front-end Terminal Processors and Cluster Processors offload user communications from the Application Processors, ensuring fast, flexible response. They also manage access to facilities like SNA and X.25 networks, print queues, local-area networks, etc.

Configurable to exactly match application load profile

The various Megaframe processors can be installed in multiples, depending on the requirements of the specific application.

□ **Designed to support workstations and terminals to achieve a least-cost fit for any application.**

□ **Low-cost processor modules provide incremental expansion from 8 to 128 users.**

CPU-intensive jobs can utilize multiple Application Processors and expansion RAM. Systems with heavy disk usage can distribute this load among several File Processors. And the number of user ports can be expanded at any time by installing more Terminal Processors and/or Cluster Processors.

Modularity even extends to disk storage. Compact, 50-megabyte Winchester modules simply plug in — up to four per cabinet. High-capacity

cluster can be supported unchanged.

Inclusion of one or more Application Processors allows running UNIX System V. All standard UNIX tools including C are included, along with COBOL, FORTRAN 77, a BASIC interpreter and compatible compiler, plus Pascal.

Communications options include 3270 and 2780/3780 emulation (both Bisynd and SNA), X.25, and Convergent's media-independent network software.

Data management facilities include multi-key, multi-user ISAM, relational DBMS, and a powerful ad hoc query language and report generator.

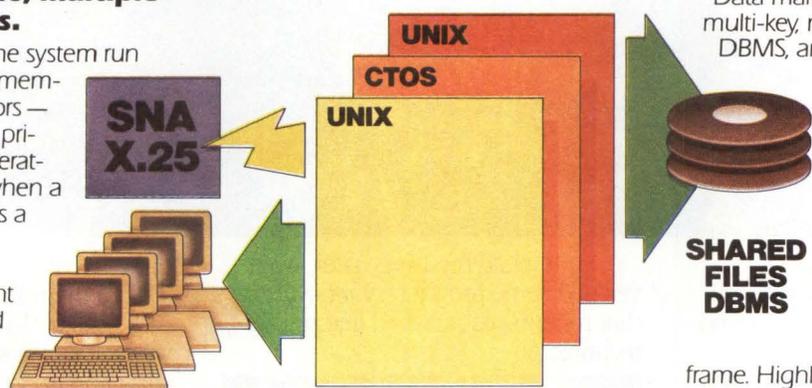
Megaframe: The solution with staying power

No system has ever combined the power, flexibility, and expandability of the Mega-

frame. Highly cost-effective at any performance level from "supermicro" up, with a per-user cost that will embarrass DEC, DG, and H-P, Megaframe is the ideal solution when needs are unpredictable or subject to rapid change.

Megaframe represents a true turning point in computer system evolution. The direction for the future is clear. Join us... don't be left behind.

For more information about the new Convergent Megaframe call (800) 538-7560 (in California (408) 980-0850), or write:
Convergent Technologies
Dept. MM683
3055 Patrick Henry Drive
Santa Clara, CA 95050



SMD devices can be attached via a separate intelligent interface processor. File backup utilizes compact Winchester cartridges, 1/2" magnetic tape, or both.

Multiple cabinets daisy-chained for up to 8 MIPS and 128 users

A minimum Megaframe system supports 16 users efficiently for about \$20,000 — quantity one. As needs grow, Megaframe grows — to a 128-user system, with up to 8 MIPS execution, 24 MB of error-correcting RAM, and 21 billion bytes of disk.

Megaframe software: ready-made solutions

Megaframe offers system builders an extremely wide range of choices in application development tools.

If the chosen configuration includes Cluster Processors, then any software running on an existing Convergent



Convergent Technologies

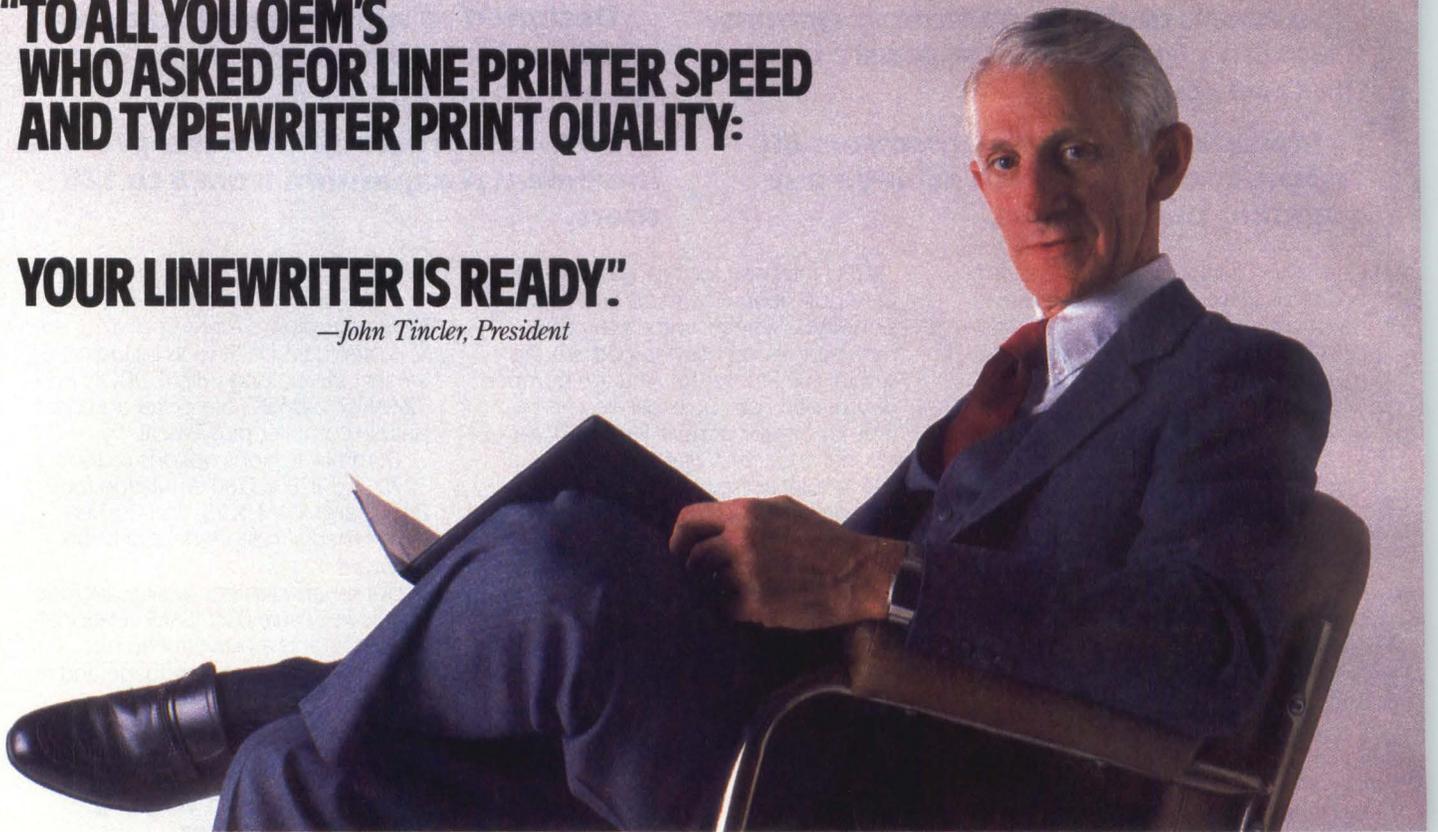
Where great ideas come together.

CIRCLE NO. 70 ON INQUIRY CARD

"TO ALL YOU OEM'S WHO ASKED FOR LINE PRINTER SPEED AND TYPEWRITER PRINT QUALITY:

YOUR LINEWRITER IS READY."

—John Tincler, President



Recently we asked what you wanted most from the next generation of line printers. You told us in no uncertain terms: typewriter quality print at line printer speed; more reliability and less need for service.

So we built it—a printer that embodies everything you want and eliminates everything you don't want.

We built *your* line printer. The Centronics Linewriter 400.

We can't describe the superior print quality—so we'll let you judge for yourself. Just look at the unbelievable difference between the Linewriter 400 and standard band printer samples.

<=>?@ABCDEFGHIJKLMN OP

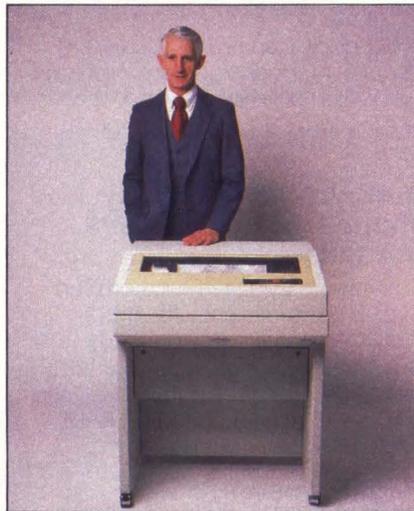
Sample of Linewriter 400 quality.*

#&.ABECDTFGOHIJ1KL2MN

Sample of standard band printer quality.*

On top of that, the Linewriter is smaller, quieter, easier to operate and maintain, with the lowest cost of ownership of any 300-500 LPM line printer ever made.

To build the Linewriter, we developed some proprietary innovations that redefine established line printer technology.



These include true linear free-flight hammers to eliminate character clipping (especially on multi-part forms); and slower, clockwise band rotation to reduce character smudging.

For reliability—LSI and VLSI electronics and up to 15 KV ESD immunity throughout. To improve throughput we included statistical printbands and early end of print. Then we finished it off with human-engineering features: extensive self-diagnostics and an alphanumeric display to pinpoint specific problems; resonating ribbon cassette that doubles ribbon life; 2860 hr. MTBF; 0.5 hr. MTTR and *no scheduled preventive maintenance*, plus a 55 dBa (optional) sound level.

The result is the Linewriter 400—the line printer that makes every other 300-500 LPM printer obsolete.

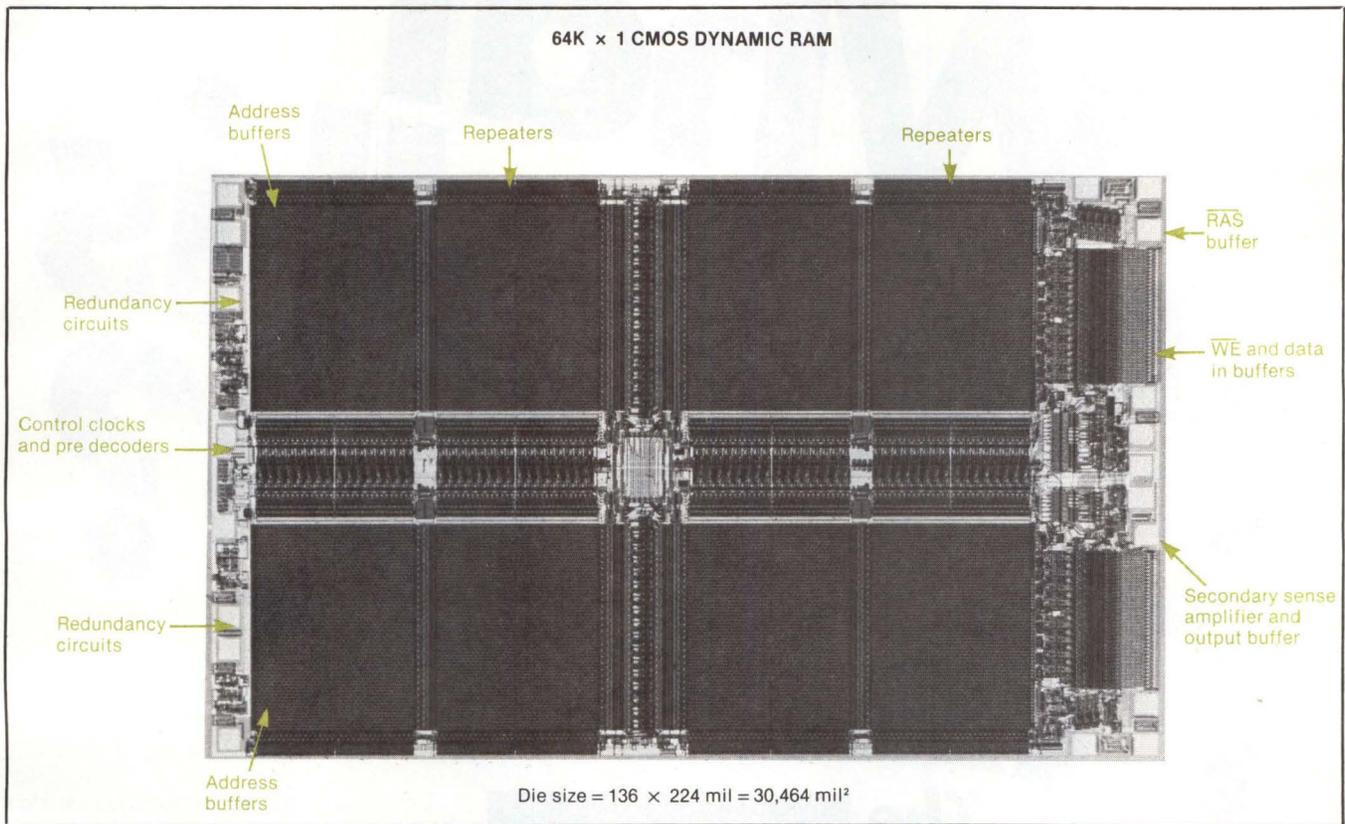
Which is no less than you should expect in a line printer you had such a large part in specifying. And one it took Centronics technology to build.

To find out more about the Linewriter 400 call our Line Printer Division (313) 651-8810, Ext. 342. Or write to us for more information and free print samples to Centronics Data Computer Corp., Dept. A, One Wall Street, Hudson, NH 03051.

*Offset reproduction.

CENTRONICS® PRINTERS

The Interpreter



Intel Corp.'s prototype CMOS 64K-byte dynamic RAM uses one-half the operating power and one-fifth the standby power required by Intel's 2164A NMOS 64K-byte dynamic RAM. It also offers higher cell capacitance for improved resistance to soft errors, faster serial access and relaxation of critical timing requirements as compared to NMOS. Intel claims the CMOS part, due to be introduced in early 1984, will enhance overall system throughput by as much as 20 percent. (WE = write enable; RAS = row address strobe; mil = 1/1000 of an inch)

average custom IC design to approximately six months and reduces the cost to around \$75,000, according to VLSI Technology Inc.

Daniel Queyssac, president of the U.S. subsidiary of Italian semiconductor firm SGS Semiconductor Corp. in Phoenix, concludes that semicustom logic will become more important. He says the technology of choice is CMOS. "Fast CMOS is replacing TTL and will be the dominant technology for logic in five years' time," Queyssac predicts.

SGS licenses CMOS technology from Toshiba and CAD system technology from LSI Logic Corp., Milpitas, Calif. Other companies with CMOS gate-array offerings similar to SGS's include Texas Instruments Inc., Motorola Inc., National Semiconductor, the Microtechnology division of Storage Technology Corp., RCA Corp. and Mostek Corp. Early this year, Intel also got into the act using its CHMOS process with ZYMOS Corp.'s CAD system to establish a standard cell library that includes Intel's 80C49 microcontroller core and more typical flip-flops and shift registers.

One interesting consequence of this new generation of technology, says Ralph Cognac, director of marketing for IDT, is that every new generation spawns a group of companies. "The first semiconductors were germanium diodes and transistors, made by tube companies, such as RCA, Bell Labs, Westinghouse and so on," says Cognac. "The next generation was silicon diodes and transistors, which spawned a new group of companies—Fairchild, Motorola, TI—that made the original transistor guys fade into the semiconductor sunset. The next generation was NMOS, which gave us AMD, Synertek, Intel, National and Mostek. We think there's a new revolution under way—high-speed CMOS—and we're pretty sure that some of today's big boys will be left behind."

But Intel's Sando doesn't see CMOS writing that scenario on the wall. "All of today's large semiconductor companies are moving to CMOS," he says, "and its advent won't have an impact on which companies are here to stay." □

What the hell is Pixel 80?

**The
world's best
supermicro
that's now
27% cheaper
and 30%
faster.
That's what.**



Until today, if you wanted to buy the world's best supermicro, you bought Pixel's 100/AP™

Now you can go one better with Pixel 80, a 68000-based supermicro with price-performance no one else can touch.

Pixel 80 also has the latest version of UNIX™ System III with Berkeley enhancements. And, it upgrades to 16 terminals, 6Mb RAM, and 420Mb of 5.25 inch Winchester storage in the same box with the same power supply.

You get unheard of freedom of choice in software, too. Like MicroINGRES™, Sequitur™, Mistress™, Informix™ and Unify™. Not to mention MDBS III™, SMC IDOL, SuperComp Twenty™ several word processing packages and a very wide range of high-level programming languages (10 at last count).

If you're an OEM/Systems Integrator, you can't afford to miss out on the supermicro that's in a price/performance class all its own. Pixel 80. More information is yours for the asking.

Pixel 80 and Pixel 100/AP are trademarks of Pixel, Inc. UNIX is a trademark and a service mark of Bell Laboratories. MicroINGRES is a trademark of Relational Technology, Inc. UNIFY is a trademark of Unify Corporation. Sequitur is a trademark of Pacific Software Manufacturing Company. Mistress is a trademark of Rhodnius Incorporated. Informix is a trademark of Relational Database Systems, Inc. MDBS III is a trademark of Micro Data Base Systems, Inc. SuperComp Twenty is a trademark of Access Technology, Inc.

- I'm asking. Send complete info on the remarkable Pixel 80 ASAP.
 Send the results of your latest comparative benchmark tests.

Name _____ Title _____
Company _____
Address _____ City _____ State _____ Zip _____
Telephone Number _____

MM

Pixel

One Burt Road, Andover, MA 01810

CALL 617-470-1790

CANADIAN SALES (416) 746-2775

EUROPEAN SALES (U.K.) (0925) 810-141

The Interpreter

Pioneering university/industry venture explores VLSI frontiers

By Dwight B. Davis

It's easy for system integrators and computer end users to take for granted continued advances in very-large-scale integration as well as the cost/performance benefits these advances allow. After all, progress in VLSI has occurred so rapidly that the scientific and technical barriers impeding this progress must seem very small to many observers. In fact, each step forward comes only through tremendous expenditures of capital and thousands of hours of research, and the investment of time and money increases with the scale of integration. Japan, which has surpassed the U.S. in several areas of VLSI technology, has made many of its advances only by pooling the resources of government, industry and universities to meet the rigorous demands of VLSI research.

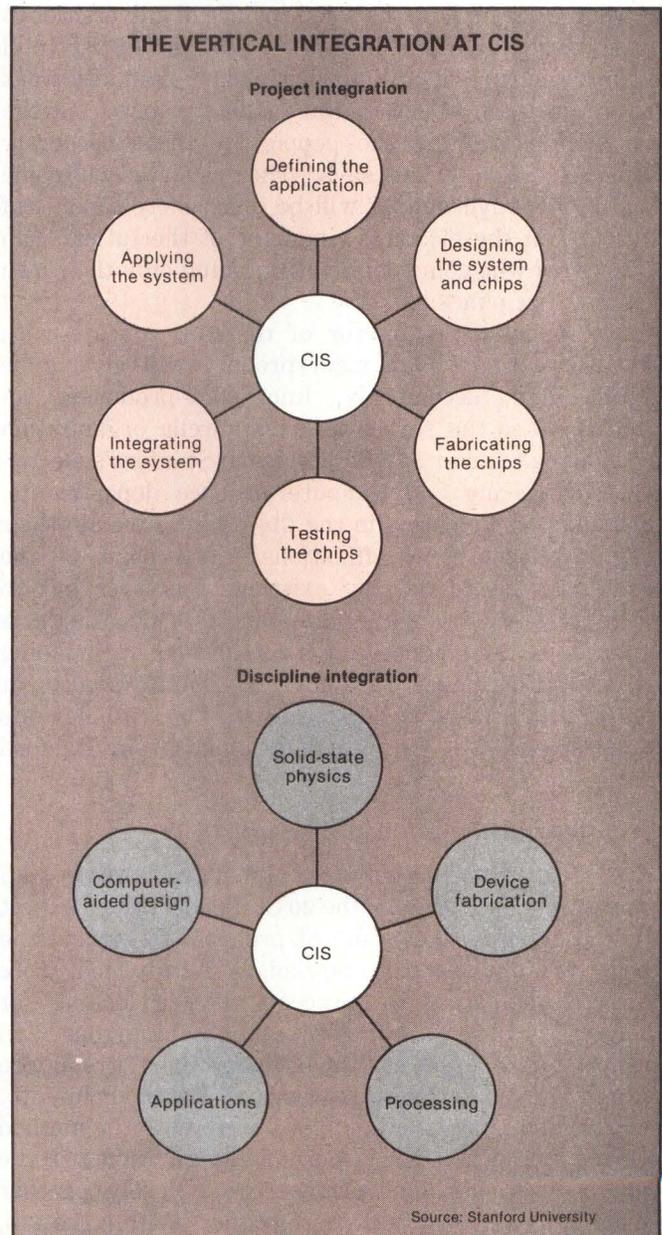
Such resource pooling is limited in the U.S. because of antitrust regulations and because of each company's desire to keep its research proprietary. But universities are increasingly serving as the crucibles within which corporate scientists can interact with each other and with university faculty and students. As such cooperative programs take hold, the participants believe university-based research will increase in importance, and expect that graduates exposed to the programs will better meet industry's needs for skilled personnel.

The Center for Integrated Systems

Industry-sponsored programs in semiconductor research are in operation at a number of U.S. college campuses, including the Massachusetts Institute of Technology, the University of California at Berkeley and Carnegie-Mellon University. The university that pioneered college/industry cooperation, however, is Stanford University, which instituted its Center for Integrated Systems in 1981. The CIS has attracted 20 corporate sponsors, each of which has contributed \$750,000 to the center for use during its first three years of operation. (The sponsors are General Electric Co., TRW, Hewlett-Packard Co., Northrop, Xerox Corp., Texas Instruments Inc., Fairchild Semiconductor, Honeywell Inc., IBM Corp., Tektronix Inc., Digital Equipment Corp., ITT Systems Inc., GTE, Motorola Inc., United Technologies Corp., Monsanto, AMI-Gould and Philips Signetics.)

Aside from its early courtship of corporate sponsors,

Stanford's CIS has distinguished itself by its interdisciplinary approach to semiconductor research, says Les Vadasz, senior vice president in charge of corporate



Stanford University's Center for Integrated Systems has taken the "integration" part of its name to heart. The CIS, which is pursuing research in semiconductor VLSI, is merging computer science, information science and physical science. Each CIS participant is expected to generate applications, which will drive the development of new systems, circuits, devices or processes.

The Interpreter

strategic staff at Intel Corp., Santa Clara, Calif. "If you look at integrated circuits," he says, "they are more and more becoming integrated systems. We're looking to the Center for Integrated Systems to place physicists, chemists, electrical engineers, computer scientists, software people and hardware people in a common environment so that their work will be much more applicable to very complex VLSI realization."

Vadasz says it isn't the sole province of universities to combine several disciplines in the pursuit of VLSI; Intel had previously set up interdisciplinary teams to work on its projects, he notes. But industry must scout the universities to find the people for these corporate research teams. Vadasz says, "The graduates who come out of this environment will be much more capable of working in the electronic industry of the future than graduates who come out after pursuing only their own narrow disciplines."

John Linvill, co-director of the CIS, concurs with Vadasz, noting, "Our main product will always be people and, secondarily, knowledge-producing research." The CIS serves as an umbrella organization covering a number of laboratories in Stanford's electrical engineering and computer science departments. Students participating in the CIS program retain their regular department affiliations. "The point of the center is not to destroy existing structures but to facilitate their strengths," Linvill says. Once the CIS is operational and housed in its 71,000-sq.-ft. building (construction began this spring), Linvill expects at least 30 students with doctorates and 100 with master's degrees with CIS exposure to graduate from Stanford each year.

Foundations for applied research

Aside from their need for qualified graduates to staff corporate research labs, the 20 CIS sponsors also expect the research at the Stanford program to expand the body of fundamental knowledge from which more directed research can proceed. "We're looking for something beyond what we can obtain in our own proprietary operations," says George Pake, group vice president for corporate research at Xerox, Palo Alto, Calif. Pake contrasts the CIS program with the method of cooperation in Japan, where, he says, "Industry, the universities and the government work closely together even on relatively applied programs." Within the CIS, he says, "We will work together in developing the basics, advancing the technologies to devise new ideas for the future that are rather broad in their applicability. We will still expect the various companies to proceed on their own with various proprietary pushes."

The chance to have early and ongoing access to the basic research within the CIS is one of the main reasons the corporate sponsors joined the program. Each company will send visiting scientists to Stanford to work with CIS faculty and students—and with other companies' scientists—on research projects.

A question yet to be answered is how scientists from competing companies will cooperate with each other when working on project teams. Mark B. Barron, vice president of research and development at GE's Calma Co. subsidiary, Santa Clara, Calif., isn't optimistic. "We really haven't interacted with other companies that much, and I doubt that it will happen," he says. Other corporate participants believe that the basic nature of the CIS research will help lessen the concerns companies may have about sharing scientific knowledge and skills.

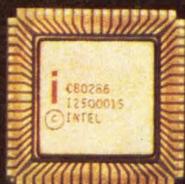
Intel's Vadasz says a typical project team might consist of a professor, some graduate students and two researchers from different companies. "I would like to think that those two individuals, while they are at the CIS, will talk openly and do the best they can to advance the project," he says. "And the results of that project should be available to all the sponsors, under some terms and conditions. If you start looking at this from a parochial point of view, you end up not gaining anything."

Expenses of semiconductor research

Semiconductor research by its nature—with requirements for sophisticated fabrication equipment, computer-aided-design systems and ultra-clean rooms—is expensive. Xerox's Pake notes, "It is difficult for any one university to put together a program like the CIS on its own because the equipment is exceedingly costly and the plant is quite substantial. It's important to have a few of these centers, though, because training students in a really modern technological setting is extremely important."

Stanford has always received substantial government support for its semiconductor research, but the corporate contributions have enabled the CIS to begin construction of the building that will combine equipment and personnel in a single environment in which the center's goals can be pursued. These goals are not inconsequential; a CIS fact sheet enumerates several of them: "to carry out fundamental research in areas relevant to VLSI systems; to develop design automation capability and computer-managed fabrication facilities including E-beam and X-ray lithography and laser E-beam annealing; to conceive, fabricate and test VLSI systems for most effective computation, communication

**WE JUST
CAN'T LEAVE A
GOOD THING
ALONE.**



INTRODUCING THE iSBC[®] 286/10.

How could we leave it alone?

When you've introduced the highest performing 16-bit CPU on the market, you've just got to make it immediately available at the board level.

Look at the stand alone specs of the 286. It offers three times the performance of any other microprocessor. It's got memory management and protection, on chip. It has 16 Mb of physical memory. It's compatible with Intel's new 80287 Math Coprocessor. And it's more than a match for today's powerful 16-bit operating systems.

Now, imagine all that raw power in the company of an Intel board.

Powerful, yes. But we couldn't leave the 286/10 alone.

So we designed it as part of a family. Joining five other new high performance MULTIBUS[®] boards and a real-time operating system: Intel's new iRMX[™] 286R. Fully compatible with our industry standard iRMX[™] 86 Operating System and its languages.

But we still couldn't leave the 286/10 family alone.

So we designed it to be totally compatible with every one of our iSBC 86, 88 families. A MULTIBUS board for every price and performance level. Complete with software.

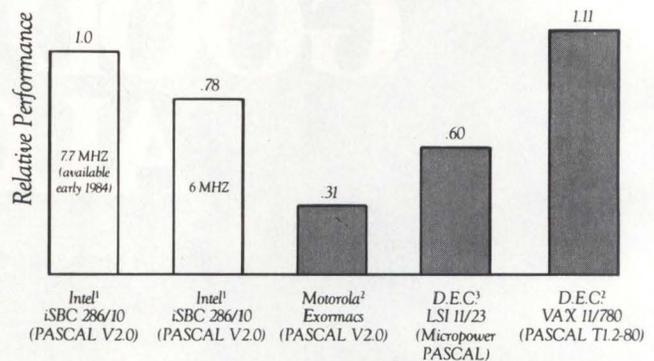
But then, we couldn't even leave all our boards alone.

Not with board extensions available. Like our new iLBX[™] Intel's Local Bus Extension. It offers arbitration-free, direct access to high performance memory. With three times the performance of any other bus system.

All this togetherness comes down to Intel's concept of "Open Systems." Giving

designers and management complete flexibility, through our entire product line. Rapid, easy access to VLSI, via industry standards.

Performance Comparisons



¹Based on Eratosthenes Sieve Benchmark in PASCAL. Details available from Intel's "Eratosthenes Sieve Prime Number Benchmark on the iSBC 286/10 Board," literature order number 210984. ²"Eratosthenes Revisited," BYTE, Jan., 1983.

³"A System/Architecture Approach to Microcomputer Benchmarking," Digital Equipment Corporation, Sept., 1982.

And naturally, when you go with Intel, you'll never be alone. We'll be there, with hardware and software support. Training, consulting and servicing. Helping you to reduce your risk, by minimizing your initial investment and maximizing your design's total potential.

Call us, toll-free. (800) 538-1876. In California, (800) 672-1833. In Europe and Japan, contact your local Intel Sales Office. We'll send you information on our new high performance products and a board development kit. A kit that'll get you started for less than \$10K.

And, if you don't mind us saying so, that alone should be enough to make you want to call.

intel[®] delivers
solutions

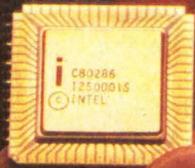
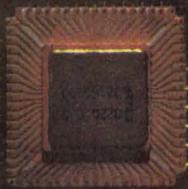
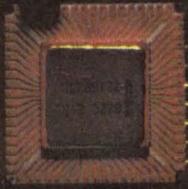
3065 Bowers Avenue, Santa Clara, CA 95051

CIRCLE NO. 73 ON INQUIRY CARD

INTEL
MADE IN USA

2285 EMULATOR P&A 145160

REV



252 U47

25 U

MADE IN USA

U30

252 2819
252 2819

C8

R1

U22

RP

S

2

2

2

2

2

2

2

2

2

2

2

2

2

2

2

The Interpreter

and control functions."

While the goals are general, some products will likely emerge from the CIS laboratories. Linvill notes that more than a decade ago, he invented the opticon reading aid for the blind. The device, produced and marketed by Telesensory Systems, required custom ICs. "The making of the custom integrated circuits for that device was the project that initiated the integrated circuit laboratory at Stanford," Linvill explains.

He says the CIS has no guidelines detailing how any CIS products with commercial viability will be handled, but the sponsors are exploring such issues through a Sponsors Advisory Committee. Calma's Barron says the committee has discussed various patent arrangements that might be instituted between the companies and the university. But, he notes, "The patent is more likely to be for generic technology than for an actual product."

Barron says the CIS has produced software tools that some of the companies are using within their proprietary design processes. "For example, the center has a modeling program that models the process used to fabricate ICs," he says. "We use that modeling program within GE to guide the development of our own devices. Generic tools such as this are very important to the companies."

John Doyle, vice president of research and development at HP, Palo Alto, Calif., also believes the production of commercial products from the CIS will be limited. For instance, he notes, HP and other companies routinely produce chips with as many as 450,000 on-board circuits, and he doubts that higher levels of integration will first occur in university labs. "But some of the inventions that make further integration possible, some of that science, may well come out of universities and then get applied," he says.

Maintaining academic freedom

The presence of industry in force on a university campus generates fears that academic freedom and integrity may be abrogated. The CIS sponsors, however, profess no desire to tamper with the center's independence. "Industry, by and large, is very sensitive to the issue of academic freedom," says Doyle. And, even though the Sponsors Advisory Committee is expected to help steer the CIS research activity to some degree, the final authority to choose the research rests with the university. "No university should ever accept restrictions on the way it conducts or promulgates its research," says Xerox's Pake. "The clear advantage for the corporations working with the CIS is that they will have an earlier and deeper awareness of what the research results are."

CIS co-director Linvill also discounts any problems with industry interference within the program. "Exactly the same concerns were raised when federal money in large amounts first came into engineering schools for graduate research programs in the early '50s," he says. "We have learned by a process of mutual adjustment to work very effectively with large government." Linvill admits the university has less experience in dealing with corporate sponsors, but he believes the problems associated with industry funding are less complex than those encountered in government. "All the questions of military security don't have to be addressed," he says.

Linvill hopes that funding from industry may someday approach the level of government funding. Much government funding is in response to research proposals from faculty members, and Linvill believes professors will look more to industry for such directed funding in the future. Several CIS sponsors fund directed research at various universities. Barron at GE's Calma explains the common rationale for such funding, noting, "Essentially, we have more programs that we're interested in doing than we have the in-house people to do them with." While this directed research may be more proprietary than that occurring in open programs such as the CIS, Barron says, "Normally, we don't fund things that we consider to be highly proprietary. We generally would fund things of the blue-sky type that are more long-term in nature. So if they don't succeed, we really don't lose a lot in terms of our own product development."

But narrow research projects and more limited semiconductor programs lack the essence of a multidisciplinary environment, which represents a key strength of broad-based programs such as the CIS. "A major intangible benefit of the center is the technical and professional stimulation that will come to our people who work there," says Pake. "With all these corporations, plus Stanford, participating, there should be quite a powerhouse of brainy people in that place. It's hard to overemphasize the value to a technical individual to be put into that kind of a stimulating environment."

Intel's Vadasz believes that, through cooperative programs like the CIS, universities will further advance semiconductor technology. "Historically, universities and industry in this area did not have a close coupling," he says. "Now that we are seeing a much better environment in which companies are sponsoring various university programs, the university activities will become much more relevant to our business. There's a tremendous technology resource at the universities, which, if we do our job right, will do a lot of good for the whole industry." □

ARE YOU DROWNING IN A SEA OF SOLUTIONS?

Recognize the symptoms?

**Applications backlog? Technology blur?
Mounting user pressures?**

You suspect that suppliers may have answers to your pressing problems, but you don't have enough time to sort through fragmented information to determine what will really work for you.

Like the shoemaker's kid who goes barefoot, you (of all people) need a system. An information system that displays all your current software, hardware and communications options for instant reference.

That system is DATA SOURCES, and you're invited to make it work for you. Simply fill in the coupon and we'll send you DATA SOURCES at 50% off its regular cover price.

What DATA SOURCES does is organize your options. It guarantees that you've considered all relevant products. And makes the most of your time for product evaluations by guiding you to those with the best possibility of success.

DATA SOURCES is a conveniently sized, extremely well-organized and skillfully indexed reference...maintained on a database, constantly updated and published quarterly.

YOU GET...

Hardware—Over 12,000 products from Micros to Mainframes including peripherals—terminals, printers, memory devices, etc...organized by systems compatibility.

Software—The largest available inventory of business packages for micros, minis, and mainframes including operating systems, utilities, and application packages.

Communications Equipment—from modems and multiplexors to local networks, carriers and services. Quick reference comparison charts, plus all diagnostic and test equipment.

Services, Suppliers, Support—Most complete organized listing of suppliers from installation design to maintenance and data center operations.

READ WHAT USERS SAY...

"...Current and comprehensive listings are becoming indispensable."

Gary Yost
Marketing Services Director
ASK Computer Systems, Inc.

"Literally use it daily...dramatically shortens research time...provides more alternatives than would have been known or considered."

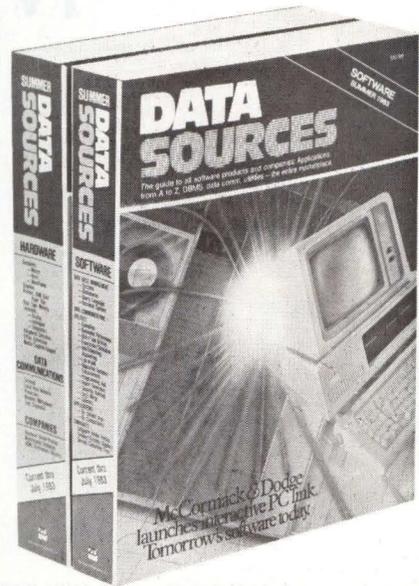
Curt Flatness, V.P.
Logic, Inc.

"Answer to a Systems Integrator's prayer...very effective for locating the equipment we need...using it for everything from single-user systems to systems interfacing with mainframes."

Richard Fletcher, President
Micro Computer Adaptation Procedure

"Dependable source of information otherwise unobtainable or costly to obtain..."

Barry Kukes, President
RSI Repair Service, Inc.



NEW FEATURES...

- ✓ Quick-reference product comparison charts.
- ✓ Market-tracking trends of new DP products.
- ✓ Before-you-buy selection criteria and checklist.
- ✓ Geographical listing of vendors offering on-site and depot maintenance.

ORDER NOW AND SAVE 50%

Yes! Rush me the latest two-volume edition of DATA SOURCES and enter my subscription at \$60.00 for 4 quarterly editions. I save a full 50% off the regular \$120.00 cover price.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

Nature of Company's Business _____

Please check appropriate box: END USER VAR/OEM DISTRIBUTOR
 DP MFG OTHER _____

An information product of Ziff-Davis Publishing Company. Satisfaction guaranteed.

Return coupon to:

DATA SOURCES

P.O. Box 5845, Cherry Hill, N.J. 08034.

Residents of Ca., Co., Ct., D.C., Fl., Il., Ma., Mi., Mo., N.J., N.Y., Vt., please add applicable state taxes.

T021

*This advertisement is neither an offer to sell nor a solicitation of an offer to buy any of these securities.
The offering is made only by the Prospectus.*

June 6, 1983

2,363,000 Shares

MICROPOLIS™

Common Stock

Price \$17 Per Share

*Copies of the Prospectus may be obtained from such of the Underwriters as may legally offer these securities
in compliance with the securities laws of the respective states.*

Alex. Brown & Sons

Kidder, Peabody & Co.
Incorporated

Bear, Stearns & Co.

The First Boston Corporation

A. G. Becker Paribas
Incorporated

Blyth Eastman Paine Webber
Incorporated

Dillon, Read & Co. Inc.

Donaldson, Lufkin & Jenrette
Securities Corporation

Drexel Burnham Lambert
Incorporated

Hambrecht & Quist
Incorporated

E. F. Hutton & Company Inc.

Lazard Frères & Co.

Lehman Brothers Kuhn Loeb
Incorporated

Merrill Lynch White Weld Capital Markets Group
Merrill Lynch, Pierce, Fenner & Smith Incorporated

Prudential-Bache
Securities

L. F. Rothschild, Unterberg, Towbin

Salomon Brothers Inc

Shearson/American Express Inc.

Smith Barney, Harris Upham & Co.
Incorporated

Wertheim & Co., Inc.

Dean Witter Reynolds Inc.

Bateman Eichler, Hill Richards
Incorporated

A. G. Edwards & Sons, Inc.

Montgomery Securities

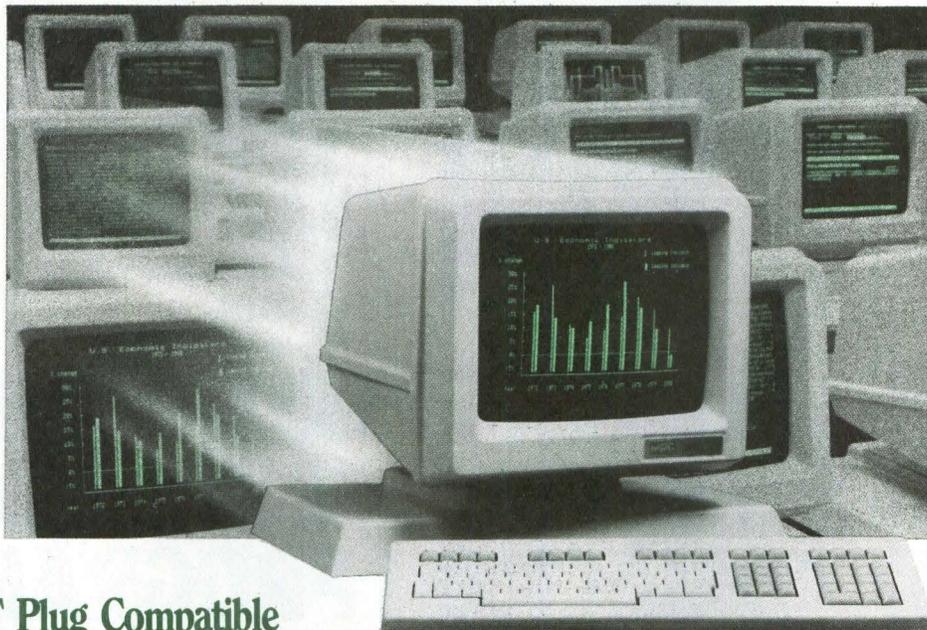
Oppenheimer & Co., Inc.

Robertson, Colman & Stephens

Sutro & Co.
Incorporated

Thomson McKinnon Securities Inc.

MPC Puts the Big Picture in Graphic Detail



DEC™ VT Plug Compatible

Today's price competitive alternative for ANSI 3.64 video display terminals, the MPC 1250 uses an enlarged 14" screen and sophisticated bit map graphics to fully emulate the DEC™ VT/125. For smart alphanumeric editing, the MPC 1200 emulates full functionality of the DEC™ VT/131-VT/132 Series. The 1250 accepts all REGIS™ operating system software.

Not only does the 1200/1250 Series deliver superior emulation of the DEC VT models, but they offer the extras you've been looking for . . . like an ergonomic design with video and screen enhancements. Any way you view it, the

heavily featured MPC 1200/1250 Series gives you the DEC™ VT alternatives worth looking into!

Available Now!!!

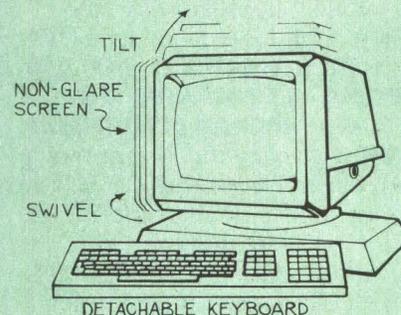
Why wait through long factory lead times? Your local MPC distributor can deliver your MPC 1200/1250 DEC™ VT plug compatibles, loaded with extras, from stock today.

A worldwide distribution network provides sales and service for the MPC family of sophisticated CRT terminals. Call (703) 430-1800 for the name of your nearest distributor.

You'll See Built-in Extras at no Extra Cost!

MPC's 1200/1250 Series brings you the costly options of other terminals as standard features. Take a closer look at the extras in MPC's new generation of engineering excellence:

- **Superior Monochrome Graphics.** Color Optional; 1250 Model
- **640 x 480 Readable bit map**
- **24 Programmable Function Keys,** plus programmable numeric keypad, store up to 36 individual function sequences in NVR.
- **Eight pages of Video Memory**
- **Double High, Double Wide Character Capability**
- **40, 80 or 132 Columns,** user selectable
- **Flexible Split Screens**
- **Enhanced Scrolling:** Jump, smooth, and bi-directional
- **Selectable Video Attributes** and adjustable brightness controlled from keyboard
- **Two RS-232 Ports**—bidirectional and independently controlled
- **14" Non-Glare Screen**
- **Detachable Keyboard** meets European DIN specs.
- **Soft Set-Up Plus Host Configurable**
- **UL Listed, FCC & CSA Approved**



Ergonomics: All MPC terminals offer an enlarged non-glare screen and adjust to individual preference by rotating 60° in either direction or by tilting up to 15°. The low profile, detachable keyboard meets new European DIN specifications.

Contact Your Nearest MPC Distributor

■ **Kierulff Electronics:** Call your Kierulff Division, (outside Calif 800-338-8811) ■ **Computer Peripherals Inc.,** Richardson, TX (214) 644-3606 ■ **Digital Solutions, Inc.,** Marietta, GA (404) 955-4488 ■ **Dayton-Forrester Associates,** Canoga Park, CA (213) 701-0127 ■ **Pro Com Sales,** Elk Grove, IL (312) 860-1028 ■ **The Tricom Group,** Hicksville, NY (516) 681-1222 ■ **MIDCOM COMMUNICATIONS, INC.,** Southfield, MI (313) 353-5696 ■ **Computer Dataco Inc.,** Kansas City, MO (816) 221-1212 ■ **Peripheral Business Systems,** Kirkland, WA (206) 823-6661 ■ **Peripheral Equipment,** Pleasant Grove, UT (801) 785-5009 ■ **Dynamic Systems North West,** Mukilteo, WA (206) 745-5311 ■ **RC Data Inc.,** San Jose, CA (408) 946-3800 ■ **Trans Alaska Data Systems, Inc.,** Anchorage, AK (907) 561-1776 ■ **Andor Systems,** Ontario, Canada (416) 746-2775

a division of C3 Inc.



Micro Products Company
Rte. 634 & Acacia Lane
Post Office Box 198
Sterling, Virginia 22170
Telex: 910759
Phone: (703) 430-1800

Barry Morgan-C3 Inc.
Kingswick House
Sunninghill,
Berkshire, England SL57BJ
Telex: 848980
Tel Ascot (0990) 23491

CIRCLE NO. 75 ON INQUIRY CARD

NOW IT'S EASY TO CREATE POWERFUL CUSTOM BAR CODE DATA COLLECTION PROGRAMS THAT DO EXACTLY WHAT YOU WANT.

The new INTERMEC 9410B Portable Bar Code Reader with INTERMEC's new Interactive Reader Language (IRL[®]) system is a *major* advance in bar code technology. The IRL system, contained in the 9410B firmware, gives you all the features of a flexible, high-level language. This means **THE NEW 9410B READER ALSO FUNCTIONS AS A POWERFUL, SELF-CONTAINED PROGRAM DEVELOPMENT SYSTEM** with only the addition of a "dumb" CRT. With the 9410B, you literally cut the development time of sophisticated, custom application, data entry programs from weeks to days and simpler programs from days to minutes. From the moment you receive the 9410B with IRL language, your program development task is almost completed.

The new 9410B with IRL language is user friendly and easy to learn. Its self-editing capability catches syntax errors as they are keyed, so the frustrations of those time consuming errors are eliminated.

With a full 64K of available RAM, the 9410B can store multiple-application programs and data so a single reader can perform several different jobs. Simply by wanding an application command, the operator can switch from shipping to inventory control, to tool crib check-out, to document tracking — virtually any data collection task.

The benefits of the new INTERMEC IRL language are enormous. Circle the reader service number to receive the technical report: "IMPLEMENTING IRL." Learn how to avoid wasting time with antiquated bar code hardware and outdated programming techniques. Get *all* the bar code data

collection tools you need to develop precisely the system you want. Contact INTERMEC, 4405 Russell Road, PO Box 360602, Lynnwood, WA 98036-9702. Call 206/743-7036. TELEX U.S. 152447. INT'L. 4740080.

INTRODUCING THE 9410B PORTABLE BAR CODE READER WITH IRL.



FOR LITERATURE, CIRCLE NUMBER 76.

FOR DEMONSTRATION, CIRCLE NUMBER 130.

INTERMEC[®]

The industrial bar code experts.

Systems in Manufacturing

Exploring the use of computers in the factory

Value-added system integration plays key role in driving robot market

By Frank Catalano

Preceding the Robot 7 conference and exhibition in Chicago last April, newsstands were filled with magazines and newspapers carrying cover or front-page articles about robots. When show time came, so did the radio and television news teams in numbers usually reserved for royal weddings.

Unfortunately for suppliers, however, robots are hotter in the media than they are in the market. Lingering effects of the recession and Japanese competition are impeding market growth, and analysts say those impediments won't soon disappear. But robot vendors could make industry problems non-issues if they supply value-added systems engineering with their products.

"Robotics isn't the business of robots anymore; it's the business of robot systems," says Laura Conigliaro, a market analyst with Prudential-Bache Securities Inc., New York. "It's the old story about end users looking for solutions to their problems, not just for devices." Those value-added solutions, she says, include tooling, gripper design, vision and sensing systems, application software and pre- and post-installation support.

Among the companies particularly geared to add such value are large factory-automation systems suppli-

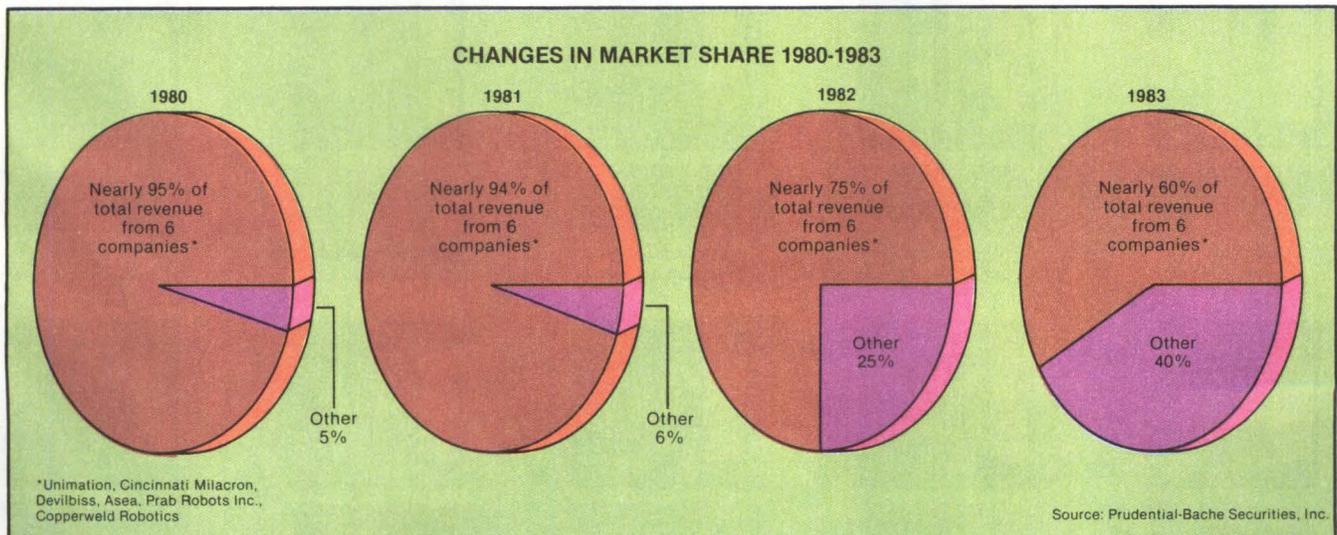
ers, robot-specialized vendors that address niche applications with turnkey systems and third-party system houses that design custom systems for end users or offer robots as options to other systems such as material-handling or test-and-inspection systems.

Gerald Michaels, director of the robotics study team within the Computer Integrated Manufacturing group at Arthur D. Little Inc., Cambridge, Mass., says that as robots are tied increasingly into factory networks, companies with roots in the computer industry will play key roles in driving the robot market by providing hardware and software interfaces to other factory systems.

The market and competition

Although the robot market totaled \$155 million in sales in 1981, Conigliaro says it grew to only \$195 million in 1982. She projects that by year-end, yearly sales will total \$205 million to \$250 million. Michaels at ADL projects that by 1987, the robot market will grow at a 28-percent annual rate and will be worth \$700 million.

In the short term, Conigliaro says, the 1981/1982 recession is affecting the growth of the robot market by limiting the amount that manufacturers can afford to spend on capital goods. But, she adds, the recession may benefit suppliers in the long term. "The recession

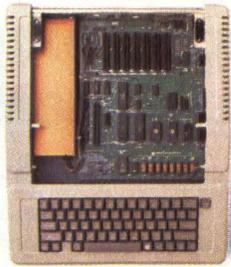


The combined market share of the six oldest vendors in the domestic robot market dropped by almost one-third between 1980 and 1983. Their share will continue to drop as the market becomes more competitive.

These people had the



Borg-Warner Educational Systems
Educational courseware



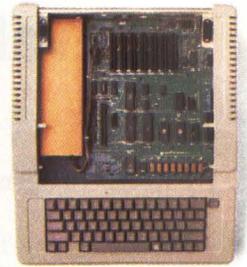
Advanced Information Systems
Computer aided drafting



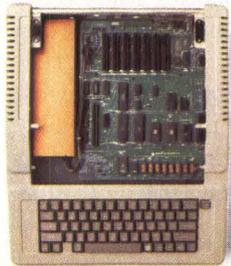
Varian Associates, Inc.
UV Spectrophotometry



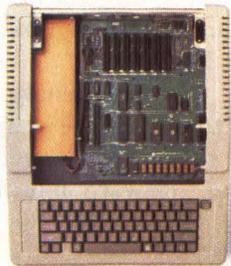
L&S Computers
Personnel profiling systems



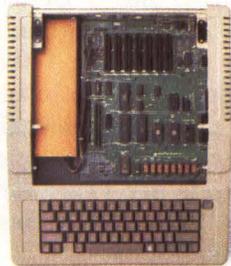
Rockwell International
Truck fleet management



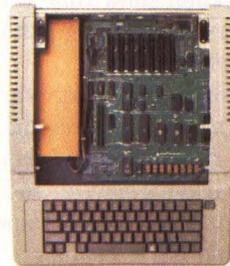
GenTech
Interactive video training



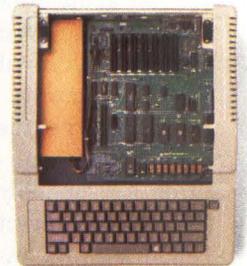
Farm Plan, Inc.
Agricultural software



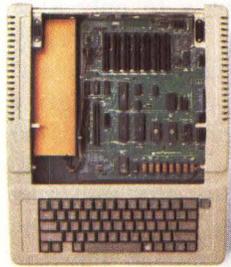
Core Technology
Burroughs terminal emulation



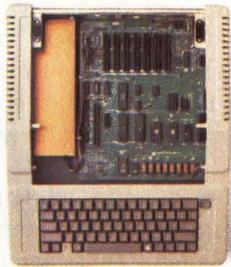
Gerber Scientific Products, Inc.
Computerized engraver



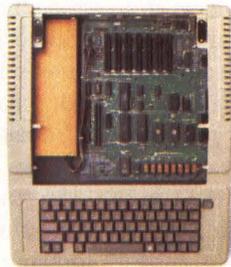
TSI Inc.
Particle sizer data analysis



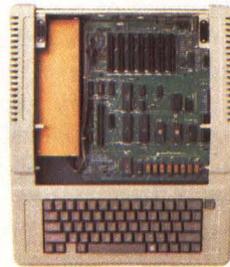
Enterprise Systems, Inc.
Hospital on-line inventory



Sandu
Industrial robotics



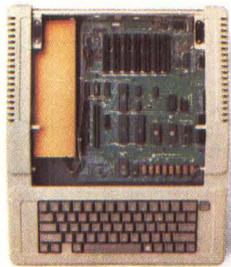
TCD, Inc.
Life insurance illustrations



Cascade Graphics Development
Computer aided drafting



CompCoWare Inc.
Custom instructional software



Autographix, Inc.
Designs, graph slides



Software Resources
Financial investment packages



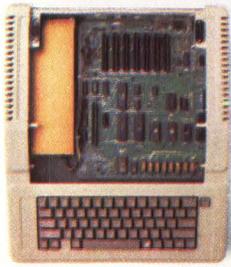
American Zettler, Inc.
Hospital nursing station



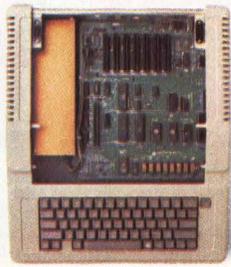
Basic Computer Literacy
Courseware



CPHA
Hospital data entry systems



Transportation Concepts
& Services
Interstate tariff rates



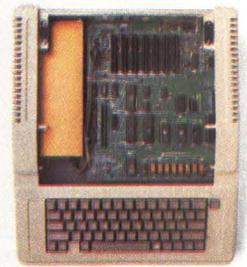
Energy Management Service, Inc.
Residential/commercial
energy analysis



Vitalograph Ltd.
Pulmonary systems,
on-line spirometer



Fisher Scientific Company
Intelligent color console
for mass spectrophotometer



First Software Corp.
Computer work station
for children

guts to be successful.



Alltech
Scientific instrumentation



Kwik-Kopy Corporation
Computerized pricing



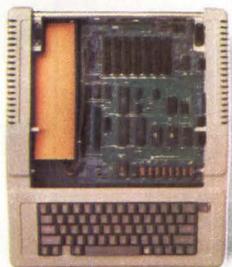
Warren E. Collins
Medical electronics



HCI Data
Agricultural software



Northwest Instrument Sys., Inc.
Digitizing oscilloscope



Federal Computer Systems Inc.
Pharmacy package



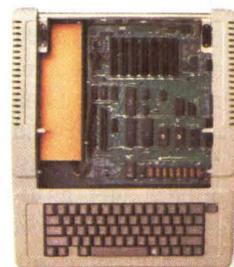
Cyborg Corporation
Lab data acquisition



Medical Graphics
Inhalation data analysis



Walman Optical
Opticians systems



Acroloc, Inc.
Milling machine control

There are more OEMs in more places doing more things with Apples[®] than with any other personal computer in the world.

Because Apples have more available software. More configuration versatility. And an OEM support program that will provide you with everything from our most basic computer products to complete, ready-to-roll systems.

All backed by technical documentation, software assistance, even hands-on training. And all part of a lasting commitment to this important marketplace.

So if you have the courage to succeed, but lack the guts, contact an Apple OEM Representative.

The most personal computer.  **apple**

Call (408) 973-3152 for more information, or for information regarding corporate purchases through our National Account Program.
Or write Apple Computer Inc., Advertising and Promotion Dept., 20525 Mariani Ave., Cupertino, California 95014. © 1983 Apple Computer Inc.

FOR OEM INFORMATION, CIRCLE NO. 60 ON INQUIRY CARD.

FOR GENERAL INFORMATION, CIRCLE NO. 148 ON INQUIRY CARD.

Systems in Manufacturing

has only served to prove the importance of cutting production costs," she says. "Manufacturers may start to look upon capital spending as more of an asset now rather than as an inevitable cost of doing business."

More menacing than the recession to established robot suppliers are new companies entering the market and chiseling away market shares. In 1980, six companies—Unimation, Cincinnati Milacron, De-Vilbiss, Asea Inc., Prab Robots Inc. and Copperweld Robotics—commanded 95 percent of the market. But within two years, the market was divided among more than 50 suppliers. The combined market share of the six vendors declined to 75 percent by 1982, and Conigliaro estimates that their share will decrease to about 60 percent by year-end.

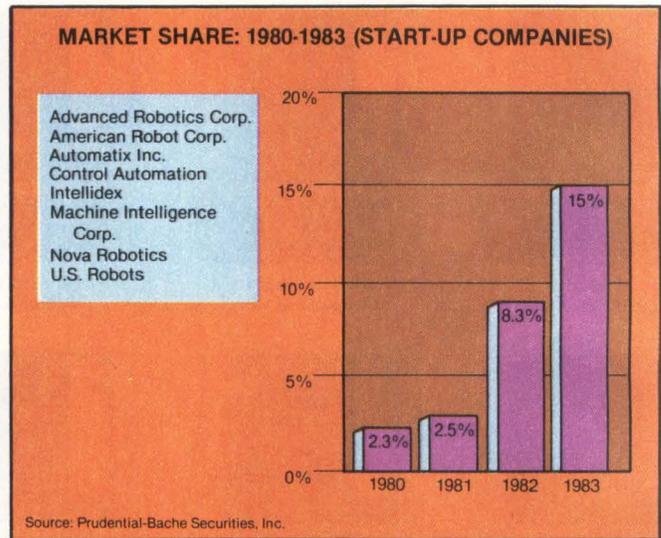
Among the recent market entrants are large system suppliers such as IBM Corp., General Electric Co. and Westinghouse Electric Co. (Westinghouse now owns Unimation, and the Westinghouse share of the market is included under Unimation's heading), as well as small robot-specialized start-ups such as American Robot Corp., Automatix Inc., Control Automation, Intellidex, Machine Intelligence Corp. and U.S. Robots.

But besides domestic competition, U.S. robot vendors must worry about Japanese competition. "On a product-to-product, price-to-price basis, Japanese robots are of exceptionally high quality," notes Conigliaro. "Were end users in the U.S. interested in simply purchasing a robot at the lowest possible price and willing to do their own engineering, application software, hardware and software integration and support, most of our domestic robot companies would be unable to compete." But Conigliaro believes that, rather than design systems themselves, most manufacturers will pay a premium for added application expertise.

Robot-specialized vendors

ADL's Michaels notes that most companies in the robot industry providing system expertise are robot-specialized vendors. Most turnkey systems still require extensive customization, although that is changing, he says. "Even if robots are being installed to do a specific application, every installation has to be considered a custom job with different tooling and software considerations," he says. "But as a vendor begins installing a number of systems into a specific application, spray painting, for example, he starts to see commonality among those installations."

Automatix, Billerica, Mass., offers turnkey systems for arc welding, inspection and assembly. Philippe Villers, company president and founder, says his company keeps prices low by narrowing in on a few



The above companies are the leading new entrants to the robot market in terms of their share of the market, says Laura Conigliaro, an analyst with Prudential-Bache Securities Inc. Their combined share began growing substantially last year and will continue throughout 1983.

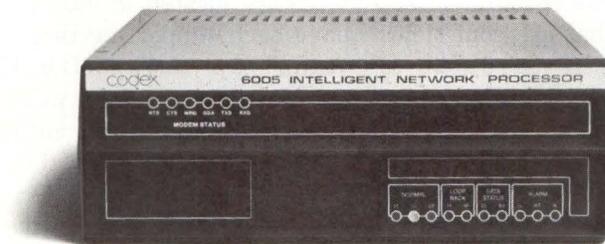
areas of specialization. "Our business is modular turnkey robotic systems, and our normal approach includes everything from conceptualization to training to actually putting the systems into the production mode," says Villers. "We offer a small selected number of robots, and the major elements in our systems intended for similar applications are repetitive. That gives us cost and performance advantages compared to what we would have if we took on a variety of applications. We're experts in a few areas."

Other companies providing turnkey systems include Intellidex, Corvallis, Ore., which offers wafer-handling and Winchester disk-head-assembly systems, and Control Automation, Princeton, N.J., which offers printed-circuit-board assembly systems.

Factory-automation systems providers

While robot-specialized vendors offer only robot systems and a few vision systems, factory-automation system companies offer a variety of factory systems that may include CAD/CAM, vision and sensing, computer numerical-control, programmable-control and factory-networking systems. "We're trying to give customers a total systems solution—the one-stop shopping kind of thing," says Charles Lamb, manager of automation systems engineering at GE. "Maybe a user wants to put a robot in today, another one next month and eventually some computer numerical-control machine tools. We provide that customer the capability to

HOW TO GET A NETWORK OFF THE GROUND.



*Codex 6000 Series
Intelligent Network Processors
for minicomputer networks.*

Say you have a small minicomputer network. A dumb terminal here, a dumb terminal there, and a DEC, HP, Data General or some other minicomputer miles from either. They're probably joined by modems and phone lines. But that's no way to run an efficient, economical network. And it doesn't give you any room to grow.

To really get a network off the ground—to really get one running efficiently—you need to take a different route.

You need a Codex 6000 Series Intelligent Network Processor specifically designed to improve the efficiency of smaller networks.

In a minicomputer situation with as few as two dumb, asynchronous terminals, these statistical multiplexers will boost operating efficiency, reduce line costs and protect your data from errors caused by line disturbance.

The model 6001 can support as many as eight asynchronous terminals. The 6005, as many as 16 asynchronous and synchronous terminals. Or any

combination of word processing or graphics terminals and printers.

Both models are inexpensively priced. So the money you save on line costs and error-free transmission will bring you a healthy return on investment quickly. Our Application Engineers offer planning expertise to help you get off the ground that much faster. And when you grow, we'll show you how these stat muxes can be linked to larger 6000 Series products as your networking needs expand.

In short, Codex 6000 Series Intelligent Network Processors can push your small network in the direction it ought to be going. Up.

Call **1-800-821-7700** ext. 898 for more information or write: Codex Corporation, Department 707-98, 20 Cabot Boulevard, Mansfield, MA 02048.

codex

 **MOTOROLA INC.**
Information Systems Group

Systems in Manufacturing

expand with systems that will all be able to compete with one another. I'm not saying that all of the pieces fit together yet—most of our robots can't talk to one another at this point—but most manufacturers are not ready for integration today and are just installing their first robots. We're working on all the problems, and when users are ready, we'll be ready too."

Along with providing a variety of factory systems, GE offers consulting and planning services to help end users decide which processes to automate. The company also provides system implementation and support.

One criticism users have of factory-automation system companies such as GE is that after buying one of GE's 11 robots or a system from the company's CAD-specialized subsidiary, Calma, users are locked into the GE solution. When users want to expand, they are forced to expand with other GE products. Lamb counters that criticism, saying that GE recognizes that other systems are on the market that are sometimes more appropriate for an application. "If you're going to be in the factory-automation systems business, you've got to recognize that there is already an invested base of products that customers have installed," he says. "We will work with these products and integrate them into our systems approach for the customer."

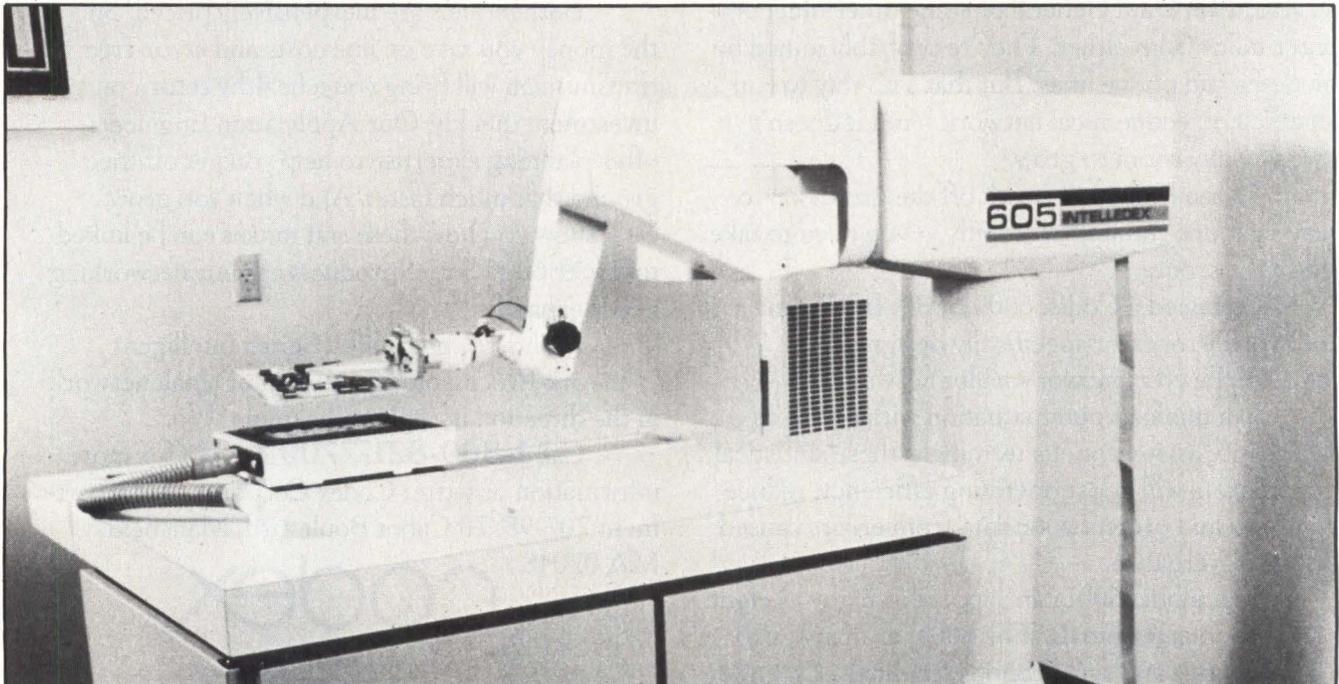
Jim McDonald, division director of industrial automation at IBM, says his company has only recently entered the robot market but has been providing other

factory-automation systems for years. Such systems include CAD/CAM systems, manufacturing-resource and material-requirements-planning packages, factory terminals, high-speed communications channels and the computers that control these systems. "If you look at all the elements of a factory-automation system, we have them," he says. However, unlike GE, IBM does not provide system engineering assistance with its robots, depending instead on value-added remarketers.

Third-party systems companies

IBM's VARs fall into two categories: those that provide optional IBM robots with their normal product lines in applications, such as conveyer systems and circuit-board test systems, and those that custom design robot systems for customers and incorporate IBM's and others vendors' systems, depending on the application. "Our VARs are located in various parts of the country and have been supporting their own lists of customers for years," says IBM's McDonald. "Usually, they've come out of the machine-tool world and have been designing systems around fixed automation. They know their customers as well as the ins and outs of factory applications. We provide them with expertise in computer controls, software and electronics. It turns out to be a complementary arrangement."

Marvin Minzen, president of Design Technology, Burlington, Mass., says that third-party systems



The Intellidex 605 robot is incorporated into a Zehntel PC-board test system. Besides designing turnkey systems in-house, Intellidex depends on third-party system houses like Zehntel to integrate robots into systems.

HOW TO GET A NETWORK OFF YOUR BACK.



Codex Data PABX for minicomputer networks.

You're in a situation now where there are more than 50 users in your minicomputer network. All of them working on dumb terminals directly linked to your processors. The situation is such that your processing capacity has just about reached its limit.

Do you add more minicomputers? Or do you add more processor ports?

Don't do either. There's a better way: The Codex IMS 7800 Data PABX.

Our Data PABX monitors and controls the way your people access your minicomputers. And it does such a good job that you can get more out of DEC, Prime, Data General or other minicomputers — even add more terminals — simply by making better use of what you already have.

So, for instance, instead of having dumb terminals dedicated to any single minicomputer, Data PABX lets you get any processor, from any terminal, from any point in your network.

This approach makes even more sense when you consider that any given terminal is only on-line about 20% of the day. It's a more efficient use of computer resources, more economical, and altogether easier to implement than any other option in front of you.

What's more, this approach is backed by Codex. Before the sale and after. So you know it will work when you install it. And you know it'll work long after.

Data PABX. It can cure all the pains of growth in a local or long-haul network.

Including the one in your lower back.

Call **1-800-821-7700** ext. 894 for more information or write: Codex Corporation, Department 707-94, 20 Cabot Boulevard, Mansfield, MA 02048.

codex

 **MOTOROLA INC.**
Information Systems Group

Systems in Manufacturing

houses like his company are a logical avenue for high-volume robot suppliers to take in getting their systems on the market. "A company like IBM can't devote its energy to installing a customer's robot system because its objective is to move as many robots as it can," he says. "Instead, IBM turns to companies that have been designing automation for years, are familiar with customers' needs and have automated parts-handling skills."

Some small robot-specialized companies also depend on third parties to incorporate robots into systems. Zehntel Inc., Walnut Creek, Calif., offers the Intellidex 605 system as the material-handling component of PC-board testing products. Stan Mintz, Intellidex president, says his company fosters such arrangements with other third-party systems houses. "We can't be experts in every application that our robot may be suited for," notes Mintz. "Instead, our company concentrates on providing turnkey systems in applications that we are most qualified to handle and in which we can sell the most robots. The third-party people can handle the rest."

ADL's Michaels says that older companies have production application experience because most of those companies evolved from the machine-tool, spray-painting and welding industries. That experience, he says, is a key to those companies' market success. In the coming years, however, users will want more than stand-alone automation islands that perform one task but do not tie into other factory systems.

Michaels says that some newer robot vendors that have evolved from the computer industry are best-suited to serve those integration needs. "Computer-oriented robot companies realize that their robots are going to have to be a part of future factory networks," he says. "They will be the leaders in bringing that technology into robots to allow that to happen." Those technologies, he adds, include high-level programming languages, sophisticated computer controllers with great computing capabilities and network interfaces. Although robot vendors are working on the technologies, their implementation is still some years away, says Intellidex's Mintz. "Users have to learn to walk, before they can learn how to run," he says. □

LOW COST DISK BACKUP OR DATA LOGGING FOR RS-232 ■ MULTIBUS* ■ S-100 ■ Q-BUS**



*Trademark of Intel Corp.

**Trademark of Digital Equipment Corp.

FEATURING:

- 15M bytes of formatted storage per cartridge
- Read/Write at up to 1.2M bytes per minute, 30 ips
- High speed 90 ips search
- Full system hardware and software compatibility
- Proven data reliability
- Streaming or start/stop operation
- Optional serpentine recording
- Tape Archive Utility software for disk backup and restore (S-100 and Multibus)
- Small desktop size

Come to Digi-Data for all your 1/4" and 1/2" tape drive requirements. Digi-Data has been designing and manufacturing tape drives and subsystems for 21 years.



**DIGI-DATA
CORPORATION**
8580 Dorsey Run Road
Jessup, MD 20794
Tel. (301) 498-0200
TWX 710-867-9254

® ... **First In Value**

In Europe contact:
Digi-Data Ltd.
Kings House
18 King Street
Maidenhead, Berkshire
England SL6 1EF
Tel. 0628 29555-6
Telex 847720



HP's 64000 Logic Development System...

How it blasts through software BOTTLENECKS

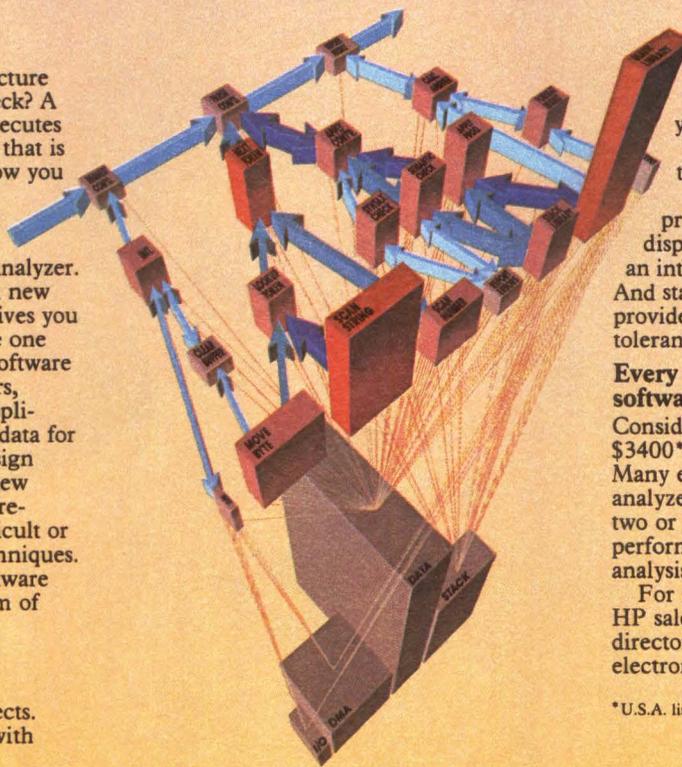
How would you like to have a picture that identifies a software bottleneck? A picture taken as your software executes in real time? Via a measurement that is completely nonintrusive? Well now you can do all that. Via a low-cost subsystem for HP's 64000 Logic Development System called the 64310A Software Performance Analyzer.

But that's not all this powerful new software tool can do for you. It gives you a perspective on software like the one shown to help you characterize software through benchmarks of processors, operating systems, algorithms, application programs, etc. It provides data for intelligent hardware/software design trade-off decisions. It gives you new insight into software debugging, revealing interaction problems difficult or impossible to spot with other techniques. And it can put a spotlight on software inefficiencies that rob your system of performance and add extra cost.

Six different perspectives on software in action

Consider your own software projects. What problems could you solve with these six measurement modes?

1. *Memory activity* measurements, which show how your memory resources are being utilized.
2. *Program activity*, giving you a direct measure of time or occurrences required by specific software modules.
3. *Module duration*, showing execution time distribution of a specific software module as it reacts to internal and external stimuli.
4. *Module usage*, a measure of module demand.
5. *Inter-module duration*, the distribution of times from the exit of one module to the entry of another.
6. *Intermodule linkage*, the number of direct transfers between specific module pairs.



That's because of its high-level symbolic interface that lets you define measurements and view results in familiar software terms using module names and variable names directly from the program being executed. Histogram displays of all measurements give you an intuitive feel for software activity. And statistical measurements and displays provide confidence level and error tolerance information.

Every lab should have at least one software performance analyzer

Consider this. The 64310A, costing just \$3400*, can be added as a plug-in board. Many engineers who have used this analyzer say they've gotten a factor of two or better improvement in software performance with very little effort. Few analysis tools offer so much for so little.

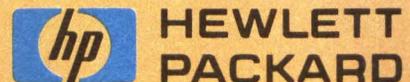
For more information, call your local HP sales office listed in the telephone directory white pages. Ask for the electronic instruments department.

*U.S.A. list price only.

Individually, in combination, and interactively with emulation and logic analysis, these measurements give you tremendous new insight into software activity resulting in higher performance software with less development time.

High-level commands and histogram displays spell simplicity

This is an analyzer software engineers and programmers will feel at home with.

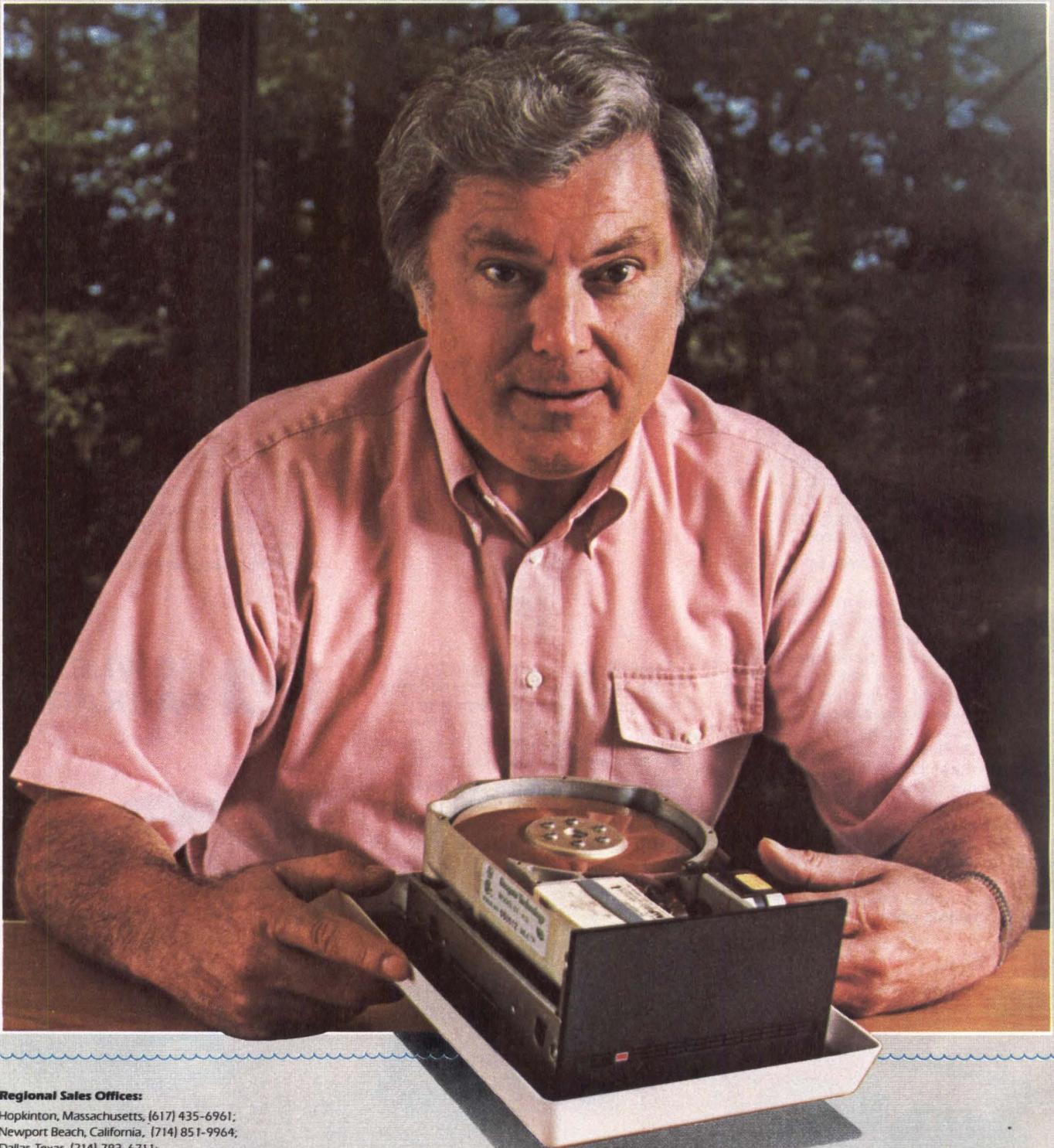


HP-IB: Not just IEEE-488, but the hardware, documentation and support that delivers the shortest path to a measurement system.



CIRCLE NO. 78 ON INQUIRY CARD

UNCOMPROM



Regional Sales Offices:

Hopkinton, Massachusetts, (617) 435-6961;

Newport Beach, California, (714) 851-9964;

Dallas, Texas, (214) 783-6711;

Schaumburg, Illinois, (312) 397-3727

Authorized U.S. Distributors: Arrow Electronics and Wyle Laboratories

European Sales Office:

Gassnerstrasse 5

8000 Munich 19

West Germany

49 89 177017

© 1983 Seagate Technology

WINCHESTER DRIVE

"We produce Winchester disc drives of uncompromising quality. We build them in high-volume, and we deliver them to you on time."

—Alan Shugart, President, Seagate Technology.

The reputation of your system depends on the quality and reliability of key components. One bad drive can destroy customer satisfaction. That's why Seagate goes beyond industry-standard testing.

Our "zero-defect" program assures that every assembly, disc, electronic component, motor, and metal part meets our design and workmanship standards *before* assembly, then tested again in final tests where functional parameters are 100% verified and data integrity certified. Every drive is shipped with an individual printout of test results.

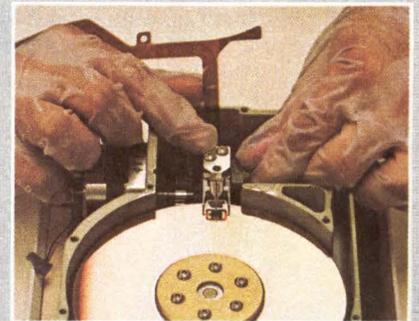
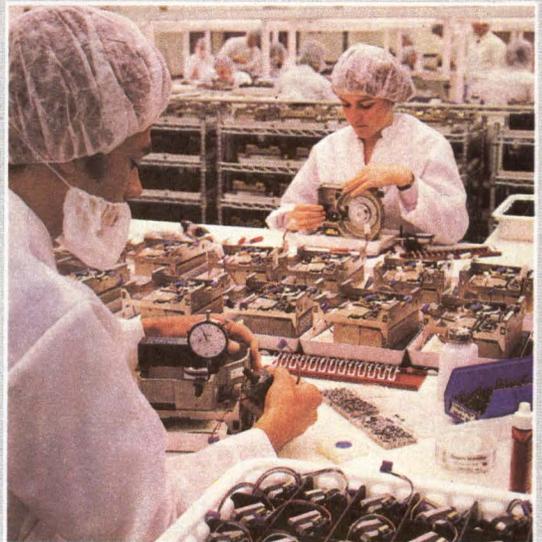
When you receive that drive, you can use Seagate's exclusive Receiving Test Station (RTS) that provides direct correlation with Seagate in-house test systems. When you assemble a Seagate drive in your system, you know it's right.

We back this promise with our industry-leading "105% Guarantee" program. If a Seagate drive doesn't pass your incoming inspection, we'll repair the unit and rebate 5% of your purchase price.

In 1983, Seagate will ship more than 300,000 Winchester disc drives from the most sophisticated Winchester production facility in the world. And every drive will be backed by the largest Winchester support team in the industry.

We also provide you with extensive technical and applications assistance, timely spares, and comprehensive documentation.

While we're proud that Seagate has been specified by the industry's largest and most quality-conscious OEMs, you don't have to be big to enjoy uncompromising quality, the lowest return rate in the industry, competitive pricing, and volume delivery. So call Seagate, the world's leading supplier of uncompromised 5¼-inch Winchester disc drives.



"Turning the tide in disc technology"

Seagate Technology



920 Disc Drive, Scotts Valley, CA 95066, (408) 438-6550, TELEX 176455SEAGATESCVL

CIRCLE NO. 79 ON INQUIRY CARD

How to buy a computer by the numbers.

Introducing the Cromemco C-10 Personal Computer. Only \$1785, including software, and you get more professional features and performance for the price than with any other personal computer on the market. We've got the numbers to prove it.

The C-10 starts with a high-resolution 12" CRT that displays 25 lines with a full 80 characters on each line. Inside is a high-speed Z-80A microprocessor and 64K bytes of on-board memory. Then there's a detached, easy-to-use keyboard and a 5¼" disk drive with an exceptionally large 390K capacity. That's the C-10, and you won't find another ready-to-use personal computer that offers you more.

But hardware can't work alone. That's why every C-10 includes software — word processing, financial spread sheet, investment planning and BASIC. Hard-working, CP/M[®]-based software

that meets your everyday needs. Software that could cost over \$1000 somewhere else. FREE with the C-10. There's really nothing else to buy.

But the C-10's numbers tell only part of the story. What they don't say is that Cromemco is already known for some of the most reliable business and scientific computers in the industry. And now for the first time, this technology is available in a personal computer.

One last number. Call **800 538-8157 x929** for the name of your nearest Cromemco dealer, or to request literature. In California call 800 672-3470 x929. Or write Cromemco, Inc., 280 Bernardo Avenue, P.O. Box 7400, Mountain View, CA 94039.

CP/M[®] is a registered trademark of Digital Research, Inc. All Cromemco products are serviced by TRW.



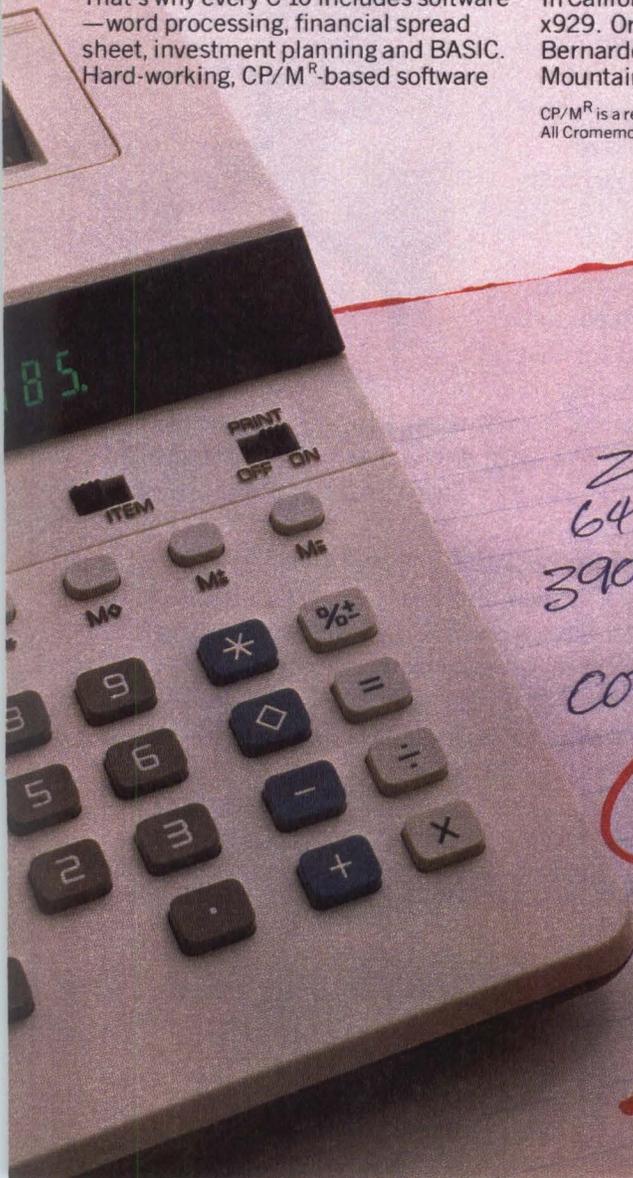
Cromemco
Tomorrow's computers today

CIRCLE NO. 80 ON INQUIRY CARD

Z-80A
64K RAM
390K DISK DRIVE
12" CRT
COMPLETE SOFTWARE

\$1785

CROMEMCO



Systems in Manufacturing

Control Automation robot works with any controller or programming language

A new robot designed to handle precision-assembly applications is available from Control Automation Inc., Princeton, N.J. Called the Mini-Sembler, the robot is intended for such tasks as inserting odd-shaped components onto printed-circuit boards, as well as assembling such electronic devices as calculators, small motors, disk drives, switches and keyboards. Customers include GTE, Hewlett-Packard Co., Magnavox, NCR Corp. and Tektronix Inc.

The Mini-Sembler is available with the HP 9915A microcomputer—the industrial version of the HP 85 system—which is programmed in BASIC and serves as the robot's controller.

Mike McCraley, director of marketing at Control Automation, says that because the Mini-Sembler's mechanical arm receives its instructions in ASCII code via an RS232 serial data port, a user can configure a system using any computer as the robot controller and can use any language to program the system. Although Control Automation wrote the robot commands in BASIC, a user who wants to use FORTRAN, for instance, can assign FORTRAN names to the BASIC commands and then use a compiler to translate his program in ASCII strings that the robot can understand. With this feature, McCraley points out, end users or system integrators are not locked into any one robot vendor's hardware/software solution.

"The early robot suppliers developed egocentric systems revolving around their respective controllers that had to be programmed using the robot vendor's own language,"

he says. "The user was short-changed because if he had more than one robot and each robot was supplied by a different vendor, his programmers had to learn a number of new languages. Worse yet, each robot had its own controller that couldn't communicate with the next robot's controller."

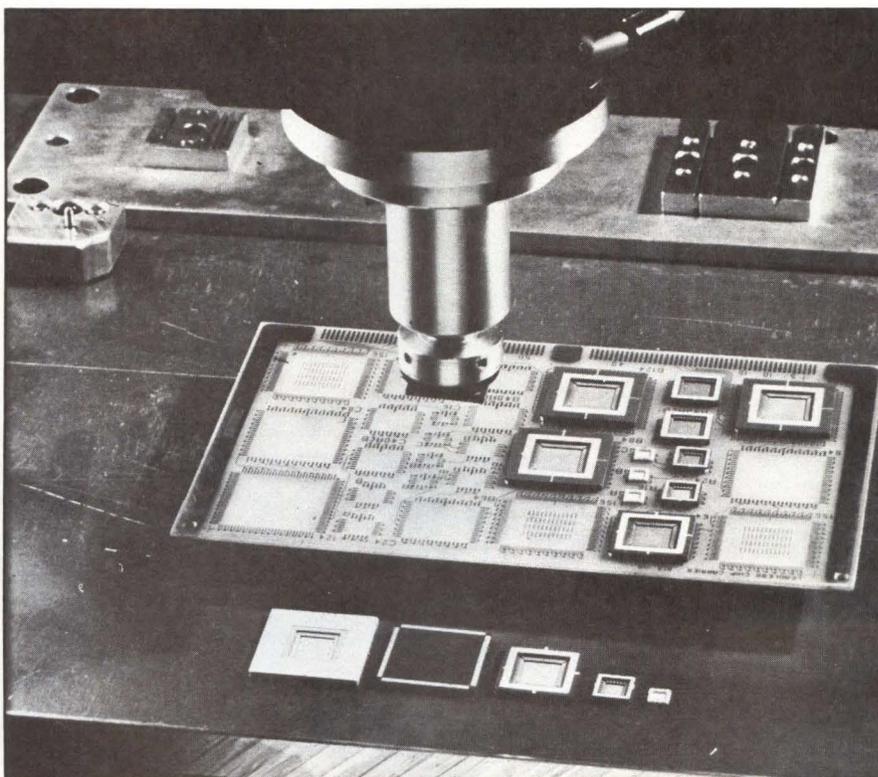
Control Automation offers the HP 9915A as an option with the Mini-Sembler because of its price/performance capabilities. "But," McCraley states, "if a customer wants to use a DEC VAX computer instead and program that system in Pascal, FORTRAN, FORTH or whatever, he has the option with our robot."

An Intel 8086 microprocessor,

housed in the Mini-Sembler's mechanical arm, coordinates the motions of the robot's four servo-powered axes. Each axis is controlled by an Intel 8051 microprocessor. The Mini-Sembler can lift as much as 5 lbs. with a precision of ± 0.001 in.

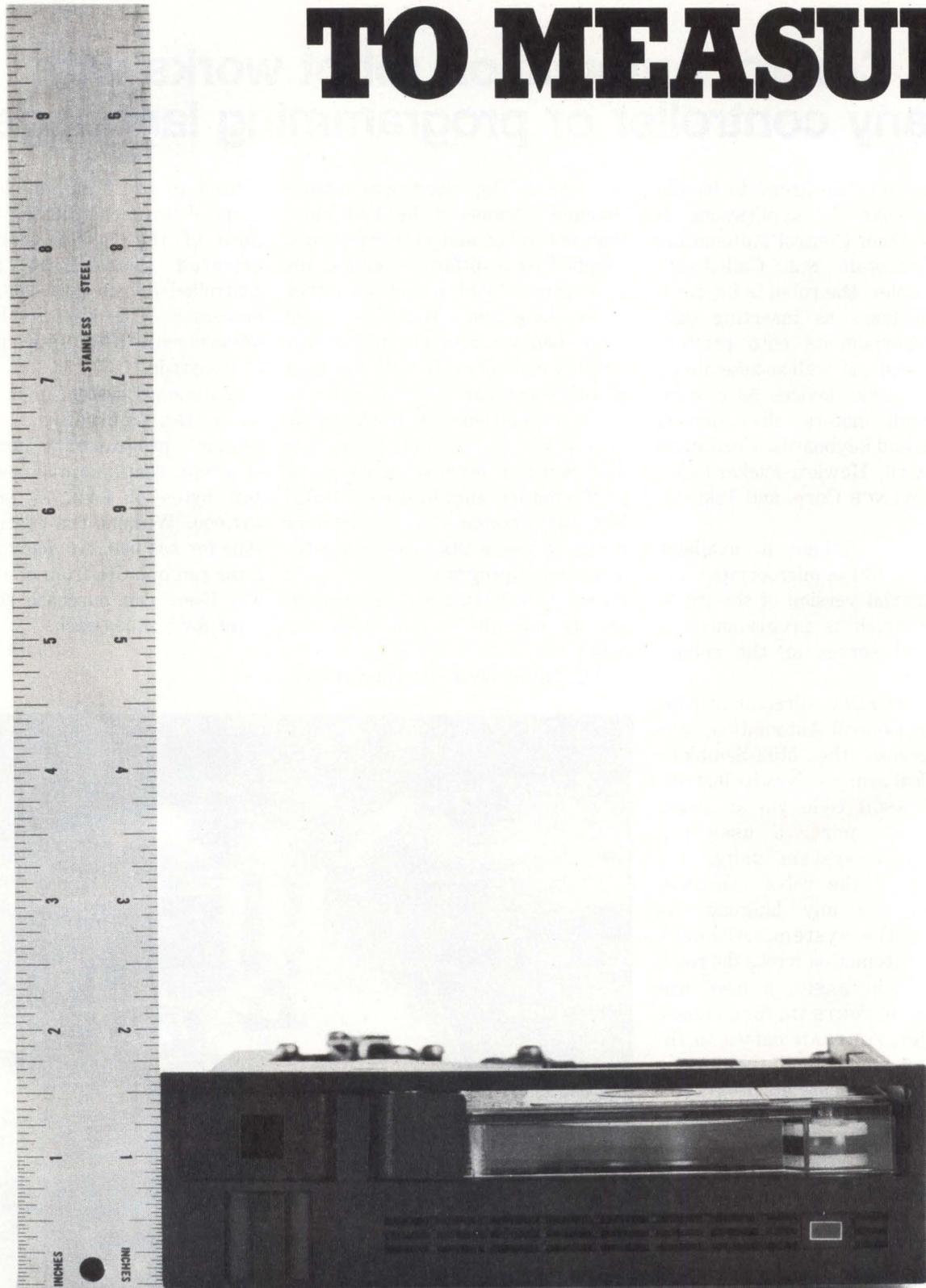
A standard system, including the HP 9915A controller, a teach-pendant programming unit, self-checking, real-time diagnostics and 16K bytes of RAM, is priced at \$37,000. Without the controller, it sells for \$35,000. As many as three arms can operate from one controller. Users can purchase additional arms for \$24,000 each.

—Frank Catalano



Control Automation's Mini-Sembler robot can be controlled by any computer and programmed in any language. It is targeted to precision-assembly applications.

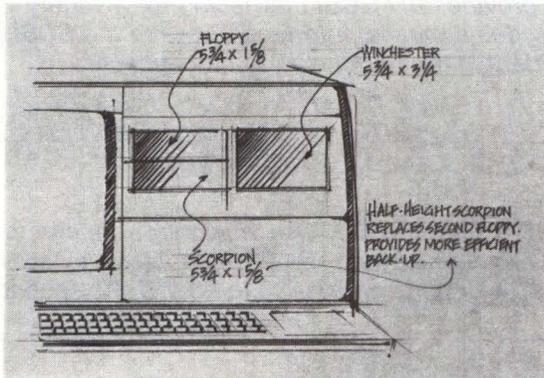
THE 5¹/₄" STREAMER TO MEASURE



OTHERS WILL HAVE DOWN TO.

Introducing the Scorpion™ half-height 5¼" mini streamer.

Once again, Archive has the Winchester back-up others will have to measure up to. Only this time, they also have to measure down. Because the Scorpion is only 1.625" high.



It fits the footprint of half-height floppy disk drives. So no change in existing cabinetry is necessary. Yet it still gives you up to 60MB of storage.

Now system designers can choose from a wider variety of storage combinations. For example, half-height Scorpion, half-height floppy and 5¼" Winchester.

And our standards meet your standards. The standard Archive (QIC-02) interface and QIC-24 format are both incorporated in the Scorpion.

But that's only part of the story. Thanks to Archive's advanced LSI technology, the half-height Scorpion gives you higher capacity and more functions than many 8" streaming tape drives. Yet it has fewer parts, uses less power and is competitively priced.

For complete details and a free copy of our 176-page streaming handbook, return the coupon. Or call Archive today.

™Scorpion is a trademark of Archive Corporation.

FREE! STREAMING TAPE HANDBOOK.

To receive your copy, return this coupon to
Archive Corporation
3540 Cadillac Ave.
Costa Mesa, CA 92626
Attn: Marketing Dept. or call
(714) 641-0279



Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone (_____) _____

Send me my free book.

Send me additional information about Archive ½" Streaming Tape Drives.

Send an Archive sales representative.

Telex: 4722063 Domestic Telex: 183561

ARCHIVE

CORPORATION

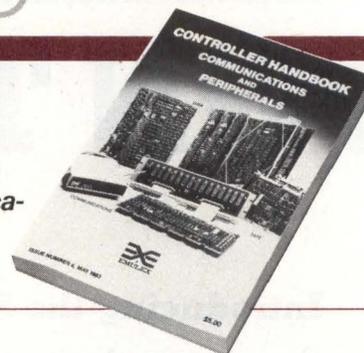
CIRCLE NO. 81 ON INQUIRY CARD

EMULEX TALKS DEC

5

WE WROTE THE BOOK ON DEC COMPATIBILITY...

The new *Emulex Handbook (Issue No. 4)* is hot off the press. It tells you everything you need to know about all Emulex disk, tape and communications controllers, including the celebrated new products introduced at NCC. Call or write to receive your free copy.



NEW PRODUCTS, PART I...

The UC01 has arrived! This single-board emulating host adapter provides full SCSI interfacing for a variety of controller/disk drives to DEC LSI-11 computers. The UC01 provides a parallel interface between the SCSI bus and the CPU. This allows up to seven controllers, usually resident in the peripheral, to be connected to each host adapter.

NEW PRODUCTS, PART II...

Emulex has something for PDP-11 and VAX-11/730 environments, too. Our new SC31 is a universal emulator for interfacing high-speed, high-density disk drives to these popular DEC computers. The SC31 handles almost any industry standard SMD disk drive in the 80 to 675 MByte range, with transfer rates up to 1.8 MBytes/second.

NEW PRODUCTS, PART III...

Don't think we overlooked VAX-11/750 and 780 users. For you, we've introduced two new disk controllers that will enhance your system's mass storage capability. The SC758 is a single-board controller that embeds directly into the backplane of a VAX-11/750. The SC788 is a single-board controller that plugs into the Emulex V-Master/780 Mass Storage Adapter, which installs as a sub-chassis within the VAX-11/780 CPU. Each controller board handles up to eight physical disk drives, ranging in capacity from 80 to 675 MBytes. Transfer rates up to 1.8 MBytes/second are supported by both controllers.

WE'VE GOT IT ALL FOR TAPE...

When you think of tape, think of Emulex. Our prices are competitive, our products reliable. We introduced the industry's first quad-sized TS11-compatible tape coupler series. For LSI-11 users, there's the TC02. For PDP/VAX-11s, try the TC12. Both models can handle every type of industry-standard formatted 1/2-inch tape transport. From conventional start/stop to streamers.

FOR THE RECORD...

The Emulex TC01 disk controller has a calculated MTBF of 41,000 hours. But in statistics compiled in field operations between 1980 and 1982, its actual MTBF was a whopping 164,930 hours! That's the equivalent of 31 years between failures, with the system in operation for 102 hours each week.



3545 Harbor Blvd., P.O. Box 6725,
Costa Mesa, California 92626,
Toll-Free (800) 854-7112, In Calif. (714) 662-5600.

Systems in Manufacturing

Martin Marietta Data Systems expands manufacturing software line

With the introduction of three new software products plus a broadening of the host computer types that can support its packages, Martin Marietta Data Systems, Greenbelt, Md., has intensified its drive into the market for manufacturing information systems. The new packages—MAS-Payroll, MAS-Personnel and MAS-Project Planning—join the established MAS-Manufacturing package in the firm's modular application systems lineup. The software runs on Digital Equipment Corp. VAX minicomputers and IBM Corp.'s 303X, 308X and 4300 series (including the 4321 SSX) mainframes. All except the project-planning module run on Hewlett-Packard Co.'s HP 3000 minicomputers as well.

In announcing the products, Gerald W. Stanley, vice president of application products, noted that all the packages are transportable among the various supported computers. Access modules and strategic system software must be acquired for each computer model, but the application code and the user interface remains constant from machine to machine. Stanley believes the software's compatibility with a number of popular computers will give the MMDS packages an advantage over packages from the computer vendors, who typically support their software only on their own machines. John P. Rohal, executive director of product marketing, says the company's Fortune 1500 customers are likely to have mixed-vendor systems, with central IBM mainframes tied to DEC and HP minis in subsidiaries or within divisions.

Another key selling point for the

MMDS products, Stanley believes, is the company's complementary remote computing services. Because all the announced packages can be run on the time-sharing service, he says, new customers can set up their operations using the vendor's remote computers and easily switch to an in-house operation.

The MAS-Manufacturing system is the same as a previous product, but it now runs on VAX and SSX systems as well. Prices for the VAX and HP 3000 implementations range from \$21,000 to \$75,000 depending on the number of modules acquired. Modules include master production scheduling, inventory control, manufacturing or shop-floor control, purchasing, cost control and engineering control.

Priced from \$19,000 to \$39,000, the MAS-Payroll software includes transmittal, payroll register, paycheck or statement of pay, tax listings, W-2 forms and 941 reports. Other features are automatic bank deposit, check reconciliation, automatic check reversal, internal balancing, audit trail and automatic deduction entry.

MAS-Personnel permits a manufacturer to consolidate personnel

data into a central, organized file. The system automates detail record keeping and provides for benefits administration; labor relations; report generation; training-skills inventory; applicant-reporting manpower planning; wage administration; and EEOC, ERISA and OSHA regulations. The package sells for \$19,000 to \$59,000.

The MAS-Project Planning package provides network scheduling; multiple-resource allocation, tracking and projection; "what-if" analysis, graphics; and flexible reporting formats. Priced at \$100,000, the package allows reports and plots to be processed while users perform other tasks on the system.

Manufacturing software likely to join the MAS family includes decision support, financing, sales and marketing and engineering and design packages, says Stanley. The engineering and design functions are expected to bring MMDS into the CAD/CAM market, he says. Another planned move is to integrate various microcomputers into the systems able to run the company's software, but when this expansion will occur is not known.

—Dwight B. Davis

Uniq introduces manufacturing system for DEC computers

Called SPIDER II, this modular closed-loop, net change manufacturing planning and control system from Uniq Digital Systems, Batavia, Ill., runs under the UNIX operating system on Digital Equipment Corp.'s VAX and PDP-11 series

computers. In addition, the DEC-MATE II word processor and DEC personal computers such as the Professional 350 can be used as workstations.

SPIDER 11 includes four basic accounting modules developed by

Reprints Reprints Reprints

Reprints of articles which have appeared in Cahners' magazines can easily become an important means of increasing your marketing results. This complete reprint service is available to you at a very low cost.

There are innumerable ways Cahners' reprints can be of vital assistance to your company's total marketing program. They are exceptionally valuable promotion pieces, particularly when you use them as part of a Cahners' Direct Mail Program.

Here are some uses which just scratch the surface of the many ways you can make reprints go to work for you and build your company's profits.

- Direct mail to customer and prospect lists.
- Trade show hand-outs
- Envelope stuffers
- Leave-behind pieces
- Direct mail to stockholders
- Sales tools for sale staff
- Use at company meetings
- Publicity Releases
- For display at corporate, field and show-room offices.
- Educate sales personnel
- Welcome new customers
- Demonstrate market superiority
- Direct mail to special lists
- Followup on inquiries about your product
- Announce a new product development

These are just a few of the ways you can strengthen your company's position as a leader in your market. Fast, high-quality service for all your reprint needs are available through Cahners' Reprint Service.

Mini-Micro Systems

FOR DETAILS, CONTACT:

A.W. Lehmann, Manager
Cahners Reprint Services
Cahners Plaza
P.O. Box 5080
1350 E. Touhy Avenue
Des Plaines, IL 60018
(312) 635-8800

Systems in Manufacturing

MiniComputer Business Applications Inc.: general ledger, accounts receivable, accounts payable and payroll. Also available are office- and factory-management packages developed by Uniq, such as the Unicalq 3D electronic spread sheet, the Unify database manager, an on-line factory time-recording system and electronic mail.

The modular structure of Spider II allows a manufacturer to expand or to modify the system after it is installed. The system is flexible and resistant to obsolescence because of its compatibility with the versatile

UNIX operating system, claims Uniq president Charles E. Richter Jr.

The basic system, including the four accounting modules and UNIX, is priced at \$65,000. Additional packages are in the \$3000 to \$6000 range, and quantity discounts are available.

Uniq Digital Systems, until recently called Digital Systems House, is an authorized DEC computer distributor. The company specializes in turnkey manufacturing and distribution systems based on VAX and PDP-11 computers.

HP adds quality-management software to MPN family

Quality Decision Management/1000 from Hewlett-Packard Co., Palo Alto, Calif., is an application software package for statistical quality control. It can help manufacturers find problems in the manufacturing process involving materials, workmanship and the process itself according to the company.

The package collects, analyzes and displays variable and attribute data from the manufacturing process and from product-test work stations. Detecting and correcting problems early can increase levels of quality and productivity and minimize costs associated with scrap, rework and work stoppages, says Gaylan Larson, division manager of HP's manufacturing and productivity division.

Using QDM/1000, quality-assurance and manufacturing engineers and production managers can get information in the form of control charts, histograms and scattergrams to identify problems and relationships between the process, materials, workmanship

and product defects. The software package runs on an HP 1000 minicomputer with the RTE-6/VM operating system and is suitable for a number of industrial-automation applications, says HP. These include incoming inspection, electronic product test, history-tracking and quality early-warning systems.

The company claims a menu-driven, fill-in-the-blanks approach allows engineers without programming experience to configure and implement the package. Data can be collected manually by user-defined CRT transactions on HP terminals, automatically from HP's family of desk-top computers or both. Users can view color graphs and tabular reports on CRTs or in hard-copy form from plotters and graphics printers.

This software product is part of HP's Manufacturers' Productivity Network, which also includes materials management, production management, processing monitoring and a programmable controller link. QDM/1000 sells for \$40,000 in the U.S. Delivery is eight weeks.

Performance runs in our family.



At WICAT, our primary objective is performance. This attitude has created today's most comprehensive line of super-micro computers. In terms

SYSTEM 220
8-48 USERS



SYSTEM 160
1-12 USERS

of breadth of product, software support, and perhaps most importantly, reliability, WICAT is a performance company.

WICAT has created a family of supermicro computers versatile enough to meet virtually any computing requirement. Our systems support from 1 to 48 users, 256K to 14 MB of main memory and from 10 MB to 474 MB of disk storage. So from the fast single user desk top S-150 to the powerful rack mounted S-220,

WICAT provides the strength, speed, and flexibility to perform according to your company's unique requirements.

In the course of just two years, we have been successful in providing WICAT's customers with two operating systems (MCS and UNIX),

performance. Our software designers have concentrated on producing tools which formerly existed only in the mainframe or mini-computer environment.

This performance story began with the introduction of the first 68000 based microcomputer and now includes the installation and support of thousands of systems worldwide. Consider this a personal invitation to call us and get more information about the WICAT family.



SYSTEM 155
1-12 USERS



SYSTEM 200
8-32 USERS



MG 8000

T-7000

9 programming languages, as well as word processing, data base management systems, a virtual electronic spreadsheet, and the WISE authoring system. This is per-

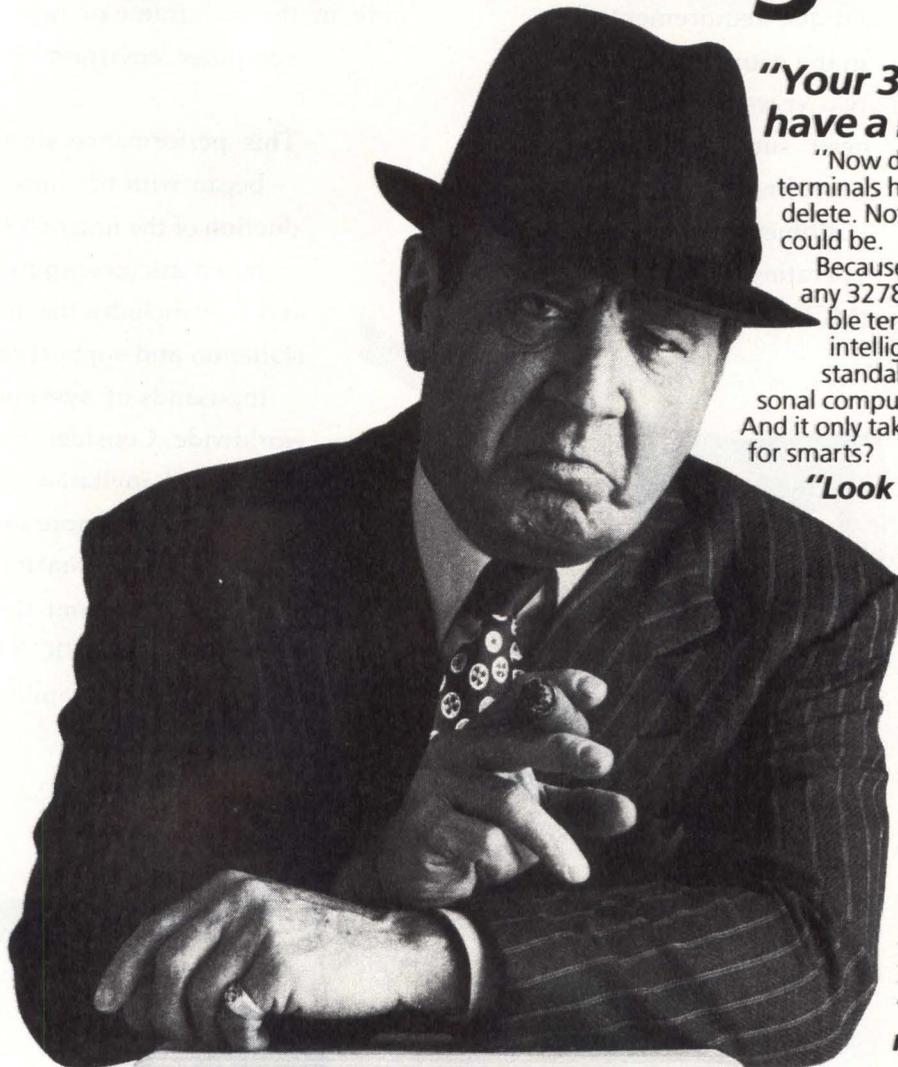


SYSTEM 150
1-6 USERS

WICATsystems

P.O. Box 539 • 1875 South State • Orem, UT 84057 • 801-224-6400 • Ext. 241

"Okay, IBM, you're smart. But you're not smart enough."



**"Your 3278 and 3178 terminals
have a lot on the ball. But."**

"Now don't get us wrong. We know your terminals have local storage. Cursor editing. Line delete. Not bad, IBM. But not up to where they could be.

Because our new AVATAR TC3278 can take any 3278, any 3178, or any IBM plug-compatible terminal and move it up past smart, past intelligent and turn it into a functioning standalone interactive workstation with personal computing capability. For not much money. And it only takes five minutes to install. How's that for smarts?

"Look at these plusses, IBM."

"This TC3278 gives you all that power with your existing terminal. So it takes less space, requires less maintenance. There's no retraining because people work on their familiar IBM equipment.

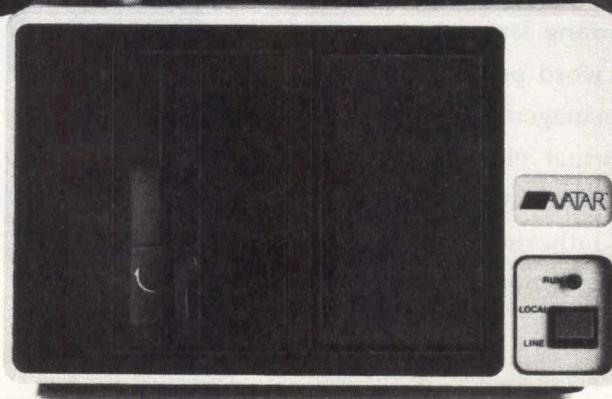
Your terminal will be able to communicate with your main database, with other non-IBM host computers in your organization, even with public databases, to ensure you're using consistent and accurate information.

Our TC3278 comes complete with its own word processing and electronic spreadsheet software, fully functional on your existing 3278 and 3178 terminals.

**"We're going to make you
more productive."**

"The name of the game is that this AVATAR TC3278 is going to increase your productivity, IBM. For not much money and no trouble at all.

Contact one of our guys for more information. Write 3R Computers, 18 Lyman Street, Westboro, MA 01581. Or call us at (617) 366-5300.



AVATAR™

Making IBM smarter since 1983.

© 1983 RRR Computers, Inc. Avatar is a trademark of RRR Computers, Inc. IBM is a registered trademark of International Business Machines Corp.

CIRCLE NO. 84 ON INQUIRY CARD

COMPUTER STORE SELLS ONE MILLIONTH LEMON

Store closes on day of celebration

PHILADELPHIA, PA—The Fruit Tree Computer Store was honored today as the first computer dealer to sell one million Lemon personal computers. Festivities were momentarily interrupted, however, when receivers for the banks appeared and seized all Fruit Tree assets, including the historic millionth Lemon.

"We were really squeezed," said Fruit Tree President Y.B. Bitter bitterly. "Personal computers with floppy disk software just don't have enough bite for important business applications. We wanted to get into real business oriented micros. But where were we going to get the applications software? It doesn't grow on trees!"

When asked if he had contacted Trac Line, Bitter was evasive. "Trac Line?" he responded. "Is that something like a tangerine?"



TRAC LINE has software solutions for business.

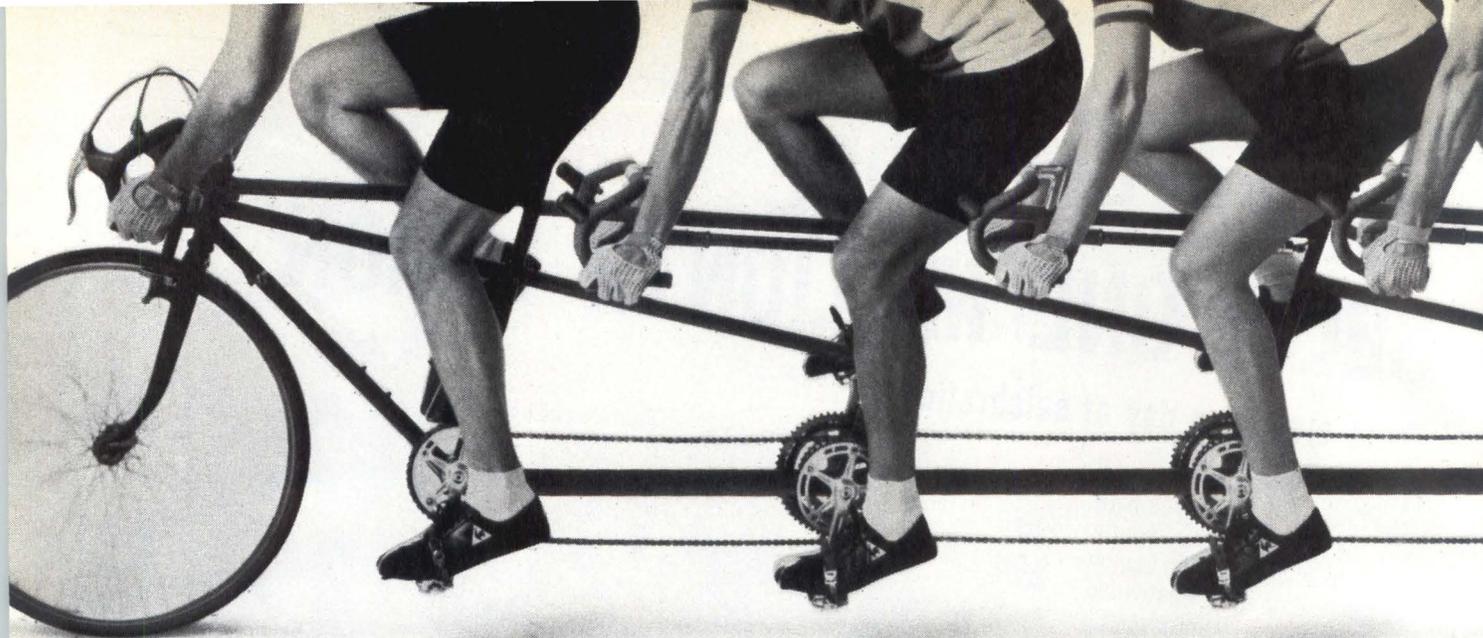
Trac Line Software Inc. offers proven business software, designed specifically for wholesalers and manufacturers. The packages, available on Oasis, are designed to run on multi-user 8 and/or 16 bit microcomputers with a minimum 10 megabyte hard disk—Dynabyte, Altos, Onyx, IBC, Compupro and many others. These fully integrated programs are decision driven to produce edited reports rather than yards of tabular data. Users call them the best solution for the problems of managing a business. Systems houses and dealers call them the best solution for staying in business.

Contact Trac Line Software Inc. at 51 Alpha Plaza,
Hicksville, N.Y. 11801, (516) 935-7500.

TRAC LINE[®]

We're the software solution for your business.

CIRCLE NO. 85 ON INQUIRY CARD



A simple analogy that explains why Plexus

The division of labor.

A very simple idea that says when you divide a job up among a lot of people or machines, the job goes faster.

In our case, this principle translates to a multiprocessor architecture, up to seven, to be exact.

And that's the reason our family of four UNIX™-based systems will get you where you want to go. Very quickly.

Multiprocessors. No waiting.

Most commercial UNIX-based systems being peddled these days rely on a single processor to do everything. No wonder they drag their feet as system loading increases.

Not us. We're all speed. All the time.

We distributed the UNIX operating system to where it does the most good.

Our 16-bit Intelligent Communications Processors rush terminal I/O to and from as many as 40 users. While also

taking care of low level communications so as not to interrupt the CPU.

Our 16-bit Mass Storage Processors handle disk I/O chores. So you get fast disk access and can keep data bases and important files easily accessible.

The performance that results is close to that of a VAX™ 11/780.

And costs about \$200,000 less.

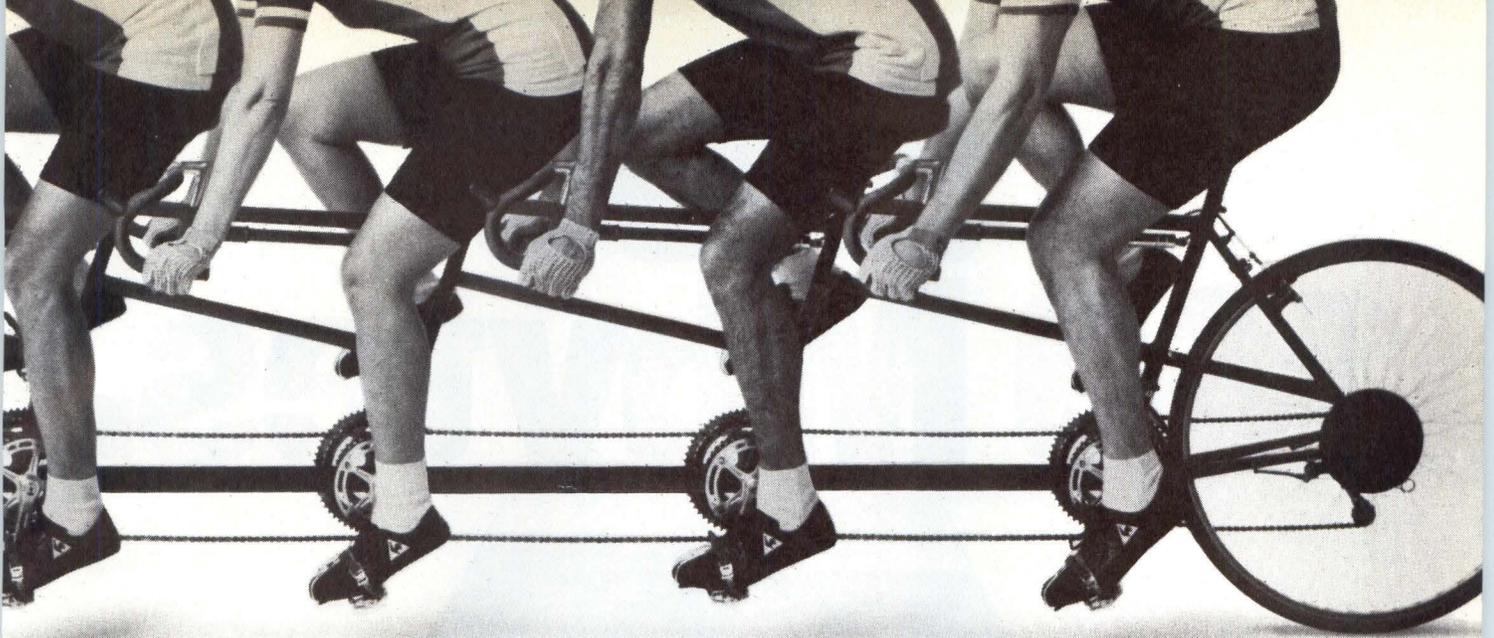
The Plexus Family. Speedsters all.

There's our Z8000 series, the economical 16-user P/25, or the 40-user P/40.

Or choose the newly introduced P/35 or P/60 models for 32-bit performance.

They're both based on the 12.5 MHz MC68000. With the addition of a few, shall we say, high performance modifications.

Like an on-board 4K cache memory. 16K of high-speed on-board RAM. A high-speed memory map. And a 32-bit memory path.



has the fastest Unix-based systems.

All of which help boost performance even further. Giving your system enough stamina to run multi-user applications at full speed all day long.

Plus more standards as standard equipment.

There are times when performance isn't everything. There's growth, too.

That's why we've included the MULTIBUS® standard for board-level expansion.

Plenty of serial RS232C ports for terminals of all kinds.

And standard software packages like COBOL, Pascal, BASIC, and C. Plus access to hundreds of third party UNIX packages.

We're right behind you.

No one, but no one, supports UNIX and you as completely as we do.

You'll get full software engineering

support, UNIX software maintenance, and even a software referral service for all your OEM programs.

Plus a field engineering force that can help you take the lead in your field, no matter what it is.

Want a race?

Come run a benchmark on one of our Plexus systems. To set one up, just call 408-988-1755, or write us at: Plexus, 2230 Martin Avenue, Santa Clara, CA 95050.

You'll see a performance feat no other commercial UNIX-based system can match. Which is understandable. We go so fast because we've got more going for us.

IPLEXIUS

Built for speed.

VAX is a trademark of Digital Equipment Corporation. UNIX is a trademark of Bell Laboratories. MULTIBUS is a registered trademark of Intel Corporation.

CIRCLE NO. 86 ON INQUIRY CARD

Save 160 Mbytes.



The D161 QIC-02 tape drive is the perfect matching mass storage device for your Winchester.

Quite a claim, true. But we can back it up.

Only the D161 gives you 160 MB of storage in an 8-inch envelope. And it's the only 1/2-inch tape drive that's compatible with industry-standard QIC-02 specifications.

In short, the D161 is the answer for applications which require more capacity than traditional

QIC-02 based hardware. And, of course, it features the reliability and interchangeability of 1/2-inch tape. To top it off, with the D161,

you just plug and go.

What could be simpler?

For a test drive, write for details on our Evaluator Package. See for yourself how easy it is to go from 20 to 160 MB in under 20 minutes.

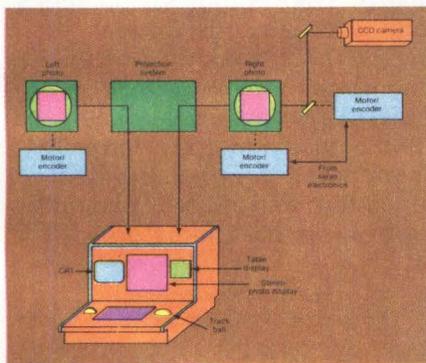
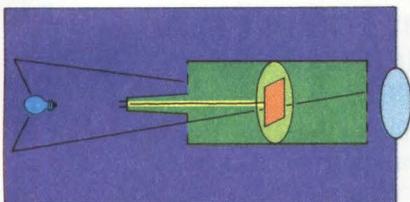
After all, you've got nothing to lose.

QIC.

ROSSCOMP
We're backing up your future.

16643 Valley View Avenue, Cerritos, California 90701 213/926-5533

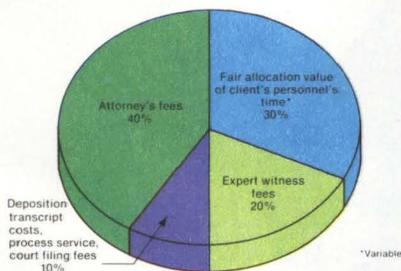
FEATURE HIGHLIGHTS



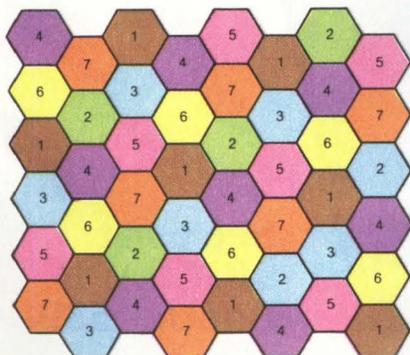
GRAPHICS: "Graphics workstation" means many things to many people, but the homogeneity of recent hardware developments is giving the term a new definition. To learn more, turn to p. 165 and consult MMS's survey of more than 80 graphics-workstation vendors and their products. . . Graphics hardware represents a much smaller percentage of system cost than it once did. Consequently, graphics users are paying increased attention to the cost of writing and maintaining software. **Software compatibility** across product lines has thus become a prerequisite for success. See p. 189 for more information. . . General Electric Co. has produced a **single-gun projector** that uses a light valve instead of a CRT. The PJ 5055, which houses the electronic gun and light valve chamber, a Xenon lamp and a projection lens, throws monitor-sharp color images onto 25-ft.-wide screens. For a closer look, see p. 197. . . Motorola's VME/10 is an example of an industry trend toward development systems with flexible, low-cost graphics capabilities. An analysis of this **desk-top micro** for OEMs in the industrial and scientific markets begins on p. 207. . . The **Traster stereo satellite** from Matra Technology integrates parallax data from binocular images into apparent 3D images that can be viewed through eyeglasses with correspondingly polarized lenses. Turn to p. 214 for further details.

STORAGE: Until recently, system integrators haven't been able to store more than 1M or 2M bytes in half-height minifloppy disk drives. Those people will be happy to find that Drivetec Inc. has produced a **"SuperMinifloppy,"** which packs 3.3M bytes and can also operate as a lower capacity industry-standard drive. The offering is profiled on p. 219.

LAW: The 1980s have been marked by numerous lawsuits from parent companies to spin-offs that present competitive challenges. The parent company claims protection rights based on patents, trade secrets and general laws against "unfair competition." The result has been lengthy, expensive trials that end in dubious decisions. See p. 231 for a look at **high technology and the law.**



DATA COMMUNICATIONS: As fast as the hardware is shrinking, the market for portable computer equipment is growing. Many applications involving such equipment depend on remote communications via telephone. But on-the-road data communications presents numerous problems. A new mobile-phone scheme, called **cellular radio**, detailed on p. 239, should add new momentum to the portable computer-equipment market.



Picture the best...

THE RAMTEK 9465: SUPERLATIVE PERFORMANCE STARTING AT JUST \$11,250.

The standard 9465 is an outstanding entry level value. The base price includes: 1280 X 1024 X 4 resolution, Z80 display processor, graphics processor, and video lookup table, all in one compact desktop unit. Add our color monitor for a package price of \$14,995.

OR, IF YOU PREFER, CONFIGURE YOUR OWN SYSTEM.

Alternately, the 9465 can be any system you want it to be. It's ideal for systems integrators, making possible an excellent match up of color graphics capabilities with applications needs. Options include: 1280 X 1024 resolution in 4-bit increments up to 16 bits, Z80 or MC68000 display processor, high-speed coordinate transforms, pixel formatter, host interfaces, peripherals, video generators, and a variety of monochrome or color monitors.

Prices are in U.S. dollars.

Z80 is a registered trademark of Zilog Inc.
MC68000 is a registered trademark of Motorola, Inc.

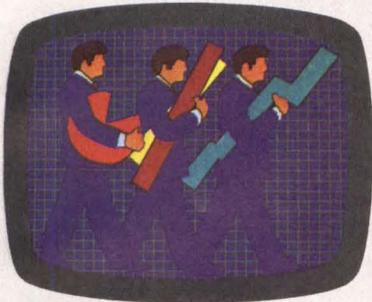


**See us at
SIGGRAPH,
Booth # 539**

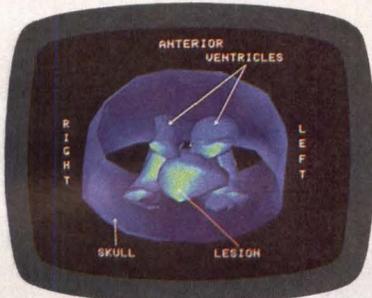
Solids Modeling System PADL
Sandia National Laboratories

for less.

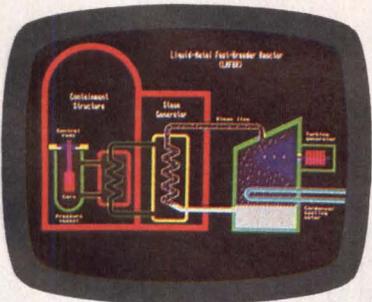
...for CAD and
business applications.



...for imaging
applications.



...for C&C and
process control.



...and beyond.



Digital Scene Simulation by Digital
Productions. Los Angeles, CA
© 1983 All rights reserved.

Introducing Ramtek's new 9465 high performance, low-cost deskside colorgraphics and imaging system.

No colorgraphic system provides you higher resolution, greater image control, or more capabilities for the money than Ramtek's new 9465.

If that sounds a lot like a repeat description of the pace-setting, Ramtek 9460 Series, it should. The 9465 is the latest extension of the 9460 concept. It shares the same design approach, is software compatible with the 9460, but adds to it a new compactness and economy.

This deskside system is available in an economical off-the-shelf version or can be user-configured, allowing you to tailor the 9465 to a wide range of applications needs. As an added benefit, the modular design of the 9465 allows for easy on-site upgrades.

Don't pay more. Don't get less. For literature and complete specifications, call our office nearest you. Or, contact us at 2211 Lawson Lane, Santa Clara, CA 95050. (408) 988-1044.

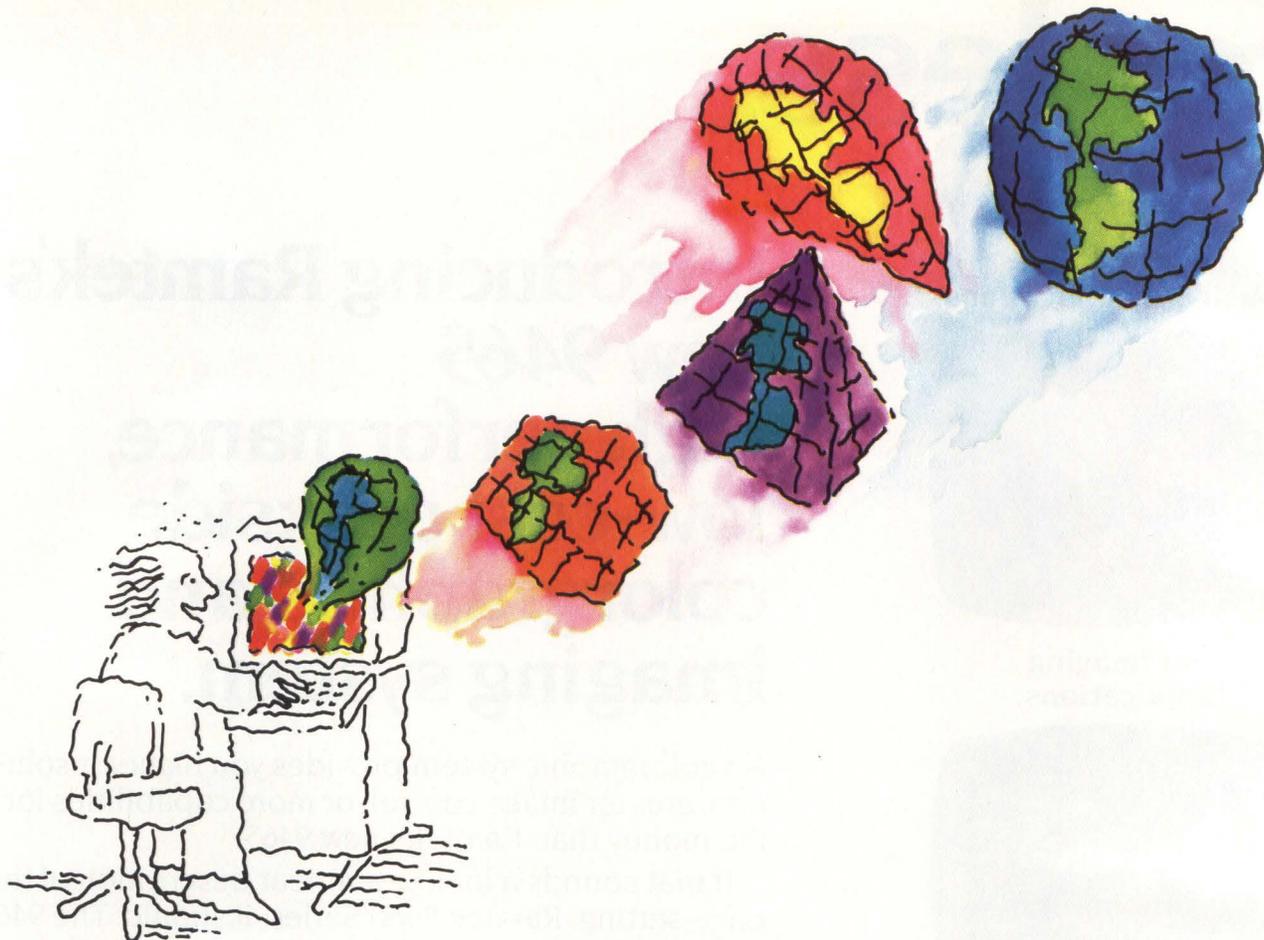


OUR EXPERIENCE SHOWS.

World Headquarters—Santa Clara, CA (408) 988-2211

European Offices—Amsterdam (31) 2968-5056;
London (8956) 76211; Cologne (2234) 78021

U.S. Offices—Dallas, TX (214) 422-2200; Los Angeles, CA (714) 979-5351;
Seattle, WA (206) 575-1600; Chicago, IL (312) 397-2279; Houston, TX (713)
774-2233; McLean, VA (703) 893-2020; Denver, CO (303) 694-0758;
Upper New York/Canada (716) 425-1742; New Jersey (201) 238-2090; Florida
(305) 645-0780; Boston, MA (617) 273-4590; Atlanta, GA (404) 446-3393.



CHANGE THE WORLD.

Or anything else you can display. Easier and faster than you imagine. Because D-SCAN's new GR-2412 terminal is changing the cost/performance standards for raster scan graphics.

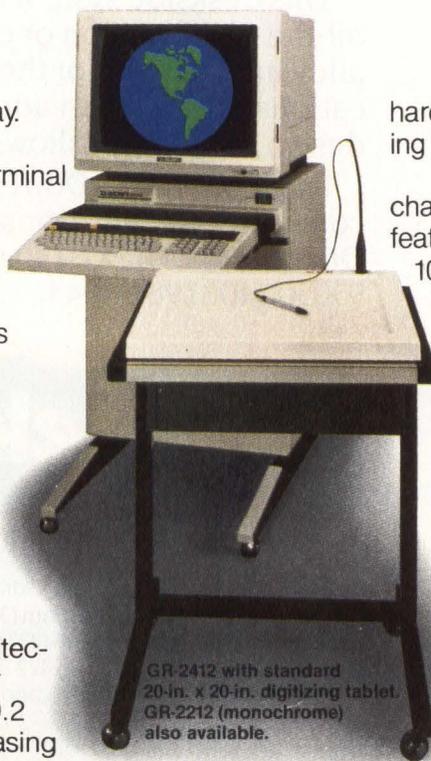
Its world address space, for example, is a full 32K by 32K. Large enough to handle the most ambitious project. Yet easily manageable with dynamic zoom, pan, window, and viewport commands.

Its zoom operation faithfully preserves resolution and detail, instead of simulating it with pixel replication.

And those aren't all the improvements we've made.

Our dual microprocessor architecture draws 12,500 short vectors per second while transferring data at 19.2 kilobaud. And our exclusive anti-aliasing

© 1982 Seiko Instruments U.S.A., Inc.



GR-2412 with standard 20-in. x 20-in. digitizing tablet. GR-2212 (monochrome) also available.

hardware removes jaggies without affecting drawing speed.

About the only thing we didn't change is our long list of standard features. Like our high resolution 1024x780 display. Local transformations. Up to 768K bytes of local segment memory. 4014 emulation mode. And the 10 years of Daini Seikoshu (Seiko) craftsmanship in every D-SCAN product.

If you're ready to make some changes, contact us at Seiko Instruments U.S.A., Inc., 2620 Augustine Drive, Santa Clara, California 95051. Telephone (408) 727-0768.

We'll give you a terminal that can take on the world.

D-SCAN
Seiko Instruments U.S.A., Inc.

Nobody offers you a wider variety of computer printers and printer experience than Facit/Dataroyal... all the way from low cost (\$695 list) matrix printers, to sophisticated graphics and color matrix printers, to models that print variable size characters and bar codes, to "daisy wheels" and a multimode near letter-quality printer. Industry standard parallel and RS232C serial interfaces are available in all printers.

Our products are built to perform day after day in the most rugged

environments. We achieve that kind of reliability by incorporating modern, trouble-free LSI circuitry, and fewer moving mechanical parts along with a high level of quality control.

Hundreds of computer systems manufacturers choose Facit/Dataroyal products with confidence, as do a great number of Fortune 500 companies who use Facit/Dataroyal peripherals with their systems.

If you want a trouble-free printer, contact your local computer

printer dealer or Facit/Dataroyal, 235 Main Dunstable Road, P.O. Box 828, Nashua, NH 03061, (603) 883-4157.



**FACIT
DATAROYAL**

Printers, printers, and more printers.

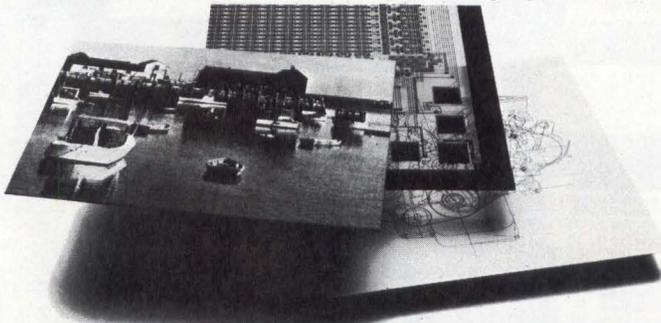


CIRCLE NO. 90 ON INQUIRY CARD

No other printer or plotter does so much for so many.



Only V-80 does so much, so fast, for so many. V-80 is a multi-user printer that delivers drafts at 1000 lines per minute. V-80 is a plot server that draws graphics, maps, even halftone pictures, for a local network. V-80 is a workstation hard copy unit that makes copies direct from your favorite display terminal. It does all these jobs quickly and quietly. And at your option, it gives you those jobs on paper or polyester film.



Print reports, complete with graphics. Draw complex plots that would take hours on a pen plotter, in just seven seconds. Even produce transparent overlays, overheads, and photocopy masters direct from computer or display terminal.

164

See us at Siggraph

Share your V-80. Nobody waits long at seven seconds per page. And you can place V-80 nearby, because it works without nerve-racking clatter.

V-80 delivers output worth sharing. It prints with three times the character definition of comparably priced impact printers. And with 40,000 points per square inch resolution, it's the choice of leading CAD and graphics workstation suppliers for high speed graphics.

Versatec serial and parallel interfaces, intelligent controllers, and multiplexers link V-80 with a wide range of multi-terminal systems. Available with Ethernet interfacing, V-80 is the ideal plot server for local networks.

Discover how V-80 can help you get more out of your multi-user system or local network. Circle our readers' service number for a free full-color brochure.

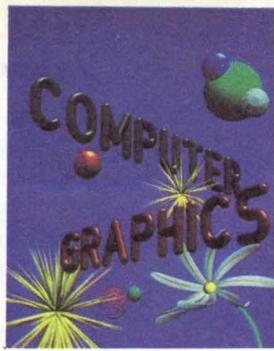
VERSATEC
A XEROX COMPANY

2710 Walsh Avenue, Santa Clara, California 95051, (408) 988-2800
27/35 London Road, Newbury, Berkshire, England (0635) 31221

XEROX® and Ethernet® are trademarks of XEROX CORPORATION V-80 is a trademark of Versatec

CIRCLE NO. 91 ON INQUIRY CARD

MINI-MICRO SYSTEMS/July 1983



Product profile: graphics workstations

PATRICK KENEALY, Senior Editor

The excitement's in the mid-range

The development of the computer graphics industry, like any other, is illustrated most easily by describing its most recent and dramatic new products. This usually means describing two kinds of products: the least expensive and the most capable. The graphics workstations in the news fit the pattern and are typified by \$2000 color terminals and full-blown \$100,000 CAD/CAM subsystems. This year, however, most of the significant graphics workstation development's involved mid-range units. The big news is in price/performance ratios rather than in absolute price or performance levels. "Workstation" is a misused word, but the homogeneity of recent hardware developments is redefining it.

What's a graphics workstation?

In surveying 80 vendors and their products, *Mini-Micro Systems* found that "workstation" is used to describe diverse graphics displays, terminals, subsystems and turnkey systems (Fig. 1). It also found that a consistent definition that describes current products is possible.

Fig. 1. "Graphics workstation" is applied to a wide variety of products. The Envision 230 terminal (top) and the Aydin Controls AYCAD are both graphics workstations. As a general-purpose graphics device intended to work with pictures more than alphanumeric, the Envision unit is more a graphics workstation than a terminal with graphics capabilities. Although the AYCAD system is designed to work with pictures, it is not a workstation because it's a stand-alone system. The Envision unit falls into the low end of the workstation spectrum, and the AYCAD falls outside of the high end.



A graphics workstation is a hardware/software combination that gives a user local graphics input, graphics display and graphics processing. A stand-alone turnkey CAD/CAM system such as those offered by Computervision Corp. and Evans & Sutherland is more than a graphics workstation. A bare-bones graphics generator without keyboard or display (such as those offered by Aydin Controls, Raster Technologies, Ramtek Corp. and others) is a great OEM component but it's not a workstation. Many desk-top personal computers have impressive graphics capabilities, but their primary application is working with letters and numbers, not with pictures. A graphics workstation gives a user what he needs to create and interact with graphics information. In many ways, "graphics workstation" is the new way to say "graphics terminal."

Giving a user a graphics display and a keyboard, tablet or other graphics input device is giving him a terminal. Giving him that plus local graphics processing is giving him a workstation. The inexpensive availability of that local processing power, thanks to powerful microprocessors, custom graphics chips and inexpensive memory, blurs the distinction between graphics workstations and stand-alone graphics systems. The microcomputers built into many workstations support enough functions to perform many applications with no host support and, as a result, are sold as low-end systems rather than as workstations. Many of these systems sell for workstation prices and for marketing reasons are called workstations, but they are far more application specific than their workstation kin.

Graphics workstations are general-purpose devices that sometimes have significant local power but are intended as part of larger systems. A few are used in networks with other workstations, minicomputers and microcomputers. Most are intended for use with supermini or mainframe hosts.

Graphics workstations, especially mid-range units selling for between \$10,000 and \$40,000, are displaying bigger, more colorful, more detailed pictures than ever before. Display screens are almost universally raster units, although some direct-view-storage-tube models from Tektronix Inc. are still in use. Screens are offered in diagonal sizes of 11, 12, 13, 14, 15, 19, 20 and 25 in.

Resolutions range from 512 (horizontally) \times 256 (vertically) pixels to 1536 \times 1024 for raster units and to 4096 \times 3120 for DVST (direct view storage tube) and vector displays. Lower-resolution units are no more common than they were last year, but 1000- \times 1000-point multicolor units have come into their own (Fig. 2). Tektronix, Ramtek, Megatek Corp., Genisco Computers, Lundy Electronics & Systems, Advanced Electronic Design, Chromatics Inc., Lexidata Corp., Florida Computer Graphics and others offer 1000 \times 1000 units, and this summer's National Computer Graphics Association and SIGGRAPH conferences promise more introductions. Refresh rates have improved as well as with 60-Hz, noninterlaced rates the rule.

This year was the first that our survey found more color than black-and-white models. Color units account for two-thirds of workstations and far more than that if DVSTs are excluded. Raster units simultaneously display eight to 256 colors. Raster Technologies offers a display controller for its workstations that it claims can simultaneously display 16.8 million colors. The news is in the number and price of 16-, 64- and 256-color units available for less than \$50,000.

Running such dynamic screens requires substantial local processing power. Workstation vendors use a wide variety of microprocessors (often together) to provide it. Most established products use Intel 8080 series, Motorola 6800 or Zilog Z80 microprocessors. New units use Intel 80186, Motorola 68000, Zilog Z8000 and DEC LSI-11 microcomputers. Math chips such as the Intel 8087 and graphics chips such as the AMD 2901, the Intel 82720, the NEC 7220 and numerous proprietary processors have also improved local processing speed and functionality. The Tektronix 4115B writes 50,000 vector

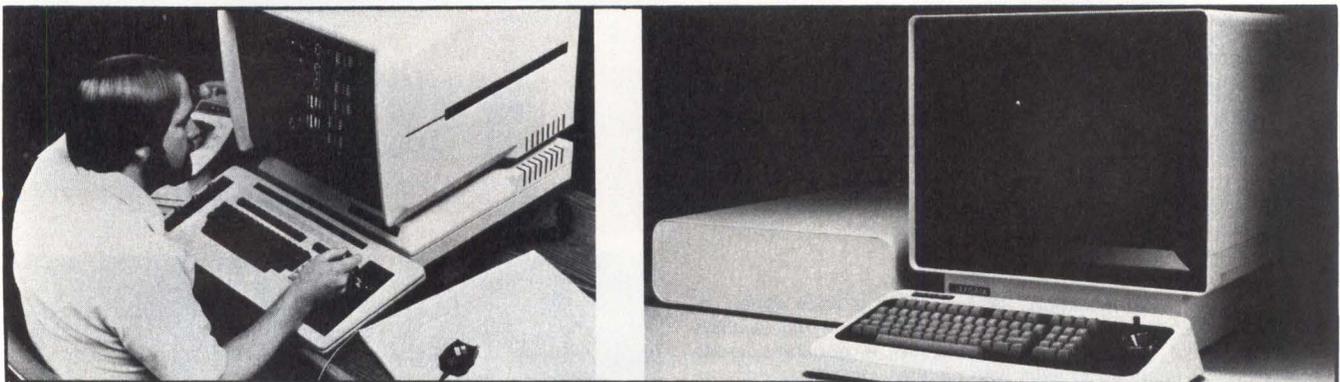


Fig. 2. Mid-range graphics workstations such as the Megatek Whizzard 1650 (left) and the Lexidata 2400 are offering better price/performance than ever. The Lexidata unit features a black-and-white 1280- \times 1024-pixel screen and an MC68000 processor at prices starting at \$11,000. The Megatek unit displays 16 simultaneous colors of a possible 4096 on a 640 \times 480 pixel screen and sells for less than \$16,000 in single-unit quantities.

Frankly, Tek, we're flattered.

When we heard that you folks at Tektronix will have a text/graphics color terminal like our Envision 220 available soon, we weren't really surprised.

We were flattered.

Because you've always had a reputation for doing things the right way.

That means providing all the features both OEMs and end-users want. Like text and graphics on the same screen. A convenient desktop size. Distributed graphics processing. High-resolution 640 x 480 color graphics. And a display of 16 colors from a palette of 4,096.

And it means designing your product to use the industry's most popular software. Our terminals are compatible with VT100 alphanumeric software, PLOT 10™, DISSPLA®, TELL-A-GRAF®, DI3000/

GRAFMAKER® and TEMPLATE™ among others.

To really do it right, you'll need a whole family of terminals that are both compatible and upgradable. Like our 210, 220 and 230.

And the innovations that people are clamoring for. Like our mouse, graphics tablet and optional 19-inch screen.

Then there's the matter of printer compatibility. Our color VectorPrinter™ prints letter-quality text and plotter-quality graphics, together.

So while we're flattered that you may be giving us a run for our money in the text/graphics color terminal market, we're not too worried.

Because it looks like the leader may be following us.

See us at Siggraph, Booth #911

Envision

631 River Oaks Parkway
San Jose, CA 95134
(408) 946-9755. Telex 176437

VectorPrinter™ is a trademark of Envision.
Nationwide service available through
ITT Courier.
Authorized service centers worldwide.



CIRCLE NO. 92 ON INQUIRY CARD

color images in less than 1 sec. and fills polygons as fast as 125 million pixels per sec.

Workstation memory has never been more plentiful. Eight planes of display memory for a resolution is common, and some units offer 24. More memory planes mean more gray shades, colors and display attributes. Many units use 64K RAMs, and many offer 128K-byte and larger program memories in addition to their display memories.

Off-line storage is another expanding capability.

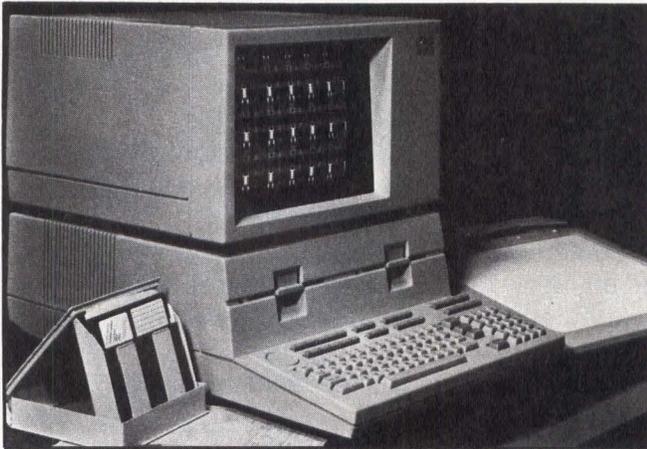


Fig. 3. Hewlett-Packard's Series 200 technical computer is typical of many such units in that it doubles as a graphics workstation. The 16-color, 68000-based unit offers a resolution of 512 x 390 pixels and sells for \$17,660, roughly \$3000 more than the standard black-and-white model.

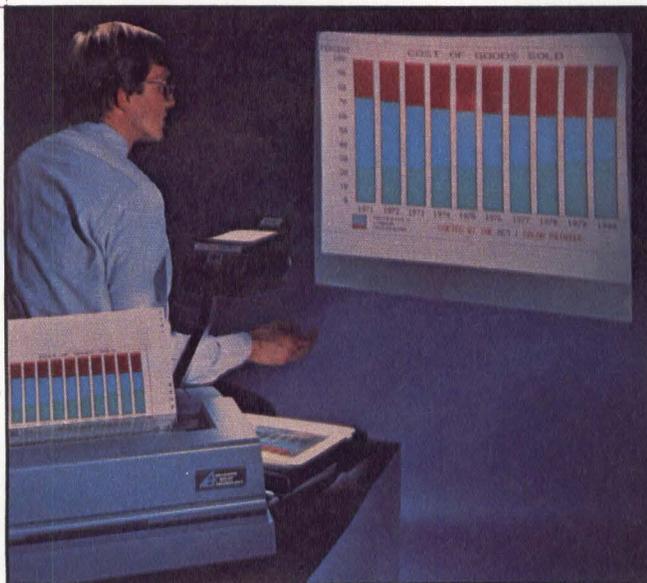


Fig. 4. Overhead transparencies are one of the media available from graphics hard-copy peripherals. The Advanced Color Technology Inc. ACT II ink-jet printer copies a color workstation image onto paper or transparent plastic in 90 sec. at a resolution of 140 x 85 dots per in. The \$6400 printer competes against impact matrix, electrostatic, thermal, xerographic, photographic, and other graphics hard copy units.

High-capacity floppy disk drives store images and programs, and new 5¼-in. Winchester are as popular on graphics workstations as they are on microcomputers.

Capabilities

Workstation price/performance levels are the result not only of better displays, microprocessors and memory, but also of better graphics software, peripherals and system design. Graphics software is becoming standard. Most of the units surveyed are at least partially compatible with Tektronix's PLOT10 package, and many vendors support popular third-party packages such as Precision Visuals' DI-3000, SAS's SASGRAPH, PDA's PATRAN and ISSCO's DISSPLA and TEL-A-GRAPH. Large workstation memories and fast workstation processors are encouraging large local graphics command sets featuring commands for point, line, arc, circle, conic and rectangle generation and for solid and patterned polygon filling. Dynamic commands for zooming, scaling, clipping, panning, scrolling and rotating can often be handled locally, but most workstations leave complex image manipulation and number-crunching analysis to their hosts.

Workstations support a wide assortment of graphics input and output peripherals, and this ability often distinguishes from "terminals" in users' minds. The keyboard is still the most popular input peripheral, but most units support joysticks, light pens, digitizer tablets, trackballs, mice and valuator dials. On the output side, camera systems, impact matrix and ink-jet printers and pen and flatbed plotters give users hard copy for every budget and application (Fig. 3).

While workstations as *Mini-Micro Systems* defines them don't ordinarily function as stand-alone CAD/CAM systems, many do function as stand-alone microcomputer systems. Most models have the memory, off-line storage and processing power, and the ability to perform local graphics program development as well as general-purpose scientific and office computing, a powerful selling point. Tektronix and Hewlett-Packard Co. have sold their graphics workstations as desk-top computers for years, and more recent competitors are following suit (Fig. 4). UNIX is the most popular local operating system, and BASIC, FORTRAN, APL and Pascal are the most popular programming languages.

Compatibility and the ability to be upgraded are becoming even more important. Compatibility among vendors is improving due to government, academic, user group and professional society efforts, and to the high cost of developing complex, hardware-specific software. Upgrade paths are being carefully planned as new products facilitate switching vendors. Minicomputer, microcomputer and terminal manufacturers are competing more aggressively with mainframe and graphics-specific vendors that have dominated the workstation market over the past few years. They've kept technical and price/performance progress moving as fast as ever. □

A Complete Graphics Department For Just \$2295



Realize day-in and day-out solid performance from a quiet and capable desktop plotter. It's true. For only \$2295* the Houston Instrument HIPLØT™ DMP-29 will provide you with world-class multi-color hard copy graphics, and deliver a level of quality and performance that you would expect in a plotter costing three times as much.

It's a hard worker. The DMP-29 goes about its job with amazing speed and precision. Unbeatable resolution and repeatability are yours in both 8½" x 11" and 11" x 17" formats, and 8-pen capability assures you of fast attention-free flexibility when multi-color output is required. High pen speed combined with an addressable resolution of 0.001" assures fast, accurate and stepless traces.

It's friendly. You can call 21 different functions directly from the front-panel membrane keyboard. It's tolerant too. The DMP-29 will modestly protect itself from user errors, as when attempting to place a pen in an already occupied stall.

And it's smart. An extensive set of firmware routines makes life easier for the user. A small sampling of the built-in talent inherent in the DMP-29 includes character generation, circle, arc and ellipse synthesis, line type variations, viewport/windowing, clipping and scaling.

For the name, address and phone number of your nearest distributor/dealer, write Houston Instrument, 8500 Cameron Road, Austin, Texas 78753. Phone 512-835-0900, or 1-800-531-5205 if outside Texas. In Europe contact Bausch & Lomb Belgium NV., Rochesterlaan 6, 8240 Gistel, Belgium. Tel 059-27-74-45. Tlx 846-81399.

BAUSCH & LOMB 
houston instrument *division*

* U.S. Domestic price only
™ Trademark of Houston Instrument

CIRCLE NO. 93 ON INQUIRY CARD

4PO05B

Finally, a single source for multi-processor, designed for OEMs and systems integrators. Now that's intelligent.



Intelligent Systems introduces the Datavue multi-processor, multi- user computer system.

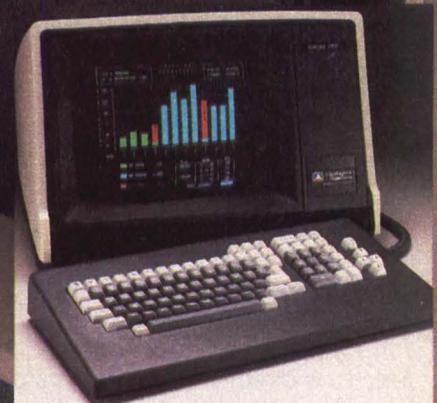
The Datavue system offers OEMs and system integrators a powerful solution for multi-user, multi-tasking, terminal-based environments—and all the advantages of single-sourcing.

With Datavue you configure just the right amount of computer power for current needs and deliver to your customers a simple, economical growth path from one to eight users.

Advanced systems architecture delivers stand-alone performance. For advanced applications—decision support systems, office automation, management productivity,

and even process control, Datavue provides a simple computing environment with a dedicated computer for each user (or control application).

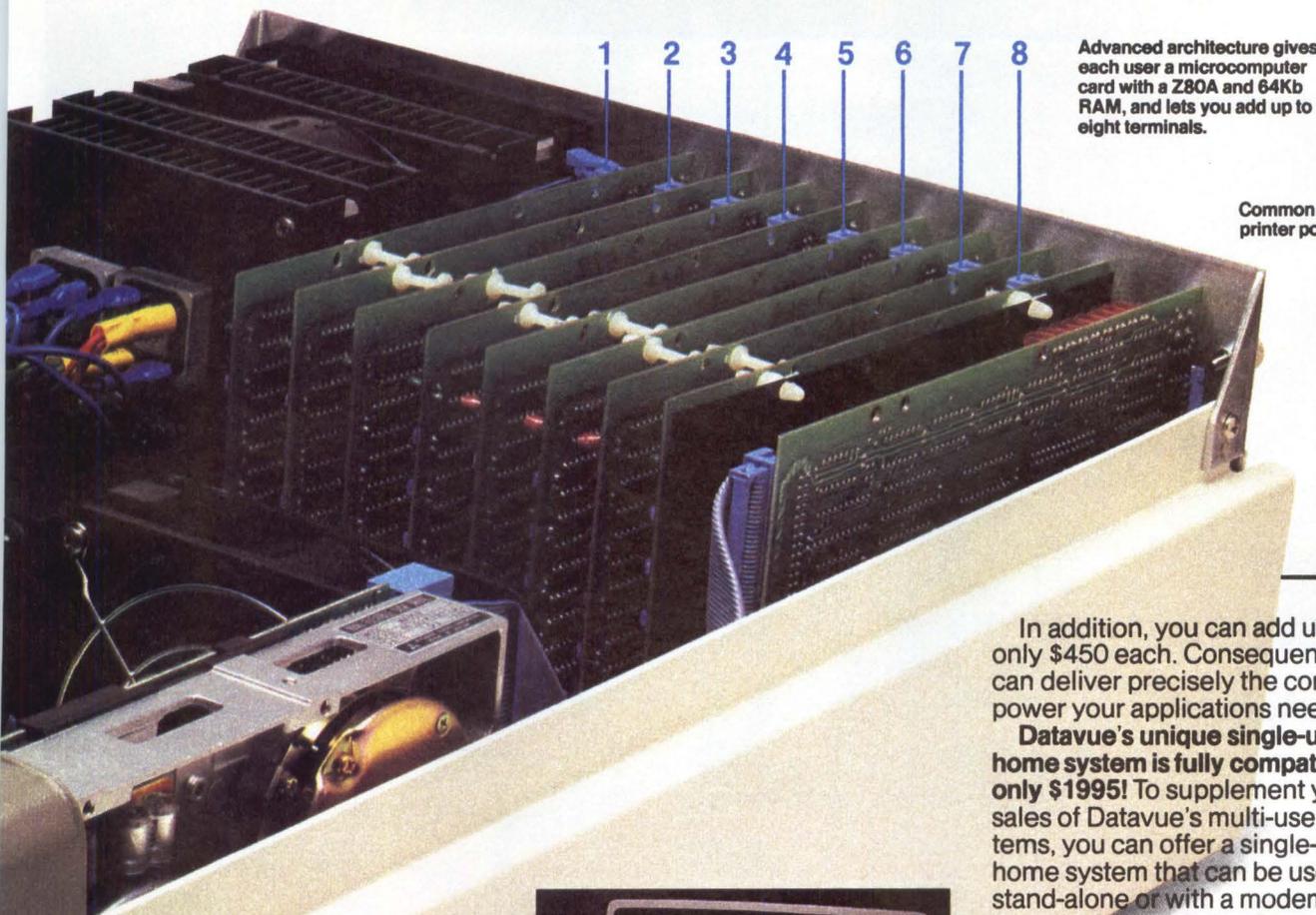
Up to eight computer cards can be inserted in the Datavue system which resource shares mass storage and common I/O. Each user gets a full microcomputer with a Z80A, 64Kb RAM, and CP/M* 2.2. As a result, all users get stand-alone performance with the economies of a multi-user shared resource system.



Intecolor 2405

Add intelligent terminals to meet your customer's needs. Since 1970, Intelligent Systems has been a world leader in designing and manufacturing color graphics terminals. Now, you can profit from our expertise with: The Intecolor 2405, the indus-

multi-user computer systems



Advanced architecture gives each user a microcomputer card with a Z80A and 64Kb RAM, and lets you add up to eight terminals.

Common Centronics printer port.

In addition, you can add users for only \$450 each. Consequently, you can deliver precisely the computing power your applications need.

Datavue's unique single-user home system is fully compatible and only \$1995! To supplement your sales of Datavue's multi-user systems, you can offer a single-user home system that can be used as a stand-alone or with a modem to communicate with the base system.

The home system includes a Z80A, 64Kb RAM, 1 Mb floppy, two RS232-C ports and CP/M 2.2. And it's very competitive—in function and price—with personal computers.

Put it all together with Datavue. Stand-alone performance. Up to eight users. Price and profitable margins. Powerful options, from synchronous communications to 80Mb mass storage, and more. Color, graphics, and wide-screen terminals (or use your own). A huge library of off-the-shelf CP/M 2.2 software. Plus, the unmatched advantages of single-sourcing.

That's Datavue multi-processor, multi-user systems. That's Intelligent Systems.

More information. Datavue is shipping now. OEM contract discounts are available. And a limited number of dealerships are open. For details, contact Marketing Communications at 404/449-5961, TWX 810 766 1581.

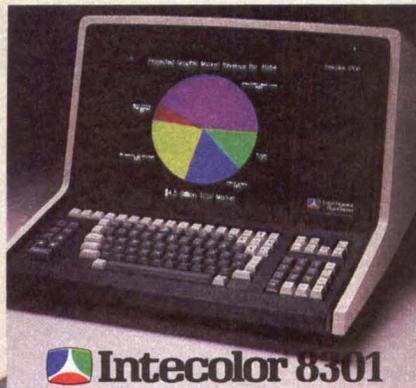
DATAVUE™

AN INTELLIGENT SYSTEMS COMPANY
Intecolor Drive, 225 Technology Park, Norcross, Georgia 30092
404/449-5961, TWX 810 766 1581
1911 22nd Avenue South, Seattle, WA 98144
*CP/M is a registered trademark of Digital Research, Inc.



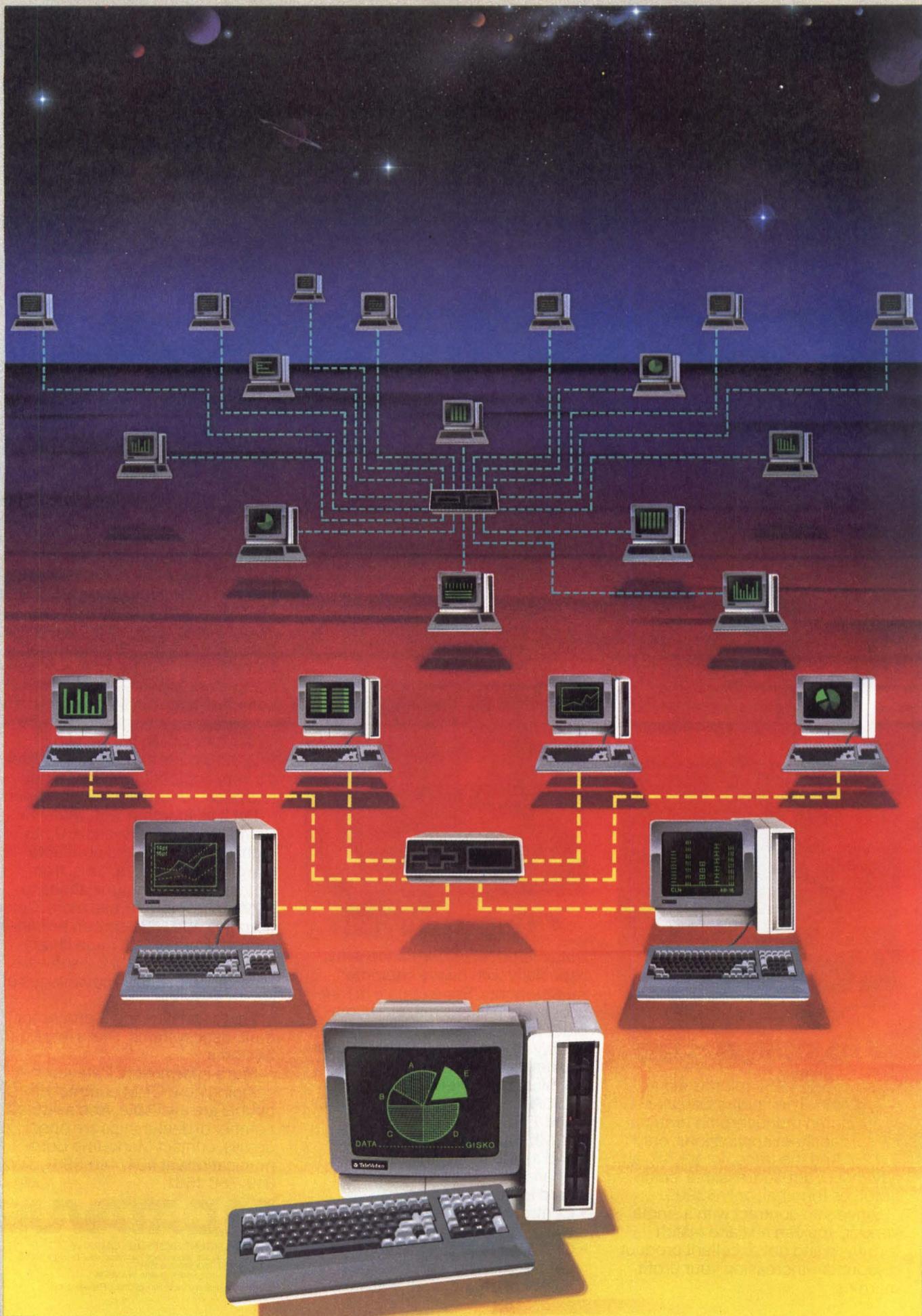
try standard ANSI color terminal; only \$1295. The unique Datavue 132-column monochrome terminal for spreadsheet applications; only \$1795. And the Intecolor 8301R, an advanced, dot-addressable, color graphics terminal; only \$3995.

Since you contract with a single vendor, you can mix and match terminals and get excellent product discounts—increasing your profit margins.



Datavue price/performance wins, especially with heavy compute requirements. For example, a four-user system with a full microcomputer for each user is only \$7045—or only \$1762 a user! This four-user system includes:

- 4 microcomputers, each with a Z80A, 64Kb RAM, 4Kb EPROM, and 2 RS232-C ports
- 12Mb 5¼" Winchester hard disk and a 1Mb floppy for back-up
- Shared resource management card for mass storage
- Centronics parallel printer port which all users can access
- CP/M 2.2 operating system, compatible with the world's largest library of off-the-shelf software.



Of all the personal computers you can choose today, TeleVideo gives you more choices for tomorrow.

Any TeleVideo personal computer can be used as a single-user, stand-alone computer. Then, when you want to expand its professional performance capabilities, you have a choice of ways to grow into a network of up to sixteen TeleVideo personal computers. You can use our 8 or 16-bit computers, or any combination, starting with your original unit.

TeleVideo also gives you more choices of professional CP/M® and MS-DOS® software, including advanced graphics. And since our software works with all of our systems, it can run on one TeleVideo personal computer or a network of TeleVideo personal computers,

without modification. So if you want a personal computer that gives you professional performance, it's obvious that you have a lot of choices for today.

But there's only one with choices for tomorrow. TeleVideo.

For more information, write TeleVideo Systems, Inc., 1170 Morse Ave., Sunnyvale, CA 94086, call toll-free **800-538-1780**, call one of our authorized distributors or dealers, or contact one of our international sales offices, listed below.

European Sales (Holland), (31) 075-28-7461.
UK/Scandinavia Sales, (44) 0908-668-778.

TeleVideo Systems are fully serviced nationwide by TRW.

 **TeleVideo Systems, Inc.**

CIRCLE NO. 95 ON INQUIRY CARD

CP/M is a registered trademark of Digital Research, Inc.

MS-DOS is a registered trademark of MicroSoft, Inc.

GRAPHICS WORKSTATION VENDORS

Company: model	Screen size (in.), resolution (horizontal x vertical)	Colors	Processor(s)	Memory (bytes)	Local functions
Advanced Electronic Design Inc.					
AEDS11	19 768 x 575	256 of 16.8 million	LSI-11/23	512K	Layout, ellipse and arc generation, polygon fill, Tektronix 4010 emulator, pattern fill, anti-aliasing
AED512	13 512 x 512	256	5502	256K	Tektronix 4010 emulation, zoom, pan, polygon fill
AED767	13 768 x 575, 640 x 480, 512 x 512, 512 x 483	256 of 16.8 million	6502	42K RAM/ROM	Tektronix 4010 emulation, continuous joystick panning, polygon fill, anti-aliasing, ellipse and arc generation
AED1024	19 1024 x 768	256 of 16.8 million	6402	Firmware, user RAM	Tektronix 4010 emulation, polygon fill, pattern fill, zoom, pan
Aydin Controls					
ICON 16	13, 19, 25 256 x 256	2 to 16 million	8086, AMD bit slice	32K RAM, 23K EPROM, 768K expansion RAM	Pan, zoom, vector generation scale, scroll, all primitives, auto circle correction, 2D and 3D transformation
C. Itoh Electronics Inc.					
CIT-414	12 640 x 480	Monochrome	6809		Tektronix 4010/4014 emulation; line, arc, circle, box generation; alpha mode
CIT-427	12 640 x 480	8 of 64	6809		Tektronix 4027 emulation; line, arc, circle, box generation
Chromatics Inc.					
CT4200	13 512 x 384 (CT 4300: 1025 x 768)	8	Z80, graphics display processor	64K	Programmable function keys, zoom, pan, graphics primitives
CGC 7900	19 1024 x 768	As many as 256 out of 16 million	MC68000	As much as 8M	Programmable function keys, zoom, pan
CT4300	13 1024 x 768	8	Z80, graphics display processor	64K	Programmable function keys, zoom, pan, graphics primitives
Convergent Technologies Inc.					
IWS	15 660 x 512		Dual 8086s	128K	
Data General Corp.					
G500	15 640 x 480	16 out of 4096	68000	0.5M	Downloaded graphics command interpreter, primitives
G300	13 640 x 240	Monochrome	Z80		Primitives
GDC/1000 color workstation	768 x 576, 1280 x 1024	256 out of 16.7 million	Bit-slice display controller, Z8000- based command processor	8 planes, each separately addressable	
Data-Type Inc.					
Autograph XK1	15 1024 x 780	Green monochrome	6809, 68000	256K	Tektronix 4014 emulation; circle, arc, ellipse generation; polygon fill; zoom; pan; bidirectional scroll; TVI 925 emulation
Autograph Series 100	12 512 x 250	Monochrome	6805	16K	Tektronix 4010 emulation
Autograph Color X5A	14 512 x 390	16 of 511	6809, 68000	256K	Tektronix 4010/4014/4027 emulation; circle, arc, ellipse generation; zoom; pan; bidirectional scroll; polygon fill; TVI 925 emulation
Quickview	12 512 x 250	Monochrome	6805	16K	Vector drawing
Digital Equipment Corp.					
VT125	12 768 x 248	4 of 64	8080, (8085 add- on optional)		Bidirectional, horizontal, vertical scroll; vector, circle, arc generation
Envision					
220	13 640 x 408 (640 x 480 optional)	16 of 4096	8088, NEC 7220	128K (256K optional)	Vector, circle, rectangle, polygon fill, pattern fill, zoom, pan

Standard peripherals	Optional peripherals	Host interface	Software	Price	Circle no.
Keyboard, joystick, 10M-byte Winchester disk drive, floppy disk drive	Data tables	RS232C, parallel (DMA channel)	RSX-11M, RT-11, RSTS-E, UNIX, VENIX, TSX +, PLOT10	\$19,995	837
Keyboard, joystick	19-in. color monitor, data tablet	RS232C, parallel (DMA channel)	Built-in command protocol instruction set (FORTRAN), ISSCO, Control Data, SAS (most third party)	\$5995, includes monitor	
Keyboard monitor	19-in. color monitor, data tablet	RS232C, parallel (DMA channel)	FORTRAN, Precision Visuals, SAS, ISSCO, Control Data (most third party)	\$7995	
Keyboard, monitor, mouse	Data tablet	DMA channel or RS232C	AED FORTRAN, protocol, ISSCO, Control Data, SAS	\$13,295	
Keyboard, pixel address devices, joystick, digitizer tablet, hard copy (photographic to ink jet)		HP, RS232C, dual DMA interfacing	ATP, I/O drives to most mainframes, high-level languages, control programs (for stand alone)	\$12,295	838
	Various printers	RS232C	PLOT10, ISSCO, GKS	\$1895	839
Keyboards, LA 120 with graphic interface		RS232C	PLOT10, ISSCO	\$3500	
64-key detachable keyboard	92-key keyboard with numeric keypad, light pen	RS232C, 11 interfaces (optional)	ISSCO, Precision Visuals, SAS	\$3995	840
Keyboard	Joystick	RS232C, RS449, parallel DMA (optional)	Edwards OS, C, Pascal, FORTRAN	\$11,995	
	92-key keyboard with numeric keypad, light pen		ISSCO, SAS, Precision Visuals	\$6995	
Keyboard	Winchester disk drive	X25, IBM 3270, 2780/3780	CTOS, COBOL, FORTRAN, BASIC, Pascal, Assembler	\$8350 to \$12,350	841
16-bit printer port, video output		RS232, 20-Ma current loop, 9600 baud	Graphical kernel software	\$9500	842
	Dot-matrix printer	RS232, 20-Ma current loop	Graphical kernel system, runs all DG graphics programs	\$3900	
2 Eclipse boards, data channel interface	Monitor		Graphical kernel software	\$19,000 to \$23,000	
Keyboard	Autograph 1001 graphics printer, digitizer	RS232C	PLOT10 compatible, ISSCO, Megatek, Precision Visuals	\$4495	843
	Dot director, cursor control, keypad, Autograph 1000 graphics printer	RS232C	PLOT10	\$1895 to \$2395	
Keyboard	Autograph 1200 color graphics printer, digitizer, mouse	RS232C	PLOT10, Tektronix 4027	\$4995	
Dot director keypad, Autograph 1000 printer	1200-baud modem	RS232C	PLOT10	\$3095 to \$4495	
None	LA50, LA100 printers	RS232C, (20-Ma current loop optional)	ReGIS	VT125 — \$3800, VT100 upgrade — \$1800	836
Keyboard	Mouse, graphics tablet, 2 optional input devices	RS232C	ISSCO, Megatek, Precision Visuals, PLOT10	\$4950	844

GRAPHICS WORKSTATION VENDORS

Company: model	Screen size (in.) resolution (horizontal x vertical)	Colors	Processor(s)	Memory bytes	Local functions
230	13 640 x 408 (640 x 480 optional)	16 of 4096	8088, NEC 7220	128K (256K optional), 128K display list memory	Point vector, polygon, polyline, circle, arc, pre- segment generation; polygon fill; rotate; translate; pick; scale; zoom; pan
Florida Computer Graphics Inc. Beacon	13, 19 640 x 480	32 of 256	Multiprocessor architecture: AMD 2901 bit slice, two Z80s, two 8048s	256K	Vector, arc, circle, rectangle generation; polygon fill; pan; zoom
Intelligent Terminal	13, 19 640 x 480	32 out of 256	AMD 2901 bit slice, two 8048s	128K	Vector, arc, circle, rectangle generation; polygon fill
Genisco Computers Corp. G-1000	19 1024 x 792	White monochrome	Z8001	32K	Tektronix 4014-1 emulation, alpha mode
G-6100 Series (6120, 6110)	19 768 x 512 (1392 x 1024 color optional)	16 of 64	16-bit slices	512K (1M optional)	Tektronix 4014 emulation, alpha mode, zoom, scroll, blink
Hewlett-Packard Co. 2623A	12 512 x 390	White, green, amber		2 pages	
2627A	12 512 x 390	8	Z80	2 pages	
2647F	12 720 x 360	White	8085	6 pages	
2700	12 512 x 390	16	MC68000	1M display, 4 pages without enhance- ments 640K	Zoom, pan, multiple views
Series 200 model 36C	12 512 x 390	16 of 4096	MC68000	640K	Rectangle, polygon, circle generation; polygon fill; edge color
ID Systems Corp. 100	13 608 x 480	4	8088		Cursor reporting, scan, selectable windows, split screen
ID 200	12 (13, 14, 19 optional) 640 x 480, (1024 x 1024 optional)	8	8088		Cursor reporting, scan, selectable windows, split- screen programmable functions
Intelligent Systems Corp. 8001 R	19 480 x 384	4913 shades	8080A	8K	arc, circle, vector
8301 G	13 160 x 192	8	8080A	8K	Baud rate, editing

Standard peripherals	Optional peripherals	Host interface	Software	Price	Circle no.
Keyboard	Mouse, graphics tablet, 2 optional input devices	RS232C	ISSCO, Megatek, Precision Visuals, PLOT10	\$6950	
845					
Keyboard	Joystick, light pen, digitizer, printer, plotter	IBM 3270, 3780, 2780; SDLC/SNA, HASP; emulates VT100; Tektronix 4010, 4012, 4014	BASIC, FORTRAN, Pascal, Assembly, C, graphics application, kernel package, PLOT package, interfaced drives, ISSCO, Precision Visuals, Megatek, SAS, business graphics, drafting package, word-processing graphics package, financial analysis, graphics arts package	\$13,000 to \$30,000 (average \$20,000)	
Keyboard, CRT	Ink-jet printer, plotter	IBM 3270, 3780, 2780; SDLC/SNA, HASP; emulates VT100; Tektronix 4010, 4012, 4014	BASIC, FORTRAN, Pascal, Assembly, C, graphics application, kernel package, PLOT package, interfaced drives, ISSCO, Precision Visuals, Megatek, SAS, business graphics, drafting package, word-processing graphics package, financial analysis, graphics arts package	\$8500	
846					
Keyboard, joystick	Vector generator, Versatec and Okidata printers	RS232C	PLOT10	\$9950	
Keyboard, joystick	Tablet	RS232C, RS442/449, DEC, DG, Gould, P-E	GENCOR, FORTRAN	\$21,950	
847					
Keyboard	Internal printer	RS232C	HP software, Precision Visuals, ISSCO	\$3250	
Keyboard		RS232C, RS422	HP, major industry graphics, Tektronix 4010 emulation, Precision Visuals, ISSCO	\$5975	
Keyboard	Minifloppy disk	RS232C, RS422	Autoplot/47	\$9950	
Keyboard		RS232C, RS422	Autoplot/2700, Paintbrush/2700, ISSCO, Precision Visuals	\$19,900 to \$36,200	
Keyboard, dual minifloppy drives		HP-IB, RS232C, 16-bit parallel	Pascal, BASIC	\$17,660	
848					
CT100-compatible keyboard	Digitizer, plotter printer	VT100, VAX compatible, Tektronix compatible	PLOT10, ISSCO, Telautograph, DISSPLA	\$2895 to \$5895	
Keyboard, CT100 compatible	Digitizer, plotter printer, mouse, trackball	VT100, VAX compatible, Tektronix compatible	PLOT10, ISSCO, Telautograph, DISSPLA		
849					
Light pen, additional memory, expanded keyboard, printer		RS232C, parallel also available	FORTRAN, Business BASIC, Assembly, SAS, ISSCO	\$3975	
Light pen, additional memory, expanded keyboard, printers		RS232C, parallel	Programming languages	\$3045	

GRAPHICS WORKSTATION VENDORS

Company; model	Screen size (in.); resolution (horizontal x vertical)	Colors	Processor(s)	Memory (bytes)	Local functions
8301 R	13 480 x 384	4913 shades	8080A	8K	Arc, circle, vector
2405	13 160 x 96	8	8085	2K	Menu-driven setup mode
2427	13 640 x 288		8085	2K	Menu-driven setup mode
8001 G	19 160 x 192	8 foreground and background	8080A	8K	Baud rate, editing
VHR19	19 1024 x 1024	8 out of 4096	Z80		NEC GDR functions
Lexidata Corp.					
2400	19 1280 x 1024	Monochrome	MC68000	128K	Pan, zoom, window, graphics primitives
2410	19 1280 x 1024, 30 Hz	As many as 16 out of 4096	MC68000	128K	Scrollable text, pan, zoom, graphics primitives
Lundy Electronics & Systems, Inc.					
T5470 Series	15 1536 x 1024	Green monochrome	M68V09	64K	Tektronix 4010 emulation; line, circle, ellipse, arc generation; polygon fill, pattern fill, alpha mode, 120 total local commands
S5480 Series	20 1536 x 1024	16 out of 4096	6809	48K	Tektronix 4010/4014 emulation; vector, block circle, ellipse generation; pan; overview; zoom, polygon fill; alpha mode
T5680 Series	13 768 x 512	256 out of 4096	M68V09	64K	Tektronix 4010 emulation; line, circle, arc, ellipse generation; 120 local commands; alpha mode
Megatek Corp.					
Whizzard 1650	19 640 x 480	16 out of 4096	8086	256K	Vector generation; zoom, scale, clip, rotate, pick, polygon fill; VT100/VT52; alpha mode; sound generation
Whizzard 7600	19 1024 x 1024	16 out of 4096	8086	Display list: 192K, 512K RAM	Vector generation, zoom, scale, clip, rotate, pick, polygon fill, alpha mode
National Computer Communications Corp.					
Termgraphics	12 640 x 240	Green phosphor		128K	80 x 24 character, alpha mode
Orcatech Inc.					
Orca Series	19 1024 x 1024	256 out of 16.7 million	8086/87, AMD2900, MC68000	512K	Tektronix 4014/4114 emulation, zoom, pan
Prime Computer Inc.					
PW93	19 1280 x 1024	Monochrome	16 bit		Pan, zoom, selective erase, circles, polygon, conics, multiple line fill, algorithms
PW95	19 1280 x 1024	8 out of 4000	16 bit		Pan, zoom, selective erase, circles, polygons, conics, multiple line fill, algorithms
PW200 Series	19 1280 x 1024		32-bit virtual memory	1M main memory, 68M Winchester, 15M cartridge tape	Z-d drafting, 3D solid modeling
Ramtek Corp.					
6211	13 640 x 480 (640 x 512 optional)	16 out of 64	Z80A	RAM	Tektronix 4014 emulation, graphics primitives
6212 Colorgraphic Terminal	13 640 x 480 (640 x 512 optional)	16 out of 64 (256 of 4096 opt.)	Z80A	12K RAM	Tektronix 4014 emulation, graphics primitives

Standard peripherals	Optional peripherals	Host interface	Software	Price	Circle no.
Light pen, additional memory, expanded keyboard, printers		RS232C, parallel	ISSCO, SAS	\$4240	
Light pen, additional memory, expanded keyboard, printers		RS232C, parallel	DEC VT100	\$995 (100 units)	
Light pen, additional memory, expanded keyboard, printers		RS232C, parallel	Tektronix	\$995 (100 units)	
Light pen, additional memory, expanded keyboard, printers		RS232C, parallel	FORTRAN, Business BASIC, Assembly	Q: \$2745	
Light pen, additional memory, expanded keyboard, printers		RS232C, parallel	CAD software, printing, publishing	not available	
					850
Keyboard, joystick	Mouse, tablet	RS232C	PLOT10	\$9900	
Keyboard, joystick	Mouse, tablet	RS232C	PLOT10	2 plane: \$13,600 4 plane: \$14,950	
					851
96-key ASCII with programmable function	Numeric keypad, joystick, data tablet, output devices, monochrome electrostatic printers, photographic hand-copy devices	RS232C, 2-Ma loop	FORTRAN IV subroutines	\$10,000	
Keyboard, joystick	Hard-copy unit	RS232C, 20-Ma loop, RS422	UltraGraphics II	\$19,500	
Keyboard, joystick	Text store, light pen, touch pen	RS232C, 20-Ma loop	UltraGraphics II (SIGGRAPH compatible), Rapidata, DataVue by ISS, UNIRAS, seismic-analysis system	\$5000 to \$10,000	
					852
Keyboard	Joystick, dials, light pen, tablet	RS232C	FORTRAN subroutine packages	\$15,900	
Keyboard, joystick	Data tablet, Versatec hard copy	IEEE-488, RS232C	FORTRAN, Template, Precision Visuals	\$50,000 to \$75,000	
					853
Keyboard		Tektronix compatible	Tektronix compatible	\$1675	
					854
Keyboard, joystick	Tablet, printers, plotters, disk drives, diskette drives	Ethernet, RS232C, parallel	FORTRAN IV, UNIX, C, Pascal, Mainsail		
					855
Video processor, video display tube, data tablet, joystick, alphanumeric terminal		Prime 50 series	Medusa CAD	\$25,000	
Video processor, video display tube, data tablet, joystick, alphanumeric terminal		Prime 50 series	Medusa CAD	\$35,000	
Processor, disk drive, terminal data tablet, joystick, keyboard		Prime 50 series	Medusa	\$61,000 to \$95,000	
					856
Keyboard	Printer, light pen, graphics tablet	RS232C	DISSPLA, Tektronix 4014, TELL-A-GRAF, PATRAN, SAS/GRAPH, DI-3000 charts and graphs	\$4995	
Keyboard, joystick, digitizer tablet	Printer	RS232C	CGL, DISSPLA, Tektronix 4014, TELL-A-GRAF, PATRAN, SAS/GRAPH, DI-3000 charts and graphs	\$10,495	

GRAPHICS WORKSTATION VENDORS

Company; model	Screen size (in.); resolution (horizontal x vertical)	Colors	Processor(s)	Memory (bytes)	Local functions
6412 Colorgraphic Terminal	19 1280 x 1024	16 out of 4096 (256 out of 16 million optional)	Z80A	12K	Zoom, pan, alpha mode, graphics primitives
Raster Technologies					
ONE/25	19 512 x 512	256 out of 16.7 million	Z8002	128K RAM	More than 150 local commands including integrated debugger, 2D display list, 4014 emulator, scrolling text windows, macro programming, graphics primitive VT100 format keyboard
ONE/25 (display station with 24 bit planes)	19 512 x 512	16 out of 16.7 million	Z8002	128K RAM	More than 150 local commands including integrated debugger, 2D display list, 4014 emulator, scrolling text windows, macro programming, graphics primitive
ONE/40	19 1024 x 1024	16 out of 16.7 million	Z8002	128K RAM	More than 150 local commands including integrated debuggers, 2D display list, 4014 emulator, scrolling text windows, macro programming, graphics primitive
ONE/60	19 768 x 576	16 out of 16.7 million	Z8002	128K RAM	More than 150 local commands including integrated debugger, 2D display list, 4014 emulator, scrolling text windows, macro programming, graphics primitive
Spectragraphics Corp.					
1250	Monochrome: 20, color: 19 1024 x 1024	Monochrome: 16 intensity levels, color: 16 out of 4096	Graphics processor: AMD 2901 16 bit slices, system supervisor: Intel 8086, channel processor: AMD 2901 8 bit slices	32K per workstation	Local diagnostics
1500	19 1024 x 1024	4096 simultaneously displayable colors	Workstation processor: Intel 8085, transformation processor with discrete components, graphics processor: AMD 2901, system: Intel 8086	128K display-list memory (expand- able to 1M), on-board 256K RAM for operating system	Local diagnostics, pan, zoom, translate, rotate, character generation
Synercom Technology Inc.					
GWS III	dial 19 1024 x 1024	8 out of 4096	16 bit	512K	Cursor tracking, grid generation, pan, zoom, diagnostics
Tab Products Co.					
132/15-G	15 512 x 384 (560 x 420 optional)	Green monochrome	8085, Z80	32K RAM	Tektronix 4010/4027 emulation; alpha mode; vector, arc generation; polygon fill; APL mode
Tektronix Inc.					
4109	19 640 x 480	16 out of 64	80186	256K	Zoom, pan, 2D transformation, segment manipulation
4107	13 640 x 480	16 out of 64	80186	128K	Zoom, pan, 2D transformation, segment manipulation
4105	13 480 x 360	16 out of 64	80186	32K	
4025A	12 640 x 480	Monochrome	8085A	Display: 16K (32K optional), graphics: 32K optional	Edit keys, user-definable keys

Standard peripherals	Optional peripherals	Host interface	Software	Price	Circle no.
Joystick, keyboard, digitizer tablet		RS232C	DISSPLA, TELL-A-GRAPH, PATRAN, SAS/GRAPH, DI-3000 charts and graphs	\$19,600	
VT100 format keyboard	Tablet joystick, mouse	RS232C, IEEE-488, DMA-to-VAX Unibus, Q-bus, Multibus, P-E, DG	FORTTRAN subroutine library	\$15,350	857
VT100 format keyboard	Tablet, joystick, mouse	RS232C, IEEE-488, DMA-to-VAX Unibus, Q-bus, Multibus, P-E, DG	FORTTRAN subroutine library	\$18,850	
VT100 format keyboard	Tablet, joystick, mouse	RS232C, IEEE-488, DMA-to VAX Unibus, Q-bus, Multibus, P-E, DG	FORTTRAN subroutine library	\$17,350	
VT100 format keyboard	Tablet, joystick, mouse	RS232C, IEEE-488, DMA-to-VAX Unibus, Q-bus, Multibus, P-E, DG	FORTTRAN subroutine library	\$17,350	
Light pen; programmable 32-key function pad; backlitged, alpha numeric keyboard; monitor	Data tablet	IBM plus compatible (3030 series, 4200, 3080 series)	IBM-compatible graphics	mono: \$21,000 per workstation, color: \$42,000 per workstation	858
	Monitor, keyboard, keyboard with integrated joystick, free-standing, joystick, light pen, digitizing tablet, evaluator dial, programmed function switcher	interfaces: IBM (4300, 3030, 3080), DEC VAX, P-E, ULI, IEEE-488, RS232C	FORTTRAN, GKS	\$19,900 without peripherals; typical 4-station configuration: \$25,000	
Camera			Infomat, TRACE, TOPS		859
Keyboard	Printer	RS232C, 20-Ma loop	PLOT10, DISSPLA, TELL-A-GRAPH, IGP, DI3000, ILS, Template, Plotpak	\$3295	860
	Digitizing tablet, color ink-jet copier/printer, plotter, graphics processor for local programming	RS232C		\$9950	861
	Digitizing tablet, color ink-jet copier/printer, plotter, graphics processor for local programming	RS232C		\$6950	
	Color ink-jet copier/printer, plotter, graphics processor for local programming	RS232C		\$3995	
	Hard copy, tape storage, plotter	RS232C full duplex, half duplex optional, current loop optional		\$5900	

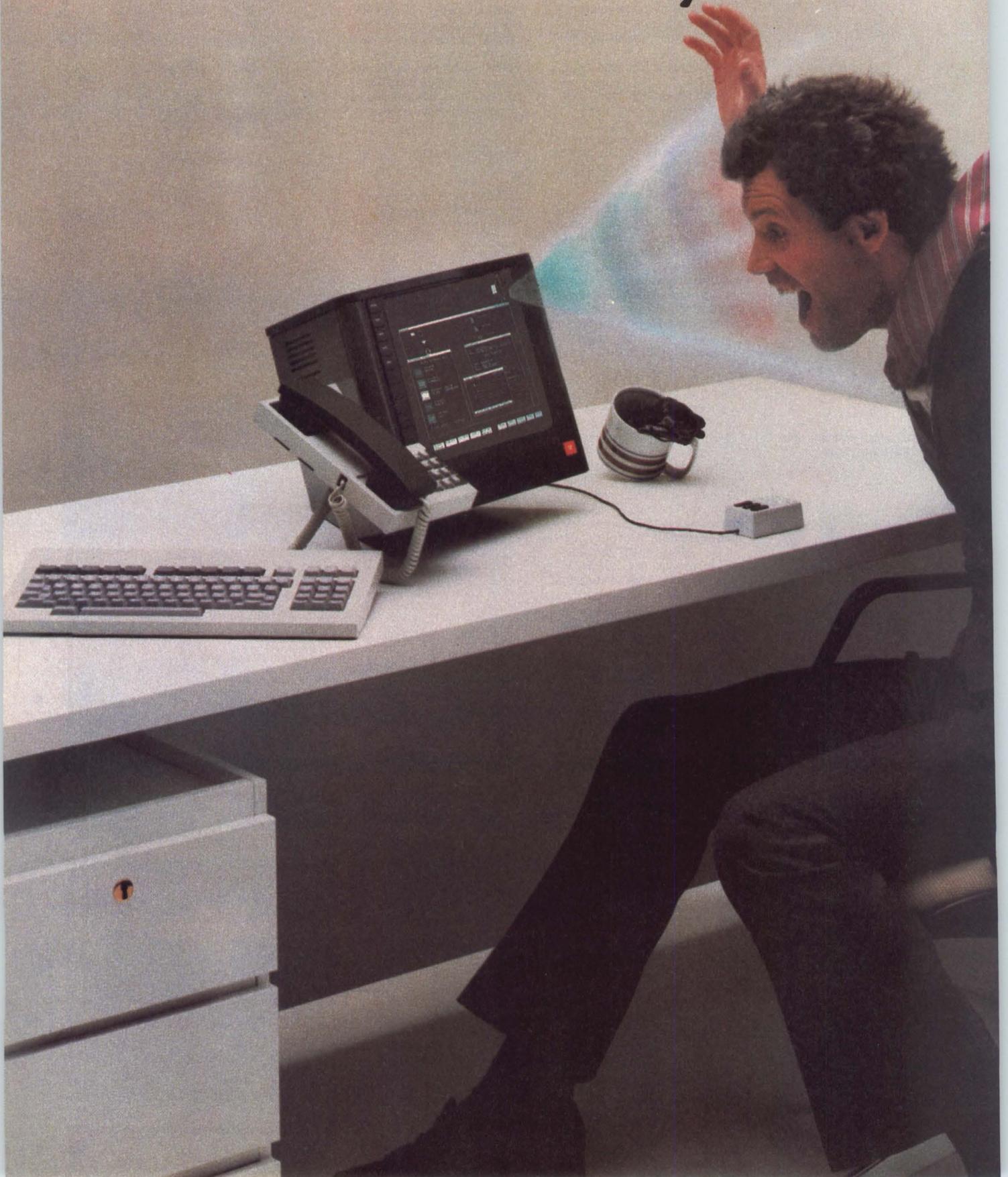
GRAPHICS WORKSTATION VENDORS

Company; model	Screen size (in.), resolution (horizontal x vertical)	Colors	Processor(s)	Memory (bytes)	Local functions
4027A	13 640 x 480	8 out of 64	8085A	Display: 16K (32K optional), graphics: 48K, 192K optional	Edit keys, user-definable keys
4012	12 1024 x 780	Monochrome		Dust screen	
4006	12 1024 x 780	Monochrome		Dust screen	
4014	19 4096 x 3120	Monochrome	None standard	Dust screen	None standard
4016	25 4096 x 3120	Monochrome	None standard	Dust screen	None standard
4112A	15 640 x 480	Monochrome	8086/8087	32K (800K optional)	Zoom, pan, local programmability
4113A	19 640 x 480	8/16 out of 4096	8086/8087	32K (800K optional)	Zoom, pan, lo-pro
4114A	19 4096 x 3072	1	8086	80K user, 1M total address- ability	More than 150 including 2D transformations, segment user-definable scrollable refreshed dialog area, local picture storage
4115B (pedestal or modular package)	19 1280 x 1024	256 out of 16 million	8086/8087 and proprietary bit-slice graphics processor	As much as 800K RAM	Zoom, pan, segment scaling, rotating, repositioning, English language commands to set terminal parameters, dialog area to separate alphanumeric text from graphics
4116A and 4116A-30 (desk version)	25 4096 x 3120	Monochrome	8086 W/8087 co-processor	32K RAM (800K optional)	Segments; fast redraw; dialog area; user-definable; 2D transformations; write- through refresh support
4054A	19 4096 x 3120	Monochrome dust standard, two-color dust optional	16-bit bipolar bit-slice	32K (64K, 256K, 512K optional)	Programmable in high-level BASIC
4051	11 1024 x 780	Monochrome (DVST)	6800	16K (32K optional)	Programmable in extended BASIC with high level graphics commands
4052A	11 1024 x 780	Monochrome (DVST)	16-bit bipolar bit-slice	32K, 64K, 256K, 512K optional	Programmable in high-level BASIC
Terak Corp. 8600	13 640 x 480	64 out of 512	LSI-11, 8086		Rotate, zoom, zone
Transiac Corp. TR1024	15 1024 x 780 viewable, 1024 x 1024 addressable	Monochrome	TI9995	64K RAM	VT100 emulation, Tektronix 4010 emulation
Vectrix Corp. VX Series (model 128)	13 672 x 480	8 (512 out of 16.8 million optional)	8088, NEC 720	128K	Rotation; scaling; translation; clipping; polygon fill; line, arc, polygon generation, zoom

Standard peripherals	Optional peripherals	Host interface	Software	Price	Circle no.
	Hard copy, tape storage, plotter	RS232C full duplex, half duplex optional, current loop optional		\$10,900	
	Hard copy, plotter, tablet tape	RS232 full duplex, half duplex optional, flagged optional		\$6200	
	Hard copy, plotter, tape	RS232 full duplex, half duplex optional, flagged optional		\$3900	
	Hard copy, plotter, tape, tablet	RS232C full duplex, half duplex optional, flagged optional		\$15,750*	
	Hard copy, plotter, tape, tablet	RS232C full duplex, half duplex optional, flagged optional		\$20,500	
None	4662/63 plotter, 4632/34 HCU, option 13/14 tablets, printers	RS232C		\$5500	
None	4691 color HCU, 4662/63 plotters, 4632 HCU, option 13/14 tablets, printers	RS232C		\$16,500	
Keyboard with thumbwheel GIN input	Local computing software — CP/M-86 plus FORTRAN 86 plus graphics routines, single/dual floppy disk drive, Winchester disk drives, graphic tablets, plotters, hard-copy units	RS232C ASCII asynchronous, current loop optional		\$17,900	
None	4691 color graphics copier and I/F, 4634 monochrome graphics copier, 4926 Winchester disk drive, one or two integrated floppy disk drives, 11- x 11-in. and 30- x 40-in. graphics tablets, DMA I/F for DEC Unibus	RS232, DMA-to-DEC Unibus		\$19,950 includes 4 bit planes and 288K-byte RAM	
None	4611 hard copy, 4631 hard copy, 4662 plotter, 4663 plotter, 1 or 2 494K-byte floppy disk drives, 11- x 11-in. or 30- x 40-in. tablet	RS232C DC1/DC3 (Xon/Xoff) flagging, blockmode optional		4116A: \$22,400, 4116A-30: \$22,900	
Integrated tape cartridge drive (600K-byte capacity)	8-in., 1.8M-byte 4907 floppy disk drive, multi-user 4909 file-management system, 32M- to 96M-byte hard disk supporting as many as 10 users, 4662/4663 digital plotters, 4611/4631 hard-copy units, 4643 line printer, 4924 digital tape drive, 4952 joystick, 4956 graphics tablets	Asynch RS232C, programmable to 9600 baud, PLOT10 emulation		\$14,950	
Integrated tape cartridge drive (600K-byte capacity)	8-in., 1.8M-byte 4907 floppy disk drive, multi-user 4909 file-management system, 32M- to 96M-byte hard disk supporting as many as 10 users, 4662/4663 digital plotters, 4611/4631 hard-copy units, 4643 line printer, 4924 digital tape drive, 4952 joystick, 4956 graphics tablets	RS232C, PLOT10 emulation		\$6295	
Integrated tape cartridge drive (600-byte capacity)	8-in., 1.8M-byte 4907 floppy disk drive, multi-user 4909 file-management system, 32M- to 96M-byte hard disk supporting as many as 10 users, 4662/4663 digital plotters, 4611/4631 hard-copy units, 4643 line printer, 4924 digital tape drive, 4952 joystick, 4956 graphics tablets	RS232, PLOT10 emulation (4012)		\$9900	
	Floppy disk drives, Winchester disk drives, printers, plotters, digitizers	RS232C	VENIX, VENIX/2, Pascal, RT-11/85, FORTRAN		862
Interface to Tektronix, Versatec, CalComp plotters, digitizer		RS232C	PLOT10, ISSCO, Precision Visuals	1 plane: \$4500, 4 planes: \$9000	863
None	Light pen, keyboard, joystick, digitizing tablet	RS232C Centronics parallel	Paint program running off of the Apple, CAD program, VX series is language independent	\$2495	864

*Includes enhanced graphics, previously option 34.

Announcing the
VoiceStation™ System.



Resounding success in office automation for OEMs.

First to combine voice with text, data and graphics. Any office worker, from manager to professional to support worker, can use the VoiceStation System by Sydis. That's because it brings freedom of speech to the office. Workers can record, edit and relay voice messages. It's the simplest method of interface yet — freedom from typing, freedom from learning difficult commands. (The keyboard is not essential for most functions.) Now OEMs can speak to the needs of the entire office with one system. This alone holds tremendous sales potential... and there's more.

Applications maximized, development minimized. Customization of the VoiceStation System is simplified by a large number of OEM and end user development tools. The system can be adapted to literally any office situation.

Multi-computers, high performance, 16-300+ users. The 16-bit multi-computer Sydis Information Manager™ (SIM*) utilizes an enhanced Xenix™ operating system, which is Unix™ System III compatible. The SIM can be cost-effectively expanded to as many as 32 single board computers, each with up to 2 M bytes of memory. This, in combination with a high speed workstation link of 320 K bits/second, allows the SIM to accommodate 16 to 300+ users without performance slow-down.

Communications, personal computing, electronic office. The system workstation, VoiceStation 1, is small, only slightly larger than a 10 button phone. Yet it gives users access to advanced office automation applications through an icon-based, object-oriented user interface. Applications include: telephone services, electronic mail, file cabinet and wastebasket services. Also personal computer applications like word processing (with voice annotation), electronic spreadsheets, business graphics, database, forms and communications.

Replaces the phone, uses existing wire. Disconnect the present telephone and hook up VoiceStation 1. That's all. VoiceStation 1 communicates with the SIM via a twisted pair of telephone wire, so the cost of installing additional cable is eliminated. And the SIM can work with any existing PBX and central office phone services.

Let's talk price/performance margins. Sydis would like to speak to OEMs. Priced lower than other systems that don't support voice, the VoiceStation System is worth talking about.

CIRCLE NO. 96 ON INQUIRY CARD



The Sound Decision.

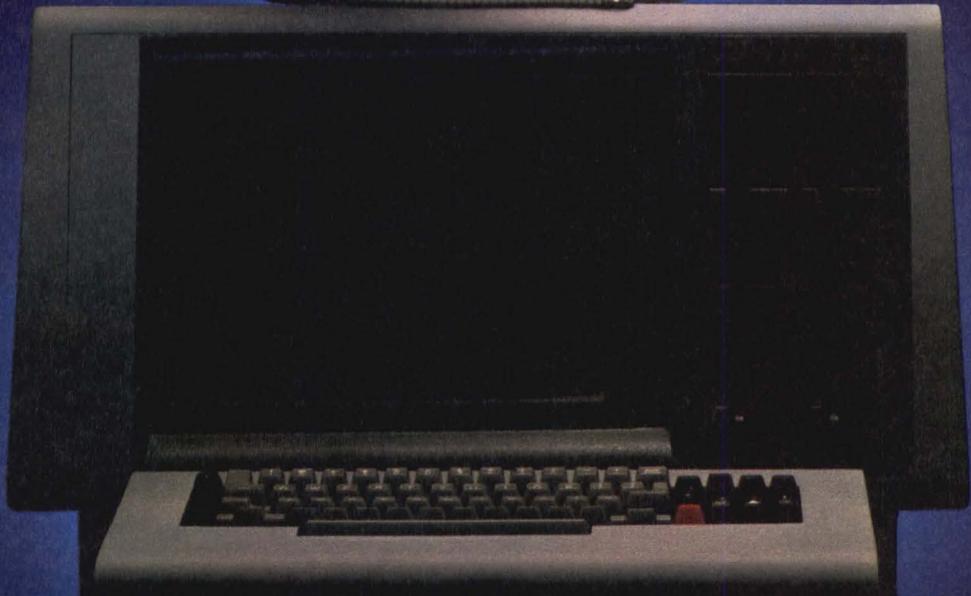
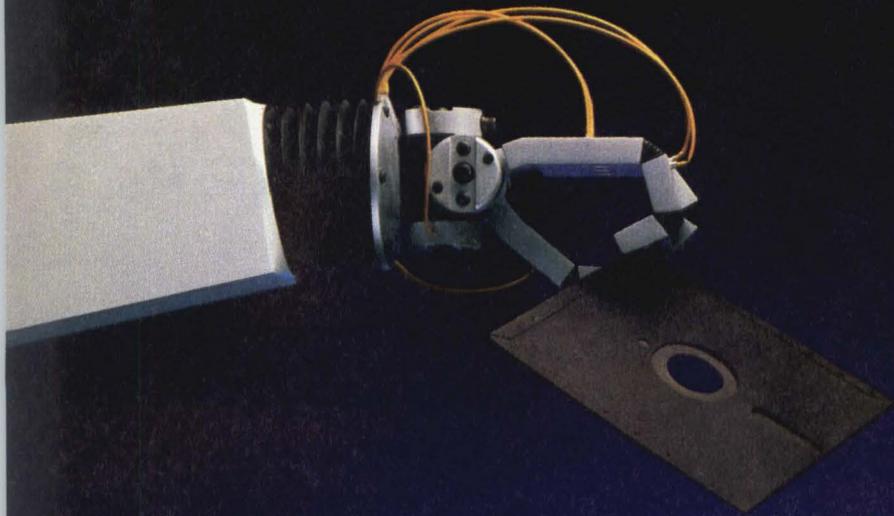
(408) 243-8430

VoiceStation, Sydis and Sydis Information Manager are trademarks of Sydis, Inc. SIM is an acronym for Sydis Information Manager. Xenix is a trademark of Microsoft Corporation. Unix is a trademark of Bell Laboratories.



Mail to: Sydis, Inc., 4340 Stevens Creek Blvd., San Jose, CA 95129

Name _____
Title _____
Phone (_____) _____
Company _____
Address _____
City _____ State _____ Zip _____



SPACE BLASTERS

SOME THINGS WOULD BE BETTER LEFT TO MEMORY.

Just think how many products could be replaced, redesigned, or otherwise improved, if only you had the memories to do the job.

Memories you could use in entirely new ways. To open up new applications. And bring old ones back to life.

Those memories are here. Right now. For military or commercial applications. From the people who've pioneered memory technology from the start.

Intel.

For example, you've no doubt heard the term "software in silicon." Well, Intel has an EPROM that can be used as a software carrier. At 256K, it's twice as dense as any EPROM on the market. So it holds a word processing program, an entire operating system, or a game that could blow the doors off the arcade.

We've had similar breakthroughs in bubble memory. Our 1 and 4 megabit bubbles let you put working storage capabilities in places that would shake a disk system to bits. Places like an earthquake monitoring system. Or the portable system in a commuter's briefcase.

What's all this whiz bang technology going to cost you? A lot less than you imagine.

Our 64K iRAMs, for instance, cost less than static RAMs. So they're perfect for smaller systems.

And our electrically alterable, non-volatile E²PROMs can be recalibrated automatically. In-system. So things like robots, medical instruments, and navigational equipment can change with the wind.

For manufacturing, our intelligent Programming™ Method cuts EPROM programming time by a factor of 6. So you save money there, too.

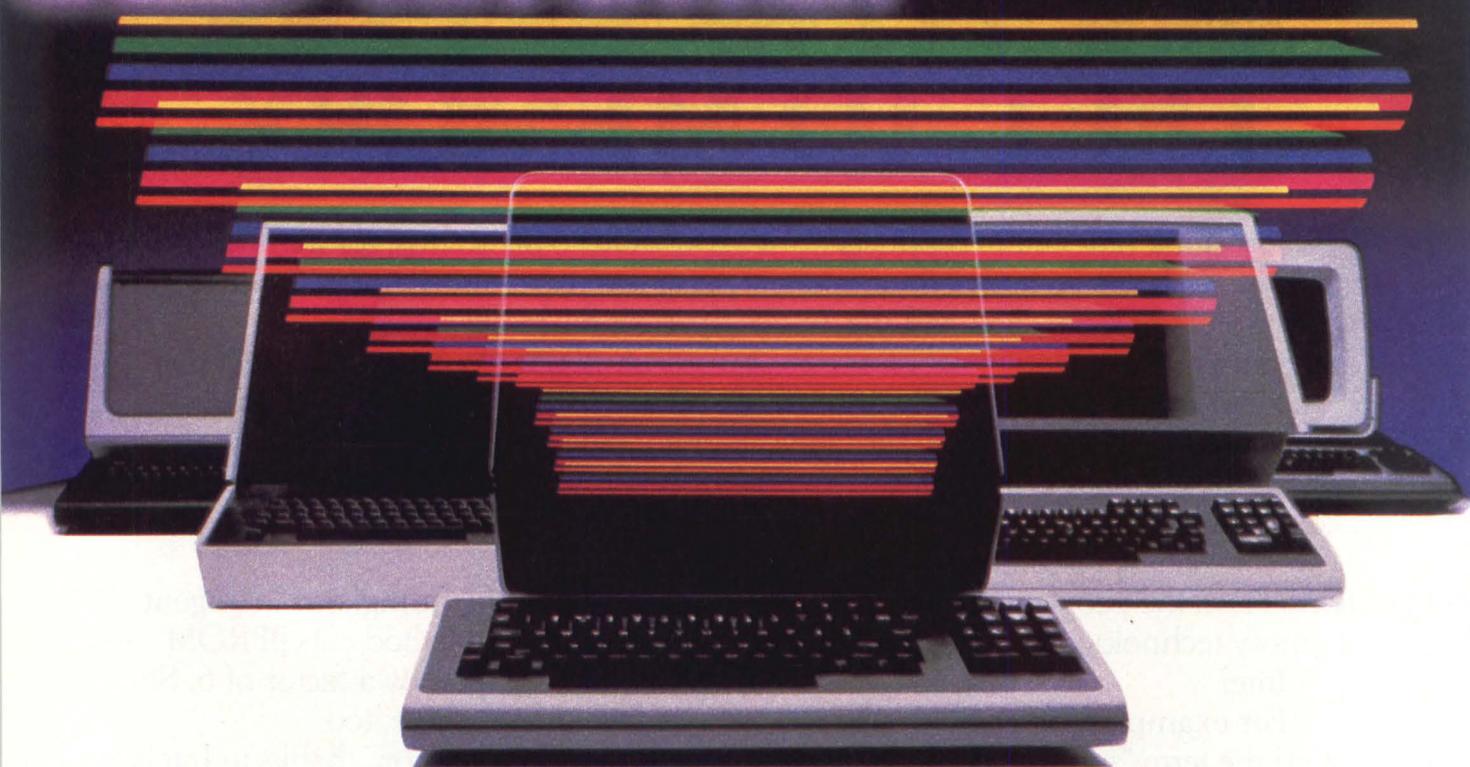
As well as later on, thanks to Intel's Reliability Monitoring Program. This program provides you with vital statistics on each part we make. No one else does that. And our reliability level, as a result of the program, helps you lower your repair costs, reduce maintenance and build a product that's more valuable, longer.

Get a copy of our full line product guide for more details. Call (800) 538-1876. In California, (800) 672-1833. Or write Intel, Lit. Dept.: Z-12, 3065 Bowers Avenue, Santa Clara, CA 95051.

You and your products will be a lot better off.

intel® delivers
solutions

ID SYSTEMS CORPORATION



One color graphics company makes others pale by comparison.

When it comes to color graphics for business or engineering, ID Systems displays a wide spectrum of capabilities. Color us...

Performance-oriented. Naturally, you want the most performance for every dollar you spend. When you choose an ID Systems terminal, you're assured that the color graphics you expected are the color graphics you get. From firmware to resolution, from alpha numeric capabilities to interactive graphics, ID Systems' product line out-performs other similarly-priced systems. It's what you would expect from a company with our success record in the graphics industry.

Affordable. We believe that color graphics should be cost-efficient, not costly, for the businesses that use them. That's why we've developed products that balance price and performance, so you get a quality system that doesn't sacrifice capability for affordability. And once you buy a color graphics terminal from ID Systems, you can count on continued customer support from reliable and experienced professionals.

Compatible. When you make the move to color graphics with ID Systems, it's smooth sailing. Our terminals are designed to be fully compatible with some of the most powerful graphics software packages currently available today... from PLOT 10™ and 4014 emulation for engineering to ISSCO® and SAS® for business graphics, ID Systems' terminals perform. They're easily integrated with existing computer systems and can be interfaced with a wide variety of hard copy devices, including printers and plotters. Business presentations can be enhanced through the use of color cameras for slides and overhead transparencies.

Confident. We're convinced that once you take a careful look at ID Systems and compare our products to others available, you'll choose ID Systems. And once you install our color graphics terminals, you won't be disappointed. Proof? Our customers return to us again and again to meet their additional requirements. So try us. We're confident you'll color your world with an ID Systems color graphics terminal.

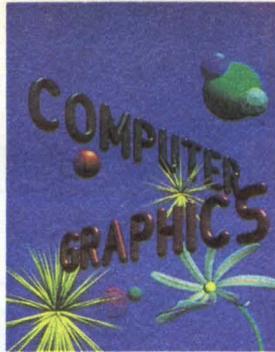
Call ID Systems today at 614/876-1595.

ID SYSTEMS CORPORATION

Color graphics for business and engineering

4089 Leap Road
Hilliard, Ohio 43026
TWX: 810-482-1049

CIRCLE NO. 98 ON INQUIRY CARD



Graphics compatibility

RICHARD FICHERA, Raster Technologies Inc.

Graphics compatibility is like computer compatibility, only trickier

Reductions in the cost of memory, logic, video timing circuitry, and video monitors over the last few years have reduced overall graphics workstation costs by an average of 25 to 30 percent annually. Graphics hardware represents a much smaller percentage of system cost than it once did. Consequently, graphics users are paying increased attention to the cost of writing and maintaining software. Given the rapid rate of graphics hardware introductions, preserving software investments in graphics applications can be difficult. Software compatibility across product lines and into future products has become a prerequisite for graphics workstation success.

In its Model One family of raster display systems, Raster Technologies Inc. has applied a number of compatibility-promoting techniques first employed in large data-processing product lines. The Model One's "compatibility level" was a fundamental choice that dictated its overall design.

Compatibility levels

Compatibility between graphics workstations is theoretically similar to compatibility between computer systems (Fig. 1).

At the highest level—hardware compatibility—systems are 100-percent compatible when their hardware implementations are essentially identical. Two hardware-compatible systems may differ in a few chips, perhaps using one chip to replace 20 in the latest

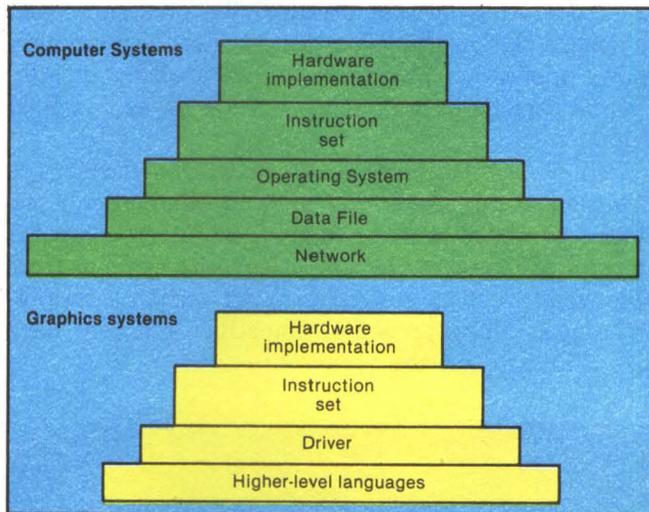


Fig. 1. Levels of compatibility exist for both computer systems and graphics systems. The level of compatibility supported by a family of graphics systems is a crucial decision for graphics vendors. Raster Technologies uses instruction-set compatibility to control software development and redevelopment costs, to preserve software investments and to adapt to changing market requirements.

design. But common backplanes and interconnection hardware allow what can be attached to one system to be attached to the other. A disadvantage is that rigid adherence to hardware compatibility can constrain the development of new products.

A second level is instruction-set compatibility, which allows computer systems with *different* hardware

implementations to run the same programs. An excellent example of instruction-set compatibility is found in Digital Equipment Corp.'s PDP-11 family of computers. Although PDP-11 models vary in size and configurations, many programs can run unchanged on all models.

Instruction-set compatibility can also make graphics devices compatible. Graphics instruction-set compatibility allows a vendor's graphics devices to use the same instruction set across all its products, despite different resolutions, bit-plane depths and price/performance levels.

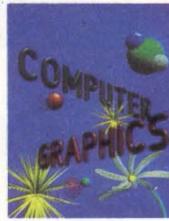
Driver compatibility is the next level. Instruction sets can differ, but users can employ host-resident drivers to make graphics devices compatible with application programs.

Language-level compatibility allows a user to access graphics devices through a higher level language such as FORTRAN. A host library of compatible programs allows the same tasks to be performed despite the use of different drivers, instruction sets and hardware implementations.

Operating-system compatibility can apply when neither the hardware nor the instruction sets allows the programs to run unaltered. However, by using the same operating system utilities, file structures and compilers, the resulting operating-system compatibility allows application programs to run unchanged. Substantial sharing of data and programs gives an added benefit.

Data-file compatibility is the next level. It refers to two computer systems that have in common only the ability to share disk or tape files. Most computer systems are at least file compatible with systems from other vendors. Some standards initiatives have attempted to make all systems file compatible, but they have met with little success.

The final level, network compatibility, allows communication between machines that are otherwise incompatible. For instance, many vendors support IBM 2780 protocol, but this level of compatibility results in very limited functionality.



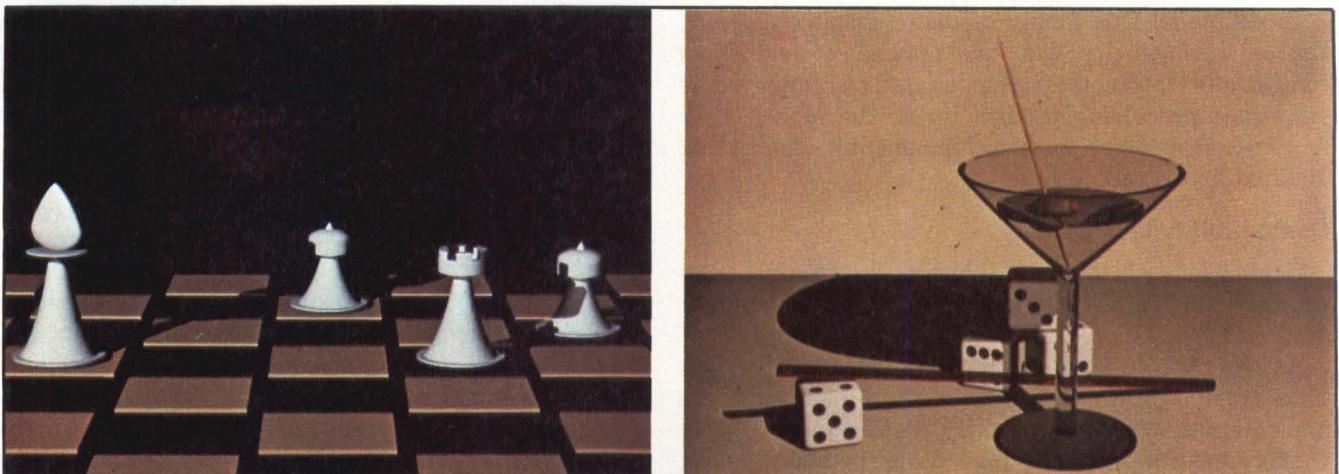
Versions of the Model One graphics systems use different resolutions, bit plane depths and peripherals

Most commercially successful computer system underscore the importance of compatibility. Much of a computer or graphics vendor's success results from its strategic choice of the right compatibility level. For example, both the DEC PDP-11 family and the IBM 360/370 product families use instruction-set compatibility. Less successful computer families have used lower levels of compatibility and have burdened users with substantial conversion problems and large software-development and redevelopment expenses.

Designing for compatibility

In designing a multi-product compatibility strategy, a graphics vendor faces important technical trade-offs. The closer the vendor moves to hardware-implementation compatibility the more difficult the engineering of new products becomes. The closer the vendor moves towards host-library-level compatibility, the simpler hardware engineering becomes because new hardware need not be tied to the old. At this level, a user is limited to the use of a higher level language and a vendor-supplied library. Thus, system flexibility and overall performance are constrained.

Instruction-set compatibility provides the most bene-



Two 1024 × 1024 pixel images generated by the Raster Technologies Model One graphics subsystem. The Model One is available in a number of instruction sets compatible with differing resolutions and prices.

How to get a lot more color for your money.



Actual unretouched photo taken directly from screen.

Introducing the HP 2627A Color Graphics Terminal.

Now you can have a bright, sharp image that's easy to read. For only \$5,975. Which means our compact new color graphics terminal is setting completely new price/performance standards.

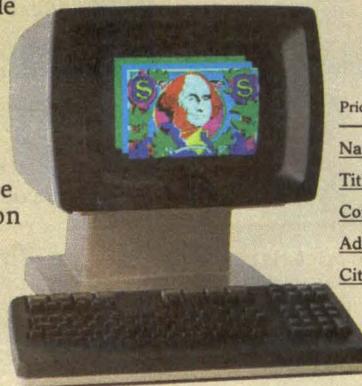
You get 8 basic colors, plus hundreds of additional user-defined ones. Including colors that match our plotter pens. On a black screen with 512 x 390 line resolution. You get raster display technology for fast, selective screen updates. You get vector graphics and polygonal area fills, a combination that makes it easy to create complex shapes, symbols, and even timesteps. In a lot less time. With a lot more precision.

Of course, it's also software-compatible. In addition to HP's DSG/3000

and Graphics/1000-II software, the 2627A runs PLOT 10 from Tektronix, SAS's SAS/GRAPH, Precision Visual's DI-3000 and GRAFMAKER, ISSCO'S DISSPLA and TELL-A-GRAF.

But that's not all; the 2627A has user-definable softkeys and graphics edit keys that make this one of the easiest-to-use terminals on the market. It even gives you complete alphanumeric

capability. In a separate memory. So whether you're interested in business or technical applications, just return this coupon and we'll send you more information. Or call your local HP sales office. We're listed in the white pages.



Price U.S. list. _____ 42204

Name: _____

Title: _____

Company: _____

Address: _____

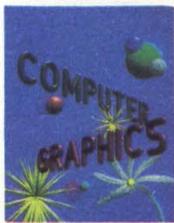
City: _____

State: _____ Zip _____

Send to: Hewlett-Packard, D.T.D., Dept. 08159,
974 E. Arques Ave., Sunnyvale, CA 94086
Attn: Tom Anderson, Marketing Manager
(408) 735-1550 ext. 2468

fit to both users and vendors. Hardware implementations can evolve with new technical advances, but users must also have the flexibility to use different languages, libraries and drivers.

Maintaining instruction-set compatibility places some stringent design restrictions on new products, but these can be overcome through development of an appropriate product architecture (Fig. 2).



The instruction set is designed to support evolving graphics standards including CORE and GKS

The foundation of the compatibility strategy in Raster Technologies Model One Graphics System design is the use of a high-performance, embedded 16-bit microprocessor. This 8-MHz Z8002 microprocessor is augmented by hardware accelerators for graphics processes such as vector computation and pixel arithmetic. This design gives the user a very broad, flexible instruction set and passes commands to hardware accelerators for direct execution. The microprocessor

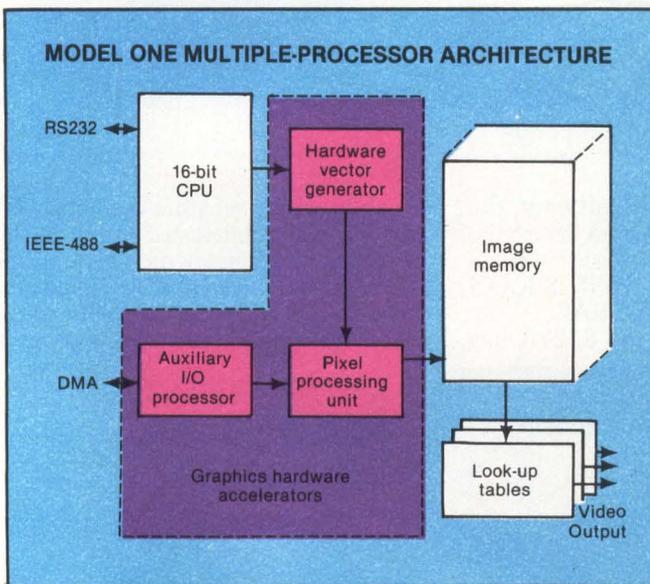


Fig. 2. Multiprocessor architecture used in the Raster Technologies Model One is a useful approach to maintaining instruction-set compatibility across a graphics product line. A collection of hardware accelerators provides fast interactive graphics, while a high-speed multiprocessor insulates the user from the details of hardware implementation.

maintains the entire user interface. The programmer deals only with a basic instruction set and is isolated from the internal implementation details of the product; the use of hardware accelerators is transparent. More graphics vendors are introducing products based on microprocessors with hardware and bit-slice accelerators.

Versions of the Model One graphics systems use different resolutions, bit plane depths and peripherals (Fig. 3). All are compatible at the instruction-set level by appropriately programming the Z8002 microprocessor, which has 64K bytes of ROM and 128K bytes of RAM. The instruction set is designed to support evolving graphics standards including CORE and GKS.

THE MODEL ONE GRAPHICS SYSTEMS			
Feature	Model One/25	Model One/40	Model One/60
Picture resolutions	512 x 512, anti-aliased; or 1024 x 1024, dual mode	1024 x 1024	768 x 576 window into 1024 x 1024 image memory
Refresh rate	30 Hz interlaced	30 Hz, interlaced or 60 Hz, noninterlaced on a 512 x 512 window	60 Hz noninterlaced
Color support	As many as 16 million simultaneous displayable	As many as 64 simultaneous displayable	As many as 64 simultaneous displayable

Fig. 3. Product compatibility via instruction-set compatibility makes these diverse Raster Technologies graphics generators seem almost identical to the graphics programmer.

Graphics systems frequently include custom graphics instructions to define interactive routines to be executed locally in the graphics workstation. Local programming reduces host computer processing and improves response time. The second important design strategy that Raster Technologies adopted to maintain compatibility is graphics MACRO programming, or the ability to program the workstation locally in its own command set.

Writing local graphics routines for menu management, function buttons, cursor movement and other local interactive routines often requires user microcoding. Microcoding is expensive and contradicts the rationale for compatibility. Once a user is forced to microcode interactive routines and custom instructions in a graphics device, he has entered the realm of hardware implementation. Transportability of the microcode, even within one vendor's product line, can be very difficult, if not impossible. If the user upgrades to a different product of the vendor's same graphics family, he may be forced to rewrite that set of interactive routines. That's not compatibility.

Raster Technologies' systems offer MACRO program-

Imaging in Motion



Like a dancer, many imaging features reveal their meaning solely in an integrated series of frames. Up to now, image processing systems haven't offered *both high spatial resolution and the top-speed data transfer rates* of video devices. You had to choose one or the other — the dancer or the dance — there wasn't enough space in display memory for both.

Now Gould DeAnza Gives You Both

Our new Real-Time Digital Disk has 300 megabytes of storage to record or playback 512x512x10-bit imagery at 30 frames per second. That means you can combine the 1,000 to 1 signal-to-noise ratio of your top resolution images — and see them at fast video display rates

Future development of many applications depends on precisely this feature: fluoroscopy, angiography, CT scanning, seismic data analysis, structure analysis and non-destructive testing, animation, modeling, and more. The Disk's virtual image storage guarantees real-time video recording and playback of 800 high resolution images in an interrelated series.

10 Times the Memory, 1/5 the Price

Custom-tailored solely to Gould DeAnza image processing systems, the Real-Time Digital Disk is a true advance in state-of-the-art imaging. It literally offers 10 times the storage capacity available from any other manufacturer — at 1/5 the price. You can't buy this expansion of imaging power from anyone else. Call us today.

 **GOULD**

Gould Inc., DeAnza Imaging & Graphics Division

1870 Lundy Ave., San Jose, California 95131 Telephone (408) 263-7155 TWX (910) 338-7656
Eastern: (516) 736-3440, Central: (312) 965-8110, Southwest: (214) 458-0052 Western: (408) 263-7155
CIRCLE NO. 101 ON INQUIRY CARD

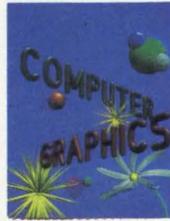
GRAPHICS

ming capability that allows the user to produce custom graphics routines and interactive graphics functions.

MACDEF 10 (Define MACRO 10, As many as 255 macros can be active simultaneously)
 VAL1 63 (Set color to white)
 PIXFUN XOR (Set pixel function to exclusive or)
 MOVABS 0, 0 (Position in center of screen)
 RECREL 100, 100 (Draw enclosing rectangle)
 MOVABS 20, 80 (Position for text)
 TEXTC 16 (Set text size to 16 pixels. Text is vector font and can be smooth scaled and rotated in one degree increments)
 TEXT1 BUTTON 1 to toggle menu (Write in text font 1. Font 2 is user definable)
 MOVABS 20, 20
 TEXT1 BUTTON 2 TO PAN SCREEN
 MOVABS 20, 20
 TEXT1 BUTTON 3 TO TRACK CURSOR
 MACEND
 BUTTBLE 1, 10 (assign button #1 to execute MACRO 10)
 BUTTBLE 2, 12 (assign button #2 to execute MACRO 12, pan)
 BUTTBLE 3, 15 (assign button #3 to execute MACRO 15, cursor)

Fig. 4. Raster Technologies MACROs handle menu-management tasks locally without host intervention. MACROs are written in the Model One graphics instruction set and not in assembler or microcode.

MACROs are written in the Model One graphics instruction set and not in microprocessor assembler or microcode. A convenient user interface is provided by the integration of MACROs with the button table. This allows groups of MACROs to be executed by a button on a digitizer or by the keys on a local keyboard (Fig. 4).



Software compatibility has become a prerequisite for graphics workstation success

With MACROs, the user is assured that interactive routines, such as menu management, tablet management and cursor management can be transported between any member of the Model One family. Furthermore, as Raster Technologies adopts new technologies, chips, RAMs and other circuitry, users' codes will run without modification. MACROs isolate users from the hardware-implementation level. □

Richard Fichera is product manager at Raster Technologies Inc., North Billerica, Mass.

PROGRAMMABLE COMMUNICATIONS TRANSLATOR



MSI's PCT-100 is a CONFIGURABLE IN-LINE RS-232 PROTOCOL AND DATA TRANSLATOR WHICH CAN PROVIDE:

- * TERMINAL OR PRINTER EMULATION
- * DEC OR IBM SYSTEM COMPATIBILITY
- * MACRO-FUNCTION KEYS
- * "TYPE-AHEAD" AND DATA BUFFERING
- * BAUD RATE CONVERSION
- * HANDSHAKE PROTOCOL TRANSLATION (E.G. CTS/RTS, XON/XOFF)

THE PCT-100 CONFIGURATION IS EASILY ENTERED AND MODIFIED USING A BUILT-IN EDITOR, COMPILER, AND DEBUGGER. CODING TRANSLATION ALGORITHMS IS SIMILAR TO PROGRAMMING A CALCULATOR.

WITH POWER SUPPLY AND CASE, THE PCT-100 IS \$398 FOR SINGLE UNIT QUANTITIES.

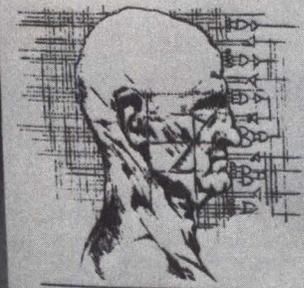
Method Systems Incorporated
 19751 SOUTH LAKESHORE BOULEVARD
 EUCLID, OHIO 44119
 (216) 531-0404

CIRCLE NO. 146 ON INQUIRY CARD

FREE

Programmable Logic

A Basic Guide for the Designer



DATA I/O

This plain-speaking guide tells you how one programmable logic device can replace a handful of fixed-function LSI/MSI devices, or how programmable logic can eliminate the long lead times and prohibitive costs of custom logic.

To receive your free copy, circle the reader service number.

10525 Willows Rd. NE
 C-46, Redmond, WA 98052
 Tel. (206) 881-6445

DATA I/O

CIRCLE NO. 147 ON INQUIRY CARD

Keep An Eye On Your Process In Living Color

PROVUE. For real-time display of dynamic processes.

For some processes, conventional monitoring devices are still okay. But for others, they're outmoded. Energy and materials are too expensive to waste. Productivity and profit are too critical to risk.

That's why Digital has introduced PROVUE.

PROVUE is a sophisticated yet easy-to-use software package for monitoring complex processes with full-color graphics displays. Develop your own unique graphics and control sequences. PROVUE gives your operators dynamic, color images of what's happening, while it's happening. With PROVUE, they'll experience a whole new dimension in process control.

No Programming

You don't need programming expertise for PROVUE. Its powerful Picture Creation Language uses simple, English-like commands. Create your process displays interactively at the graphics terminal. Or code them off-line with PROVUE's Picture Definition Language. Either way, you can have your monitoring displays in

days, not weeks. Because we've done the basics for you.

The steps are easy. Use your process diagram as background.

Overlay it with a foreground combining symbols, text and pictures. From a range of 16 displayable colors, select any or all for contrast, meaning and emphasis.

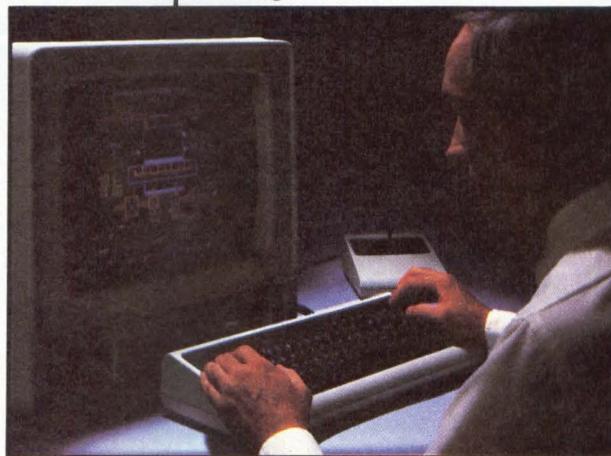
Full-Color, Dynamic Displays

The result is a dynamic, high-quality operator display that takes the guesswork and misinterpretation out of control. Color, text, and graphics combine to bring the process to life. Add an ingredient, change a parameter...PROVUE reflects whatever's done, and the results. Instantly, accurately.

Multiple Process Monitoring

If you monitor more than one process, PROVUE can store up to eight process diagrams for instant recall. Develop dynamic overlays for each. Monitor all at individual operator display stations. PROVUE supports up to four local display

stations, and up to four clusters of four remote display stations. That gives you a lot of process coverage.



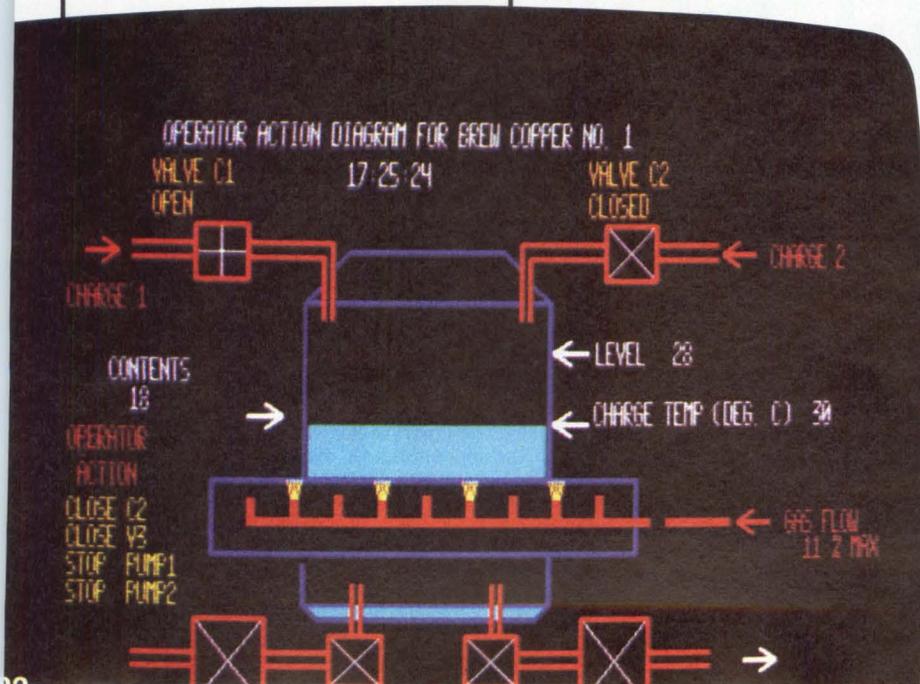
Proven — Supported Worldwide

And PROVUE is a proven, field-tested software package. It's also fully supported worldwide by Digital Software Services.

For Details

For details on PROVUE contact your local Digital Sales Office. In the Continental United States call 1-800-832-6277 or write:

Digital Equipment Corporation
Media Response Manager
200 Baker Avenue
CF01-1/M94
Concord, MA 01742



digital

Do these tough demands blow your graphics apart?

1. Power & speed!

Dual processor power.
Rapid area fill and draw.

2. Simplicity & compatibility.

ANSI X3.64, TEK 4010, 4014
and 4027 compatible.

3. Full featured graphics.

Host graphics support and
terminal primitives.

4. Dot addressability.

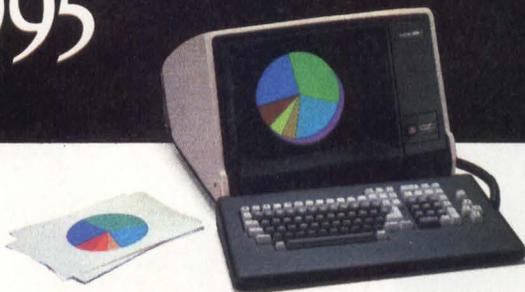
Vector drawing and point plotting.

5. Brilliant raster color.

64 color palette.

6. Affordability.

\$1995*



PRICE/PERFORMANCE BREAKTHROUGH! The new Intecolor 2427 advanced graphics terminal puts the pieces together.

Even managers explode, evaluating terminals to satisfy *all these demands*. And at a reasonable price.

Solution: Try the Intecolor 2427, for only \$1995.

Capitalizing on over 10 years of experience in the design and manufacture of color graphics terminals, Intelligent Systems has put it all together in the Intecolor 2427.

Check out the features. Compare the price. Then contact Marketing Communications at 404/449-5961. TWX 910 766 1581.

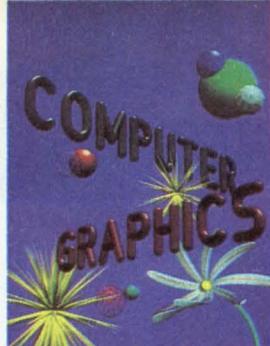
*Single-evaluation unit. U.S. domestic only. To evaluate the 2427 at this 100-piece price, your order must be received by 8/31/83. Single piece price is \$2695.



Intecolor®

AN INTELLIGENT SYSTEMS COMPANY
Intecolor Drive, 225 Intecolor Park, Norcross, Georgia 30092

- 1. Dual Processor Power:** 16-bit Z8002 graphics processor for rapid area fill and polygon drawing. 8-bit 8085 independent alphanumeric terminal functions processor. Plus independent keyboard processor.
 - 2. Convenience/Compatibility:** Extended ANSI X3.64 control system with VT100 features. Integrated graphics and alphanumeric menu set-up. Compatible with TEK 4010, 4014, 4027 terminals and Plot 10. Interactive color graphics. Easy conversion to color.
 - 3. Complete Graphics Capabilities:** Supported by popular host graphics packages. Terminal resident TEK 4027-like graphics primitives. Full featured bit-map graphics.
 - 4. Dot Addressability:** Absolute addressing of points for point plotting with complex graphics. 560H x 288V. Full three-bit pixel array. 80 characters by 24 line alphanumeric display.
 - 5. Raster Color:** Brilliant 64-color palette with color mapping. Eight displayable colors. Self converging, 13" diagonal CRT.
- PLUS: Enhanced Text Features:** Five character sets (two are user-definable). Two vector character sets. **ANSI X3.64:** Industry standard control sequences. Easy to implement. **Two Full Pages of Screen RAM:** Simplifies graphics programming. **72 Function Keys (optional):** Speeds up programming. **Clean, Simple Design:** Assures reliability, cost efficiency. **VT100 Features:** Familiar DEC functions.



Light valve brightens large-screen displays

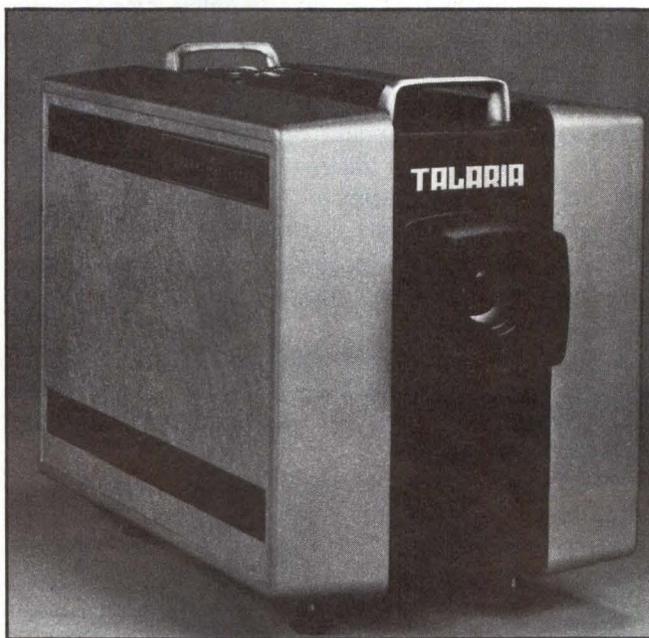
ROY FRIEDMAN and DAVID FREEDMAN, Associate Editors

GE's single-gun projector generates 25-ft.-wide color images, rivaling those of a monitor

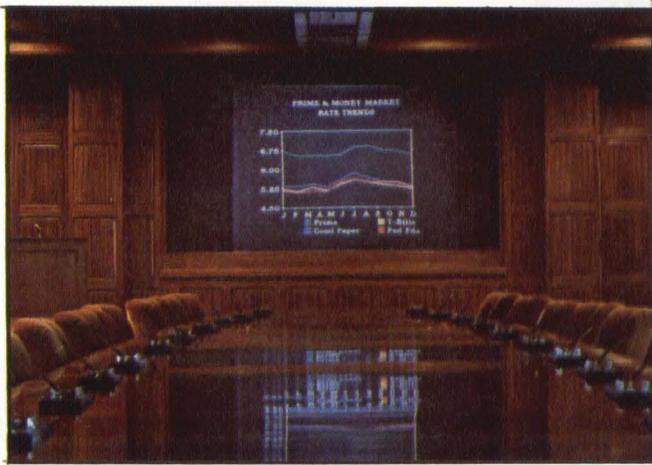


General Electric's PJ 5055 color projector houses a Xenon lamp, an electron gun, a light-valve chamber and a projection lens. The unit weighs only 140 lbs. and accepts RGB and NTSC color signals.

Most video projection systems for large-audience viewing of computer graphics provide images vastly inferior to those of a color monitor. Large-screen projection systems such as those used for home television do not have sufficient brightness and resolution for most business and professional applications.



Sealed light-valve chamber reduces maintenance requirements of GE color projector. Maximum voltage of 7.2 KV eliminates x-ray hazard.



But one type of projection system, using a light valve instead of a CRT, throws monitor-sharp color images, bright enough to be viewed in an undarkened room, onto 25-ft.-wide screens. Color projectors using light-valve technology are available at prices of \$65,000 to \$90,000. These devices are the precursors of professional-quality, large-screen display systems that could be available within a few years at a small fraction of today's prices.

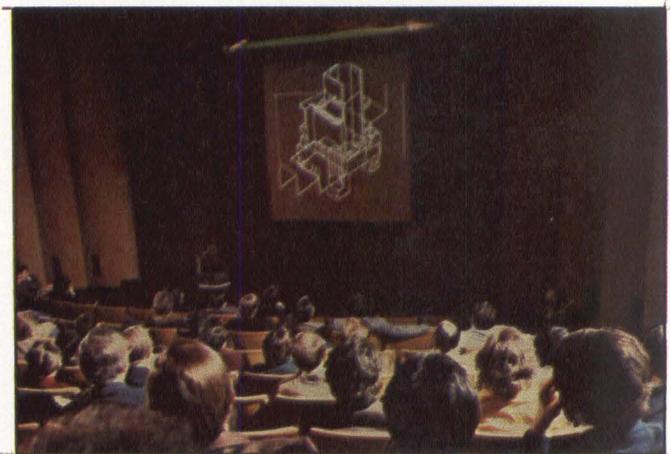
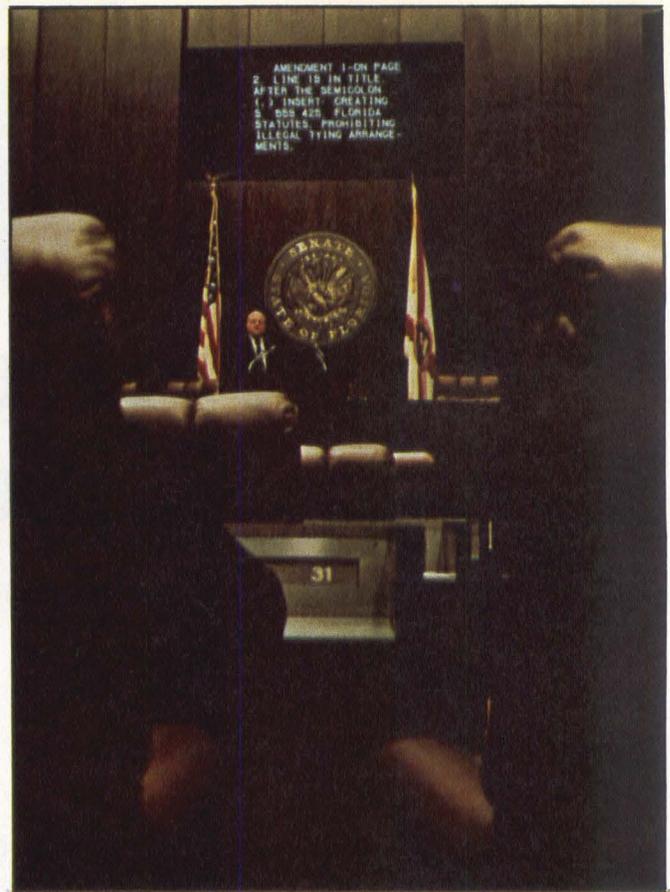
Light valve instead of CRT

Conventional large-screen projection systems use one or more CRTs. The simplest such systems, using a color CRT, have prices as low as \$500 each, but images tend to be blurred, and viewers must see them in completely dark rooms.

More sophisticated systems employ three monochrome CRTs that each accept a separate color signal. The three beams pass through color filters, and a lens converges the beams for viewing on a screen. The best of these systems have prices of \$15,000 to \$20,000 each and project 6-ft.-wide images readable in rooms with low ambient light. Because of the need to converge beams from three CRTs, these systems must be precisely aligned for a given screen position; if either the screen or projector is moved, the system must be realigned.

Light valve projectors do not use CRTs. Instead, an electron gun writes images on the oily surface of a transparent disk, which produces color by diffracting white light from a 650W Xenon lamp (see, "How the light valve works," p.200). Because the Xenon lamp is much more luminous than the phosphor used in CRTs, light-valve images are twice as sharp and 10 times as bright as those of CRT systems.

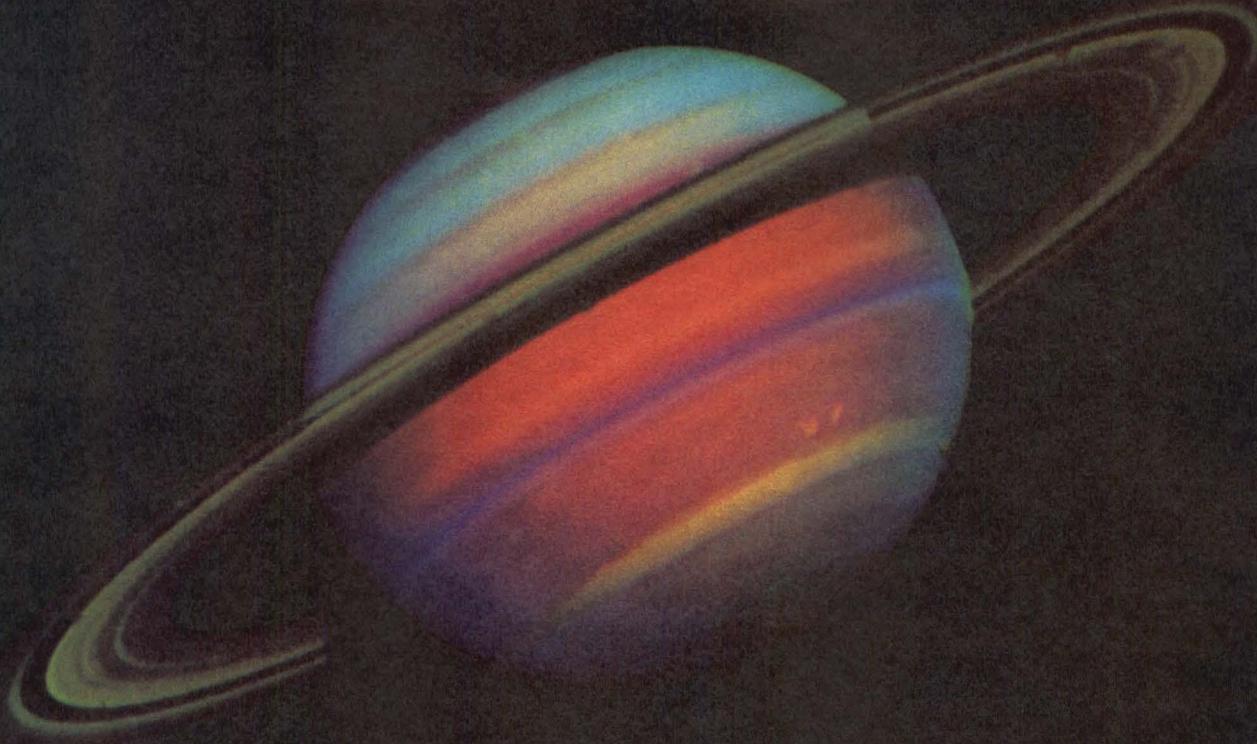
The two major suppliers of light-valve projection systems are General Electric Co. and Eidaphor, in Switzerland. Eidaphor's system produces color images sharp enough to be viewed on a 60-ft.-wide screen in



Applications of the light-valve projector include computer-generated charts at the Mellon Bank of Pittsburgh, legislative text at the Florida Senate and computer-aided-design at the Engineering Society of Detroit.

bright surroundings. But at \$600,000 per unit, the Eidaphor projector generally is limited to large sports and entertainment complexes. Moreover, the Eidaphor system uses a separate light valve for each of three colors, resulting in the same requirement for precise color alignment as many CRT systems.

GE's projector uses a single light valve to provide inherent color alignment. With no alignment requirement, the GE projector need not have a fixed location relative to the viewing screen. Other features of the GE projector are its suitability for front or rear projection, its absence of x-ray hazard and its sealed maintenance-



Only your imagination can limit the application of Comtal's new Vision Ten/24 Image Processing System.

Whether you're exploring the outer regions of space or exploring for oil in some remote area of the world, Comtal's new Vision Ten 24 is the only digital image processing system that processes and displays 1024 x 1024 high resolution images with a clarity never experienced before in image processing. It's a powerful tool for interpreting and analyzing images for such diverse applications as LANDSAT, meteorology, seismology, graphic arts, earth resource management, medical imagery, or something only you know about.

Four times the resolution at 30% lower cost.

The Vision Ten 24 is the only image processing system capable of processing and displaying images at a 1024 x 1024 resolution in real time (1.30 second) with a 40 MHz video output rate. That's four times the resolution of the industry-standard 512 x 512 systems. With it, whole new worlds open up. Inter-

pretation and analysis become more precise. Best of all, the basic Vision Ten 24 system price is 30 percent less than our previous 1024 x 1024 system because of our design and manufacturing refinements. Giving you incomparable price performance.

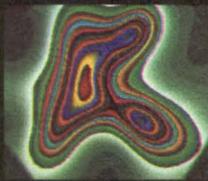
Building block flexibility.

Our modular design approach with the architecture of the Vision Ten 24 gives you flexibility along with easier system upgrades. You can increase video paths, memory size or processing power by simply adding modules. Making the Vision Ten 24 able to keep pace with your image processing requirements. In addition, the system can operate as a standalone image processor or can be interfaced to a variety of host computers.

Comtal—a generation ahead in image processing.

Our new Vision Ten 24 is a generation ahead of any other digital image processing system. It's not surprising since our systems have consistently been the state-of-the-art in image processing. For example, our 512 x 512 systems offer more exclusive features and options, and give you more standard models to choose from, than anyone else. With a decade of experience in image processing and more than 600 systems installed worldwide, only Comtal gives you the leading edge of image processing technology.

Put your imagination to work and give Comtal a call today for a firsthand look at our new Vision Ten 24. Comtal, a subsidiary of 3M, 505 West Woodbury Road, Altadena, California 91001, (213) 797-1175



COMTAL



free light-valve chamber.

Trade shows to war rooms

The GE light-valve projector accepts RGB and NTSC (TV) color signals at various scan rates and can be used with 2- to 25-ft.-wide screens. The system provides clear graphics and alphanumeric, making it suitable for lecture hall illustrations and corporate meetings. Several system and software vendors have leased light-valve projectors to display wares at trade shows. The projectors also are popular for military applica-

tions, which account for 20 percent of GE's light-valve sales. Countries whose armed forces use light-valve projectors include the U.S., Canada, Venezuela, Morocco, Spain, Italy and Germany. Teleconferencing, which often includes graphics presentations, likely will become a significant market for light-valve systems.

GE ships 200 light-valve projectors a year at prices of \$65,000 to \$90,000 per unit, and video-display marketing manager J.P. Gundersen doesn't expect shipments ever to exceed 300 to 400 units per year. But Gundersen says that in less than two years the company will market a light-valve color projector expected to sell for about \$20,000. Such a device would have tremendous impact on the video-display market and could lead to the replacement of monitors by projection screens in many applications. □

HOW THE LIGHT VALVE WORKS

General Electric Co.'s light-valve projector includes more than 150 patented inventions in optics, electronics and fluid mechanics. Major components of the projector are a Xenon lamp, an elliptical reflector, an electron gun, slotted input and output plates and an oil-coated, transparent glass disk (A).

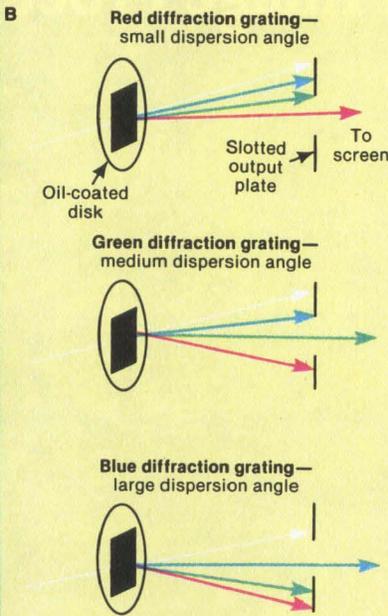
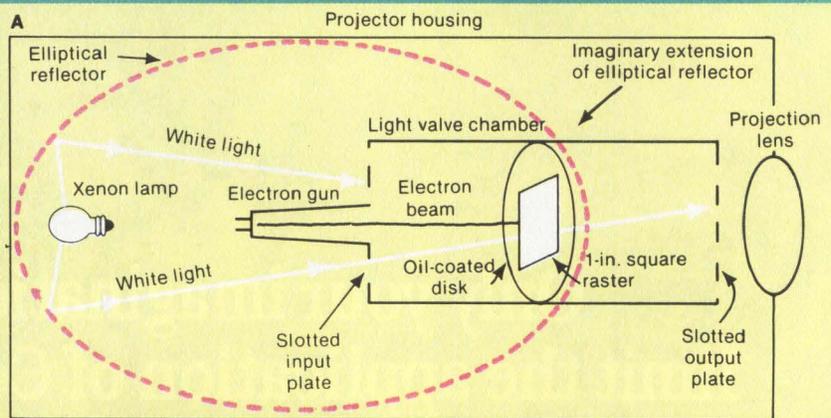
Light rays from the Xenon lamp at one focus of the elliptical reflector strike the slotted input plate, which blocks some of the rays. The remaining light rays enter the light-valve chamber and impinge on the oil-coated disk at the second focus of the reflector. The electron gun performs a raster scan of a 1-sq.-in. area on the disk.

When no video signal is present, oil on the disk is unaffected by the electron beam. Light rays pass through the disk without modification and are blocked by bars in the slotted output plate. No light reaches the screen.

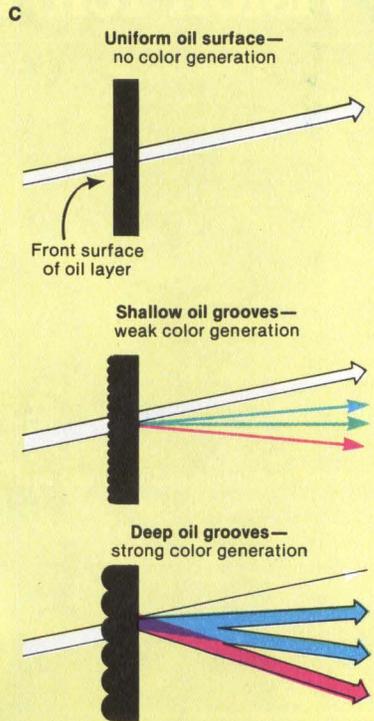
When a red, green or blue video signal is present, the electron beam deforms the surface of the oil into a pattern of closely spaced grooves that acts as a diffraction grating. Red, green and blue video signals each produce a unique type of grating.

The diffraction grating causes a prism-like dispersion of colors and each of the three types of gratings generates a different angle of dispersion (B). Pixel color is determined by the position of output plate slots relative to the dispersion angle. Light that passes through the output plate is magnified by a lens and projected onto the viewing screen.

Pixel brightness is determined by the amplitude of the video signal and the consequent depth of the oil



grooves (C). The deeper the oil grooves, the greater the amount of color generation and the brighter the pixel image on the screen.



In the world of emulating terminals... **VISUAL** is a world apart.



VISUAL EMULATION CAPABILITY

VISUAL 50/55 are low cost smart terminals. The VISUAL 50 emulates DEC VT52[®], Lear Siegler ADM3A[™], Hazeltine Esprit[™] and ADDS Viewpoint[®]. VISUAL 55 emulates the same plus Hazeltine 1500/1510 and VISUAL 200/210.

VISUAL 100 is 100% compatible with the DEC VT100[®] and also emulates the VT52.

VISUAL 300/330 are versatile terminals that can be easily customized. The VISUAL 300 emulates the DEC VT100 and VT52. VISUAL 330 emulates the DEC VT52, ADM3A, Hazeltine 1500 and Data General D200.

VISUAL 500/550 are low cost, high resolution graphic terminals with powerful alphanumeric capabilities. The VISUAL 500 emulates the VT52, ADM3A, Hazeltine 1500, D200 and Tektronix[®] 4010/4014. The VISUAL 550 emulates the VT100, VT52 and Tektronix 4010/4014.

VISUAL terminals feature extended ergonomics including tilt and swivel non-glare 12" or 14" screens, detached keyboard, large character size, menu-style setup, sculptured key caps and more.

VISUAL has earned for itself an exclusive place . . . a solitary niche . . . in the arena of emulating terminals. Four great terminal series offer a combination of advanced features found on no other terminals anywhere in the world. Each series delivers higher performance at lower cost for its particular market segment. And nobody else gives such a wide choice of emulations as VISUAL . . . the pioneer in the field.

So check the chart before you choose your next terminal. See for yourself why VISUAL stands alone as the first choice for emulating terminals.

Service available in principal cities through Sorbus Service, Division of Management Assistance, Inc.

VISUAL

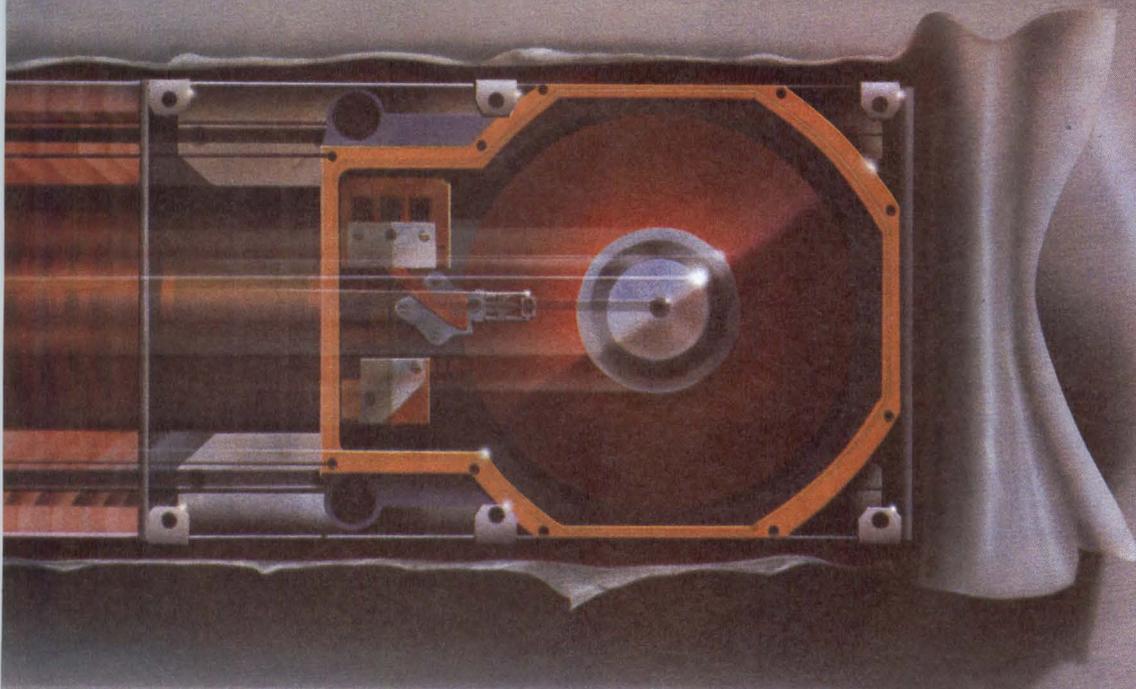
See for yourself

Visual Technology Incorporated
540 Main Street, Tewksbury, MA 01876
Telephone (617) 851-5000. Telex 951-539

CIRCLE NO. 105 ON INQUIRY CARD

PRIAM

**THE
DRIVING
FORCE IN
WINCHESTERS.**



In the world of Winchester's, only one company delivers the proven technology and breadth of line you need—PRIAM.

Proven Performance. From the beginning in 1978, PRIAM has been the driving force in high-performance Winchester technology. And our technical superiority and high reliability have been field-proven in the most dynamic multiuser/multi-tasking environments.

A Growing Family Of Winners. We've established ourselves in the 14-inch market with 34, 68 and 158-Mbyte Winchester's. Our 8-inch drives have capacities of 35, 70 and 105 Mbytes in a floppy-sized package. And we've just added a high-performance family of high-capacity 5¼-inch Winchester's.

PRIAM Winchester Family.

Size	Model	Capacity (Mb)	Access Time
14"	3350	34	46ms
	6650	68	46ms
	15450	158	46ms
8"	3450	35	42ms
	7050	70	42ms
	804	105	42ms
5¼"	502	55	32ms
	503	71	32ms
	504	86	32ms
	505	111	32ms

SMART Interfaces. PRIAM gives you the finest in interfacing flexibility. Our intelligent interfaces can control up to four drives in any mix, plus tape and floppy backup. They're the fastest and easiest route to putting a Winchester database in your system.

Or, if you have an SMD or ANSI controller, our drives can be supplied with a matching interface.

Quality By Design. We're driving upwards towards higher capacities, more compact packaging and enhanced performance—with increased emphasis on high quality and long-term reliability. And we've committed the resources to meet that objective.

PRIAM Time. If you're thinking about Winchester's—think PRIAM. For more details, call (408) 946-4600 or the sales office nearest you: Los Angeles (714) 680-5195; Dallas (214) 690-0980; Minneapolis (612) 854-3900; Waltham (617) 890-8920; New York (201) 542-8778; Reading, England UK-734-884788.



PRIAM

20 West Montague Expwy.
San Jose, CA 95134
(408) 946-4600
TWX 910-338-0293
FAX 408-946-5679

ADAPTEC'S PIPELINE TO PERFORMANCE

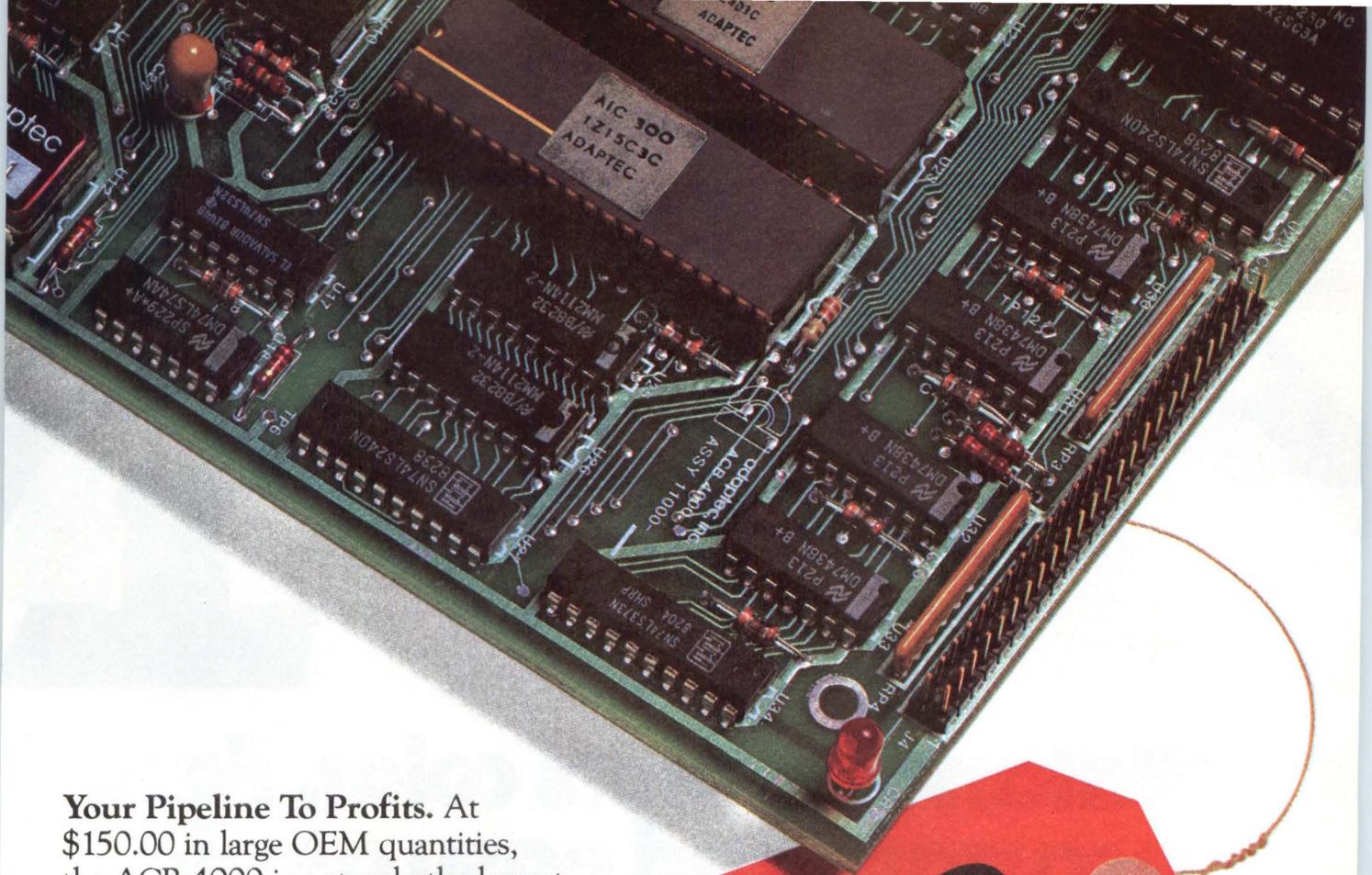
Break the I/O Bottleneck With High Performance Winchester Controllers for \$150.00. Or Less.

Wrench Open Your System's Performance. Adaptec's ACB-4000 Winchester disk controller is the highest performance, lowest cost small disk controller available today.

Period. Features like non-interleaved operation provide up to four times the performance of competitive controllers in I/O operations. Sector-level defect skipping slashes seek times while yielding more usable disk capacity. And

since Adaptec controllers offer extended SASI/ANSI SCSI compatibility, they are more flexible and easy to integrate. So getting your 8/16-bit system to market fast is more than a pipe dream.





Your Pipeline To Profits. At \$150.00 in large OEM quantities, the ACB-4000 is not only the lowest cost, but also the most cost effective complete controller solution available today. SASI/ANSI SCSI compatibility provides a number of important benefits like reduced system design time, and device independent operation. ACB-4000 power consumption is only about half of competitive controllers', further saving you time and money. But just as important, the ACB-4000 provides a direct, easy upgrade path to our multi-user system controller, the ACB-5000. So your present system is also your pipeline to the future.

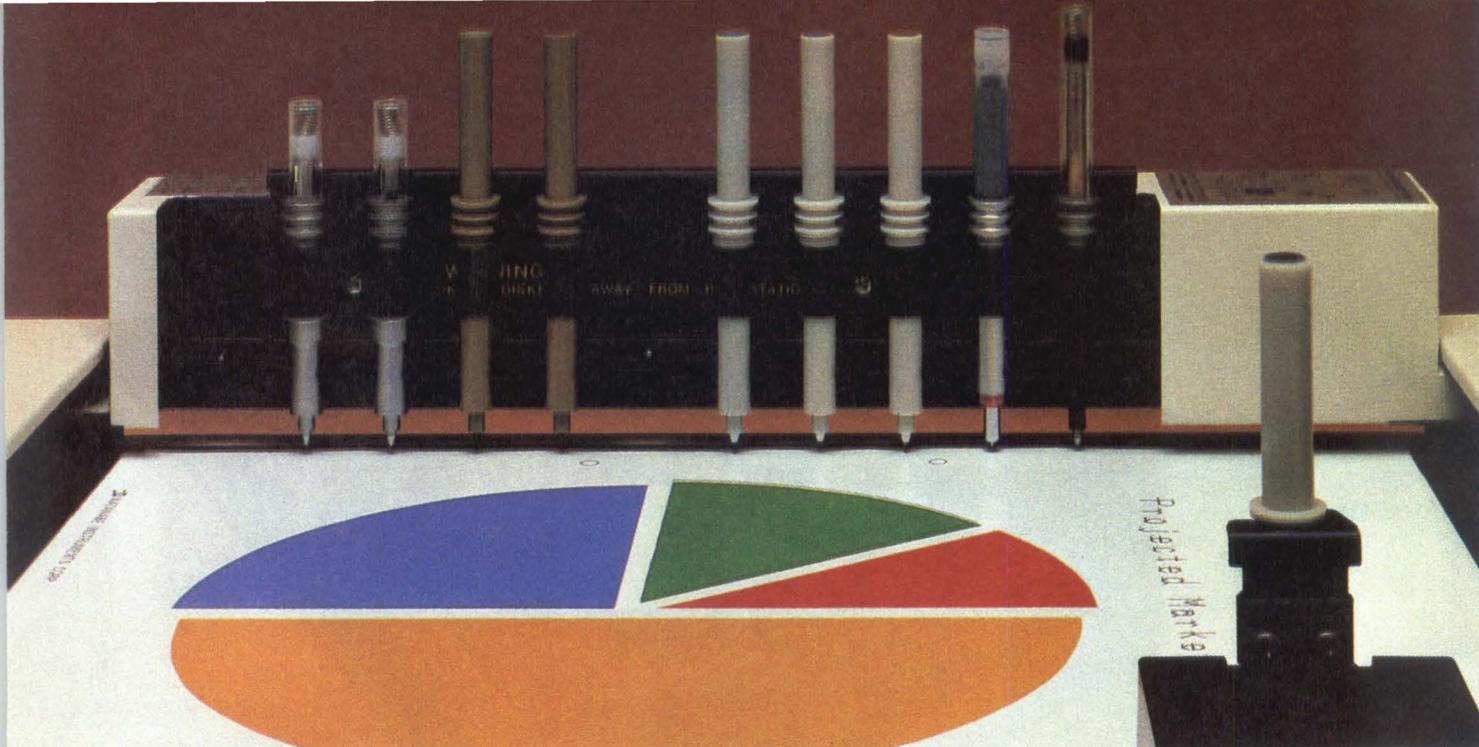


The Best You Can Make ... Or Buy. The ACB-4000 solution is also available as a 3-chip set, the ACS-4000, with complete software, PCB design and manufacturing information. That means you can drive board costs way below \$150.00 by taking advantage of your high volume manufacturing economies. And of course, we'll be happy to provide complete ACB-4000 boards while you are ramping up production.

A Great Connection. For more information about Adaptec's high performance family of host adapters, Winchester controller boards, chips and chip sets, connect with Jeff Miller, Director of Marketing, (408) 946-8600. Or write Adaptec, 1625 McCarthy Boulevard, Milpitas, CA 95035.

 **adaptec, inc.**

**The best controller connection
you can make ... or buy**



Watanabe plots color. Fast, accurate and easy as pie.

Watanabe brings you a multi-pen digital plotter you can even use at your desk. Its low cost makes it affordable. And its sophistication makes it the answer to your need for economical high-speed, hard-copy graphics. Whether for engineering drawings, scientific plotting, architectural design, or business graphics.

Easy to program and use. You don't have to be an engineer to use a Watanabe plotter. Yet it can produce complex engineering drawings. Intelligence is built into the plotter through our unique microprocessor controllers.

So it can perform complex tasks using the single-letter commands you give it. Programs are also simple to write, making the plotter very convenient to use. Or you can use one of the many software packages available for Watanabe plotters.

Choose the model that's right for you. Why pay for features you don't need? Watanabe plotters are available in a variety of models. One will be best for your budget and graphics needs. Choose from our low cost, single-pen plotter, through a range of multi-pen configurations, to our high-speed, intelligent plotters. Or select a machine that

blends analog and digital technology.

Use water or oil-based pens, or ink pens. Choose from sheet-feed or roll-feed models, or produce drawings on acetate for overhead projection. In addition to programmable graphics and function commands, the complete ASCII character set is standard. Each plotter can interface to any computer with an RS-232-C serial interface, IEEE-488 interface, or parallel port.

Designed for long use. Just one example of Watanabe's built-in reliability is the ingeniously simple, automatic mechanical pen pickup used on the multi-pen models.

When your plotter does need maintenance or repair, one of our many locations worldwide will provide prompt service. We design, manufacture, and service our plotters ourselves. So we know we can stand behind them with confidence.

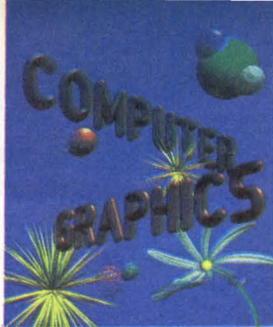
Let us put a plotter at your fingertips.

Call Don Pierson toll-free at (800) 854-8385 to arrange a demonstration. In California call (714) 770-6010. Or write: Watanabe Instruments Corporation, 12 Chrysler Street, Irvine, California, 92714.



WATANABE

Watanabe Instruments Corporation, 12 Chrysler Street, Irvine, California, 92714.



Desk-top design station features multimode graphics

JAY GLASER, Motorola Inc.

MC68010-based micro provides seven-color displays, graphics hardware for efficient pixel manipulation

Designers of microcomputer application systems increasingly use special-purpose graphics in addition to traditional character displays. This trend emphasizes the need for development systems with flexible, low-cost graphics capabilities. An example of such a development system is Motorola Inc.'s VME/10, a desk-top microcomputer for OEMs in the industrial and scientific markets. The VME/10 has multimode graphics, a modular design and many hardware- and software-development tools.

Multimode graphics

To produce displays for a variety of applications, a development system should offer flexibility in features such as resolution, color and character set. The VME/10 provides a number of such choices: two graphics-resolution modes, seven colors and intensity levels, two ways to access pixels and user-definable characters and character attributes. Graphics- and character-handling are separate in memory. The contents of the two are logically "OR"ed to allow composite displays of graphics and characters.

The two graphics-resolution modes are 800×300 pixels (low-resolution mode) and 800×600 pixels (medium-resolution mode). The ability to select the resolution mode is useful because the low-resolution mode requires less graphics RAM (96K versus 192K bytes) and provides faster operation than the medium-resolution mode. In low-resolution mode, unused RAM is

available for general system use.

Graphics RAM is divided into three contiguous banks. Each bank represents one of the system's three primary colors: blue, green and red. Each pixel is controlled by 1 bit in each of the three memory banks. Since bank 1 represents blue, bank 2 green and bank 3



VME/10 expansion modules available from Motorola and other suppliers provide flexibility for many OEM industrial and scientific applications. The basic system includes an MC68010 microprocessor, 384K bytes of RAM, a 15-in. display and 20M bytes of unformatted mass storage.

red, it follows that a "1" bit in banks 1 and 2 generates blue-green, a "1" bit in banks 1 and 3 generates purple, a "1" bit in banks 2 and 3 generates yellow, and a "1" bit in all three banks generates white. In monochrome applications, the three banks of graphics RAM are used to produce multiple intensity levels for each pixel.

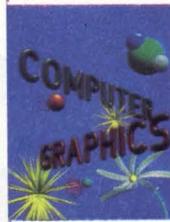
To draw a bar graph, fill an object with color or blank the screen, it is useful to access several adjacent pixels at once. The VME/10 can access 8 or 16 pixels at once by byte- or word-length read and write instructions. But these instructions are inefficient for drawing lines and curves or making small modifications to displays. For these functions, it is desirable to access pixels individually. The VME/10 can access the 3 memory-bank bits that control a pixel by using a single hardware instruction (Fig. 1).

Character displays on the VME/10 are 25 rows × 80 columns. Users can define characters and fonts using any 7-bit code to provide 128 symbols. Characters are stored in RAM in 16-bit words containing 7 bits for a character and 9 bits for character attributes. The character attributes are color, intensity and special effects such as blinking, underlining and inverse video. Users can define additional special effects that are implemented by software.

VMEbus and I/O channel provide flexibility

The VME/10 has a modular design consisting of a control unit, a keyboard and a CRT. The control unit houses the system control card (Fig. 2), the disk drives, the VMEbus and the I/O channel.

VME/10 mass storage consists of a 19M-byte, 5¼-in.



To draw a bar graph, fill an object with color or blank the screen, it is useful to access several adjacent pixels at a time.

Winchester and a 1M-byte, 5¼-in. dual-sided, dual-density floppy disk drive. The disk controller, which is FIFO buffered, allows continuous sector transfers to facilitate movement of large data blocks.

The VMEbus offers 16-/32-bit asynchronous, bidirectional operation and supports additional system capabilities such as direct memory access and multiprocessor operation. In multiprocessor operation, any designated VMEbus master device, including the main system processor, can issue a bus request and become the temporary bus master to perform a VMEbus-related activity.

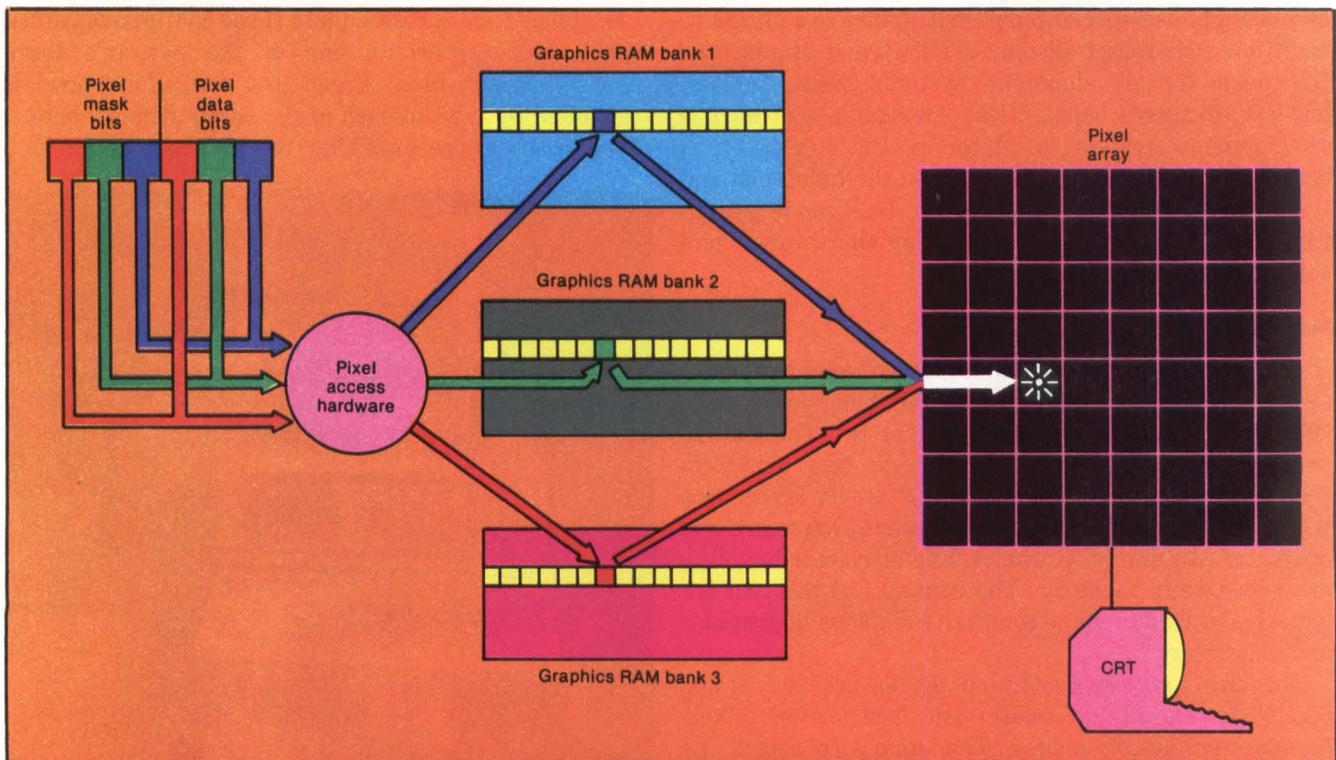


Fig. 1. Pixel access hardware empowers a single CPU instruction to write 3 bits of pixel data into three separate bit positions in graphics RAM. Mask bits can disable the data transfer to any of the three banks, allowing one or more banks to remain unchanged while the others are modified. The pixel color displayed on the CRT is a combination of the three primary colors in which each primary is used if the pixel bit in the corresponding memory bank is on. Since each of three bits controlling a pixel can be on or off, there are 2³, or eight, possibilities: a blank screen location or one of seven colors.



Introducing the sophisticated professional workstation.

The Symbolics 3600 Lisp-based system puts unlimited computing at your fingertips

Unlimited computing power

The Symbolics 3600 puts the level of computer power associated with supermini class computers in your hands at a fraction of the usual cost. It has a 36-bit tagged architecture and executes programs at an average of one million high-level instructions per second. Our standard 3600 system software, a powerful and proven Lisp-based operating and program development environment, also supports FORTRAN, PASCAL, C, Interlisp compatibility and Flavors object-oriented programming.

Symbolics' innovations in symbolic computing extend the limits of solutions in traditional applications. For example, large-scale software system development and VLSI circuit design are massive undertakings. The Symbolics 3600 software environment takes care of many of the

routine tasks a programmer or designer is now required to perform, dramatically reducing programming and design time while significantly in-

creasing productivity. These benefits apply to emerging application areas such as development of expert systems, symbolic mathematics, robotics, CAD/CAM, genetic engineering, training simulators, and a broad range of research activities. Each user in a typical workstation environment has access to all other computing facilities on the network.

Join the new age of computing

The Symbolics 3600 brings to you today a new age of computing—symbolic processing systems that are being used by a growing number of 3600 customers as the sophisticated means for problem-solving. Join them in this new age of computing.

Call or write today. Symbolics, Inc., 9600 De Soto Avenue, Chatsworth, CA 91311 (213) 998-3600.

Symbolics 3600 Capsule Specifications

System CPU	50 KHz sample rate audio output	Autodial/Autoanswer 1200 baud modem (optional)
36-bit tagged, stack oriented architecture	Color: 1280 x 1024 with 8 to 32 bits/pixel, 10 bits/color RGB (optional)	Operating System
2.3 megabyte RAM with ECC, expandable to 34 megabytes	Mass Storage	Enhanced Zetalisp with on-line edit, compile, inspect, debug, network file system, electronic mail
1.125 gigabytes virtual memory	Built-in 169 megabyte Winchester	Totally interactive with sophisticated display system
20 million byte/second memory bus	Optional disk memory up to 1.8 gigabytes	Languages
Floating point accelerator (optional)	Optional cartridge or 9-track tape drives	Lisp, Fortran-77, C, Pascal, Interlisp
Console and Keyboard	Communications	Flavors object-oriented programming
Bit-mapped raster display	10 megabit/second Ethernet local area network	Printer
B&W 17-inch, landscape format, 1100 x 800 pixel	One parallel and three standard serial ports	Laser Graphics Printer LGP-1 (optional)
88 keys with n-key rollover		
3-button mouse		

symbolics inc.

CIRCLE NO. 109 ON INQUIRY CARD

See the Symbolics 3600 at Siggraph Booth #860.

Symbolics is a trademark of Symbolics, Inc., Cambridge, Massachusetts.

© 1983 Symbolics, Inc. Domestic sales offices: Chatsworth, CA (213) 998-3600 • Palo Alto, CA (415) 494-8081 • Cambridge, MA (617) 576-2600 • Houston, TX (713) 820-3001 International distributors: United Kingdom and Western Europe: Scientific Computers Ltd., England, Tel. (04446) 5101 • South Central Europe: Delphi Electronic Design Systems SpA, Italy, Tel. (0584) 31881 • Japan: Nichimen Corporation, Tel. (03) 277-5077

System integrators have a choice of two VME/10 configurations to provide system expansion. An entry-level configuration has no VMEbus, but instead has a five-slot I/O channel card cage with ribbon cable and connectors installed in each card location, since I/O channel busing does not require a solid backplane. An application of the entry-level VME/10 is to add I/O channel modules for serial communications and printer support, enabling the VME/10 to serve as the supervisor for several remote controllers in a distributed-processing environment.

A high-end configuration contains a VMEbus backplane with five connectors for double-Eurocard VME modules and four positions for single-Eurocard I/O modules, permitting users to add both high-performance VMEbus boards and lower cost I/O channel boards (Fig. 3). The high-end VME/10 with the VERSADOS operating system and the VME module GPIB controller comprise a system for monitoring and controlling laboratory instruments, performing complex calcula-

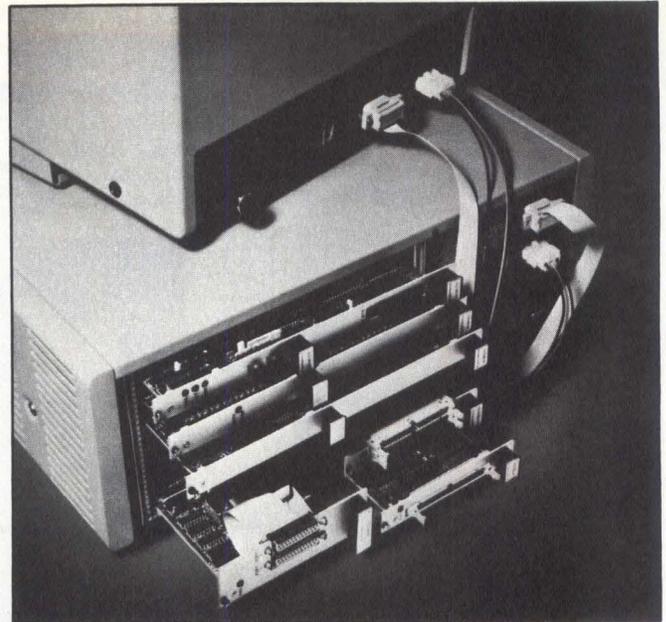


Fig. 3. The VME/10 high-end configuration has a "combination" card cage offering five slots at the top for VMEbus-compatible double-Eurocard boards (three shown here) and four slots at the bottom for I/O channel single-Eurocard boards (three shown here: one left, two right). The top (VME module) slots normally are used for additional processors, memory and intelligent peripheral controllers. Bottom (I/O module) slots are used for interfaces to devices such as modems, printers and analog converters.

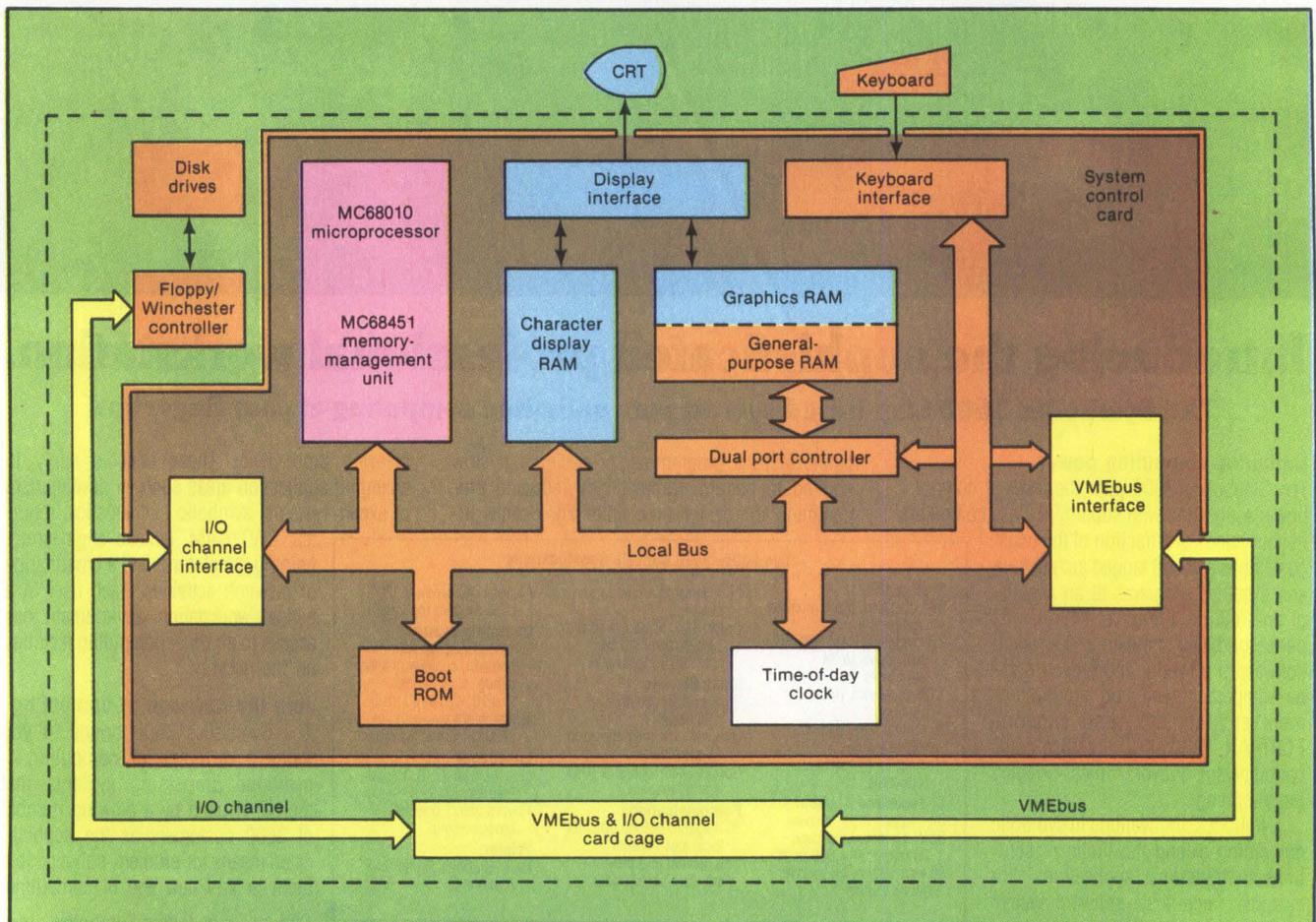


Fig. 2. The system control card contains the microprocessor and a memory-management unit that permits multitasking with full memory protection for each task. A dual-port controller allows shared access from the local bus and VMEbus. A battery-backed clock using an MC146818 CMOS chip provides the time of day, generates time-related interrupts to the microprocessor and stores 50 bytes of RAM for configuration parameters.

Announcing Retro-Graphics for \$749.



You can now update your ADDS, TeleVideo, or Lear Siegler terminal with the most economical Tektronix graphics around!

With our invention, the RG512 Retro-Graphics terminal enhancement, we introduced more than 25,000 operators to the standard of value in Tektronix®-compatible graphics.

We'd now like to introduce you to our latest innovation: 512-Series Retro-Graphics. Currently shipping at the industry's newest standard, \$749 (quantity one).

The 512-Series. A *user-installed* PCB assembly that converts your TeleVideo®, ADDS, or Lear Siegler® terminal into a powerful bit-map graphmaker. With Tek™ 4010/4014 features. And compatible with Tek's *PLOT 10™* or your RG512-based program.

In fact, Retro-Graphics *ensures* your software investment. Now or in the future. Because it works with a variety of graphics programs, including ones from ISSCO®, Precision Visuals, and Megatek.

Its 4010/4014 protocol enables you to draw complex images in bright, high-detail resolution.

You can quickly generate dotted, dashed, or solid vectors. Incremental point plots. Graphics text in four character sizes. With crosshair cursor capability. And "local" printer support.

With the RG512, we led the way to affordable graphics. Now, at \$749, 512-Series sets the new standard for low-cost graphics.

Call today or clip and mail the coupon for full details from your local Retro-Graphics dealer.

CLIP AND MAIL TO: MMS 7/83
Digital Engineering
630 Bercut Drive, Dept. 217
Sacramento, CA 95814

- Send information on 512-Series Retro-Graphics
 Arrange an informative demonstration

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

TELEPHONE () _____



**DIGITAL
ENGINEERING**

630 Bercut Drive, Sacramento, CA 95814
(916) 447-7600 Telex: 910-367-2009

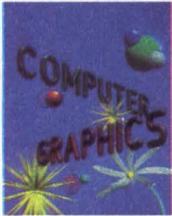
Retro-Graphics is a registered trademark of Digital Engineering, Inc. © 1983 Digital Engineering, Inc.

GRAPHICS

tions on experimental data and displaying results graphically.

Hardware and software tools

The VME/10 comes with a large set of development tools including the VERSADOS operating system; the



The high-end VME/10 comprises a system for monitoring and controlling laboratory instruments, performing complex calculations and displaying results graphically.

UNIX System V operating system (planned for late 1983); Pascal, FORTRAN, and C compilers; a macro assembler; a symbolic debugger; and a bus analyzer. These tools enable the VME/10 to be a stand-alone development system or a component of an application

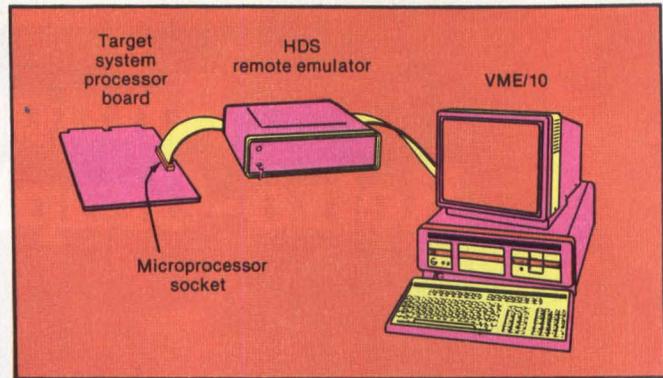
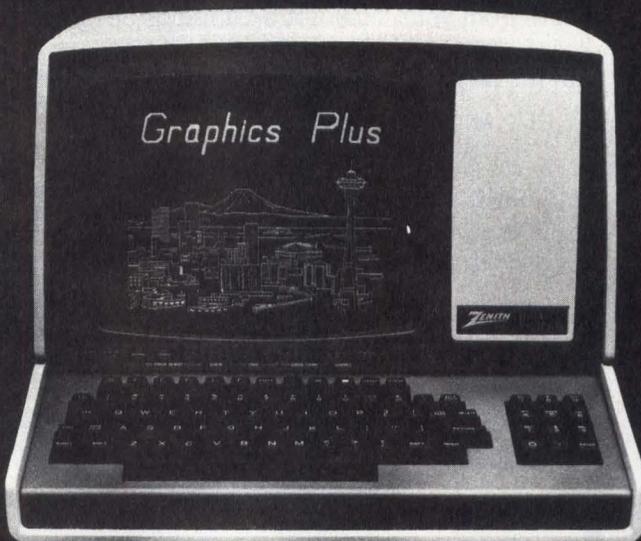


Fig. 4. Target system emulation can make the difference between streamlined or plodding passage through hardware and software integration. The VME/10 can host Motorola's HDS-400 (MC68000 family) or HDS-200 (MC6800 family) remote emulators. Software is edited, compiled and linked on the VME/10 and then down-loaded to the HDS station, which emulates the target system by plugging into the microprocessor chip socket in the target system processor board.

system. A third possibility is to incorporate the VME/10 into a development and testing system that performs target system emulation (Fig. 4). Development tools and target system emulation are available for both MC68000 family (16-bit) and MC6800 family (8-bit) target systems. □

Jay Glaser is a product planning manager for Motorola Inc., Tempe, Ariz.



GRAPHICS-PLUS is a field installable enhancement board for the popular Zenith¹ Z19 video terminal adding many powerful features found only on terminals costing much more. GRAPHICS-PLUS provides Tektronix² 4010 compatible vector drawing graphics, VT100³ compatible 80 and 132 column display formats, off-screen scrolling memory, programmable function keys, "Plain English" menu-driven Set-up mode, and a host of other enhancements. Installation can be accomplished within 15 minutes using only a screwdriver.

GRAPHICS-PLUS an enhancement For Z19 Terminals from Northwest Digital Systems

- Tektronix² 4010 Compatible Graphics
- 512 Horiz by 250 Vert Resolution
- 80/132 Col and 24/49 Line Text Displays
- Seven Page Off-Screen Text Memory
- Menu-driven "Plain English" Set-up Mode
- 16 Programmable Keys- 128 Chars Each
- Optional Hardcopy Port
- Simple Field Installation

1 TM Zenith
2 TM Tektronix
3 TM DEC

GP-19 Upgrade for Z19 Terminal	\$ 849
Z19 Terminal With GP-19 Installed	\$ 1495

Northwest Digital Systems

P.O. Box 15288, Seattle, WA 98115 (206) 362-6937



NOW, A TASK FORCE OF ONE BRINGS REVOLUTIONARY NEW SKILLS TO DOT MATRIX PRINTING.

Outmaneuvers Lines and Daisies at 350 cps. Okidata's new multifunction Pacemark 2410 combines three printers in one remarkable machine. At 350 cps, it pumps out data at line speeds up to 420 lpm. Delivers drafts with extra-dense characters at 175 cps. Its 85 cps correspondence quality is three times faster than most daisywheels.

But that's just the opening salvo. This high powered dot matrix printer has an arsenal of extra features. Two-color printing. Dot addressable graphics. 96-character ASCII set, plus resident and alternate 96-character downline loadable sets. Column capabilities range from 136 to 233.

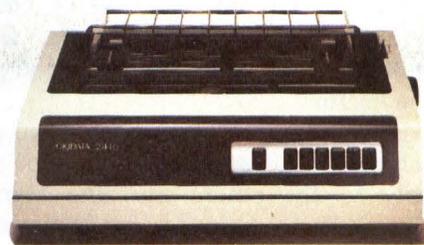
Tough As Nails. The 2410 won't suffer from battle fatigue or duty cycle

limitations. It's armed with our long-life, stored-energy print head with 9 tungsten pins to crank out up to 500 million characters with ruthless precision. Add laser-welded, precision-controlled construction and a rugged, stamped steel frame, and this machine's virtually invincible.

Compatibility Plus. Teams up with all the big guns in high performance desktops and small business computers, plus most low-end minis. Available with standard parallel or RS 232C serial interface with current loop. Additional interfaces on the way.

Mean Machine. Nice Price. It's capable. It's tough. It should cost a bundle. But it doesn't. Suggested retail is \$2995; \$2695 for its data-processing-only part-

ner, the Pacemark 2350. For more information, phone 1-800-OKIDATA. In New Jersey, (609) 235-2600.

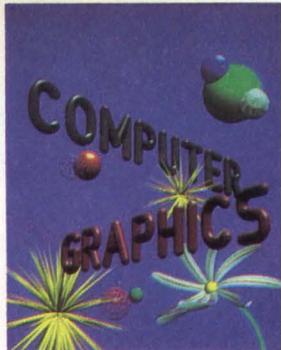


OKIDATA

Mt. Laurel, New Jersey 08054.

A subsidiary of Oki Electric Industry Company, Ltd.

CIRCLE NO. 113 ON INQUIRY CARD



Terminal measures 3D objects

*Stereo photographs provide 3D image for
microprocessor-controlled measurement*

Whether dealing with a large mountain or a miniature model of a power plant, obtaining precise measurements can be a problem. Photographs provide one solution because they enable the precise indirect measurement of complex objects while an operator sits at a desk. But photographs present 2D images, and many applications require 3D measurements. A new microprocessor-based system provides 3D measurement using stereo photographs and polarized light.

How the system works

The Traster stereo satellite terminal from Matra Technology, Los Gatos, Calif., integrates parallax data from separate and differently polarized binocular images into apparent 3D images that can be viewed through eyeglasses with correspondingly polarized lenses.

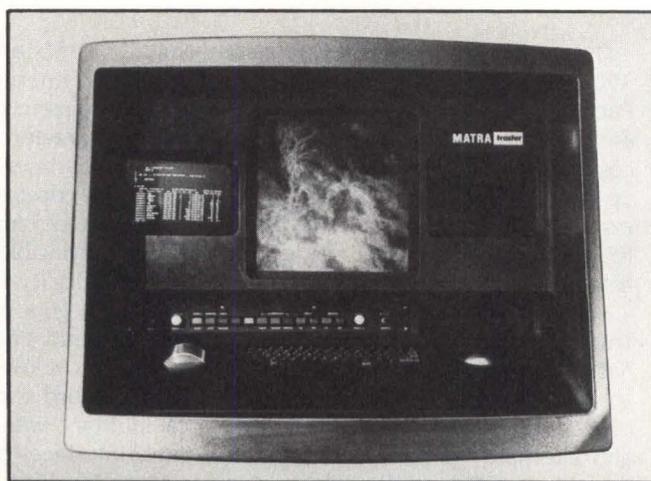
The technique starts by placing a pair of stereo photographs taken by a dual-lens camera on servo-controlled film carriages. Using positional data from high-precision optical encoders, an 8086 CPU and attached 8087 co-processor align the carriages to within one micron.

Images from the two photos are projected through polarizing filters—each of which polarizes perpendicularly to the other—onto the stereo photo display screen. The combined image is viewed through glasses in which the left lens is polarized perpendicularly to the right lens, so that each eye sees only one image. Thus, the image is perceived as 3D.

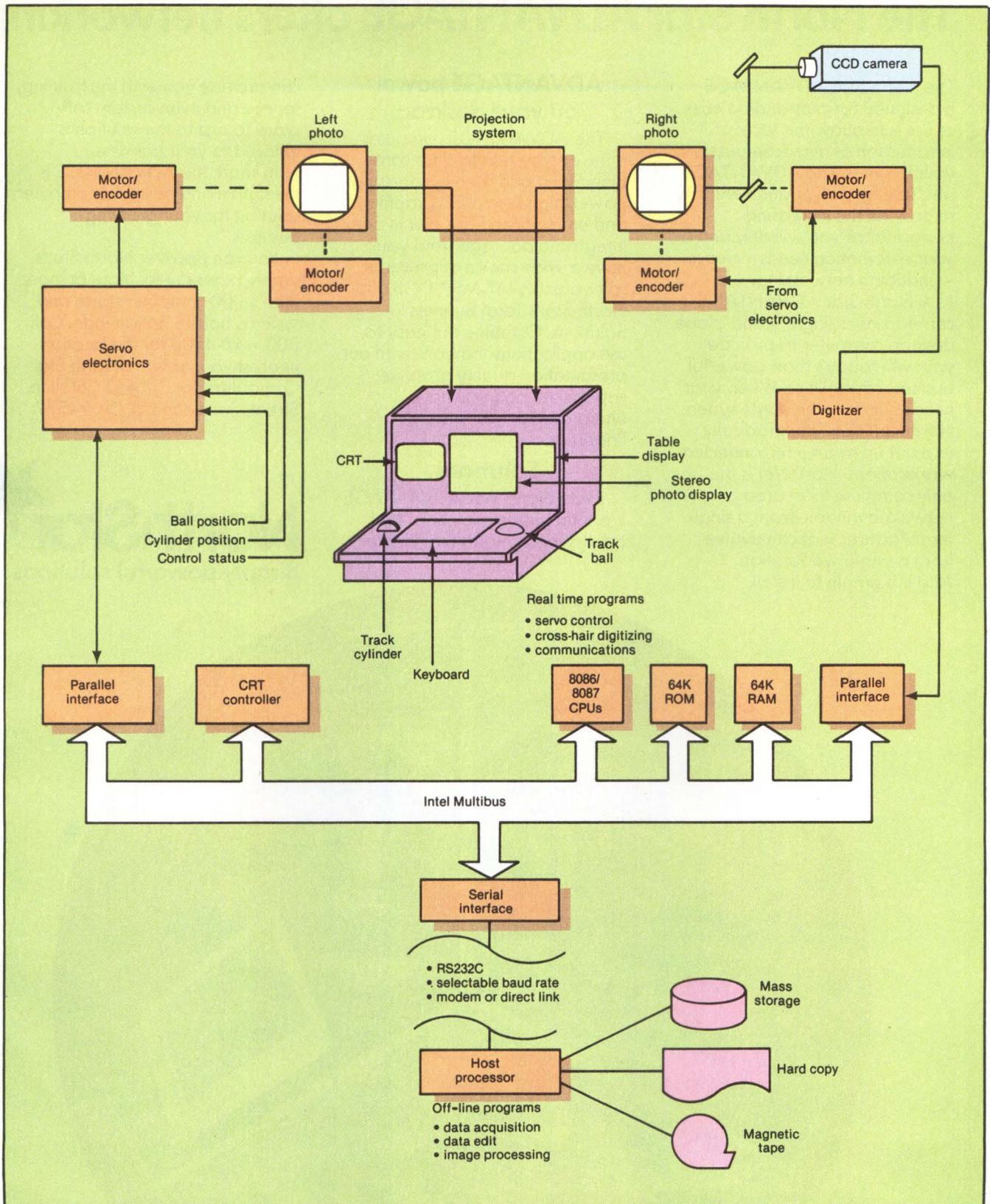
To take 3D measurements, an operator moves a cross hair through the image. A trackball controls the motion of the cross hair parallel to the plane of the screen.

A track cylinder controls apparent motion perpendicular to the screen. As the cylinder is rotated, the cross hair appears to move toward and away from viewer. The operator presses a key to record the point's x, y and z coordinates when a cross hair is aligned with a desired point in the stereo image.

A keyboard and CRT screen on the left of the console are used to communicate with the microprocessor. A TV monitor on the right of the console is connected to a CCD camera focused through a beam splitter on either of the stereo photos. This allows the operator to overlay compiled information directly on an image of the photo.



Traster 3D measurement terminal provides three displays—a CRT (left) for data, a stereo display screen (center) for 3D viewing with polarized glasses and a screen for overlaying data on one of the two stereo photographs. Trackball (right) and track cylinder control cross-hair movement on 3D screen.



Traster system design consists of 8086-8087-based console, stereo projection system and host interface. Projection system uses an optical encoder to position the photos. Communications, servo positioning and cross-hair position digitizing are microprocessor-controlled.

The console can pass digitized coordinates through a serial interface to a host processor for storage or applications processing, or to a hard-copy device. Results of computations, such as distances between pairs of points and areas enclosed by polygons, can be

passed back through the interface to the CRT screen.

Applications for the system include aerial surveying and mapping, civil engineering and complex structural analysis. The Traster SST terminal sells for \$150,000, with a plotter available for \$25,000. □

The North Star ADVANTAGE offers networking.

The North Star ADVANTAGE is designed for outstanding ease of use — to allow the successful introduction of microcomputers to your business. The ADVANTAGE also has the power and flexibility to provide the increasing performance you will demand as your automation needs increase — including networking.

A North Star ADVANTAGE can start as a single, stand-alone desktop computer to provide you with today's most powerful business capabilities. When your needs outgrow the single system, NorthNet™ lets you gradually expand up to 64 interconnected workstations. NorthNet is the only complete local area network available from a single manufacturer that can evolve from a single workstation. And it is simple to install.

ADVANTAGE power on your desktop

The ADVANTAGE computer is the only system to offer combined 8 bit and 16 bit processing power, high resolution graphics, and up to 15Mb hard disk in one integrated package. And you have a wide choice of powerful software: CP/M®, MS™-DOS and North Star's Total Business Solutions. Combine our easy-to-use applications software with our presentation-quality graphics capabilities and you have unmatched power at your fingertips.

Solutions

Every North Star ADVANTAGE is a total business solution. And a full-service North Star dealer

can provide you with the training, service and even custom software to assure the solution is tailored to your business.

In short, the ADVANTAGE is the simple and powerful computer solution for your growing business.

You can discover North Star's simply powerful solutions at more than 1,000 computer stores and systems houses nationwide. Call 800-447-4700 for the location nearest you, or write North Star Computers, Inc., 14440 Catalina Street, San Leandro, CA 94577.

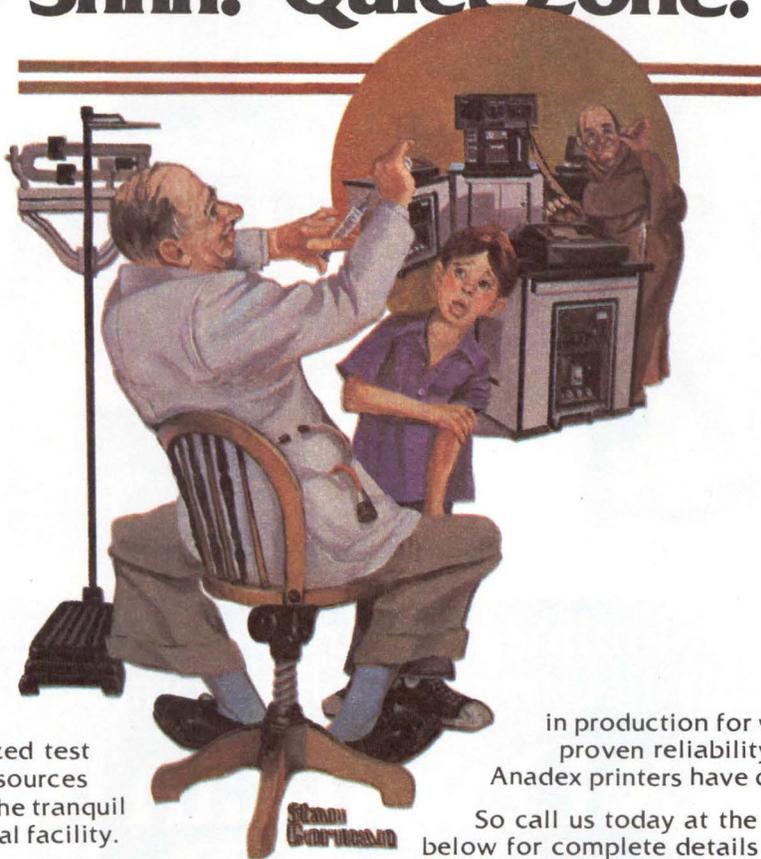
NorthStar™
Simply powerful solutions.



CP/M is a registered trademark of Digital Research Inc.
MS-DOS is a trademark of MicroSoft, Inc.
The North Star logo, tagline and NorthNet are either trademarks or registered trademarks of North Star Computers, Inc. © 1983.

National ON-SITE and CARRY-IN service is available through MAI Sorbus Service Division.

Anadex SILENT/SCRIBE™ Printers: Shhh! Quiet Zone.



From needle-shy children to computerized test labs, potential noise sources can play havoc with the tranquil atmosphere of a medical facility.

And although there may be no easy way to quiet panicky children, Coulter Electronics – a leading manufacturer of blood analyzing systems – significantly reduced their system noise levels by installing our Silent/Scribe matrix impact printers. Operating at less than 55dBA, they run almost unnoticed while recording test data.

But besides being among the quietest printers available, there are a number of excellent reasons for buying Anadex printers.

Here are reasons people give us.

- The ultimate in printing flexibility...high speed for drafts and letter quality for finished copy.
- High resolution graphics capability standard with all printers...and simple software.
- Ribbons are quick-in, quick-out long lasting cartridges; no messy, difficult spool-threading.
- Both RS232C serial, and parallel interfaces are standard, so interfacing to your computer is usually a matter of plug-it-in and start printing.
- Anadex printers are among the most reliable you can buy. The basic print mechanism has been

in production for well over two years with proven reliability. Field data verifies that Anadex printers have over 99% reliability.

So call us today at the toll-free numbers listed below for complete details and to set up a demonstration.

You may not need the quiet atmosphere of a hospital in your home or office, but isn't it nice to know that it's available?

CALL (800) 792-7779
In California Call (800) 792-9992

Anadex
© Copyright 1983, Anadex, Inc.

MADE IN
USA
FOR THE WORLD

Model
DP-9000A



Silent/Scribe Printers. Quietly going about your business.

ANADEX, INC. • 9825 De Soto Avenue • Chatsworth, California 91311, U.S.A. • Telephone: (213) 998-8010 • TWX 910-494-2761
U.S. Sales Offices: San Jose, CA (408) 247-3933 • Irvine, CA (714) 557-0457 • Schiller Park, IL (312) 671-1717 • Wakefield, MA (617) 245-9160
 Hauppauge, New York, Phone: (516) 435-0222 • Atlanta, Georgia, Phone: (404) 255-8006 • Austin, Texas, Phone: (512) 327-5250
ANADEX, LTD. • Weaver House, Station Road • Hook, Basingstoke, Hants RG27 9JY, England • Tel: Hook (025672) 3401 • Telex: 858762 ANADEX G
ANADEX GmbH • Behringstrasse 5 • 8752 Mainaschaff • Frankfurt, W. Germany • Tel: 011-49-06021-7225 • Telex: 4188347

CIRCLE NO. 115 ON INQUIRY CARD



Our 8" Slimline disk drives are the smallest and our 5¼" half heights are rolling out by the truck load. That's R&D you can bank on: Response and Delivery.

You say you need drives that are half the height but all-the-way reliable? From a source that's equally reliable? And you want a choice of configurations too?

Our response is a line of 5¼" Slimline™ drives built with three different bezels and door styles, your choice of direct or belt drive motors, and either of two densities, 48 TPI or 96 TPI. But only one quality standard: the highest.

They come single or double-sided, with capacities from 250 Kbytes to 1 Mbyte. And for those who can do with a little less speed MPI responds with a consumer model at a lower price tag.

And when you wanted smaller, compact 8" drives, we replied with the smallest ones there are. Our 8" Slimline™ series. Only 2" thick and 11.5" deep. The selection doesn't end there. You can also get a 4.6" bezel as well as a half size version at 2.3".

To the cry for ever-smaller disks, MPI answered with the smallest disk drive ever. A 3" micro floppy that interfaces with 5¼" systems, handles 500 Kbytes of data and uses media protected by a hard shell so you can carry it in your shirt pocket safely.

That's how MPI operates. By responding with what you need. Then delivering. By the truck load from the West Coast. By the ship load from Singapore. Our own second source in the Orient that duplicates the precision production of our California plant. What's more, we are manufacturing our own heads.

That all adds up to MPI's kind of R&D. Response and Delivery. And that makes us the company to bank on.

MPI 
MICRO PERIPHERALS, INC.

Micro Peripherals, Inc., 9754 Deering Ave., Chatsworth, CA 91311 Phone (213) 709-4202 TWX (910) 494-1213
MPI Inc. Europe, 11A Reading Rd., Pangbourne, Berkshire, RG8 7LR England Phone 7357 4711 Telex 848 135 MPIEURG
CIRCLE NO. 116 ON INQUIRY CARD

Half-height minifloppy stores 3.3M bytes

HERB THOMPSON, Drivetec Inc.

Mechanical design innovations ensure high-precision read/write accuracy

System integrators have greeted half-height minifloppy disk drives with open arms, but until recently, they haven't been able to store more than 1M byte or 2M bytes in these streamlined packages. Drivetec Inc.'s 320 "SuperMinifloppy," however, packs 3.3M bytes into a half-height, 5¼-in. drive that can also operate as a lower capacity industry-standard drive. Even in high-capacity mode, the 320 offers a 500K-bit-per-sec. transfer rate and a 160M-sec. average access time.

The 320's impressive capacity-to-size ratio is largely the result of innovative mechanical engineering. The combination of a high-precision track-following servo system, media-friendly "gumball" heads, vertical media clamping and a patented anti-backlash positioning system allows the drive to read and write high-density, 192-track-per-in. diskettes and standard media. A low-profile DC motor assembly and a reduced electronic parts count allow the drive to fit into the standard half-height minifloppy form factor, and a Shugart-compatible interface lets it use industry-standard controllers.

Dual-stepper positioning system

The key to both the accuracy and reliability of the drive is the dual-stepper, track-following servo positioning system (Fig. 1). A coarse-stepper motor and a fine-stepper motor under microprocessor control position the read/write heads. The heads read pre-written servo information from the disk, and the control logic adjusts the stepper motors accordingly. Both motors step in 15-degree increments and a 5:1 lever is used to provide the coarse/fine resolution.

In a track-seek operation, the coarse stepper positions the heads to a track as a result of a command from the control unit. The fine stepper then responds to the servo burst information and positions the head to within 100 µin. of the track centerline. The servo

information is located at the end of each diskette sector (Fig. 2). The servo ID and the servo burst information (2 bytes of FF) are written exactly one-half track off-center from the data track. This means that when the read/write head is following the centerline of the data track, the signal strength of the servo burst on alternate tracks should be equal. If the head is off-center, either too far in or too far out, one of the servo signals will be stronger than the other. In this case, the appropriate fine-step corrections are made. This system ensures track-following accuracy regardless of the changes in the diskette itself due to thermal and humidity variations. It also guarantees diskette interchangeability from one drive to another.

Under worst-case conditions in which the data track

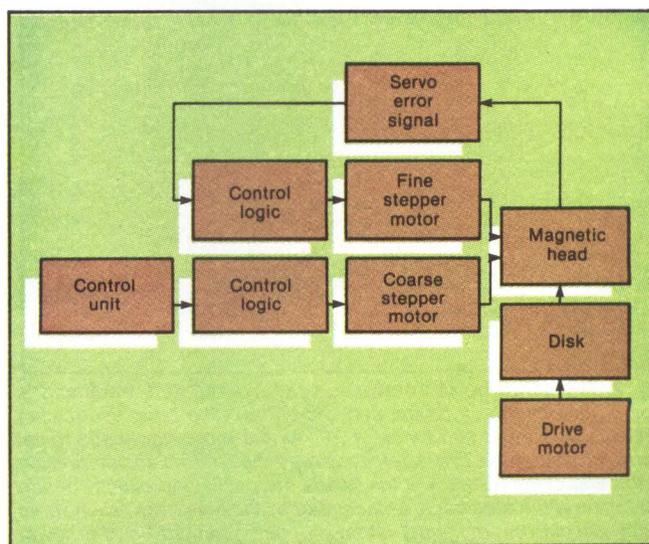


Fig. 1. The dual-stepper servo-positioning system's microprocessor-based control logic monitors the servo error signal read from the diskette through the read head and controls coarse- and fine-stepper motors that position the read/write heads.

centerline is not at a constant radius because of thermal, humidity or media-clamping variations, the head approaches the data track centerline at the rate of one step per sector until it crosses the centerline. At that point, it proceeds to track the data line within the 100- μ in. accuracy of the system (Fig. 3).

The media used in the drive is a standard minifloppy 0.0003-in. substrate, coated with a lubricated, 50- μ in. magnetic oxide. While the first minifloppy diskettes used 100- μ in. oxide, many media vendors are now moving to the thinner oxide-coated diskettes in response to the need for higher density. BASF Systems Corp., Brown Disc Manufacturing Inc., Dysan Corp., Maxell Corp. of America, Memorex Corp., 3M Co., Verbatim Corp. and Xidex Corp. produce higher density diskettes.

Unformatted track capacity is 10,416 bytes, and formatted capacity is 7680 bytes, divided into 30 sectors of 256 bytes. Each sector is defined by the pre-written ID field, followed by the user-written data in the data

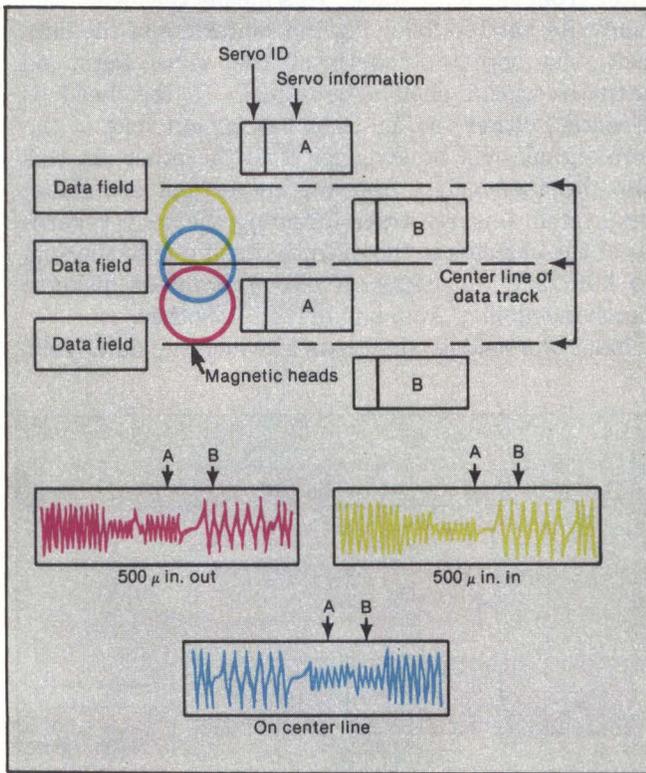


Fig. 2. The servo burst information follows the data track and is located one-half track off the centerline (top). The burst information contains an ID and two bytes of FF. As the magnetic heads travel along the data track, they alternately read the servo burst information at the end of each sector. If the heads are positioned exactly on the centerline of the data track, as indicated by the blue head, each servo burst should be of equal strength, as indicated in the lower oscilloscope trace. If the heads are off-center, one or the other signal is stronger, indicating that the heads are too close to or too far from the centerline. The fine-stepper control logic then repositions the heads until the two signals match.

field. There are cyclic redundancy checks for both the ID field and the data field and several gaps for timing and signal synchronization.

Media/head registration

Drivetec uses spherical "gumball" heads that capitalize on the elastic properties of the diskette substrate. The two magnetic heads are opposing and identical (Fig. 4). The standard head centerline offset is 0.0833 in. Because of this offset and because each of the heads can be rotated through an angle, the centerline distance between the two spherical heads self-adjusts to match the elasticity of the media. One of the heads is mounted rigidly, and the other is mounted on an arm to allow only enough translation so that the diskette can be inserted. The translating head is loaded with a force that exactly opposes the spring force of the diskette. The heads are then held apart by the reaction force of the diskette. An elliptical zone is formed between each head and the diskette, and the head-to-disk spacing is very small, stable and uniform. In addition, unlike

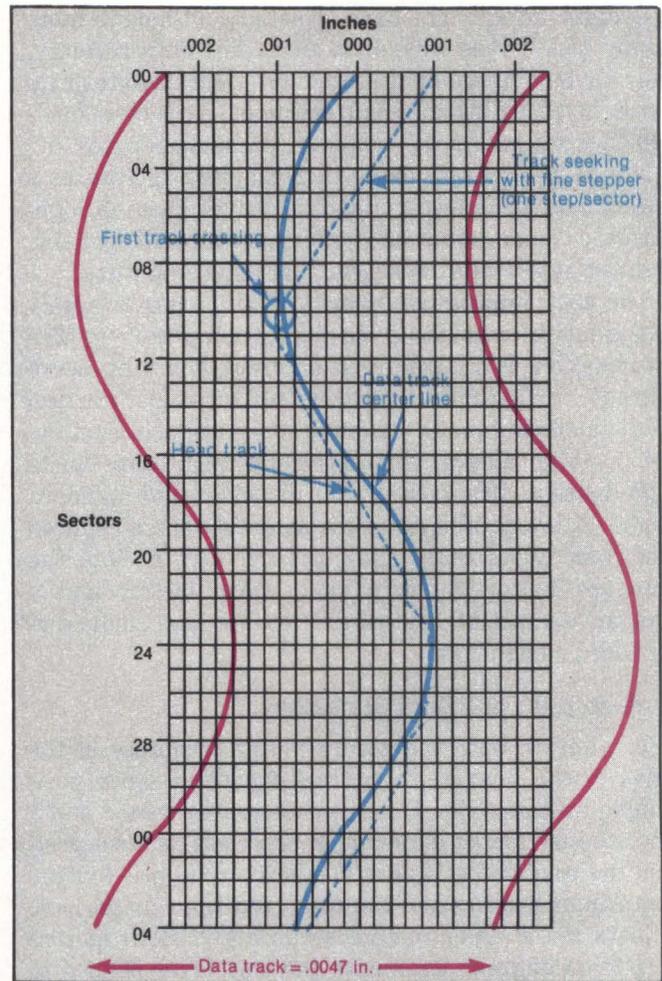


Fig. 3. A worst-case condition is indicated by a solid line (the data track) when it is not at a constant radius from the spindle. The dotted line is the track of the head position. If the head is positioned off the data track centerline (top of the grid), it approaches the data centerline at a rate of one step per sector. When it crosses the centerline, the head proceeds to track it to within 0.0001 in., regardless of how the data track centerline fluctuates.



You missed it.

The best micro-mini you've never seen.

It's on the previous page.

All alone.

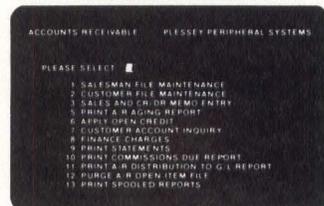
Because there isn't another computer made with the power, the performance and the low price of the Plessey System 6600/6700.

We've put the squeeze on the minis.

Our micros are the closest thing to a mini that you can get. And getting them from us costs about 30% less.

The Plessey System 6600 is our 256 kbyte powerhouse. The fastest 84 Mbyte Winchester hard disk known to man. A 9x hex-wide backplane. Six communications ports standard, add more if you need them.

Or go to our System 6700. It's the top of our line and packs all the wallop of a 22-bit mini while still allowing you to use 18-bit controllers. It's everything that the



6600 is, but has Plessey memory mapping and supports up to 4 Mbytes of main memory. So you

get faster response times and more users per system for your business, scientific industrial and communications applications.

The 6600 can be easily upgraded to the 6700 by adding our memory mapping

board and additional memory (no cabling, no software changes).

And both systems can be expanded with floppies, more hard disks, start/stop and streamer tapes, terminals and any other peripherals you need.

DEC and UNIX and CP/M® and you.

Both systems support whatever you're doing (or will be doing) in software: DEC™ operating systems like RSX-11M/M+™, RSTS/E™ and RT-11™ or TSX-Plus™.

UNITY™ (System III UNIX™) and the new

	January	February	March	Total	Grand Total
Net Profit Analysis					
Operating Sales	300,000	320,000	340,000	960,000	2,780,000
Operating Expenses	100,000	105,000	110,000	315,000	920,000
Total Sales	1,200,000	1,280,000	1,360,000	3,840,000	10,980,000
Cost of Goods Sold	424,000	435,000	446,000	1,305,000	3,952,000
Operating Profit	176,000	185,000	190,000	551,000	1,838,000
Operating Expenses	140,000	145,000	150,000	435,000	1,270,000
Marketing Expense	40,000	42,000	44,000	126,000	352,000
Admin Expense	30,000	31,000	32,000	93,000	268,000
Total Operating Exp.	180,000	187,000	192,000	559,000	1,530,000
Interest Expense	20,000	21,000	22,000	63,000	176,000
Tax and State Taxes	80,000	80,000	80,000	240,000	648,000
Net profit	86,000	87,000	88,000	261,000	712,000

crop of software. M-11 (MUMPS) and hordes of public domain applications. And even CP/M™ and

all those low-cost programs.

And you can use BASIC, COBOL, DIBOL™, C, PL/I, FORTRAN, Pascal and MACRO™ languages to develop your programs just the way you want them.

Don't miss out.

For a closer look at the best micro-mini you've never seen, contact: Plessey Peripheral Systems, Computer Systems Division, 17466 Daimler, Irvine, California 92714. (800) 854-3581 or (714) 540-9945 in California.



FLOPPY DISKS

conventional squarish heads, which can rub the media, slowly destroying the surface coating, the rounded gumball heads ease the passage of the media and cause less surface wear.

The head carriage assembly has a number of features that provide precise alignment. The head carriage is registered to the guide rod by the spring forces of the load rod (Fig. 5), which effectively holds the carriage in place, eliminating any need for field realignments. Further, an anti-backlash spring attached to the lead screw nut absorbs rotational and linear forces caused by the carriage movement along the lead screw. Thus, possible off-centering caused by movement in any direction is accounted for and corrected by the various spring attachments. The connection between the lead screw and the lead screw nut is also prone to possible mispositioning. As the nut is pushed forward and back, a gap between the two elements can cause a slight positioning error. This is eliminated by canting the lead screw nut at a slight angle relative to the threads in the screw (Fig. 6). When moving forward, the top edges of the screw move the nut forward; in reverse, the bottom edges move the nut backward. Meanwhile, a tight mechanical fit is maintained. This intentional cocking eliminates the tolerances of the connecting assembly and another source of potential positioning error.

The Drivetec 320 employs a modified acme thread to provide vertical clamping of the media (Fig. 7). Previous designs bring the media clamp down onto the media at a slight angle that can sometimes cause the media to be misclamped. In the Drivetec 320, the clamp

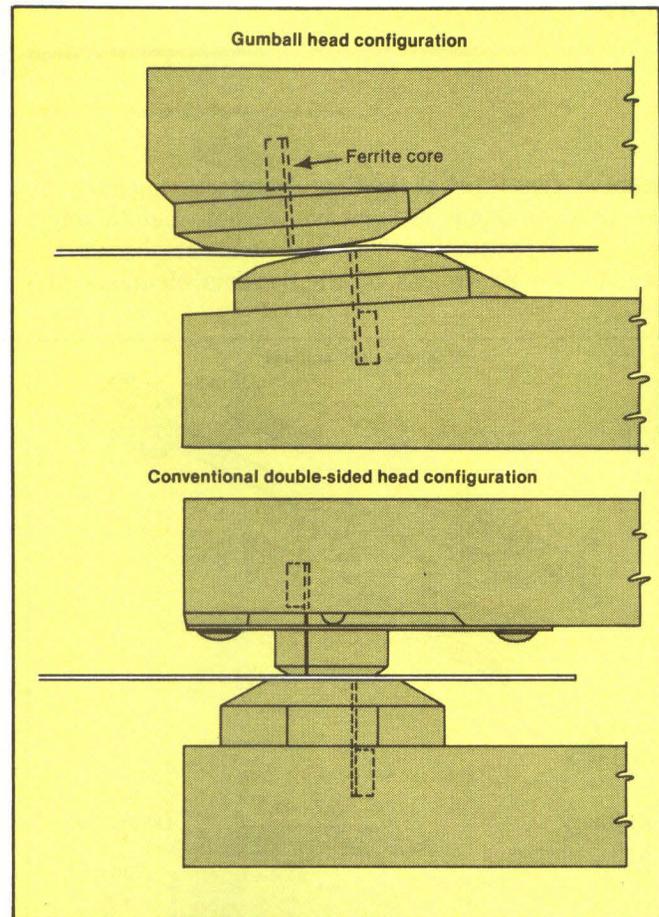
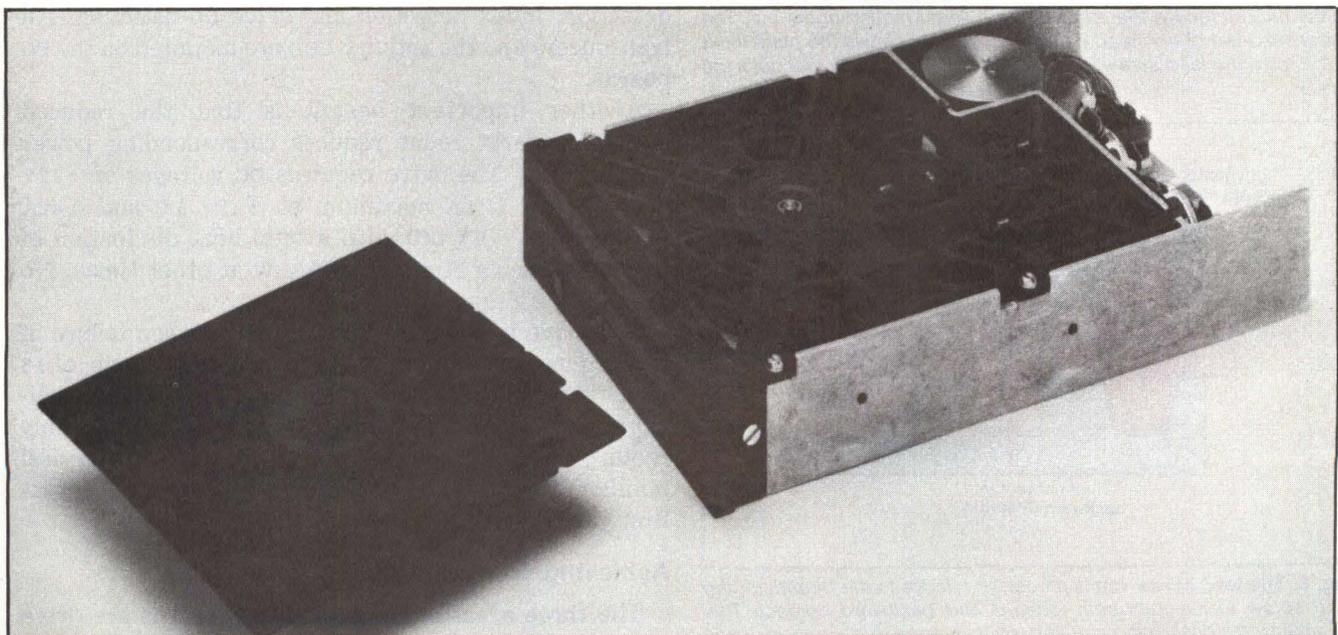


Fig. 4. The Drivetec gumball heads are spherical to reduce media wear. Unlike conventional heads, there are no sharp edges that can damage the media. The angled positioning of the gumball approach promotes smooth media rotation between the heads while allowing enough proximity to achieve a strong signal.

is at the same centerline as the spindle. This is accomplished by using a self-centering shaft/bearing



The Drivetec 320 "SuperMinifloppy" drive offers 3.3M bytes of storage in a half-height, 1.62- × 5.75- × 8.48-in. package. The new drive is priced at \$333 in large OEM quantities.

assembly that is set at the final manufacturing stage by inserting the clamp onto a wave washer, maintaining a true center positioning. This wave washer absorbs the accumulated tolerances of the various elements and

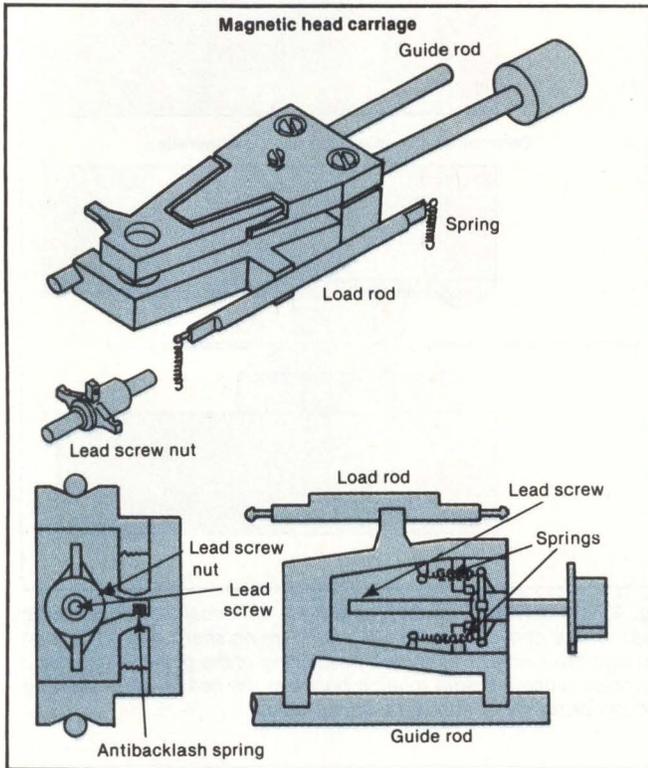


Fig. 5. The head carriage assembly (top) has a spring attached to the load rod to align the assembly into the proper orientation for precise head/media alignment. An anti-backlash spring on the lead screw nut decreases the rotational and linear motion of the nut. The underside view of the head carriage assembly shows the placement of the rods, the lead screw, the nut and the two springs that cock the nut.

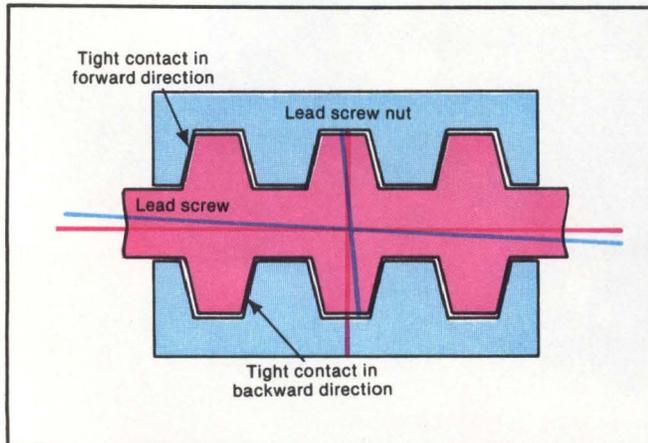


Fig. 6. The lead screw nut is off-center relative to the threads of the lead screw to maintain both forward and backward contact. This eliminates mispositioning caused by tolerance problems in these parts. The overlapping centerlines show the center position of the lead screw versus the center position of the nut.

assures that spindle/clamp centering is accurate. The tapered clamp grabs the media as it begins to rotate and centers it before clamping it into place. No center ring media reinforcement is necessary.

Down-sizing techniques

To pack the drive into the space of a half-height package, Drivetec employs a low-profile DC motor assembly and an integrated electronics design that uses four custom LSI chips and an 8-bit 6805 microprocessor. The motor assembly is a belt-driven, brushless DC motor rated for a five-year life within the defined specifications. Although some half-height drives use direct-drive DC motors, Drivetec finds that this type of motor mounted directly under the read/write heads causes unacceptable EMI radiation. Therefore, a belt-

An anti-backlash spring absorbs rotational and linear forces caused by the carriage movement along the lead screw.

driven, brushless motor is used. Belt-and-pulley systems previously had tolerance problems resulting from wear and thermal changes. Recently, however, belt materials that eliminate these problems have been developed.

Reducing the control electronics to a few custom LSI chips and the 6805 microcontroller enables the resulting printed-circuit board to fit into the space of a half-height drive. The electronic circuitry handles track-positioning control, drive motor speed control, read/write circuits, track zero detection, write protect detection, index detection and drive I/O selection. All transducers and the activity LED are mounted on the PC boards.

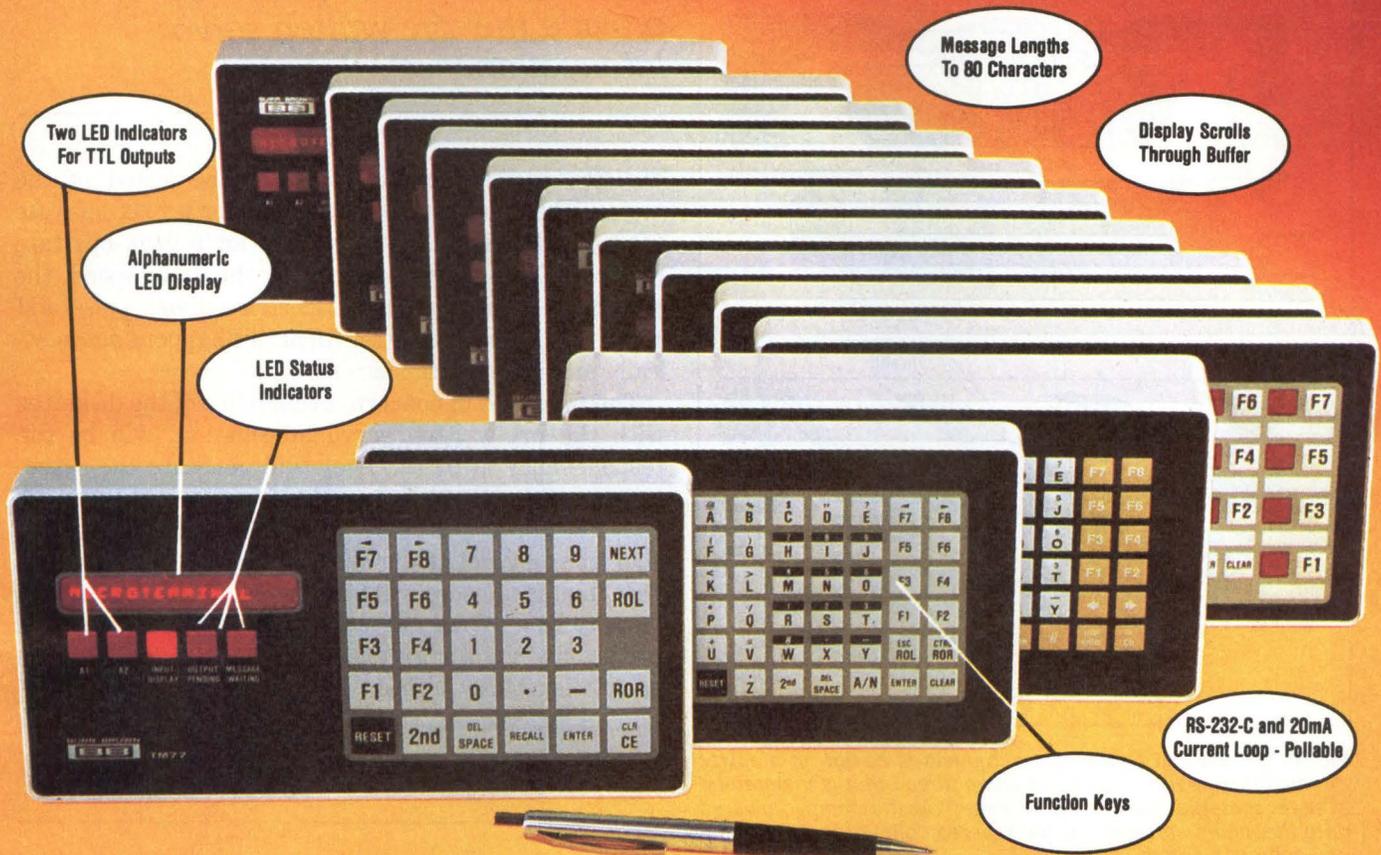
Another important benefit is that the reduced electronic parts count reduces corresponding power consumption. The drive requires DC voltages of +12V and +5V DC (1.2A maximum at +12V DC and 0.42A maximum at +5V DC) with a total heat dissipation of only 20W during stepping and 13W at other times. No AC power is required.

The drive is rated for mean time between failure of 10,000 power-on hours and a mean time to repair of 15 min. The embedded-servo information scheme, self-aligning head carriage and sealed DC motor assembly require no field alignments. By comparison, a typical minifloppy requires six or more alignments during its first year of use.

Achieving compatibility

The three areas of compatibility concerns are drive size, electrical interface and media availability. The 320 drive is designed to be exactly one-half the height of a

13 Small, Smart Solutions For Data Entry & Display



Microterminal: small, smart, tough . . . easy to install . . . simple to interface and operate - the logical, space saving substitute for bulky, fragile CRT's!

Rugged and water resistant for in-plant use - uncomplicated keyboards plus bar code wand and mag stripe reader options are perfect for factory data collection. Priced for OEM's and styled to enhance control consoles.

Serial ASCII (110 to 19,200 baud), RS-232-C, RS-422 and 20mA current loop communications. Only 8.5" x 4.5" x 0.6" and priced from \$192.00.* Request new full line Microterminal brochure.

Data Acquisition and Control Systems Division
3631 E. 44th Street, Tucson, AZ 85713 (602) 747-0711

Model	Alpha Display Characters	Baud Rate	Data Buffers: Characters	Keyboard	Function Keys: (3)	Features	Supply Voltage
TM71	16	110-19200	320 ⁽¹⁾	Alpha	14	Full feature	+5VDC
TM77	16	110-19200	320 ⁽¹⁾	Numeric	14	Larger keys	+5VDC
TM71-I/O	16	110-19200	320 ⁽¹⁾	Alpha	14	TTL I/O	+5VDC
TM77-I/O	16	110-19200	320 ⁽¹⁾	Numeric	14	Larger keys	+5VDC
TM71B	16	110-19200	320 ⁽¹⁾	Alpha	16	Bar Code Wand Mag Stripe Reader	+24VAC/ DC
TM71MS			5 x 50 ⁽²⁾				
TM77B	16	110-19200	320 ⁽¹⁾	Numeric	16	Mag Stripe Reader	+24VAC/ DC
TM77MS			5 x 50 ⁽²⁾				
TM71M	16	110-9600	320	Alpha	14	Military	+5VDC
TM70	12	300 & 1200	36	Alpha	8	Low cost	+5VDC
TM76	12	300 & 1200	36	Numeric	8	Larger keys	+5VDC
TM25	8	300	8	Numeric/ Hex	7	Low Cost	+15VDC
TM27	8	300-4800	8	Numeric/ Hex	6	Low Cost, polled	+8 to +12VDC

1) Two 80-character input buffers - two 80-character output buffers. 2) 5 x 50-character buffers also included for bar-code and magnetic-stripe reader data. 3) User programmed.



Tomorrow's Solutions Today

CIRCLE NO. 118 ON INQUIRY CARD

(206) 455-2611 - (213) 991-8544 - (214) 681-5781 - (303) 663-4440 - (312) 832-6520 - (313) 474-6533 - (408) 559-8600
(602) 746-1111 - (614) 764-9764 - (617) 444-9020 - (713) 988-6546 - (714) 835-0712 - (805) 496-7581 - (914) 253-9333

*TM27 (50 to 99)

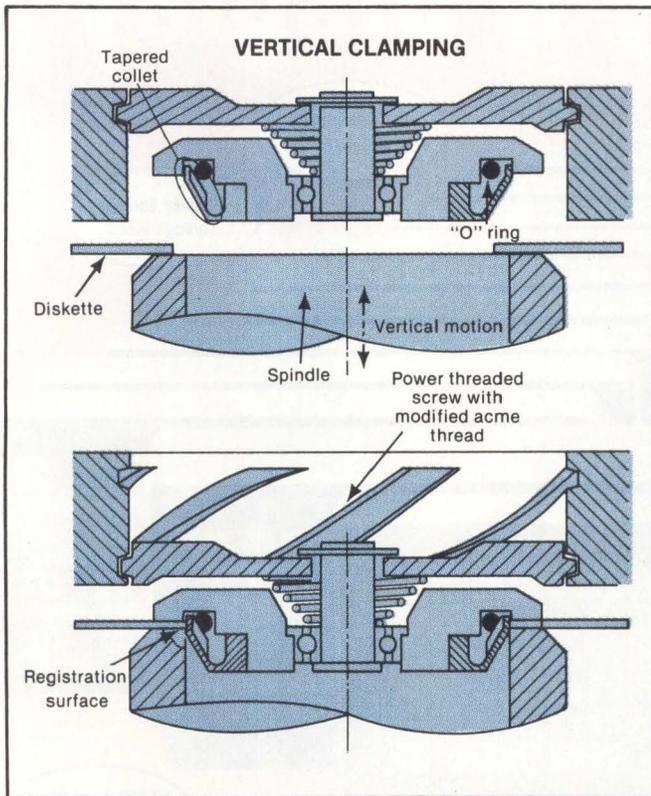


Fig. 7. The vertical clamping mechanism is based on a power threaded screw with a modified acme thread that is maintained at exact centerline over the spindle shaft. As the clamp is lowered onto the media and spindle, the tapered collet grabs the media and centers it before clamping.

standard 5¼-in. minifloppy drive, allowing two 320 drives to be mounted in the space typically occupied by a single standard minifloppy or an ST-506-type 5¼-in. Winchester. The 320 has four mounting holes on the bottom and two on each side. It must be mounted in a position that allows horizontal diskette entry.

The electrical interface is similar to the standard minifloppy drive interface. The IN USE and MOTOR ON signals are not needed because the activity LED is activated from the drive select lines and the DC motor runs continuously. The other significant change is that the DRIVE STATUS line has been changed to a ready signal that indicates that a seek operation is complete and the head is centered on the data track. These changes are easily handled in the microcode of most controllers.

The 320 has a data-transfer rate of 500K bits per sec., a disk rotation speed of 360 rotations per min. and a track density of 192 tpi. A speed adjustment must be made to enable the drive to read conventional 48- or 96-tpi diskettes. The position of the write protect cutout on the diskette jacket was changed to enable the drive to detect when a conventional diskette is inserted. In typical minifloppy diskettes, the cutout is

on the lower left corner. In the 320, the cutout is on the upper right corner. The microprocessor logic of the drive electronics detects the presence of a 48- or 96-tpi

It is the responsibility of the OEM to provide the pre-written servo information.

diskette and automatically alters the speed of the motor. The drive rotates at 300 rpm for a 125K-bps rate (48-tpi diskettes) and at 600 rpm for a 250K-bps rate (96-tpi diskettes). After changing the drive speed, the control electronics seek the electrical index pulse and begin reading the diskette. All of this happens automatically and is user transparent.

The final area of concern, availability of the diskettes with the pre-written servo information, will be the responsibility of OEMs. They will generate the servo-written diskettes and provide them to end users. A Drivetec servo-writer system will probably be available from several media manufacturers as well as from Drivetec. End users will be able to obtain the diskettes initially from OEMs and later from general suppliers at prices only slightly greater than those of double-sided, 96-tpi diskettes. □

Herb Thompson is president of Drivetec Inc., San Jose, Calif.

CORRECTION		
The following companies were omitted from our April survey of 32-bit mini-computers.		
Vendor	BTI Computer Systems	Ridge Computers
Product line	BTI 8000	Ridge 32
Line announced	1980	1982
Smallest model	BTI 8000	Ridge 32
Model announced	1980	1982
Packaging	19-in. rack mounted in 6-in. cabinet	34-in. cabinet
Performance		8 MIPS; 1500 single-precision Whetstones (FORTRAN)
Main memory (bytes)	512K-4M	1M-8M
Mass storage (M bytes)	67-254 (formatted)	60-985
Maximum workstations	as many as 200	8: 4 for high resolution graphics, 4 for alpha
Software	demand paging, time sharing, transaction processing, data-base management	demand paging, time sharing, word processing, database management, electronic mail
Networking		LAN
Languages	ANS, COBOL 74, ANS FORTRAN 77, Pascal 8000, BASIC 8000	Pascal, FORTRAN, C, assembly
Purchase price	\$105,000	\$54,500
Comments:	CPU includes 32- or 64-bit integer arithmetic, virtual memory; as many as 8 CPUs can be connected	Designed for CAD, scientific, engineering applications

FOR MULTIBUS AND EXORCISER COMPATIBLE BOARDS...

NOBODY MATCHES BURR-BROWN!

When you need I/O boards, there is one place to call. Burr-Brown.

SELECTION Over 35 boards compatible with Intel Multibus alone... 30 with Motorola EXORciser, DEC LSI-11, and Zilog.

QUALITY Each board is made with the technical precision and reliability that has become our trademark worldwide, because every board is burned in at 70° centigrade for 120 hours.

PRICE You can have the exceptional performance and selection of Burr-Brown at a price that's competitive with anyone...and a *full-year* warranty to back it up.

MICROCOMPUTER INPUT/OUTPUT BOARDS

INTEL AND NATIONAL MULTIBUS COMPATIBLE

Intel iSBC80 and 86; ICS80 and MDS800, National BLC80 and Starplex, and other Multibus Systems.

MODEL NUMBER	DESCRIPTION
ANALOG INPUT	
MP8418-PGA	15-channel Differential/31-channel single-ended, Fixed gain, 12-bit.
MP8418-PGA	15-channel Differential/31-channel single-ended, Programmable Gain, 12-bit.
ANALOG INPUT/OUTPUT	
MP8418-AO	15-channel Differential/31-channel single-ended input, Fixed Gain, 12-bit. 2-channel output, ±10VDC, 12-bit (individual DACs)
MP8418-PGA-AO	15-channel Differential/31-channel single-ended input. Programmable Gain, 12-bit. 2-channel output, ±10VDC
ANALOG OUTPUT	
MP8316-I	16-channel 0-20mA, 12-bit (common DAC).
MP8316-V	16-channel ±10VDC, 12-bit (common DAC).
SPECIAL PURPOSE INPUT	
MP8430	16-channel RTD 3-wire (100 ohm or 1000 ohm).
DISCRETE OPTICALLY ISOLATED INPUT	
MP810	24-channel Dry-Contact Closure, 1.5mA Wetting Current at 24VDC.
DISCRETE REED RELAY OUTPUT	
MP802	32-channel Relay, 0.5A at 28VDC
DISCRETE INPUT/OUTPUT	
MP830-72	72-channel TTL levels. User configured in 8-channel increments of inputs or outputs.
MOTOROLA EXORCISER COMPATIBLE	
Motorola Exorciser, Rockwell System 65 and Synertek Systems.	
ANALOG INPUT	
MP7217	16-channel, single-ended, Fixed Gain, 12-bit.
ANALOG INPUT/OUTPUT	
MP7432-AO	32-channel Differential/64-channel single-ended inputs, Fixed Gain, 8-bit. 2-channel output, ±10VDC, 8-bit (individual DACs).
DISCRETE OPTICALLY ISOLATED INPUT	
MP710	24-channel Dry Contact Closures, 1.5mA Wetting Current at 24VDC.
DISCRETE REED RELAY OUTPUT	
MP702	32-channel relay, 0.5A at 28VDC.
DEC LSI-11 COMPATIBLE	
LSI-11, -11/2, -11/23 PDP 11/03, 11/23	
ANALOG INPUT	
MP1216-PGA	16-channel Differential/32-channel single-ended, Programmable Gain, 12-bit.
ZILOG Z80 COMPATIBLE Z90, MCS	
ANALOG INPUT/OUTPUT	
MP2216-AO	16-channel Differential/32-channel single-ended inputs, Fixed Gain, 12-bit. 2-channel ±10VDC outputs, 12-bit (individual DACs)

BURR-BROWN®

Call us...



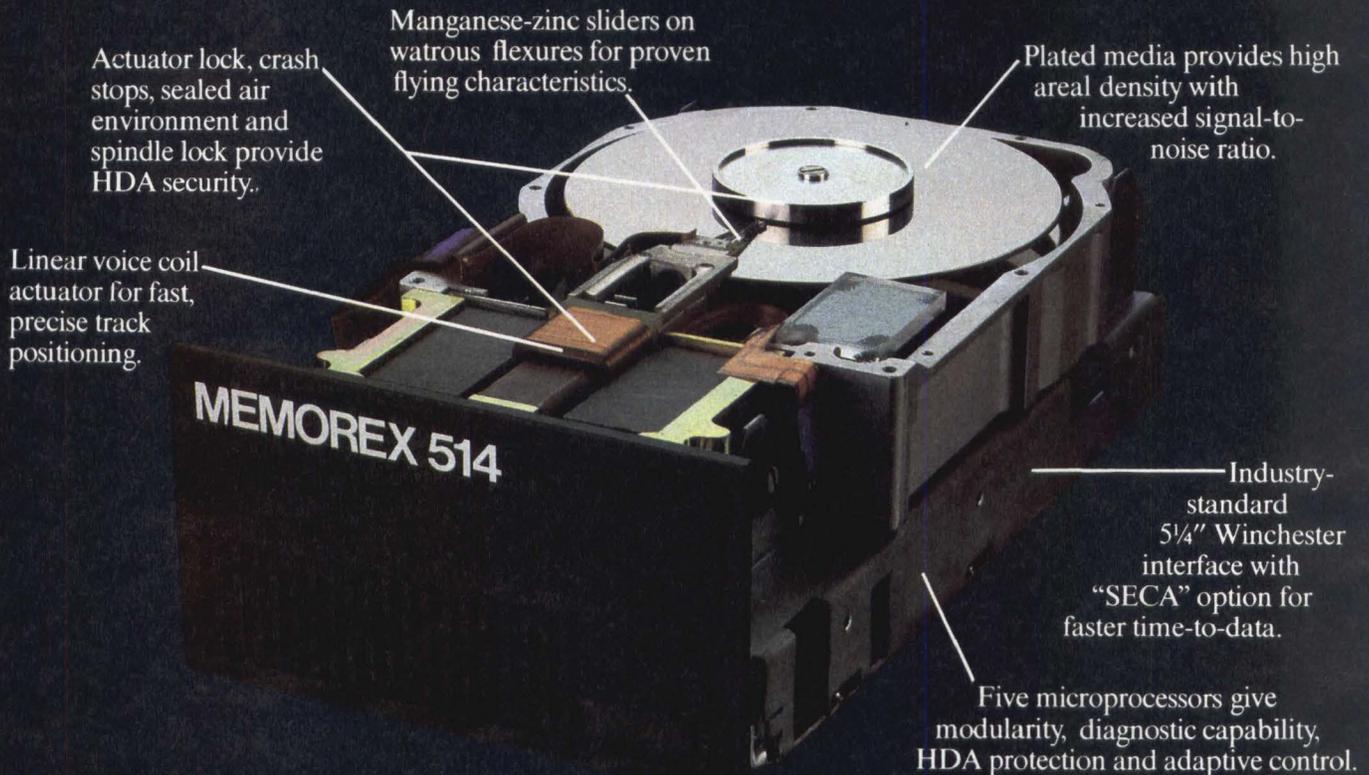
Tomorrow's Solutions Today.

* PARTIAL LISTING. FOR COMPLETE
HARD COPY OF BURR-BROWN
COMPATIBLE CARDS, CONTACT:

Data Acquisition and Control Systems Division
3631 E. 44th St., Tucson, Az. 85713 (602) 747-0711 TWX: 910-952-1115

CIRCLE NO. 119 ON INQUIRY CARD

70 Mbytes. 5¼" Package. Memorex Quality. And Just The Beginning.



Actuator lock, crash stops, sealed air environment and spindle lock provide HDA security.

Manganese-zinc sliders on wondrous flexures for proven flying characteristics.

Plated media provides high areal density with increased signal-to-noise ratio.

Linear voice coil actuator for fast, precise track positioning.

Industry-standard 5¼" Winchester interface with "SECA" option for faster time-to-data.

Five microprocessors give modularity, diagnostic capability, HDA protection and adaptive control.

Memorex Introduces 14" Drive Capacity And Performance In A 5¼" Disc Drive Package.

When Memorex decided to be a major manufacturer of 5¼" products, we already had an edge. An edge which we have now designed into a new family of 5¼" disc drives which not only meets today's system requirements but has designed-in capabilities to support tomorrow's needs for even higher capacity and performance.

The Memorex 500 Family: Expandability, Accessibility And Reliability.

The first three members of our 500 Family, the 510 Series, feature a choice of 30, 50 and 70 megabytes of capacity with an industry-standard 5¼" disc drive interface. Average seek time is 25ms which, when combined with our switch-selectable "SECA" mode, significantly reduces net system time-to-data. Our linear voice coil actuator and advanced servo design give a maximum seek time of only 45ms and a track-to-track time of just 3ms. But even more significantly, this technology sets a base for future drives with higher capacities and even faster access times.

Above all else, reliability and quality are key to the 500 Family design. By choosing a base design with capabilities well beyond the current series, our drives feature servo and read channels with extremely wide operating margins. And

by using an advanced electronic architecture with five interconnected microprocessors, we provide adaptive control systems which continually monitor critical parameters throughout the life of the drive and make dynamic adjustments to compensate for wear and component aging. In this way we obtain and retain true reliability throughout the life of the system.

Working Within The Systems. Today And Tomorrow.

It's a Memorex tradition, a summary statement that speaks to our experience, technology and resources. And it's a commitment to supply a complete family of 5¼" rigid disc products, such as our 400 Series fixed/removable drives for system back-up, our 510 Series drives for high capacity with fast access, and products yet to be announced in the 400 and 500 Families.

Call Memorex OEM today for complete information.

MEMOREX
A Burroughs Company



Working Within the Systems

Memorex Corporation, OEM Equipment Sales, San Tomas at Central Expressway, Santa Clara, CA 95052, (408) 987-3308, Telex 334492
In Europe: Staines, England 078451488, Telex 93508, Hamburg, West Germany 0406322075, Telex 215019, Frankfurt, West Germany 061166051,
Telex 411240, Liege, Belgium 041644544, Telex 23438

CIRCLE NO. 120 ON INQUIRY CARD

Ink jet technology comes of age

The New Chromajet™ Series

When you demand quality and need only Chromajet™ will do.

30 seconds a copy. Eight colors with 125 shades. Instant overhead transparency capability on a specially designed film from Polaroid Corporation. Using DuraPulse™, a self-cleaning, self-purging head technology which is warranted for two full years. These are just some of the features which make the first member of the Chromajet Series the state-of-the-art in ink jet technology.

There's more. Every printer subsystem is designed to deliver high quality graphic images with minimum operator hassle. Continuous forms paper lets you go off and do other things while Chromajet prints your presentation hard copy or transparencies. Advanced Color Technology's special non-water based inks give you rich, saturated images, and clean operation. The snap in ink cartridge gives up to 3000 copies between replacements. Ideal for shared resource operation.

Advanced Color Technology wasn't satisfied with building the best color ink jet printer. They wanted to make it more reliable and easier to service. The best news is the price. In OEM quantities the price is under \$4300, including Centronics interface.

Call us today. Let Chromajet solve your color hard copy needs. 1-617-256-1222.



CIRCLE NO. 121 ON INQUIRY CARD 21 Alpha Road, Chelmsford, MA 01824



Writing HP software can be doubly rewarding.

Doubly rewarding, because every time Hewlett-Packard sells a new system with your software, you'll not only get a check from the customer, but one from HP as well!

As thanks for writing software for our systems, we'll give you a bonus of 30% of your software's sales price—up to 6% of the net HP system's price. That could mean \$3,000 on a \$50,000 system... or as much as \$30,000 on a \$500,000 system. And you'll get it *every time a new system is sold with your software.*

We won't tell you what kind of program to write. What industry to write it for. Or even specify the system. Our only restriction is that, to qualify for the bonus, your software must sell for at least \$10,000.

Of course, extra cash isn't the only incentive. To help you get started, we'll sell you a development computer at a 40% discount.

We'll also promote your software in HP catalogs, direct mail and advertisements. And you'll have the benefits of being associated with HP—one of the worldwide leaders in computing systems. A company whose products range from widely-used business computers, like the HP 3000, to one of the world's most advanced 32-bit computers, the HP 9000.

If you'd like to learn more, write to Hewlett-Packard, Attn Gwen Miller, Dept. 08173, 19447 Pruneridge Avenue, Cupertino, CA 95014. In Europe, write to Henk van Lammeren, Hewlett-Packard, Dept. 08173, P.O. Box 529, 1180 AM Amstelveen, The Netherlands.

We'll give you all the details on our HP Plus Software Supplier program. And all the reasons why it will be rewarding for *you* to develop software for HP.



CIRCLE NO. 122 ON INQUIRY CARD

U.S. List prices only.
BD-02301

LAW

Law: the ultimate high-tech battleground

DAVID J. GOSS, ESQ., Rubin, Eagan & Feder

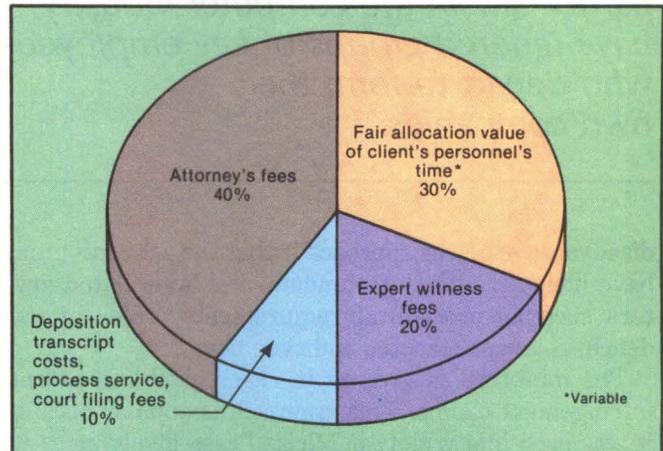
Complex legal and technical issues are leading to lengthy trials and dubious decisions

The 1980s have seen a significant increase in lawsuits to protect the intellectual property of high-technology firms. In many cases, these companies are trying to preserve their competitive edge in the face of economic stagnation and threats from spin-off companies. They can claim protection rights based on patents, trade secrets and general laws against "unfair competition." Yet the guarantor of these rights, the legal system, has not proved effective in dealing with most high-technology cases. Neither traditional judges and juries nor recently introduced alternatives such as arbitration, "mini-trials" and court-appointed technical advisors has been able to avoid expense, delay and uninformed decisions.

Legal challenges to spin-offs

Historically, large corporations, particularly in the computer industry, have ignored groups of key employees who depart to form their own companies; an "unfair competition" lawsuit against a fledgling enterprise was perceived as lending more credibility to the spin-off than the potential legal relief was worth. But recession-hit corporations can no longer afford to ignore the infringements of former employees and so have turned to the courts as a recovery mechanism.

Recent high-technology litigation has illustrated this increased acceptance of legal action. For example, within the last year, Intel Corp. obtained a preliminary injunction against Seeq, a company formed by key technical personnel from Intel. National Semiconductor



High-technology litigation's costs. An average high-technology case costs \$650,000 to litigate. While attorney's fees account for the largest share of overall cost, expert witnesses, at \$100 to \$250 per hour, may be the most expensive personnel. The "value" of the client's personnel is the most variable factor in a cost breakdown, since a chief executive officer's litigation time can be worth more than that of a dozen junior engineers.

Corp. has twice sought protection from the courts when groups of former employees gravitated to a new place of business. IBM Corp. sued Bridge Technology before Bridge's alleged "founders" even left IBM, and Atari sued a group of former programmers who created Activision. Several video-game manufacturers and software houses have recently pioneered legal activity, demanding copyright protection for programs that they claim have been substantially copied by competitors. To

these companies, a "dot gobbler" by any other name is still a Pacman.

That more and more companies are invoking legal protection does not mean that the court system is better prepared to deal with technology. Most technology lawsuits stagger to inconclusive results or remain pending. Nevertheless, a number of vehicles have been developed by high-technology litigants to cope with the judicial system's lack of technical sophistication. These include arbitration by a mutually designated expert, the mini-trial and appointment by the court of technical advisors to assist trial judges in wading through the morass of high-technology litigation.

Arbitration and mini-trials

A number of recent disputes such as the litigation between National Semiconductor and Zilog Inc. have been turned over to arbitrators. Through this arrangement, the parties avoid committing large amounts of time and money to "educate" the judge and jury. The

Historically, large corporations, particularly in the computer industry, have ignored groups of key employees who depart to form their own companies.

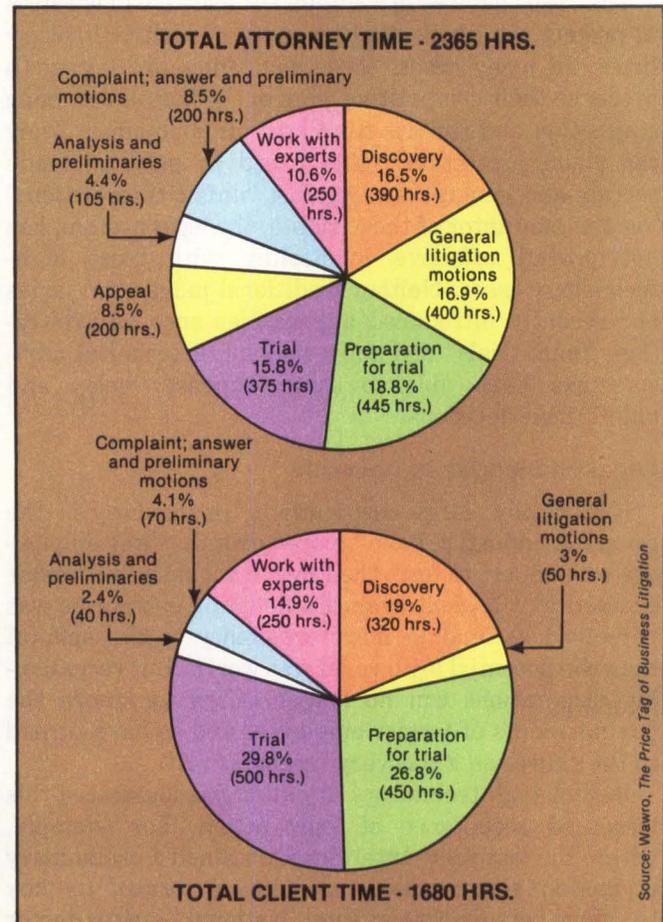
disadvantage of this approach is that the arbitrator may have little sensitivity to fundamental law-related matters such as procedural requirements, rules of evidence, relevant statutes and case law.

The mini-trial is favored in cases involving patent-infringement claims. This approach is popular because it was used in a widely publicized case involving TRW. The mini-trial involves selecting an expert moderator with legal and practical experience to serve as "judge." In the TRW case, a former judge of the Patent Appeals Court was selected. The decision of the judge is not binding on the parties.

What distinguishes the mini-trial from nonbinding arbitration is that key business personnel of the involved parties actively participate. While parties may agree upon different procedural ground rules for mini-trials, in general, there is minimal involvement of counsel. Business personnel present the reasons why litigation is being pursued. The mini-trial is only as good as the cooperation of the participants. Parties could come to the mini-trial without business representatives authorized to make substantive decisions, reducing the exercise to a replication of the pre-trial

Litigation step	Activities involved
1. Analysis and preliminaries	Client-attorney interview; review documents; legal research; inspection of physical items; strategic discussions
2. Complaint/answer and preliminary motions	Drafting preliminary documents; prepare preliminary briefs
3. Work with experts	Educate and prepare impartial experts to testify favorably about evidence that is unavailable to the client's own personnel because of confidentiality orders
4. Discovery	Prepare demands to get proper evidence; present evidence; take depositions
5. General litigation motions	Deal with disputes regarding discovery and procedure; examine the viability of legal theories
6. Preparation for trial	Conduct witness interviews; prepare documentation; issue subpoenas; draft pretrial statements
7. Trial	An average of three weeks, with two lawyers in court daily; prepare for the next day's testimony
8. Appeal	Organize, record and prepare briefs; present oral argument

Steps in litigation, breakdown of time. While the courtroom scene is the most public part of the litigation process and involves the largest portion (about 30 percent) of a client's litigation time, the trial is only one of several steps in which counsel must approach the bench. Complex motion procedures require that counsel spend a significant amount of time on pre-trial motions, while the client has a limited involvement.



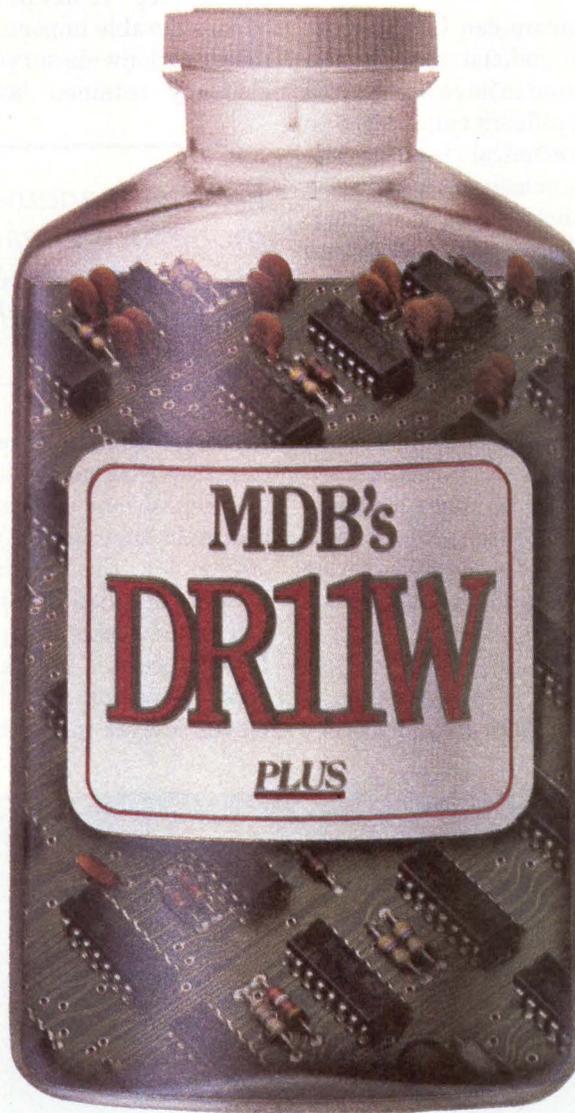
How do Unibus* users spell peak I/O rate relief?

High speed data acquisition can be a real headache. Especially during peak I/O rates when transfer can exceed the CPU's capacity and key bits of information go off in thin air.

So we developed a DR11-W module. First for the Unibus. Now for the Q-Bus. Both feature our exclusive DMA Throttle that efficiently regulates data flow down to average rates to maximize overall CPU performance. But that's not all.

Additional design features make it a cure for many other troublesome Unibus or Q-Bus system ills. For example, it offers:

- Edge mounted LED's to illuminate performance status
- Micro-sequencer driven, self-test diagnostics
- Long lines capability
- Switch selectable 22-bit addressing (Q-Bus)



- Bus Address Extension for memory transfer throughout the 4 megabyte range (Q-Bus)
- Switch selectable, 4-level or single level interrupt arbitration (Q-Bus)
- Compatibility with 16, 18 and 22-bit backplanes (Q-Bus)

This high speed, digital input/output device is prescribed for such typical applications as:

- High speed graphics
- Digital data acquisition
- Parallel information processing
- Interprocessor linking between a Unibus and Q-Bus

There's more. And we're anxious to spell out all that the DR11-W and our complete line of computer interfaces can do for you. Call or write today and ask about full year warranty. Available under GSA contract #GS-00C-03330.

Now for Q-Bus* users too.

*TM Digital Equipment Corp.

MDB
SYSTEMS INC.

1995 N. Batavia Street, Orange, CA 92665
714-998-6900 TWX: 910-593-1339

Circle 20 For LSI-11 99 for PDP-11

discovery process.

Technical advisors

Court-appointed technical advisors can be the most effective interface between the judicial system and technology issues. Some federal courts have designated such experts as temporary court officers empowered to hear evidence and rule on technical issues. The technical-advisor approach is as unbiased as arbitration and is within the context of judicial decision making. The court can direct its technical advisor to investigate the facts and present a written opinion. After submitting a report, the advisor testifies under cross-examination and monitors and assesses the testimony of partisan technical witnesses.

The technical-advisor approach differs from arbitration and mini-trials in that it is selected at the discretion of the court, not the parties. Moreover, the court need not follow the recommendations of its advisor. Many judges do not appoint technical advisors, preferring to go it alone rather than deal with the administrative difficulties of appointing, monitoring and assessing the reports of court-appointed experts.

Wasting time and money

Large expense and delay are found in virtually every

method of resolving high-technology issues. Pre-trial maneuvering makes lots of money for litigation counsel but does little to decrease the inherent uncertainty of the legal process.

The willingness of some parties to incur vast expense was demonstrated by the IBM litigation against Greyhound Corp. To define the "relevant market" (a matter of considerable importance in antitrust litigations), IBM took a nationwide survey of the computer industry. The company retained lawyers in each section of the

Pre-trial maneuvering makes lots of money for litigation counsel but does little to decrease the inherent uncertainty of the legal process.

country, issued subpoenas to virtually every U.S. company that made data-processing devices and took live depositions of principals of all these companies to ascertain their activity in the computer market. The outlay for this exercise exceeded the cumulative budgets of a half dozen small states.

The inevitable companion of expense is delay. The legal process is painfully slow in comparison with the rapid development of sophisticated technologies. A clever lawyer in the high-technology arena has more

RECENT SIGNIFICANT HIGH-TECHNOLOGY CASES

- **Microcomputer Systems Corp. versus Data Technology:** Data Technology, a spin-off of Microcomputer Systems Corp. (now called Xelsec), was found to have misappropriated the architecture for the Microcomputer Systems disk-controller design. Microcomputer Systems was awarded a preliminary judgment of \$1.4 million to \$2 million. The case was settled as a final judgment was about to be entered.

- **IBM Corp. versus Hitachi America Ltd.:** This trade-secrets civil suit arose from "Computerscam." IBM's case was set back when one of its principal law firms was disqualified because of a conflict of interest. This case demonstrates that major corporations are no longer nonchalant about trade-secret violations.

- **State of California versus Magnuson:** The District Attorney of Santa Clara, Calif., issued a criminal complaint against Paul H. Magnuson, co-founder of Magnuson Computer Systems. After leaving Magnuson

Computer Systems to found Prodigy Corp., Magnuson allegedly offered financial inducement to other Magnuson Computer Systems employees to join Prodigy and to bring sensitive information about the older company. This case shows the public prosecutor's interest in trade-secret violations.

- **Fairchild versus Data General Corp.:** Fairchild is appealing the court's reversal of a favorable jury verdict. The jury ruled that DG violated the federal antitrust laws by "tying" its operating systems to the purchase of its computers. The federal judge reversed the decision by issuing a "judgment-notwithstanding verdict," a legal way of imposing his opinion that the jury could not possibly have reached the proper conclusion.

- **Tandy Corp. versus Personal Computer Systems:** This case extended copyright protection to programs recorded in a PROM, rather than limiting protection to printed software listings. This case set a

precedent.

- **The Bally-Midway and Warner Communications "Pacman" litigations:** Bally-Midway obtained sealed orders for federal marshals to seize alleged counterfeit "dot-eater" games. The alleged counterfeiters were not informed that Bally-Midway sought these seizure orders, so that the evidence would not be destroyed. These cases have broadened the copyright protections, ruling that, although the copyright itself might specify only a few visual displays in a video game, it covered all of the possible ways in which the game could be made playable.

- **Intersil Inc. mask litigation:** Intersil has claimed that the 1979 copyright law extends protection beyond the traditional integrated-circuit design as written on paper and that the laws protect the design as it is embodied in the mask from which the circuit is made. A favorable decision in this vanguard case could significantly expand the copyright's domain.



I've been a certified public accountant for twenty-three years. During that time, Basic Four® was the best business software I found. Now, Basic Four is making this experienced software available on micros for small business. And the timing is perfect, I've just signed up as a Basic Four® microproducts dealer. My customers are impressed with the capabilities of the software—and I'm impressed with the profits!

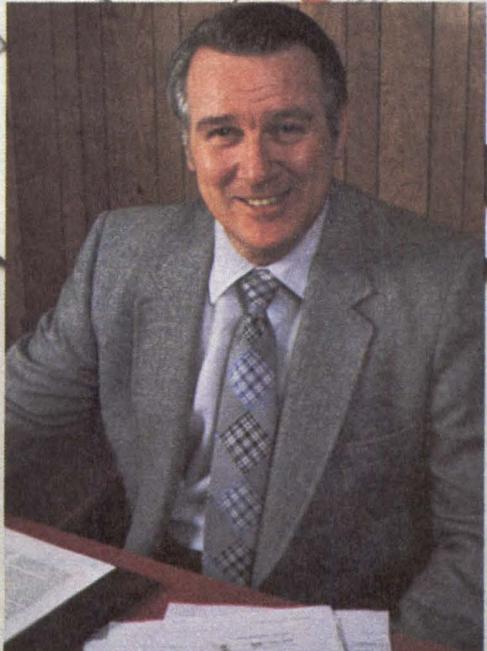
This is proven software that has been working successfully many years in thousands of businesses all over the country. Basic Four has taken this time-tested software and packaged it with the best documentation I've seen. My training time is kept to a minimum—so I can spend more time getting more sales.

My Demonstrations Were Never Easier.

How many customers do you usually have to demo before you get a sale? 5? 10? 12? With Basic Four, once I bring a customer in for a demo, my conversion target is one in two. It's especially easy with the qualification and demonstration programs furnished by Basic Four. My success rate would make almost any dealer profitable.

It's obvious that this is no ordinary accounting software.

I let the software do all the talking, Basic Four® software does what it says it will do. It's menu driven—all instructions are clear and straightforward. It's easy for my customers to understand. And it's impressive—even for my most demanding customers.



“BBIM™ IS THE SECOND BEST SOFTWARE I'VE EVER FOUND!”

Preston Lockhart, President
Lockhart, Rogers & Co.
Ft. Worth, Texas

MAJ Basic Four Business Products®
601 San Pedro, NE
Albuquerque, NM 87108
1-505-266-5811



I Count On A Single Source.

Whether it's hardware, software, or service support, I can look to MAI® for my solution.

If I have a customer problem, I know I can get on the phone to Basic Four® Support for answers. Quick answers... I can't recall any solution taking more than a five minute call. This single source support helps me control costs, makes for satisfied customers, and keeps my profits in my pocket!

One Great Opportunity For Microproducts Dealers.

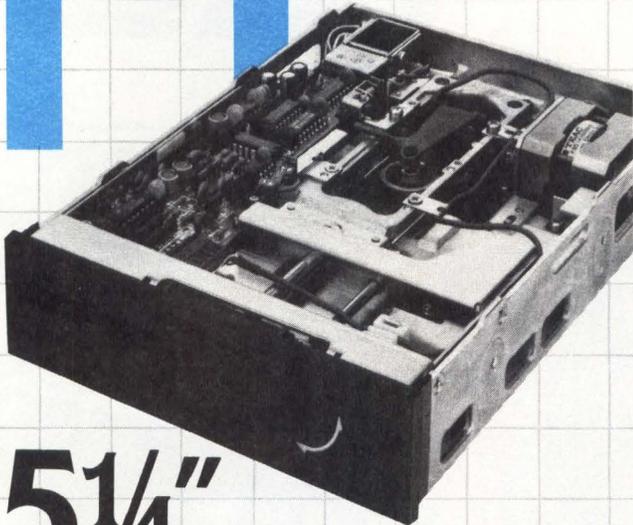
Only as an authorized Basic Four® dealer can you take advantage of this exciting business opportunity.

To me, a Basic Four business opportunity like this can spell **PROFITABILITY!**

CALL RIGHT NOW!
1-505-266-5811
Or send us this coupon with your business card, and we'll respond immediately!
Save \$100 on your first copy of Basic Four's General Ledger!*
*Subject to qualifications necessary for authorized Basic Four Microproducts dealer ship recognition
MM 1

CIRCLE NO. 123 ON INQUIRY CARD

HALF HIGH



5 1/4" Floppy Disk Drives TEAC FD-55 Series

AT 1 5/8" HIGH, TEAC FD-55 SERIES 5 1/4" FLOPPY DISK drives use half the space and run cool at half the power of conventional drives. High-reliability, low-noise brushless DC motors provide an MTBF of over 10,000 hours, backed by a one-year parts and labor warranty.

FD-55A	FD-55B	FD-55E	FD-55F
• 48tpi	• 48tpi	• 96tpi	• 96tpi
• 40 track	• 40 track	• 80 track	• 80 track
• 250KB	• 500KB	• 500KB	• 1MB
• single side	• double side	• single side	• double side

Power Requirements:

DC +12V \pm 5% 0.3A typical, 0.7A max.
DC + 5V \pm 5% 0.5A typical, 0.7A max.

Phone, write or wire TEAC Corporation of America for complete technical data, price and delivery.

TEAC

TEAC Corporation of America
Industrial Products Division
7733 Telegraph Road
Montebello, CA 90640
213/726-0303

© 1982 TEAC Corp.
MP82501M

LAW

opportunities to slow litigation than he would in any other commercial dispute.

The confidentiality protective order is the principal delay mechanism used in high-technology litigation. In theory, this order prevents a party from accessing the sensitive business information of its adversaries. The order clashes, however, with the constitutional right of a party to confront the evidence introduced against it. The classifying of documents can force a party into employing the "Seeing Eye dog" approach to litigation. In such a situation, counsel must retain independent experts (the Seeing Eye dogs). These experts are educated in the relevant technology and business considerations, and must sift through mounds of documentation that could be examined much more expeditiously by the parties' own engineers. At least one of the camps involved in the dispute, desires the resultant slowdown, and it is generally the party that would lose if there were a speedy and focused resolution of the technical issues.

An example of the effect of delay is Digital Equipment Corp.'s litigation against Computer Operations involving DECTAPE. Computer Operations accused DEC of committing fraud in connection with applying for and obtaining a patent on a tape-memory technology. After conducting hearings, the U.S. Patent Office concluded that DEC had suppressed information that would have precluded the viability of its patent application. To

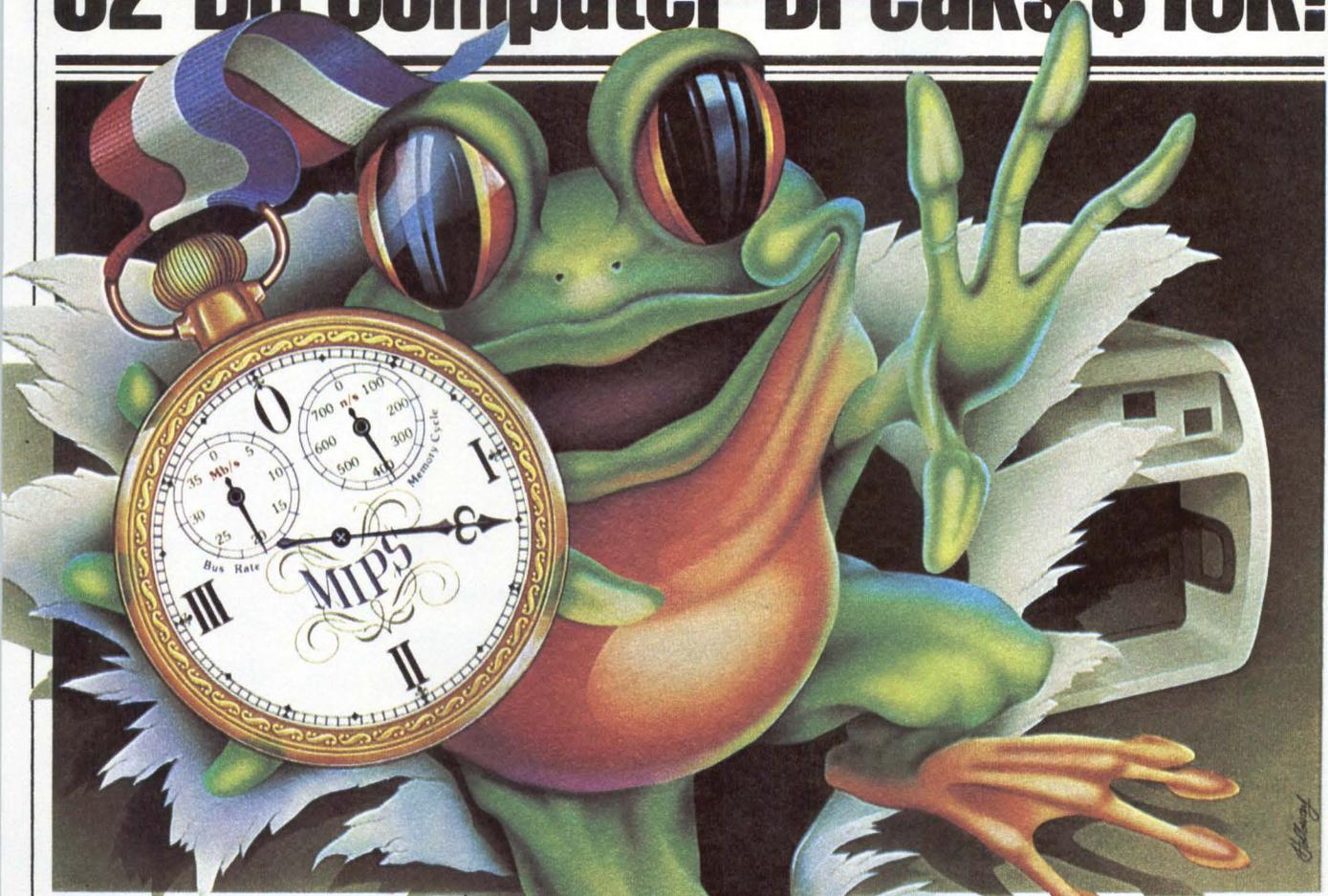
The mini-trial is favored in cases involving patent-infringement claims.

obtain compensation for these grievances, however, Computer Operations was forced to commence an antitrust lawsuit. It simultaneously had to appeal the Patent Office's determination through the federal courts. According to the federal court of appeals that ruled on this matter, the Patent Office had committed a number of procedural violations that invalidated its determination. The case was remanded to the Patent Office for further proceedings. But, by then, the parties had moved to other endeavors, and the invocation of the legal process had become irrelevant. □

David J. Goss is a lawyer who specializes in high technology counseling and heads litigation activities of the Rubin, Eagan and Feder law offices in San Francisco.

★ ★ ★ E X T R A ★ ★

32-Bit Computer Breaks \$10K!

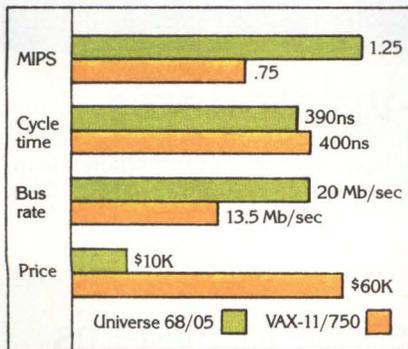


Universe 68/05 First to Smash Price Barrier

The new Universe 68/05 is the first true 32-bit computer priced under \$10,000 (OEM quantity one). "True" because, unlike other 68000-based systems, the Universe 68/05 handles 32 bits in parallel on its VERSAbus.

Outperforms VAX*

Its price is even more impressive when you look at Universe 68/05



performance versus that of 32-bit "superminis" several times more expensive, like the VAX-11/750.

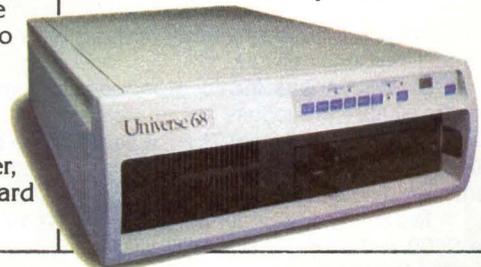
High-Speed 68000, 4Kb Cache, 32-Bit Bus

The key to that performance is a 4Kb cache that eliminates processor wait-states and takes full advantage of a 12.5MHz 68000 processor. Also included are a separate 68000 I/O processor, four serial I/O ports (expandable to 64), 256Kb RAM (expandable to 3Mb), 20Mb/sec, 32-bit VERSAbus, 10Mb Winchester, 1.25Mb floppy disk, and 5-slot card cage. All in a 7-inch enclosure.

UNIX-Compatible Real-Time OS, Too

UNOS*, our UNIX* Rev7-compatible operating system with real-time features, runs Pascal, Fortran, C, BASIC, DBMS, and third party application programs.

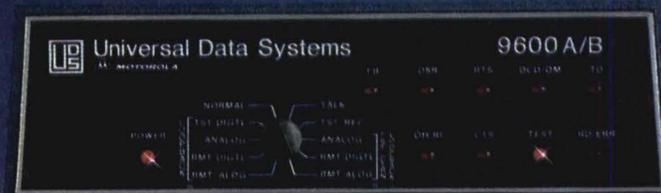
For more information, just attach your business card to this ad and mail to Charles River Data Systems, 4 Tech Circle, Natick, MA 01760. Or call us at (617) 655-1800. We'll send you a copy of "The Insider's Guide to the Universe," a detailed discussion of the technical concepts behind this remarkable new computer.



CHARLES RIVER DATA SYSTEMS

*VAX is a trademark of Digital Equipment Corporation. UNIX is a trademark of Bell Laboratories. UNOS is a trademark of Charles River Data Systems.

CIRCLE NO. 125 ON INQUIRY CARD



UDS raises the speed limit for dial-up modems

At last there's a 9600 bps modem designed especially for the dial-up telephone network.

Our 9600 A/B is the ideal modem for projected system growth. Realize immediate line-charge savings by moving from 208 A/B to 9600 A/B now! Then, if your system demands dedicated lines, simple strap modifications will convert your modems. Nothing else changes!

A faster turnaround time than 208 A/B's further increases the 9600 A/B's efficiency. Multiple test modes are selectable from the front panel.

Contact Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805. Telephone 205/837-8100; TWX 810-726-2100.

 Universal Data Systems

 **MOTOROLA INC.**
Information Systems Group

DISTRICT OFFICES:
Old Bridge, NJ, 201/251-9090 • Blue Bell, PA, 215/643-2336 • Atlanta, 404/998-2715 • Chicago, 312/441-7450 • Columbus, OH, 614/895-3025 • Boston, 617/875-8868
Richardson, TX, 214/680-0002 • Englewood, CO, 303/694-6043 • Houston, 713/988-5506 • Tustin, CA 714/669-8001 • Sunnyvale, 408/738-0433

CIRCLE NO. 126 ON INQUIRY CARD

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

Cellular radio gives rise to portable data communications

DAVID H. FREEDMAN, Associate Editor

New radio technologies promise to put computers on-line in cars and briefcases

The market for portable computer equipment is growing almost as quickly as machines are shrinking. Executives, salesmen, service technicians and others can be seen in airports and on highways with angular plastic briefcases containing printers, keyboards and even entire systems. Many applications involving such equipment depend on remote communications via telephone. But telephones are often the most difficult to find when they are most needed by field personnel: in cars and vans, at outdoor sites or in a client's busy office. In addition, on-the-road data communications is often a one-way street, as a home office must wait for a traveling computer user to phone in before downloading data.

These problems may be solved by a new mobile-phone scheme that is expected to put telephones under the dashboards—and perhaps in the briefcases, tool boxes and even pockets—of millions of people who work away from their desks. This scheme, called cellular radio, as well as other developments in radio communications, should add new momentum to the portable computer-equipment market.

Cellular radio takes over

Mobile phone service in the U.S. has been based on radio communications between weak car-based transceivers and powerful base transceivers connected to telephone land lines. Connections to the land lines are automatic, so calling to or from a mobile phone is no



Mobile phone unit from Oki includes a handset, usually mounted within reach of a driver, and a box mounted in the trunk handling transceiver and control functions. Most mobile units are used with two antennas for optimum reception.

different from using a desk phone. The major problem with the current mobile service lies with the Federal Communications Commission's allocation of channels: only 23 duplex channels are available for use with this type of service, of which only 12 can be used within a given area. Thus, even in major metropolitan areas, only 12—and sometimes fewer—conversations can be supported simultaneously. Base transceivers can carry conversations of acceptable quality for only 25 miles,

and channels cannot be reused within a 100-mile radius without risking interference, even further stretching limited channel resources. As a result, the demand for mobile phone service grossly exceeds its availability.

To limit channel clogging, telephone companies have offered mobile service to only a small percentage of those people requesting it. The Eastern Management Group, a consulting firm in Morris Plains, N.J., is preparing a market study on cellular radio. EMG president John Malone estimates that 100,000 people in New York alone are on mobile-phone waiting lists. "Their grandchildren wouldn't get phones under the current system," says Malone. "It's worse than waiting for Giants tickets." But even the small number of customers who do get mobile phones are not assured of adequate service. Finding an open channel in urban areas can range from difficult to impossible in the early morning and late afternoon.

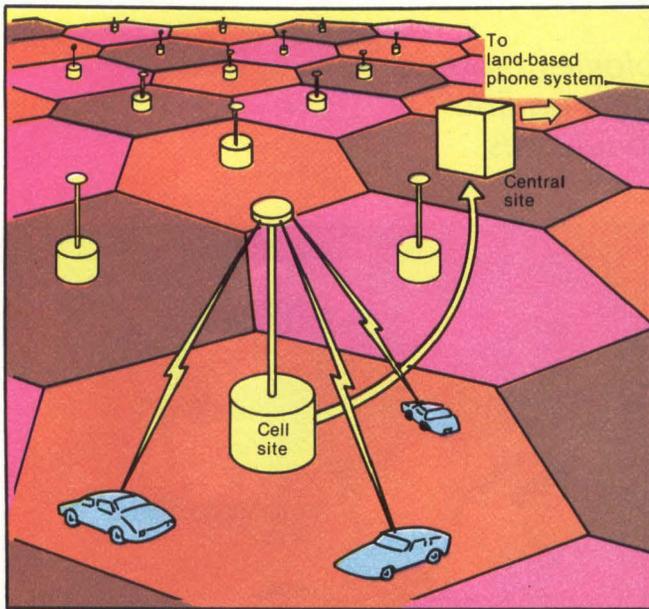


Fig. 1. Cellular radio scheme divides an area into cells, each with its own transceiver. A mobile unit in a given cell communicates with the transceiver in that cell, which relays the transmission through a dedicated land line to a central site. The central site connects the cellular system with the land-based phone system. When a mobile unit passes into a new cell, the call is "handed off" from the transceiver in the old cell to that in the new cell. Because cell transceivers broadcast within the boundaries of the cell, channels can be shared by several nonadjacent cells without interference.

The FCC seized on cellular radio in the early 1970s as a solution to the mobile-channel availability problem. Under cellular radio schemes, a geographic area is divided into smaller areas, or cells. Each cell has its own base transceiver (or set of transceivers) and communicates only to those mobile phones within the cell (Fig. 1). The signals are weak enough so interference need be

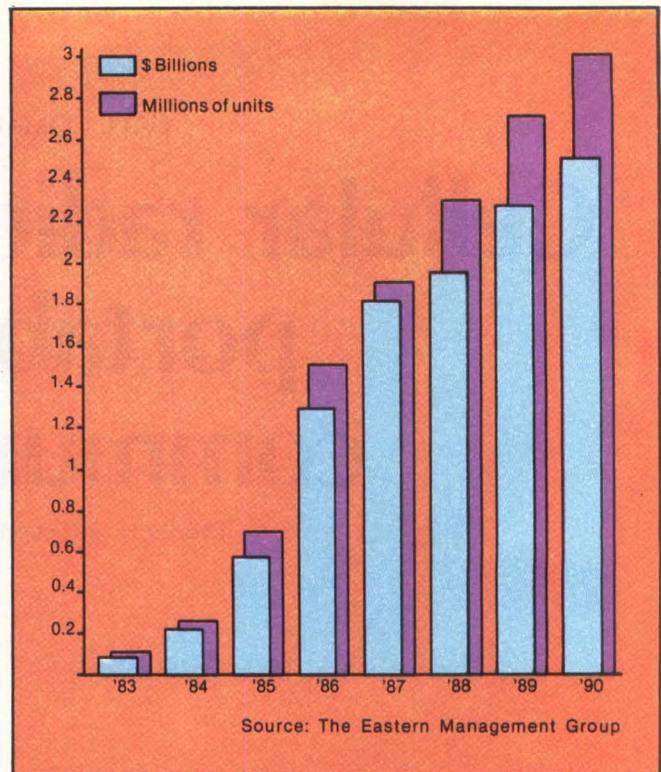
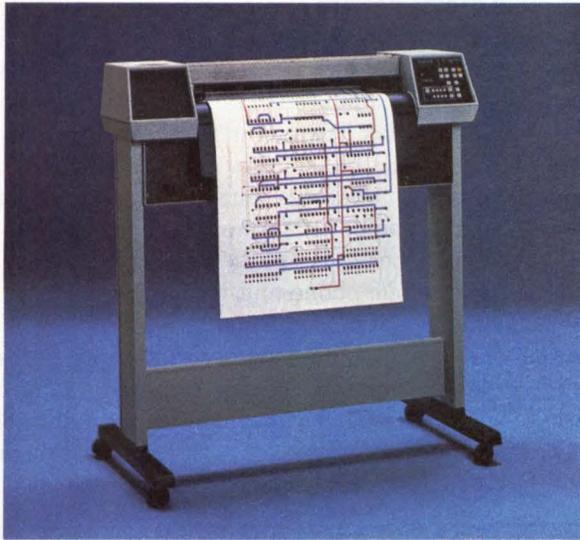


Fig. 2. Predicted revenues and unit sales in cellular radio should climb into the billions of dollars and millions of units over the next seven years.

considered only in nearby cells. Thus, several cells within an area can use the same channel simultaneously, as long as no proximate cells use the same channel. When an active mobile phone moves from one cell to an adjacent cell, the call is transferred to a new channel under control of the new cell, with no perceptible disruption in service. Because channels can be shared by several cells within the area, a cellular radio mobile phone system can provide service to many more callers than can a conventional system using the same number of channels. In addition, the number of serviceable mobile users can be increased by redividing an area into smaller cells, without increasing the number of channels. "In one fell swoop," says Malone, "all the applicants on waiting lists will be offered service."

The FCC is currently examining applications from wire-line and non-wire-line carriers for licenses to provide cellular mobile phone service in 30 large U.S. cities. The Bell System's Advanced Mobile Phone Service will typically receive one of the two licenses that will be granted in each city. With mobile phone service revenues expected to exceed \$2 billion by 1988 (Fig. 2), competition is fierce for the remaining licenses. Cellular mobile phone services have been implemented on a trial basis in Chicago with AMPS and in the Baltimore-Washington area with American Radio Telephone Service using Motorola's cellular system. Both experiments are working, and many major cities can expect to have cellular mobile phone service within two years.

Now you have a choice!



The best way to make the HP 7580 better was to make it bigger.

You asked for it!

Ever since its introduction two years ago, the HP 7580 Drafting Plotter has enjoyed an unparalleled reputation for price/performance excellence. User reaction has been overwhelmingly positive.

But some of you wanted *more*, and expressed the desire for even *larger* plotting capabilities. And now Hewlett-Packard has met your challenge.

The new HP 7585 Drafting Plotter maintains *all* of the many benefits of the HP 7580. The significant difference is the ability to output plots up to 36.5" x 48"

Now, *both* plotters can:

Interface with HP, DEC®...

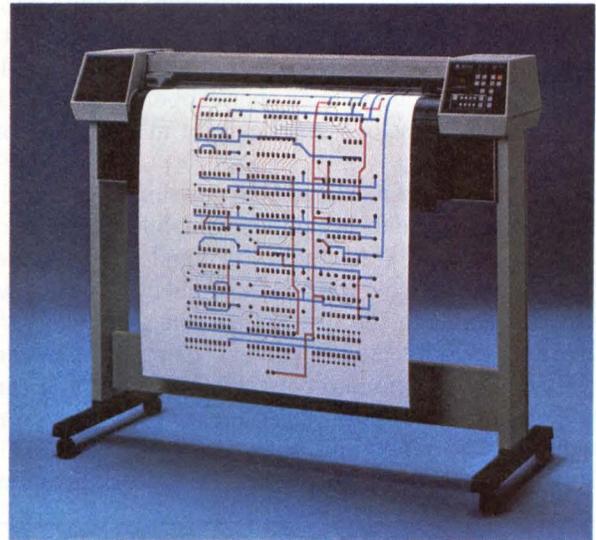
and other ASCII computers with RS-232-C or IEEE 488 (HP-IB, GP-IB) interfaces. (Both interfaces are standard on each plotter.) Also, a new capability for both plotters is modem operation for remote or timeshare applications.

Interface with existing FORTRAN application programs...

using the HP Industry Standard Plotting Package, our version of the standard CalComp plotting software.

Give you high throughput and quality output.

4 G's acceleration; 60 cm/s (24ips) speed; addressable resolution 0.0250 mm (0.000984"), with a mechanical resolution of 0.0032mm (0.00012").



Introducing the new, larger-format HP 7585 Drafting Plotter.

Cut the cost of high-performance plotting in half.

It took a technological breakthrough to bring the price of an E-size, high-performance plotter in at only \$22,900, and a D-size unit at \$16,100. (*Domestic USA prices only.*)

Provide long-term satisfaction with their ease of use and reliability.

Hewlett-Packard has a worldwide support organization that can provide quick on-site maintenance.

Take the hassle out of handling pens.

8 pens are capped automatically in each of three carousels, keeping your pens always ready to write. Carousels are matched for fiber tip, roller ball, and liquid-ink drafting pens. This al-

lows automatic, manual, or program control of pen forces and speeds for optimum plot quality.

Plot on a wide range of media and sizes.

Produce plots on paper, vellum, double matte polyester film — even preprinted forms. All standard sheet sizes from notebook size sheets to 24.5" x 48.0" for the HP 7580, and 36.5" x 48.0" for the HP 7585 are easily accommodated.

For more information.

To receive a *free sample plot* and more detailed information, *mail the coupon today*. Or call Bill Fuhrer at:

(619) 487-4100



**HEWLETT
PACKARD**

Mail the coupon to: Hewlett-Packard
16399 W. Bernardo Drive, San Diego, CA 92127
Attn: Nancy Carter

11302-MM7

- Please send me more information about the HP 7585 and HP 7580.
- Send a sample plot from one of your drafting plotters.
- Have a Hewlett-Packard representative call me.
- I am interested in re-selling your plotter as part of my system. Have your OEM sales manager call me.

My computer and operating system are _____

My application and software are _____

Name _____ Title _____

Division/Dept. _____ Company _____

Address _____ City, State & Zip _____

Phone Number (____) _____

DEC is a registered trademark of Digital Equipment Corporation.

Computer applications

The major application for the new mobile-phone service will be voice communication, just as it is for the regular land-based phone system. But the sudden availability of mobile phones should open opportunities in data communications, particularly in portable computer equipment.

Mobile phones will allow field personnel to receive and transmit data over a car-based mobile phone linked via a modem to a portable terminal or computer. Salespeople with changing lists of clients to visit will probably be among the first to use this technology. "A real estate agent could receive a printout of names, addresses and phone numbers while driving in a car," says Peter Erb, president of Millicom Inc., New York, which offers a mobile unit with an RS232C port.

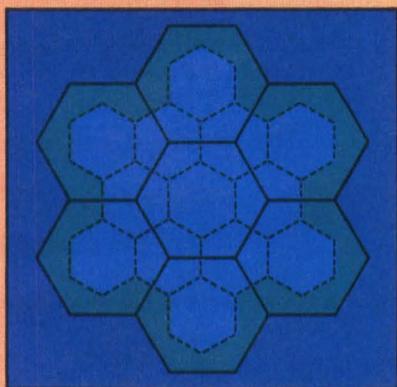
In addition to field sales, mobile phone data commu-

nications should prove useful for on-the-road executives keeping up with developments at their offices and with related markets, and for hospital-based medical personnel who must monitor ambulance patients over a wide area. Taxi companies are also considered prime targets by many mobile phone vendors, and many fleet operators are considering installing meter systems based on a central computer to calculate fares and route drives. But Douglas Turner, general manager of the People's Cab Co., Pittsburgh, points out that his company already operates such a system reliably without cellular radio. "It's a new technology, and I'll be taking a good look at it," says Turner, "but the \$1500 to \$2500 for a mobile phone unit is ludicrous next to the \$350 to \$800 for a standard radio."

As mobile phone equipment becomes more portable than the bulky units currently required, additional markets will arise. "There are many applications above and beyond the automobile," says the Eastern Management Group's Malone. "Service people who used to

HOW CELLULAR RADIO WORKS

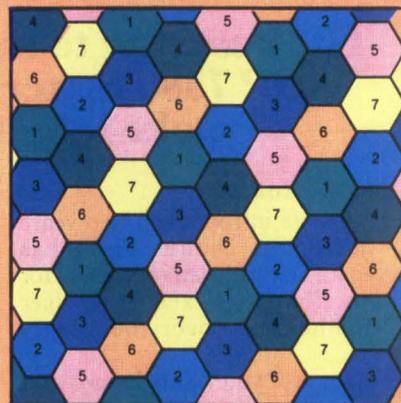
Despite the sudden attention recently accorded cellular radio, it is not a new concept. Bell Laboratories scientist D.H. Ring first proposed a cellular scheme in 1947 as an alternative to increasingly overworked conventional mobile radio systems. Although recognized as good, the idea languished for want of cost-effective switching technology fast enough to "hand off" a moving car from one cell to another. Since the technology became available in the late 1960s, the FCC has been wrestling with licensing and frequency-allocation schemes.



Cell splitting involves reconfiguring an area into smaller hexagons, usually one-half the width of the original. Each cell then covers one-quarter the area, but can handle the same number of mobile units, so that the entire system can then support four times as many units. Most systems start with 8-mile-wide cells, supporting as many as three splits for resultant 1-mile-wide cells. Such a system could service millions of units.

The basic elements of a cellular system are a mobile transceiver, a cell transceiver and a central control site. The mobile and cell transceivers communicate via radio, while the central control site is linked to each cell site through land lines to oversee mobile-unit location, channel selection and hand-offs. The central control site also links the cellular system and the land-based telephone system. The FCC has allocated 40 MHz (825 to 845 MHz and 870 to 890 MHz) of the radio spectrum to cellular radio, with 20 MHz going to each of the two systems in an area. Channel spacing is 30 KHz, leaving any one cellular system with as many as 666 channels.

An active mobile unit constantly monitors a 20,000-baud data channel used by each cell to transmit control information; the mobile unit chooses the channel of the cell transmitting the strongest signal, switching to another cell if the first signal fades. When a call for the mobile unit is received by the central site, all cells transmit the unit's name over the data channel. The mobile unit recognizes its name and sends an acknowledgement to the cell site, which then receives a voice channel assignment from the central site. Channels are assigned on a random basis from the pool of 666, with one restriction: a channel is not assigned if it is being used at that moment by a cell within interfering distance, typically about three cell-widths. The mobile unit is instructed to tune to the chosen frequency, and a user is alerted—that is, the phone

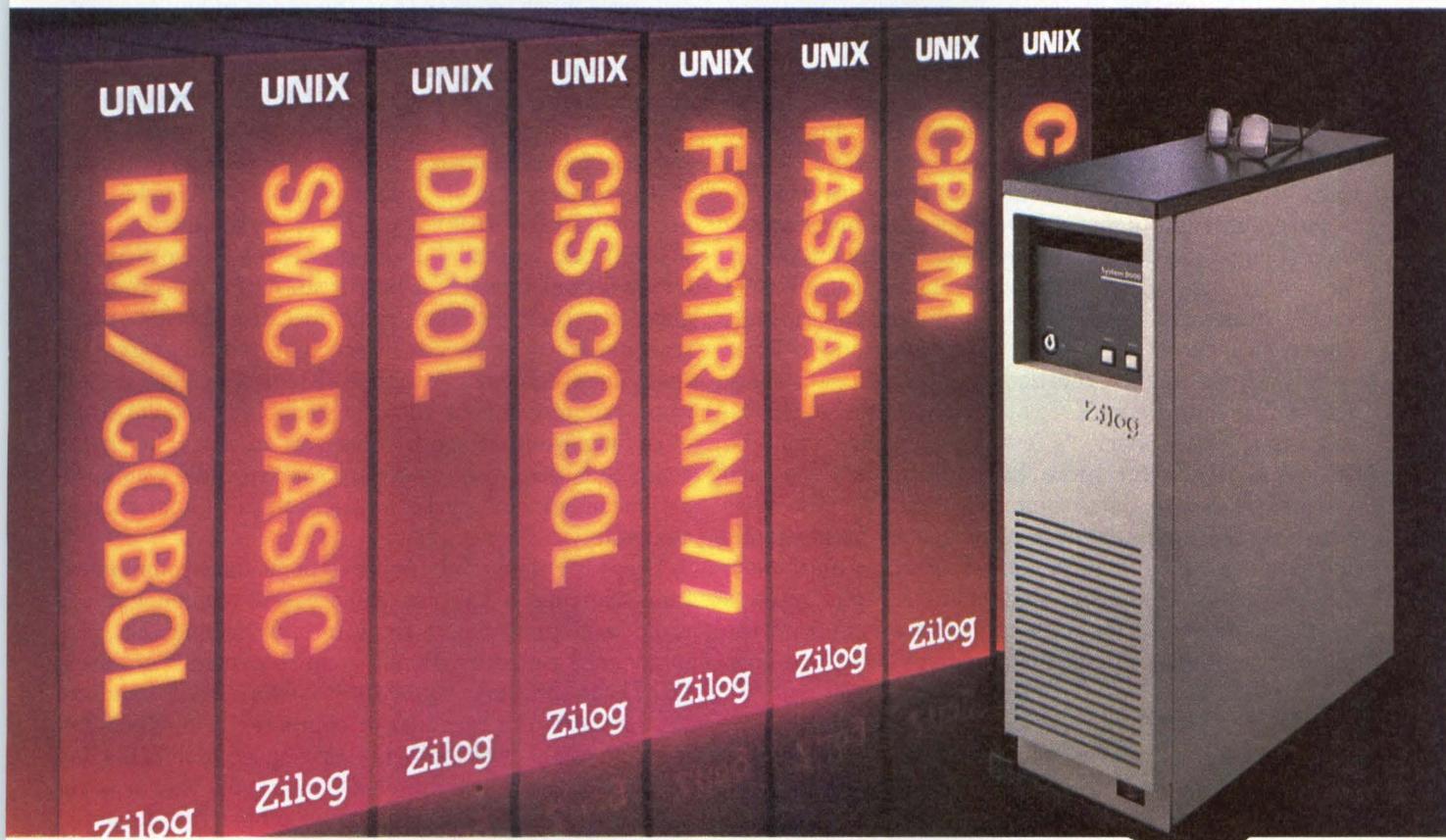


A frequency-reuse pattern shows how several cells separated by a sufficient distance can simultaneously use the same channel without interference. The number assigned to each cell represents a frequency; cells with the same number could use the same channel at the same time. Frequency reuse is not bound to a pattern or assignment; in practice, a cell would have as many as 666 channels to choose from, each of which can be shared by non-neighboring cells.

rings (some mobile phones allow the user to enable a horn alert when leaving a car).

While the phone is being used, the mobile unit monitors the signal strength. If the signal is fading, usually because the car is leaving the cell, the mobile unit determines which new cell has the strongest signal and alerts the central site through the data channel. A new channel is selected in the new cell, and the call is transferred, or handed off, to the new cell and channel without interrupting the call. Calls made from the mobile unit are handled in similar fashion.

There's no language barrier with Zilog's System 8000 family.



If you're an OEM or systems house, you can now buy Zilog's UNIX-based System 8000 without losing your software investment. Because now Zilog offers industry-compatible languages and operating system support. You get the power of minicomputers for micro prices, the advantages of UNIX, and complete software protection!

For instance, now your commercial users can select Business Basic III-compatible SMC BASIC, DEC DIBOL-compatible SIBOL, RM/COBOL and CIS COBOL. Technical users can choose from Fortran 77, Pascal or C. System 8000 even runs the ever-popular Z80[®] CP/M code. What's more, since most of these languages use C-ISAM, a common file access method, they can share databases. But regardless of which languages

you need to run, you can be sure that System 8000 will run them faster and more efficiently than any other machine, thanks to Zilog's high performance VLSI components.

Take the Model 11 shown here, for example. This compact eight-user system features 256 KB of parity memory, an 18 MB Winchester disk for on-line storage and a 17 MB cartridge tape for back up. And Model 11 is just the beginning. When you're ready to expand to more powerful machines with larger memories, just plug in Zilog's other family members, the Model 21 and 31. The family is entirely software compatible and is priced from \$14,950 to \$37,950.

So, if you're an OEM or systems house who wants to move valuable applications software over to

high performance micros without losing your investment, then move it to System 8000. The powerful family of microcomputers with no language barriers.

Discover Zilog's unique opportunities for OEM and systems house success. Give us a call at 800-841-2255. Or write Zilog, Inc., Corporate Publications, 1315 Dell Avenue, MS A1-4, Campbell, CA 95008.

UNIX is a trademark of Bell Laboratories. CP/M is a registered trademark of Digital Research, Inc. SIBOL is a registered trademark of Software Ireland, Ltd. DIBOL is a registered trademark of Digital Equipment Corporation. RM/COBOL is a registered trademark of Ryan McFarland Corp. C's/COBOL is a registered trademark of Microfocus, Inc. SMC BASIC is a trademark of Science Management Corp.

Zilog

Pioneering the Microworld

An affiliate of **EXON** Corporation

CIRCLE NO. 128 ON INQUIRY CARD

carry pagers will soon carry small dot-matrix printers on their belts."

Many computer users will use mobile phones with equipment that remains in their homes or offices, as well as with portable units, to avoid missing data sent to wrong locations. Anyone wishing to contact a mobile phone user would simply dial his number, regardless of where the unit might be located at that moment—as long as it was within range of a compatible cellular radio system. "The great advantage to mobile phones," says Erb, "is that your phone number travels with you."

Some observers point out that data communications via mobile phone will be at least temporarily limited by the narrow bandwidth of the voice channels used. Saul Sherr, director of market planning for North Hills Electronics, Glen Cove, N.Y., thinks that some cellular radio systems might eventually implement data channels similar to those used for system operations. "In the meantime," says Sherr, "a few voice channels could be thrown together for more bandwidth." Malone also downplays mobile data communications for the near future, estimating that less than 5 percent of mobile phone use will be for data communications until 1990. But Millicom's Erb feels that cellular radio systems should be designed for data communications from the outset. "It will be difficult to implement later," he says.

Other radio schemes

While cellular radio is one of the most visible new communications schemes, other technologies also offer opportunities to link radio with data transmission. Two such approaches are packet-switching radio for completely portable networks and radio modems for simple point-to-point communications.

Packet switching radio differs from cellular radio in two important ways: packet-switching radio does not require fixed cellular areas with base transceivers connected to land-line systems, and packet-switching radio uses wide-band bursts of digital data, in contrast

to cellular radio's narrow-bandwidth analog transmissions.

Each mobile unit in a packet-switching radio network can act as a repeater, receiving transmissions and rebroadcasting them if it does not recognize its own name code as the intended receiver. Thus, a given message can be transmitted and retransmitted over distances much greater than the range of any one unit. Because a packet-switching radio network does not depend on fixed transceiver stations, major uses include military and public safety applications. "Packet radio is well-suited for rural, hostile environments," says Leonard Kleinrock, a computer science professor at the University of California at Los Angeles and president of the Technology Transfer Institute.

Kleinrock points out that packet radio's wider bandwidth also makes it better suited for data communications than cellular radio because packet radio transmits data at speeds as much as 100 times greater than does cellular. Although Kleinrock feels packet radio cannot compete with the reliability and coverage of cellular radio's fixed transceivers in cities, he claims companies that want to switch soon to radio communications may install packet systems until cellular radio is available.

Users requiring only point-to-point data communications can use a simpler radio-based technology: the radio modem. Gandalf Data Inc., Wheeling, Ill., has introduced the RadioModem, which provides an interface between any VHF/UHF two-way radio and an RS232C port of a terminal or computer. The RadioModem, an offshoot of the firm's taxi-based mobile display terminal system, communicates synchronously or asynchronously at rates as high as 3600 bps. It is targeted for remote mining, forestry and oil exploration.

Cellular, packet and point-to-point radio schemes have not yet been widely implemented for data communications. But the increasing demand for computer access in virtually every application and environment should ensure the radio schemes' popularity, which is fueling and being fueled by the market for specialized portable terminals. □

WHO'S WHO IN CELLULAR RADIO

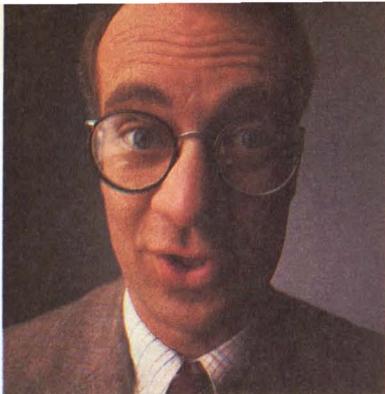
The enormous revenues predicted for cellular radio have attracted a host of contenders for licenses to operate cellular systems and for potentially lucrative equipment contracts.

Bell's Advanced Mobile Phone Service can hardly avoid becoming a leader in cellular radio, given the FCC decision that effectively allots it one license in almost every major city. Most of AMPS's equipment will probably come from Western Electric Corp. and will establish the company as a major mobile-phone equipment supplier.

Some companies vying for licenses are relatively old hands at cellular radio, by virtue of the fact that they operate systems in other countries. NEC Information Systems Inc. had provided cellular radio service to Japan since 1977 and currently services more than 17,000 mobile units there; additional systems are operating or are being implemented in Australia, Mexico City and Hong Kong. Millicom Inc. holds a cellular license in the U.K. in conjunction with Racal Electronics, and is expected to play an active role in U.S. systems as

well. Other companies hoping to get into cellular radio include Time Inc., Metromedia and General Electric Co.

A number of companies hope to grab a share of cellular radio's profits through equipment sales to licensees, or even to users. These include Motorola Inc. (said to have spent four times the \$2.5 million it received from the American Radio Telephone Service in the Washington-Baltimore trial system), Oki, E.F. Johnson, Harris Corp. and Fujitsu America Inc.



“GET IBM 3270, 3780 AND HASP COMMUNICATIONS—ADDING A ONE-BOARD PROCESSOR TO MY PC?”

“YOU CAN WITH PERSYST.”

The Persyst DCP/88. The only compatible front end communications processor that can support a range of IBM communications.

It's a Persyst exclusive. The DCP/88 distributed communications processor. A one-board computer that can be configured by software to handle communications between a PC and another computer system.

In fact, the DCP/88 enables the IBM or TI PC to support a range of sophisticated IBM communications—all with just one processor.

So it gives corporate users unprecedented, low-cost flexibility to incorporate the PC into virtually any environment.

Convert any PC into an IBM 3270 terminal. An IBM 2780/3780 RJE workstation. Or a HASP/RJE workstation—instantly.

Just combine the DCP/88 with Persyst software—and you can connect your PC to any compatible host mainframe or minicomputer.

PC/3270 enables your PC to emulate an IBM 3274 Cluster control unit and 3278 terminal, supporting up to four additional devices. Including a printer and

PC/HASP Dynamic design lets you assign incoming I/O streams to different devices—disk files, printers and RS-232 ports.

three other PCs functioning as 3278 terminals.

PC/3780 converts your PC into a 2780/3780 remote job entry terminal that can send and receive batch files to and from the host.

And with PC/HASP, your PC instantly becomes a full-function HASP/RJE workstation that can support up to seven input and seven output multi-leaved job streams concurrently.

Capability to support your communications needs now. And in the future.

Because the DCP/88 supports bisync, SDLC, HDLC and async protocols, it is the only communications processor you'll ever have to buy.

Use it to connect your PC to an expanding network of IBM communications. Configure your system to meet virtually any communications need—without adding another piece of hardware. Or expense.

All of which makes the DCP/88 as practical as it is powerful.

The Persyst Coax/3278. Still another way to expand your IBM communications.

Here's another fast way to incorporate the PC into existing SNA or bisync data processing installations.

The Coax/3278. A single-slot expansion board that converts your PC into an IBM 3278 display terminal. And with its high-speed coaxial port, you can connect the PC directly to IBM 3274 or 3276 cluster controllers.

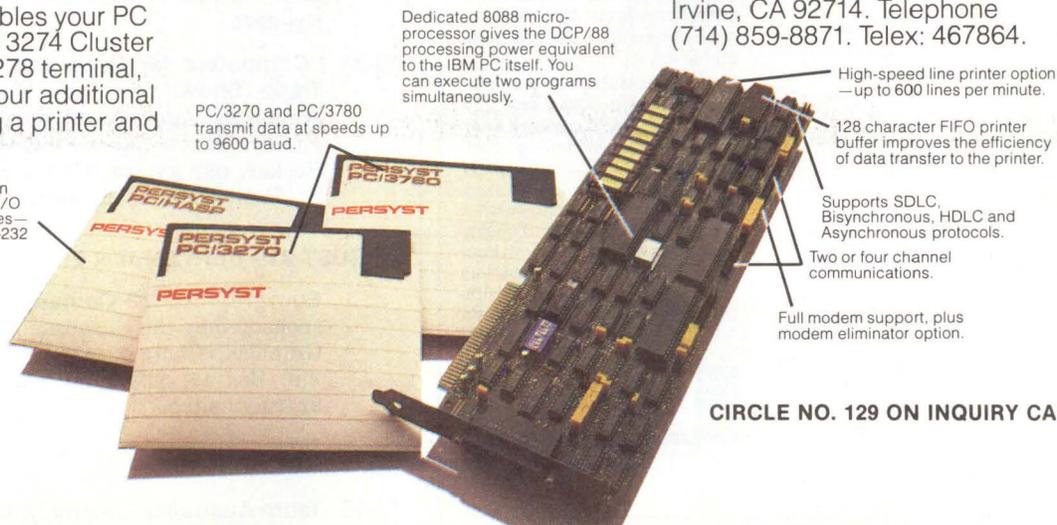
Sophisticated communications products for the corporate user. Insist on Persyst.

Persyst communications products are designed to make corporate information systems more powerful. And more efficient.

Write or call Persyst today for complete information.

PERSYST™

Persyst Products, Personal Systems Technology, Inc., 15801 Rockfield Blvd., Suite A, Irvine, CA 92714. Telephone (714) 859-8871. Telex: 467864.



CIRCLE NO. 129 ON INQUIRY CARD

THE DCP/88™ BY PERSYST.

The Image Solution

*The CAT 1600 Series
lets you take full
advantage of your color
graphics potential.*



Plug this powerful color video graphic system into your IEEE-696 bus and watch your computer open its eyes. Exercise your creativity developing new ways to study your world and discovering the flexibility of video imaging. Our real time frame grabber gives you instant availability of the image to be processed. The CAT 1600 is the creative link between machine, man and the world.

Resolution is the name of the game, and we've got it. Physically you're looking at 512×512 pixels up to 24 bits deep. And that's real color. Now, center on a pixel, any pixel, and roam the screen through an image space as large as $1K \times 2K$. Zoom in and explore a close-up of 32:1, not in the usual quantum leaps of integer zooms, but in smooth logarithmic steps of 1.1%. A smooth zoom... that's human engineering.

At the heart of the matter is a dedicated 8086 image processor. It blazes a 16 bit wide path through the various memories, lookup tables and image parameters as it executes high level commands from your host processor. Up to 48K of static

RAM makes the image processor useful for downloading custom programs from the host.

When it came to adequate memory, we didn't forget. 768KB of dynamic memory gives you plenty of image. Our PROMs have a library of 64K organized into over 130 sophisticated graphics commands such as continuous live digitization, character and shape generation, global image manipulation and animation effects, to relieve the host computer from low level primitives.

At your disposal is a palette of 16.7 million colors and 256 shades of gray. Quantized lines or free-hand sketching completes the picture. Use a variety of pen widths, brush strokes, even airbrush! Now imagine what you can do with a superb quality image captured in real time from a color video camera. Contact us for an eye opening demonstration: 935 Industrial Avenue, Palo Alto, CA 94303. 415/856-2500



What you see is what you get.

CIRCLE NO. 131 ON INQUIRY CARD

Calendar

JULY

25-29 SIGGRAPH '83, 10th Annual Conference on Computer Graphics and Interactive Techniques, Detroit, sponsored by the Association for Computing Machinery's Special Interest Group on Computer Graphics. Contact: SIGGRAPH '83 Conference Office, 111 E. Wacker Dr., Chicago, Ill. 60601, (312) 644-6610.

25-29 "Fundamentals of Control" Course, Calgary, Canada, sponsored by The Foxboro Co. Contact: Registrar, Educational Services, The Foxboro Co., Foxboro, Mass. 02035, (617) 543-8750. Also to be held Aug. 1-5, and Nov. 14-18, Foxboro, Mass., Oct. 17-21, Toronto, Canada, Nov. 28- Dec. 2 Calgary, Canada.

AUGUST

1-5 "Introduction to Process Computers" Course, Foxboro, Mass., sponsored by The Foxboro Co. Contact: Registrar, Educational Services, The Foxboro Co., Foxboro, Mass. 02035, (617) 543-8750. Also to be held Aug. 15-19, Calgary, Canada and Oct. 24-28, Houston.

6-10 International Federation of Operational Research Societies Triennial Meeting, Washington, D.C., hosted by the Operations Research Society of America. Contact: Richard M. Soland, George Washington University, Washington, D.C. 20052, (202) 676-7531.

8-12 "Advanced Computer Process Control" Course, Foxboro, Mass., sponsored by The Foxboro Co. Contact: Registrar, Educational Services, The Foxboro Co., Foxboro, Mass. 02035, (617) 543-8750. Also to be held Nov 28 - Dec. 2.

AUGUST

8-12 Eighth International Joint Conference on Artificial Intelligence, Karlsruhe, West Germany, hosted by the Federal Republic of Germany. Contact: Institut für Informatik I, Universität Karlsruhe, Postfach 6380, D-7500 Karlsruhe, West Germany, (0721) 608-3975.

26-28 "Computers for Farm and Family" Seminar and Trade Show, St. Paul, Minn., organized by the Minnesota Agricultural Extension Service and *The Farmer/Dakota Farmer* magazine. Contact: Sandra J. Becker, OSP-XY, 405 Coffey Hall, 1420 Eckles Ave., St. Paul, Minn. 55108, (612) 373-0725.

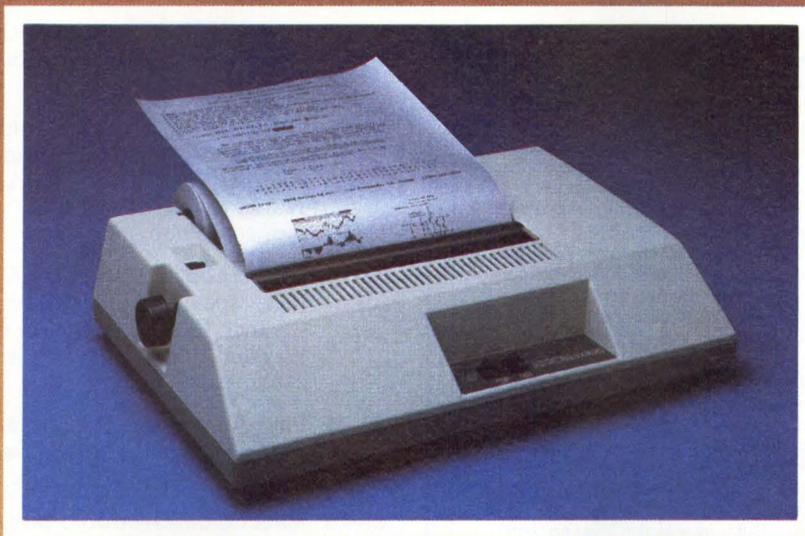
AUGUST 31 - SEPTEMBER 2

Eurographics '83 Conference, Zagreb, Yugoslavia, sponsored by the European Association for Computer Graphics. Contact: ATLAS, Congress Department, P.O. Box 17, YU-41001, Zagreb, Yugoslavia, Telex: 22413 yu alcon.

SEPTEMBER

12-15 Tenth Australian Computer Conference, Melbourne,

Q. WHAT DO YOU CALL A \$795 PRINTER THAT'S 10-TIMES FASTER AND REQUIRES 1/10 THE MAINTENANCE OF AN IMPACT?



A. AN AXIOM EX-1620!

Virtually Maintenance-free

For speed and reliability you can't beat our new EX-1620 electrosensitive printer. It's tough, simple, low-cost and virtually maintenance-free. There are no adjustments to make. No inky ribbons to change. Other benefits: the printout (formed by passing a high current from printhead to paper for a few microseconds) is permanent, shelf-life is no problem unlike thermal paper, print quality is unaffected by sunlight, moisture, or age, and the high contrast makes excellent photo copies.

960 Character-Per-Second

Our EX-1620 can knock out 960 alphanumeric characters per second in the exclusive "Quick-Print" mode. That's 10-times faster than a comparably priced impact printer. And 20% faster than a 300 LPM line printer! A 3500 line program could be finished in 10 minutes compared to over an hour using an impact printer. Even in the NLQ mode, the EX-1620 is faster than impacts, printing near-letter quality at 240 cps.

Built-in 8K Buffer

Another benefit is the built-in 8K buffer which allows the contents of a VisiCalc screen, or many pages of word processing, to be transferred from the computer, freeing it for other tasks.

High Resolution Graphics

The EX-1620 has a genuinely readable resolution of 144 dots per inch both horizontally and vertically. This is perfect for CAD/CAM, data logging, and instrumentation systems, and for screen dumping from a high resolution CRT. Some impact printers claim this resolution, but the size of the pins in the printhead itself results in dot pile up and a blurred printout.

Four Models To Choose From

The EX-1620 is the top of our printer line. We do, however, have others that may better fit your needs.

Model	Paper Width	Speed	Hi Res Graphics	Price
EX-1620	8-1/2-inch	960 cps (Quick-Print) 240 cps (NLQ mode)	Yes	\$795
EX-1601	8-1/2-inch	240 cps	No	589
EX-420	5-inch	550 cps (Quick-Print) 138 cps (NLQ mode)	Yes	745
EX-401	5-inch	192 cps	No	395

Don't settle for an impact when our printers give you 10-times the speed with 1/10th the maintenance.

AXIOM

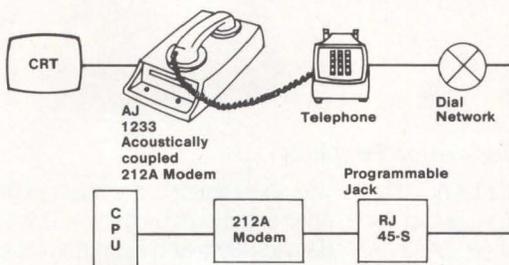
AXIOM CORPORATION

1014 Griswold Avenue, San Fernando, CA 91340 • Telephone: (213) 365-9521 • TWX: 910-496-1746

CIRCLE NO. 132 ON INQUIRY CARD

The Case of the Modem Operandi

One of our best customers with a large network of hard wired 1200 baud terminals and 212 modems felt it would be convenient to use a portable Anderson-Jacobson 1233 acoustically coupled 212 compatible modem for sales demonstrations and to work on programs from an office at home. Unfortunately, after delivery he found that whenever he called his own computer using the coupler, the computer received his transmissions perfectly, but the computer's replies were hopelessly garbled. The other clues seemed to make the case even more confusing. A hard wired 212 worked just fine in both the send and receive directions, but the acoustic coupler also worked just fine in both directions when the A.J. test center, or a time sharing service, was called. Since nothing untoward was to be observed at the coupler end, the investigation moved to the computer site where it was observed that the modems interfaced to the switched network via RJ45S programmable jacks. This jack contains a resistor which interacts with components inside the 212 modem to set the transmit level to approximately -9 dbm. However, a quick check with a meter showed that the transmit level was close to 0 dbm., and it was clear that such a high signal level must be generating severe distortion in the remote telephone earphone. This caused the AJ 1233 receiver to garble the data. But why was the level so high?



Inspection of the cable going from the modem to the jack revealed a jumper shorting the programming resistor thus raising the transmit level. It turned out that the 212 modems were of a type that could be used alternately on 2 wire private lines at a higher voltage merely by switching line cables. The wrong cables had been used at installation putting the modem into the wrong mode of operation. Clipping the short set the proper transmit level, eliminating the distortion and the garble.

—R.G.

**NEXT MONTH:
The Case of the Prejudiced BERT**

Call or write for a free Glasgal catalog to solve your data communications problems. Over thirty leading brands of modems, multiplexers, testers, data converters, switches, cabinets, cables and lots, lots more stocked for same day shipment. On-site service and installation available many locations. Overseas orders invited!

Call for our schedule of free monthly Datacomm Seminars.

Just out: "Techniques in Data Communications" — 209 pages \$35.00.

**GLASGAL
COMMUNICATIONS, INC.**

207 Washington Street, Northvale, NJ 07647
(201) 768-8082

CIRCLE NO. 133 ON INQUIRY CARD

Calendar

Australia. Contact: Susan Coleman, Publicity Chairperson, P.O. Box 4063 Mail Exchange Melbourne, 3001, (03) 41 6220.

13-15 "Automating Technical Information from Design to Support" Symposium, San Diego, Calif., sponsored by Aerospace Industries Association. Contact: John W. Stahl Jr., 1725 De Sales St. N.W., Washington, D.C. 20036, (202) 429-4635.

13-15 1983 Federal Computer Conference, Washington, D.C., sponsored by Federal Education Programs. Contact: Federal Computer Conference, P.O. Box 368, Wayland, Mass. 01778, (800) 225-5926 or (617) 358-5181.

23-24 First Annual Dakota Computer Fair, Bismarck, N.D. Contact: Stephen Cobb, Dakota Computer Fair '83, P.O. Box 7036, Bismarck, N.D. 58502, (701) 224-0166.

26-28 Maecon/83 Electronic Show and Convention, Kansas City, Mo., sponsored by Kansas City and St. Louis Sections of the IEEE and the Heart of America and Spirit of St. Louis Chapters of the ERA. Contact: Maecon/83 Professional Program Committee, c/o Dale Litherland, Director of Education, 8110 Airport Blvd., Los Angeles, Calif. 90045.

26-28 Sixth European Conference on Electrotechnics, Brighton, England, organized by the Institution of Electrical Engineers, sponsored by the Convention of National Societies of Electrical Engineers of Western Europe and Region 8 of the IEEE. Contact: The Manager, Conference Services, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, U.K. (01) 240-1871, ext. 222.

28-29 Ottawa Computer & Office Automation Show, Ottawa, Canada, presented by Industrial Trade Shows of Canada. Contact: Industrial Trade Shows of Canada, 20 Butterick Rd., Toronto, Ontario M8W 3Z8, (416) 252-7791.

OCTOBER

10-12 Online '83 Conference, Chicago, sponsored by Online Inc. Contact: Jean-Paul Emard, Conference Chairman, 11 Tannery Lane, Weston, Conn. 06883, (203) 227-8466.

10-14 Seventh International Fiber Optics & Communications Exposition, Atlantic City, N.J., sponsored by Information Gatekeepers Inc. Contact: Paul W. Fitzgerald, Exposition Marketing Manager, Information Gatekeepers Inc., 167 Corey Rd., Suite 111, Brookline, Mass. 02146, (617) 739-2022.

18-19 Sixth Annual Newport Conference on Fiber-Optic Markets, Newport, R.I., produced by Kessler Marketing Intelligence. Contact: Conference Coordinator, Kessler Marketing Intelligence, 22 Farewell St., Newport R.I. 02840, (401) 849-6771.

ONE COMPUTER CAN'T RUN ALL THIS SOFTWARE.



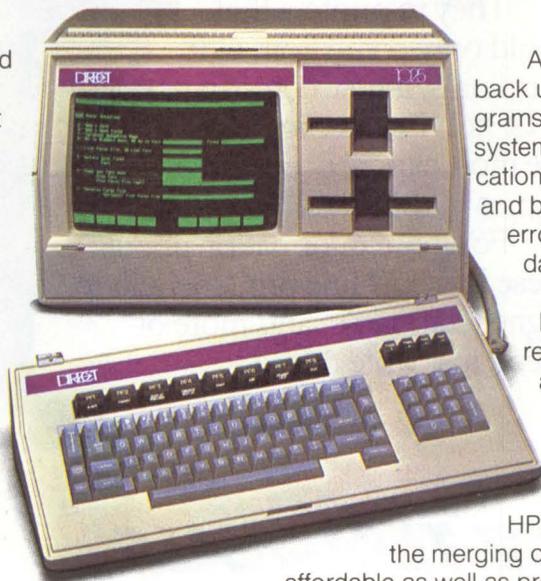
ONE TERMINAL CAN.

From the beginning, we designed the 1025 to meet the demand for both host and personal processing at HP3000 sites. With the touch of a key, you select either the flexibility of our HP-compatible 825 terminal or the problem solving power of a personal computer. All from one integrated, transportable unit.

As a terminal, the 1025 delivers everything you need for true interaction with your host programs. Like a selectable 80 or 132 column display. Programmable function keys. On-screen, programmable labels. And enough display memory (32K minimum) to handle all HP3000 block mode software.

As a personal computer, the 1025's dual Z-80 architecture, 128K of memory, and up to 1.2 Mbytes of disk storage let you run the vast array of CP/M compatible software. Without running up a tab for additional hardware.

CP/M is a registered trademark of Digital Research, Inc. WordStar is a trademark of MicroPro International Corporation. VisiCalc is a trademark of VisiCorp. SuperCalc is a trademark of Sorcim Corporation. MBASIC is a registered trademark of Microsoft Corporation.



And for the first time you can store, back up, and distribute all your programs and data under the HP3000 file system. Our Direct-Link 1025 communications package lets you transfer ASCII and binary files to and from the HP3000, error free, for increased security and data integrity.

(For applications needing only host processing, like data entry or retrieval, you'll find that installing an 825 makes excellent operational and economic sense.

Especially since it's upgradeable to a 1025 at your option.)

Best of all, our unique line of HP3000 compatible terminals makes

the merging of host and personal processing affordable as well as practical. For information contact Direct, Incorporated, 1279 Lawrence Station Road, Sunnyvale, California 94086. Or call (408) 734-5504. Ask for a demonstration of our 1025 and 825.

And in no time you'll be off and running.



When you compare CIE matrix line printers with others, you'll find others either do a lot less. Or cost a lot more. Or both.

Our CI-300 gives you 300 LPM for data processing and 85 LPM of letter quality. Our CI-600 increases DP to 600 LPM and letter quality to 170 LPM.

Both are plug-in compatible with virtually every type of computer system, including IBM.

Both have variable shuttle speeds.

Both give you graphics, up to 2400 DLPM on the 300 and up to 4800 DLPM on the 600.

Both bring high resolution to Bar Codes, Optical Character Recognition, Form Generation, Labels and Word Processing.

Both have an unusually small print head diameter for needle-sharp character clarity.

Both give you hundreds of unique character fonts. And you have broad customization potential with RAM and EAROM.

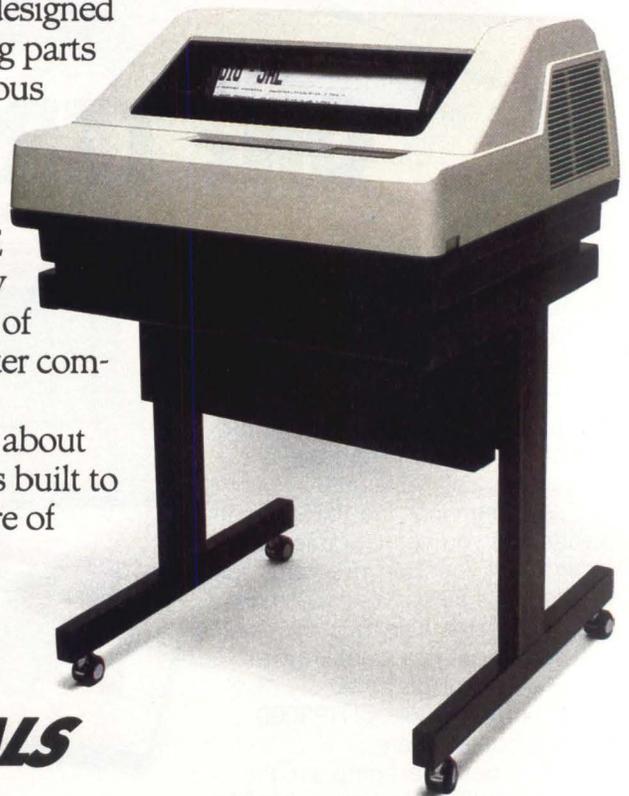
Both come with three built-in interfaces, two parallel and one serial.

Both give you flexible line spacing, line feed speed and three paper-loading points—front, bottom and back.

And because they're designed with a minimum of moving parts and have undergone rigorous testing, both give you unmatched reliability.

They're printers that could only come from CIE Terminals, a new company of C. Itoh Electronics, one of the most experienced printer companies in the world.

For more information about these low-cost line printers built to higher standards, and more of them, just write or call.



CIE TERMINALS

A new company of
C. ITOH ELECTRONICS, INC.

New headquarters and Southern California sales office: 2505 McCabe Way, Irvine, CA 92714-6297. (714) 660-1421. Or call toll-free, 1 800 854-3322. Other regional sales offices: San Jose, CA (408) 977-1146; Cherry Hill, NJ (609) 983-5075; Chicago, Ill (312) 992-2346; Houston, TX (713) 777-1640; Atlanta, GA (404) 257-1814.

New Products

SYSTEMS

Business computers feature high performance, expandability

Higher performance characterizes three new business computer systems in Hewlett-Packard Co.'s HP 3000 family, the Series 68, 48 and 42. Improvements in the HP 3000 Multi-Programming Executive Operating System and disk caching are the keys to the systems' capabilities.

Depending on the application, the Series 68 provides a 30- to 100-percent performance improvement over the Series 64 that it replaces. The Series 68 supports as many as 400 terminals, 336 of which are point-to-point terminals. It also supports 24 disk drives with a total storage capacity of 9.5G bytes and 24 intelligent network processors for data communications. Maximum main memory is 8M bytes. The system is available in configurations with one or two I/O bays.

The Series 48 provides a 20- to 30-percent increase in performance over the HP 3000 Series 44 that it replaces. The Series 48 supports as many as 152 terminals, 104 of which are point to point. It accommodates as many as 16 disk drives with a total storage capacity of 4.2G bytes, as much as 4M bytes of main memory and as many as seven intelligent network processors for data communications.

The Series 42 features a 20- to 30-percent performance improvement over the HP 3000 Series 40 that it replaces. The Series 42 supports as many as 92 terminals, as much as 3M bytes of main memory, as many as eight disk drives with a total storage capacity of 3.2G bytes and as many as three intelligent network processors for data communications.

HP 3000 Series 68 prices begin at \$245,614 for a configuration consisting of a Series 68 processor, 3M bytes of main memory, a system console, 12 terminal ports, a 404M-byte disk drive and a 1600-bpi magnetic-tape drive.

HP Series 3000 Series 48 prices begin at \$109,500 for a configuration consisting of a Series 48 processor, 2M bytes of main memory, a system console, four terminal ports, a 132M-byte disk drive and a 1600-bpi magnetic-tape drive.

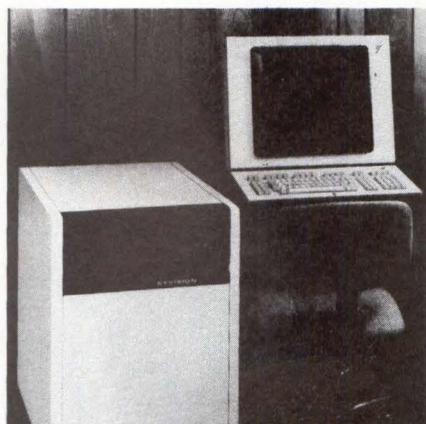
HP 3000 Series 42 prices begin at \$72,400 for a configuration consisting of



Hewlett-Packard Co.'s HP 3000 Series 68 business computer system features performance enhancements such as disk caching and an improved MPE operating system.

a Series 42 processor, 1M byte of main memory, a system console, four terminal ports, a 132M-byte disk drive and a 1600-bpi magnetic-tape drive. Hewlett-Packard Co., 3000 Hanover St., Palo Alto, Calif. 94304.

Circle No 300



Computerized publishing merges text and graphics

The Xyvision modular, Motorola MC68000-based composition/pagination system can integrate text and graphics, including line art, halftones and charts, into fully composed and paginated documents. The system provides inter-

active on-screen page makeup in addition to background, algorithmic pagination processing. The system is built around three hardware components: the Xyview text/graphics display terminal on which operators can edit, manipulate and reformat pages or parts of pages interactively; the Xytext input/editing terminal that accepts input from local or remote word processors, scanners and computers; and the Xycomp system control unit that contains a Motorola MC68000 32-bit microprocessor for I/O control, file-management functions and background composition processing. The system control unit also contains Winchester and floppy disk drives and an optional 1/4-in. cartridge-tape drive for on-line database storage, archiving and disk backup purposes. A typical configuration consisting of a 70M-byte Winchester disk drive, two editing terminals, a text/graphics terminal, an interface to an on-line phototypesetter, software and documentation is priced at \$78,000. Xyvision Inc., 52 Cummings Park, Woburn, Mass. 01801. Circle No 301

Single-board computer features no wait state

The model IV-1600 VMEbus single-board computer includes a 68000 CPU, 256K bytes of RAM with a dual port option, 10 universal 28-pin memory sockets, as many as four serial I/O ports, a SASI bus mass-storage interface and a buffered parallel printer port. A VMEbus interface with all system controller functions is available on board for expansion. Other features include a three-channel programmable counter/timer, a vectored interrupt controller and an optional real-time clock/calendar with battery backup. The IV-1600 can be configured with an 8-, 10- or 12-MHz 68000 CPU and executes from its local RAM with no wait states. Prices for the IV-1600 vary depending on configuration and options. The 8-MHz version is priced at \$2995 in single-unit quantities. Ironics Inc., 117 Eastern Heights Dr., P.O. Box 356, Ithaca, N.Y. 14850.

Circle No 302

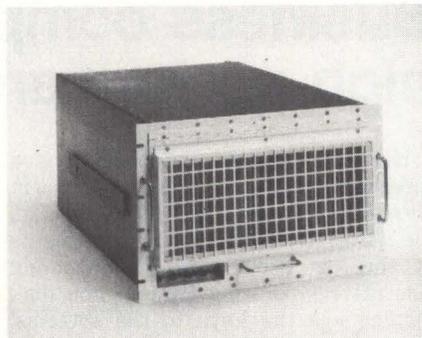
New Products

SYSTEMS

Ruggedized DEC system is Winchester based

The Trilobite II ruggedized Winchester-based PDP-11/LSI-11 system is housed in a 12¼-in. rack-mount package that provides cooling and protection from dust, shock and vibration. These

features allow the use of commercial Unibus/Q-bus processors, memories, interfaces and disks in adverse environments. The rugged aluminum rack-mount chassis is designed to withstand the abuse of field, mobile and factory applications. The single-chassis design reduces space requirements and elimi-



nates interconnect cables, yet accommodates two full-height or four half-height, 8-in. Winchester or floppy disk drives. The Trilobite II accepts the standard DEC Hex-by-9 backplane format allowing full PDP-11 Unibus and 4M-byte LSI-11/23-Plus systems. Other backplane configurations include dual Q-bus (nine and 18 dual slots) and split Q-bus/Unibus. The Trilobite II runs RT-11, TSX+, RSX-11/M-Plus, RSTS/E and UNIX operating systems. To handle marginal utility power, the Trilobite II uses Kepco switching supplies with full-line isolation for 120V/240V AC and 12V/24V/48V DC input. A Trilobite II with an LSI-11/23 processor, 0.5M bytes of main memory, a 36M-byte Winchester disk drive, a 1.2M-byte floppy disk drive and an RT100 terminal is priced at \$27,044 in single-unit quantities. **Trilobite Computer Corp.**, 780 W. Grand Ave., Oakland, Calif. 94612.

Circle No 303

Home Sweet Home for Your Multibus*

Finally there's a system chassis that is designed and manufactured with the thoroughness and care you expect in your Multibus system. It's Electronic Solutions' new Multichassis™.

- 9 slots, 0.6" spacing—or 7 slots, 0.75" spacing
- Hefty 4-output 300W power supply— 40A at +5V
- Cool operation even with high-density boards

There's a field-proven card

cage and backplane, plus full RFI filtering, locking front panel function switch, power fail detection, and quiet dual cooling fans with quick-change filters.

And best of all, the removable front panel lets you easily customize the Multichassis to match your company color and logo.

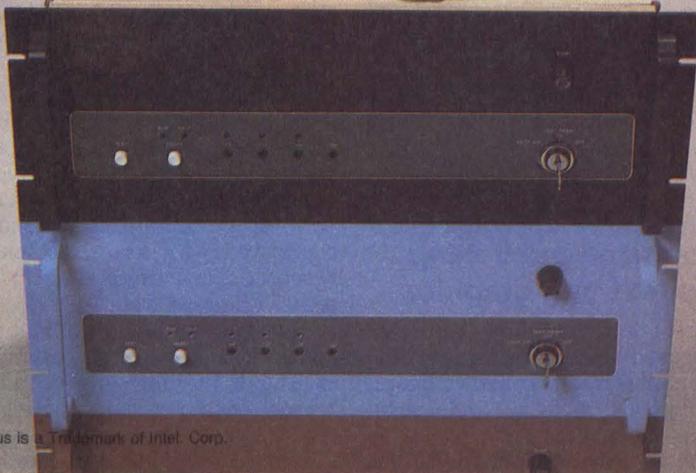
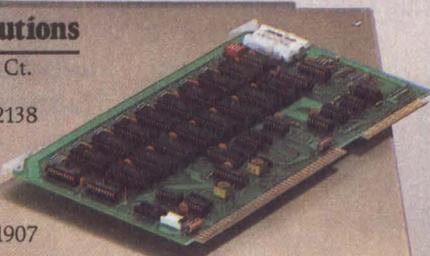
So treat your Multibus system to an elegant but affordable new home—the Multichassis by Electronic Solutions. Call us today for full specifications and prices.



Electronic Solutions

5780 Chesapeake Ct.
P.O. Box 85244
San Diego, CA 92138
Call Toll Free
(800) 854-7086

In California (619) 292-0242
In Canada call:
Transduction Ltd. (416) 625-1907



*Multibus is a trademark of Intel Corp.

CIRCLE NO. 136 ON INQUIRY CARD

STD-bus-compatibles offer on-board options

The Series 8800 family of STD-bus-compatible microcomputers boards is designed for computation and control applications such as inertial navigation, vibration analysis and robotics. The models ZT8810/8811 and ZT8812/8813 feature direct addressing of as much as 1M byte of main memory, a choice of 5- or 8-MHz, 16-bit 8088 CPUs, wait states for compatibility with slower memories and I/O, 16K bytes of ROM capacity and an optional development/debug monitor PROM. The model ZT8810 also features an on-board serial I/O port. An 8087 math co-processor and RMX-86 or CP/M-86 silicon operating systems are also available on the models ZT8812/8813. Prices range from \$425 to \$499. **Ziatech Corp.**, 3433 Roberto Court, San Luis Obispo, Calif. 94301.

Circle No 304



Some of our VARs' best ideas began on the backs of envelopes.

Great ideas, plus hard work, business sense and commitment to customer satisfaction. That's what it takes to be a Value Added Remarketer for IBM.

IBM is looking for business people with specialized industry experience. For companies that can successfully merge our systems with applications software. For those to whom quality is fundamental.

Put IBM to work for your customers.

To begin with, IBM wants qualified VARs to have the broadest choice of systems and software: the IBM Personal Computer, Displaywriter, Datamaster, CS-9000, 4300 systems, System/36 and Series/1 with its new enhancements.

These products carry IBM's reputation for quality. Equally important, all have access to IBM's nationwide service.

That means VARs who work with IBM have more to offer their customers. But that's only part of what IBM can offer to its VARs.

Put IBM to work for you.

IBM also provides VARs with tools to assist them in marketing to their customers and prospects.

For instance, IBM helps VARs with business shows and product literature. We help VARs create their own direct mail programs.

And IBM brings prospects with special needs together with VARs who have unique solutions. It's done with a special referencing system which supplies information about our VARs' offerings to IBM's sales force.

IBM's Value Added Remarketer Program: Great ideas, hard work and business ability are what's required. For more information, call 1 800 IBM-VARS or send in the coupon.



MMS-7-83

Larry Humphreys
IBM Distribution Channels
P.O. Box 76477
Atlanta, GA 30358

Please send me information about qualifying as a VAR.

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____

What makes the HiNet™ local area network a star performer in OEM sales?



With HiNet, you sell a complete system: unique microcomputer work stations, peripherals, system software, and central or distributed disk drives. All from one supplier. All turnkey. All backed by

Digital Microsystems' national service program.

Thousands of installations worldwide are proving HiNet's reliability right now (and providing you with solid reference accounts.) Digital Microsystems is the leader in Local Area Network technology, backed by international financial, technical and marketing resources.

Shown are just three of the versatile HiNet stations: the DMS-5000 (8- or 16-Bit) with graphics and rotating screen; the compact DMS-3/F "Fox"; and the DMS-86, the computer that turns any terminal into a 16-Bit HiNet station. All are CP/M® compatible.

HiNet communicates with large scale mainframes and stands prepared for the voice/data integrated office.

HiNet. For star performance in OEM sales.



Digital Microsystems



Because man was not meant to work alone.

Corporate Offices: 1755 Embarcadero, Oakland, CA 94606 (415) 532-3686 TWX 910-366-7310.
England & Europe: Molly Millars Bridge, Molly Millars Lane, Wokingham, Berkshire, England,
RG11 2PQ, Tel. (0734) 793131, Telex 849925 DMSLTD.

HiNet™ is a registered trademark of Digital Microsystems. CP/M™ is a registered trademark of Digital Research, Inc.

New Products

SYSTEMS



Computer includes application generator

The Unidata 3000 self-programmable small business computer is designed for ease of use. Unified software, including an application generator and a database manager, is at the heart of the system. The application generator allows users without computer expertise to create customized application programs based on routine business forms. Using an interpretive language called Unisyn, novices enter a sample of every line in a form and provide directions for filling in each blank by answering the computer's questions. Unidata 300 hardware consists of a computer module, a letter-quality daisy-wheel printer, a detachable keyboard with numeric keypad, cursor control, function and editing keys and a 12-in., tilt-and-swivel display screen. The computer module contains a real-time clock, an 8-bit Z80 microprocessor, 128K bytes of memory, two 8-in. floppy disk drives with a combined capacity of 2.5M bytes and two communications ports. Single-unit price is \$15,000. **Unidata Systems Inc.**, Newington Park, Portsmouth, N.H. 03801. **Circle No 305**

Workstation emulates IBM 3278 terminal, IBM PC

The model 9010 modular, multifunctional workstation emulates IBM 3278-2 terminals and IBM Personal Computers. The model 9010 includes a computer system unit, a disk storage unit, a display monitor unit, a display logic unit and a keyboard unit. Major features include a 16-bit 8088 microprocessor, 128K bytes of RAM, five system expansion slots that are compatible with

IBM PC option boards and two 320K-byte, 5¼-in. floppy disk drives. The P9010 supports the CP/M-86 and MS-DOS operating systems. A companion product, the model P9002 information-processing facility, adds P9010 capability to an IBM 3278 terminal or the vendor's P3278 terminal. The P9002

includes the computer system unit and the floppy disk drives. Prices are \$4990 and \$3195 for the models P9010 and P9002, respectively, in single-unit quantities. **Phaze Information Machines Corp.**, 7650 E. Redfield, Scottsdale, Ariz. 85260.

Circle No 306

Meet The Infoscribe Family.



Whether your computer system is large or small, simple or complex, Infoscribe multifunction matrix printers match your real needs.

Family Characteristics

All Infoscribe models share certain advanced features. These include microprocessor-controlled electronics in bi-directional, logic seeking designs; standard or double-width upper and lower case characters; double density printing; up to 136 columns at 10 cps; true descenders, underlining, subscripts, and superscripts; rugged, full-duty-cycle performance; unique integrated, structural-foam chassis; and many more.

Model Variations

Each Infoscribe model offers features and benefits ideal for particular applications:

FEATURE	MODEL				
	500	1000	1100	1200	1500
DATA PROCESSING (CPS)	150	200	200	200	400
CORRESPONDENCE (CPS)	75	100	100	100	200
NEAR LETTER QUALITY (CPS)			40	40	100
GRAPHICS (72 x 72)	♦	♦	♦	♦	♦
GRAPHICS (144 x 144)			♦	♦	♦
PROGRAMMABLE FONTS	♦	♦	♦	♦	♦
FOUR COLOR RIBBON				♦	

Something For Everyone

To top it off, Infoscribe delivers the most user-friendly printers on the market. They're extremely quiet (approximately 54 dBA), easy to learn, easy to use, easy to maintain, and easy on the eyes. Whether you're a computer expert, or don't know a volt from a bolt, Infoscribe will make you a friend of the family.

Manufactured in the U.S.A. and sold and serviced internationally by Infoscribe, Inc., 2720 South Croddy Way, Santa Ana, California 92704, U.S.A.

Phones (714) 641-8595, (800) 222-8595, In California (800) 223-8595, Telex 692422.

PRINT WITH INFOSCRIBE

CIRCLE NO. 139 ON INQUIRY CARD

New Products

DISK/TAPE

Floppy disk drives for use with Ace 1000 computers

The ACE 1100 add-on disk drive assembly for the ACE 1000 personal computer includes a controller and one or two ACE 10 5¼-in. floppy disk drives. The unit replaces the cover of the ACE 1000 computer and slips in place. The ACE 10 floppy disk drives used in the ACE 1100 read and write any Apple II-compatible diskette. The controller, which accommodates two drives, can be used with DOS 3.2 and DOS 3.3 and includes a built-in disk drive exerciser. The controller plugs into one of the eight peripheral connectors. There is no



external cabling. The single-sided ACE 10 drives store as much as 143K bytes and feature an 18-msec. track-to-track access time and a 250K-bit-per-sec. transfer rate. The single-drive ACE 1100 is priced at \$699 including the controller. A second drive adds \$399. **Franklin Computer Corp.** 2138 Route 38, Cherry Hill, N.J. 08002.

Circle No 307



Tape drive features cache buffer

The CacheTape 75 ½-in. reel-to-reel tape drive features a 64K-byte cache buffer. The nine-track drive accommodates 7-, 8½- and 10½-in. reel sizes and is available in two versions. One version operates at 100 ips and stores 46M bytes (unformatted) using a 1600-bpi recording density, while a second version operates at 50 ips and stores 92M bytes

(unformatted) using a 3200-bpi recording density. Both versions feature a 225-ips rewind speed and user-selectable transfer rates from 20K to 120K bytes per sec. to match the performance of the drive to multiple host system needs. In OEM quantities, CacheTape 75 is priced at \$2820. **Cipher Data Products Inc.**, 10225 Willow Creek Rd., P.O. Box 85170, San Diego, Calif. 92138.

Circle No 308



Winchester drives feature technical advances

The Cogitator Series I, models 906 and 912 5¼-in., half-height Winchester disk drives store 6.38M bytes (unformatted) on one platter and 12.76M bytes (unformatted) on two platters, respectively. Both drives are compatible with the Seagate ST-506/412 interface, and both have an average access time of 85 msec. and a data-transfer rate of 5 MHz. The drives feature thin-film-plated media, a dynamic braking system, manganese/zinc composite read/write heads mounted on an IBM 3370-type suspension and single-PC-board construction for high reliability. In OEM quantities of 500, price of the Cogitator Series I, model 906 is \$725, and price of the model 912 is \$825. **Cogito Systems Corp.**, 118 Charcot Ave., San Jose, Calif. 95131.

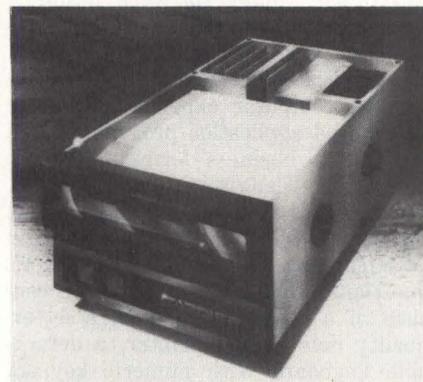
Circle No 309

Tape subsystems work with Onyx computers

The models TD-1050 and TD-1012 are ½-in., nine-track, 800-/1600-cpi, IBM-, ANSI-, ECMA- and ISO-compatible mag-

netic-tape systems for Onyx 16-bit UNIX-based computer systems. The tape drives store approximately 40M bytes per 7-, 8½- or 10-in. reel and can generate or read tapes in ASCII, binary or IBM EBCDIC code. They feature a data-transfer rate of 40K bytes per sec. The tape subsystems use an intelligent microprocessor-based controller providing an 8-bit bidirectional parallel interface. A UNIX System III software application driver is supplied as part of the software operating system furnished by Onyx. The TD-1050/Onyx system is priced at \$9175 and supports dual-mode, 800- and 1600-cpi recording at 45 ips start/stop, while the TD-1012/Onyx system is priced at \$6995 and supports only 1600-cpi recording at 12.5 ips. **Innovative Data Technology**, 4060 Morena Blvd., San Diego, Calif. 92117.

Circle No 310



Disk drives feature removable dual media

The Cardiff family of 5¼-in. Winchester disk drives includes fixed-only, removable-only and fixed/removable models with unformatted data storage capacities ranging from 20M to 80M bytes. The Cardiff drives are compatible in size, power requirements, interface and data-transfer rate with available microcomputers and controllers. Measuring 3¼ × 5¼ × 8¼ in., they require +5V DC or +12V DC, use the ST-506 interface (modified to accommodate removable-media status information for the removable-media models) and have a data-transfer rate of 5M bits per sec. Average seek time is 25 msec. Price for a 40M-byte fixed/removable drive is \$2250. **Innovative Data Technology**, 4060 Morena Blvd., San Diego, Calif. 92117.

Circle No 311

ACHIEVE THE STANDARD IN WINCHESTER, FLOPPY AND TAPE DEVICE TEST!

Come up to the standard in rotating memory device test in **HARDWARE**: with complete correlation of test results from system to system.

in **SOFTWARE**: with fully configured menu driven test programs including inside and outside window margins, long term read errors and random read/write error testing as well as flaw mapping.

in **SYSTEMS**: with complete compatibility throughout the entire product line of final production and receiving test systems.

in **PRODUCTIVITY**: with the ability to test up to 100 devices in simultaneous operation.

ACT systems today test more than 2,000 5 1/4" drives daily. But ACT's experience does not stop there. Since its inception in 1976, Applied Circuit Technology has gained valuable experience in designing and manufacturing the electronics for servo track writers, single and multi-disk analyzers, drive controllers, data separators and floppy media certifiers as well as its own line of highly-advanced, unique test systems and disk certifiers.



ITS (Intelligent Test System) tests up to 100 units in simultaneous operation.

CIRCLE NO. 140 ON INQUIRY CARD

All this has made ACT systems the standard in final production and receiving test.

You can achieve the standard by contacting Hank Pselos at Applied Circuit Technology, 2931 La Jolla Street, Anaheim, CA 92806. (714) 632-9230.

ACT Applied Circuit Technology

MORE THAN A QUESTION OF PASS/FAIL

Regional sales offices:
Westlake Village, CA (805) 496-8778
San Jose, CA (408) 287-8720

New Products

PRINTERS

Low-cost, dot-matrix printers feature high-resolution, multi-mode printing

Available in three models that are priced from \$799 to \$1250 in single-unit quantities, the Pinwriter series of multimode, dot-matrix printers offers 180-cps printing for high-volume printing, near-letter-quality output at lower speeds and nearly unlimited font flexibility for graphics. The latter is made possible by the 18-pin, 2×9 staggered structure of the Pinwriter's print head.

The 80-column model P1 prints at 180 cps in a high-speed mode and 90 cps in a high-density mode. It offers a Centronics-type interface. In addition to 180-cps, high-speed printing and 90-cps, high-density printing, the 80-column model P2 offers program- or operator-selectable dual-pass printing at 35 cps to



NEC Information Systems Inc.'s Pinwriter series of low-cost, dot-matrix printers features 18 printing pins to form high-density characters.

produce near-letter-quality output. The model P2 features an IBM PC interface that recognizes the IBM command set as well as an optional RS232 interface. The 136-column model P3 offers the same three print modes and interfaces as the model P2.

All three models of the Pinwriter family feature proportional spacing, boldface printing, elongated characters and continuous underline. Standard character sets stored within the printers include high-speed pica (7×9 matrix), high-density pica (13×9 matrix), high-density elite (13×7 matrix) and a condensed character set for printing 17 cpi (7×9 matrix). The models P2 and P3 also feature dual-pass pica (26×18 matrix) and elite (26×14 matrix). Optional character sets can be

downloaded from the host computer to the models P2 and P3.

Using friction paper feed, the models P1 and P2 accommodate forms from $4\frac{1}{2}$ to 10 in. wide, while the model P3 handles forms as wide as $14\frac{3}{4}$ in. Optional forms handlers include a

tractor feed and cut-sheet guide that are available on all models and a cut-sheet feeder option for the models P2 and P3. NEC Information Systems Inc., 5 Militia Dr., Lexington, Mass. 02173.

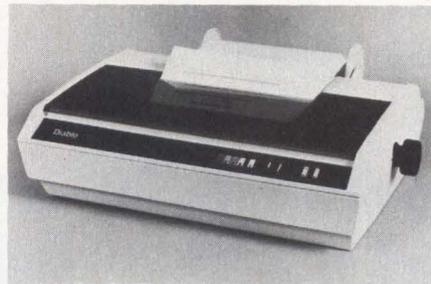
Circle No 312

Diablo expands products with new technologies

Seeking to become the industry's leading single-source supplier of printers, Diablo Systems Inc., a Xerox subsidiary known for its 11-year development and production of daisy-wheel printers, has introduced a series of printer products based on other technologies. The new products include two impact dot-matrix printers, a non-impact, thermal-transfer, plain-paper printer and a color ink-jet printer.

The models 11A and 31A 80- and 132-column, 100-cps printers use a 16×35 dot-matrix pattern to create near-letter-quality text and line and block graphics. They print at 30 cps in correspondence-quality mode. They feature front-feed cut-sheet capability, a 2K-byte print buffer and Xon/Xoff and ETX/ACK line protocols. They will be available in the third quarter of this year, with expected end-user, single-unit prices of \$750 and \$1099, respectively, for the models 11A and 31A.

The Series 200 electronic printing



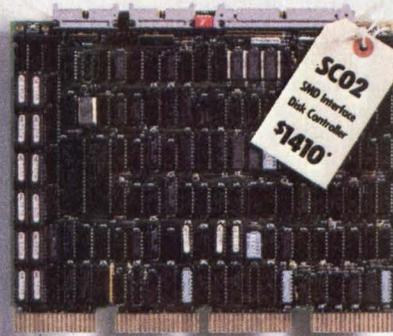
Diablo Systems Inc.'s Series C seven-color ink-jet printer integrates text and graphics on plain or clay-coated paper at 20 cps.

machine non-impact, thermal-transfer printer uses plain paper and generates as many as six pages of text and graphics per min. It generates its image by energizing the thermal head elements that in turn cause the transfer of black ink from an ink-donor film roll onto plain paper via a pressure roller. Each ink-donor film roll can produce as many as 1300 pages. With its 200×200 -dpi resolution, the printer can be programmed to generate a virtually unlimited array of text and graphic characters and symbols. Many of the more popular fonts designed for the company's daisy-wheel printers are available via software license to EPM users. Single-unit price is \$4995, with volume discounts available.

The Series C non-impact ink-jet printer uses drop-on-demand color ink-jet technology to address the image-processing and color-graphics requirements of personal-computer, professional-workstation and business-system users. This four- and five-pass, 20-cps printer features switch-selectable unidirectional and bidirectional printing and integrates text and graphics on cut-sheet or roll paper in seven colors including cyan, magenta, yellow, black, violet, green and red. The printer features 1024×1024 -dot-per-page resolution, a 96-character U.S. or European ASCII set and an additional set of 64 mosaic graphics characters. The printer will be available in the third quarter of this year with an expected end-user, single-unit price of \$1250. Diablo Systems Inc., 24500 Industrial Blvd., Hayward, Calif. 94545.

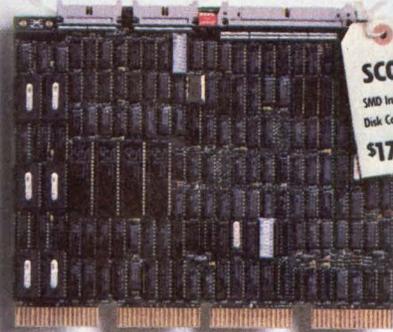
Circle No 313

The LSI-11 controllers with features comptrollers love.



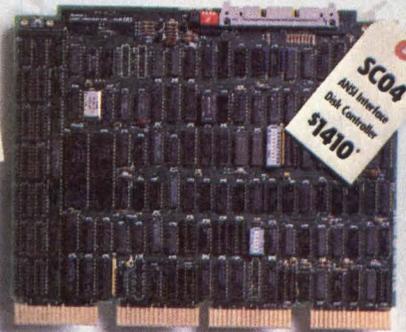
SC02
SMD Interface
Disk Controller
\$1410*

Handles small 12-80MB disks, emulates RP02/03, RK06/07 and RL01/02.



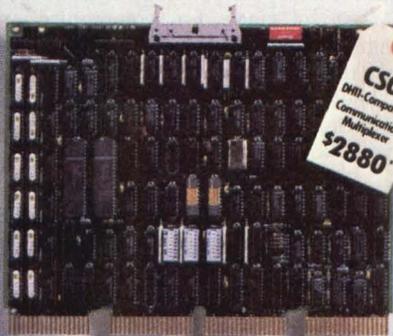
SC03
SMD Interface
Disk Controller
\$1790*

Operates with new high-performance 80MB and larger disks on LSI-11/23.



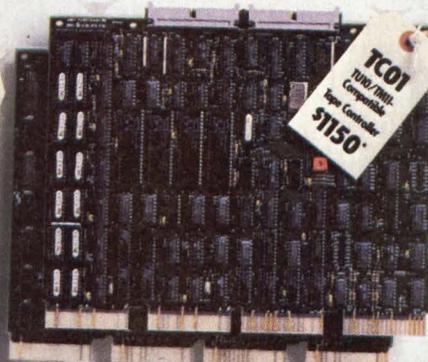
SC04
SMD Interface
Disk Controller
\$1410*

Handles up to eight ANSI 8" Winchester, emulates RK06/07 and RL01/02.



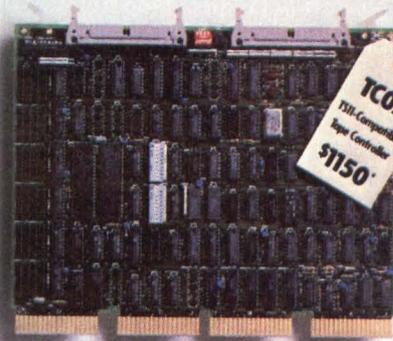
CS01
DM1-Compatible
Communications
Multiplexer
\$2880*

Handles 8-64 channels, 16-bit word transfers (DMA), 22-bit addressing. (16-channel price)



TC01
TUD/TM1-
Compatible
Tape Controller
\$1150*

Dual density at up to 75 ips, handles up to four 1/2" transports.



TC02
TUD-Compatible
Tape Controller
\$1150*

Coupler works with all NRZI, PE, GCR formatters at speeds from 12.5 to 125 ips.

Handles new cartridge Winchester disk drives, emulates RLV11/12.

*Quantity 100

Flinty-eyed finance types are push-overs for Emulex controllers.

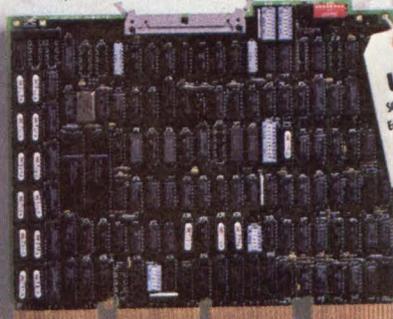
And why not? Emulex controllers have great figures.

DEC LSI-11 users simply don't pay extra for higher Emulex quality, performance and reliability. In fact, Emulex controllers are priced to be highly competitive with the lower quality brands. And that's just the beginning.

There's no up-front investment because Emulex controllers are totally software transparent to LSI-11 CPUs. No special software drivers, handlers or tweaks required.

Smart comptrollers don't tie up cash in needless inventory. With Emulex's remarkably fast delivery, inventories can be kept economically small.

Quantity discounts are another opportunity for



UC01
SCSI Interface
Emulating Host
Adapter
\$1216*

are pleased to know that nationwide applications assistance, training, and technical support is only a quick phone call away.

Great figures?

Write or call Emulex Corporation, 3545 Harbor Blvd., P.O. Box 6725, Costa Mesa, CA 92626. Telephone (800) 854-7112 toll-free. In California call (714) 662-5600.

comptrollers with sharp pencils. With Emulex you can mix and match across a very broad product line of Q-Bus, Unibus & VAX controllers so it doesn't take long to bring prices down even further.

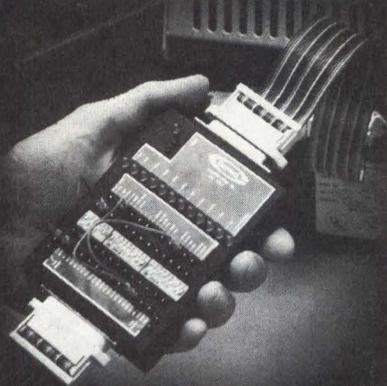
Knowledge that Emulex products work (at up to 72,000 hours MTBF) is important, too. But when support is necessary, comptrollers



The genuine alternative.

CIRCLE NO. 141 ON INQUIRY CARD

THE LIFE LINE



Pinpoint the source of your problem fast with the Line Tester from Carroll Touch Technology.

- No battery required.
- 24 lines accessible.
- True 3-state indication

\$195 (includes shipping)

For orders or information, call: 217/351-1700
Or send check:

Carroll Touch Technology
2902 Farber Drive
Champaign, IL 61821

CIRCLE NO. 142 ON INQUIRY CARD

This publication
is available
in microform.



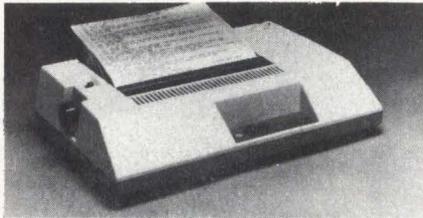
University Microfilms International

300 North Zeeb Road
Dept. P.R.
Ann Arbor, Mi. 48106
U.S.A.

30-32 Mortimer Street
Dept. P.R.
London WIN 7RA
England

New Products

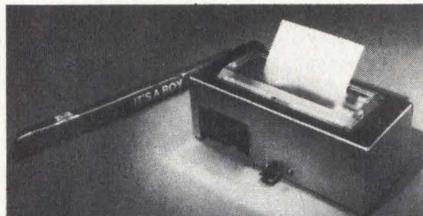
PRINTERS



High-speed OEM printer prints on full-sized paper

The model EX1601 non-impact, electrosensitive printer prints at 240 cps. Its speed and low maintenance make it suitable for applications in communications, instrumentation, medical data logging and other data-gathering systems. The model EX1601 prints the full 96-character ASCII set on standard 8½-in.-wide paper and features 128 additional symbols and foreign-language characters. The printout is software selectable for an 80-, 40- or 27-column format. Print sizes can be mixed on a line. A choice of parallel, RS232C and 20-mA serial or IEEE-488 interfaces is available. Single-unit price is \$699, with quantity discounts available. **Axiom Corp.**, 1014 Griswold Ave., San Fernando, Calif. 93140.

Circle No 314



Minaturized printer fills industrial requirements

Designed for a variety of industrial and commercial applications, the model EUY-3T miniaturized thermal printer measures 4.69 × 1.79 × 2.64 in. It features ⅛-in.-high characters on a 40-character line, bidirectional printing, a printing speed of 1.2 lines per sec., dot-addressable graphics and use of 3.15-in.-wide paper. In OEM quantities, the EUY-3T is priced at less than \$100 each. **Panasonic Industrial Co.**, One Panasonic Way, Secaucus, N.J. 07094.

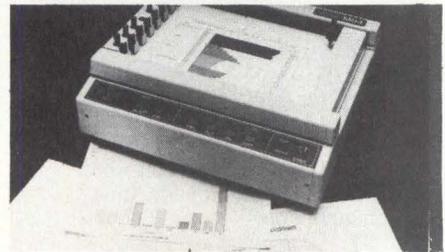
Circle No 315

Demand printer delivers labels, tickets, tags

The Zebra demand printer can print and dispense labels, tickets or tags. It

can print on pressure-sensitive, heat-sensitive and gummed labels; card-stock tickets and tags; multiple-part forms; and various other paper stocks as thick as 0.016 in. Labels can be dispensed singly or in strips that can be torn off. A backing rewinder option takes up pressure-sensitive backing paper as labels are dispensed. This impact, dot-matrix printer produces approximately 250 lpm when operating with a normal print-line width of 2.3 in. It offers OCR-M fonts as well as four alphanumeric fonts. It can also print eight popular bar codes of various heights and densities that are readable by hand-held and moving-beam scanners. The printer uses a standard RS232C interface for communication. Single-unit price is \$3650 with the backing rewinder option or \$3470 without the backing rewinder option. **Data Specialties Inc.**, 3455 Commercial Ave., Northbrook, Ill. 60062.

Circle No 316



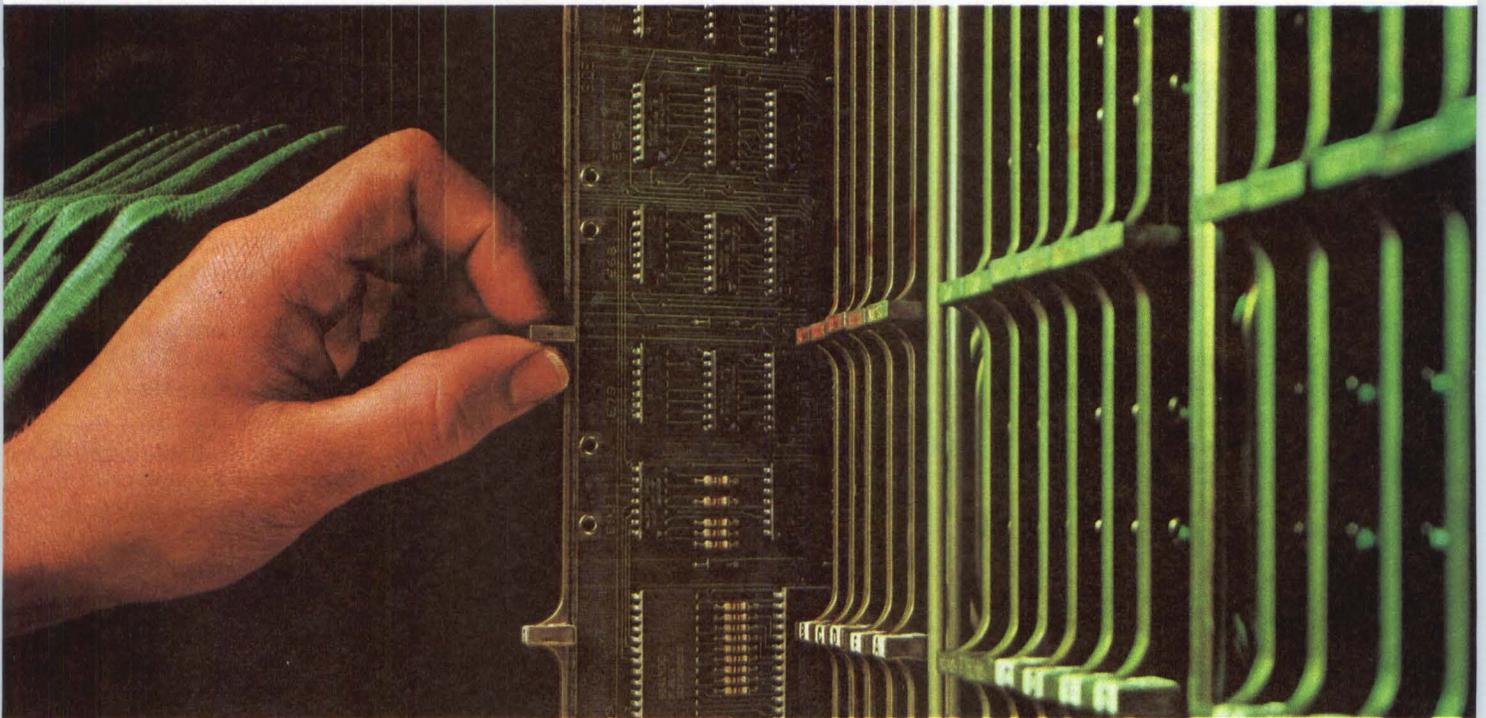
Desk-top plotter has high resolution

The model 84 eight-pen desk-top plotter produces high-resolution charts, graphs and drawings on paper or overhead transparency film. It has a plot speed of 16.5 ips and a resolution of 0.004 in. It plots on 8½ × 11-in. or 287 × 200-mm. paper in as many as 10 colors using liquid ink or nylon- or ceramic-tipped pens. Based on a Z80 microprocessor, this intelligent plotter has firmware commands including five line styles, selectable character rotations, special symbols, six character sets, viewporting/windowing, scaling and circle/arc generation. The plotter features an RS232C, IEEE 488 or Centronics parallel interface. With the RS232C interface, baud rates from 110 to 9.6K baud are switch selectable as is parity. Single-unit price is \$1995, with quantity discounts available. **California Computer Products Inc.**, 2411 W. La Palma Ave., Anaheim, Calif. 92801.

Circle No 317

The things we hear about General Electric service.

“DO YOU FIX EVERYTHING?”



Just about. Micros to minis to modems to multiplexers, General Electric services *thousands* of pieces of computer and communications equipment.

We've got the service facilities to help you all across the country.

We've got carry-in depot service that can save you time and money.

Plus *qualified* service engineers and technicians to do the job *right*.

When your system goes down, you need someone who knows what's up. You need GE.

For the service center nearest you, call 800-528-6050, Ext. 406. (In Arizona, call 800-352-0458, Ext. 406.) Or write: General Electric Company, Instrumentation and Computer Service Department, 705 Corporation Park, Scotia, NY 12305.



GE. Because your system is only as good as its service.

GENERAL  ELECTRIC

CIRCLE NO. 143 ON INQUIRY CARD

How do you create a microcomputer to match the power of the UNIX™ operating system?

Imagine. You are perfecting a revolutionary operating system. In about two years, it will be the system of choice for 16-bit microcomputers.

It will be called the UNIX operating system.

But the breakthrough features of this operating system are going to make stringent demands on the computer.

The microcomputer developed specifically for the UNIX operating system more than two years before its commercial distribution is called ONYX.™

ONYX will live up to every demand and expectation.

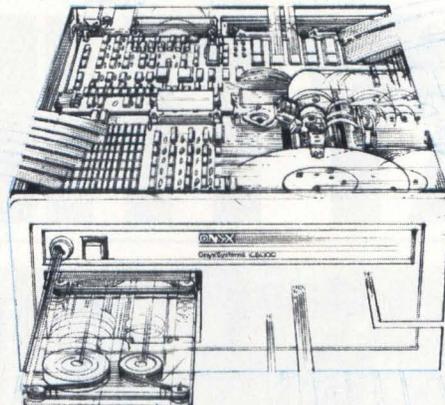
To achieve the ultimate flexibility, simplicity, efficiency and productivity, the UNIX operating system will incorporate a file system of highly uniform sets and sub-sets of directories, arranged in a tree-like hierarchical structure.

And flexible directory and file protection modes, allowing all combinations of "read," "write," and "execute" access, independently for each file or directory, for a group of users.

But these advantages will require intensive disk access, and superior memory management. In simple language, disk access must be as fast as possible, and the disk must have an unusual capacity to maintain complex file systems on-line at all times.

Floppy disks with their low capacities and high access times won't do.

Winchester disk drives that utilize slow-moving stepper motor head positioning devices won't do.



ONYX's IMI Winchester disk storage system, with its servo-driven voice coil head positioning, is more than twice as fast!

So, obviously the ONYX C8002 will do.

And, as developed, the ONYX C8002 features expandable memory up to 1 Mbyte, and disk storage up to 160 Mbytes on-line. Its cartridge tape backup offers cyclical redundancy checking on every backup. Both the Winchester disk storage system and the cartridge tape backup are *internal*.

In the UNIX operating system environment, the disk becomes an extension of main memory. "Swapping" programs between the disk and main memory



increases the number of operations that can run concurrently. ONYX's memory management system utilizes "scatter" instead of "contiguous" allocation, and the more efficient swapping minimizes demand on the disk channel. That's why ONYX assures a highly efficient environment for the UNIX operating system.

Now it's 1982. The UNIX system's pre-eminence among 16-bit operating systems is established. And ONYX is the only company that has significant production experience with UNIX systems.

ONYX has installed over 1500 UNIX systems.

Today there are a lot of systems being developed to operate UNIX (and "look-alike") operating systems. But there are many reasons why you should consider ONYX and the UNIX operating system as inseparable.

System III available now for immediate delivery.

Phone this special number: (408) 946-6330 Ext. 251. Ask about these System III enhancements, including:

- Multi-key index sequential files under RM COBOL;
- "Term Cap" capability that supports a wide variety of terminal interfaces;
- Enhanced printer handling capability;
- SCCS to maintain edit histories in text management applications.

*UNIX is a trademark of Bell Laboratories.

Make the Connection

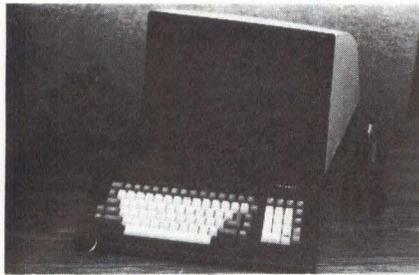
ONYX-UNIX

OPERATING SYSTEM

Onyx Systems Inc., 25 East Trimble Road, San Jose, CA 95131
CIRCLE NO. 144 ON INQUIRY CARD

New Products

TERMINALS



APL editing terminal features instant replay

The ANSI X3.64-compatible model 16-APL user-definable, multi-page APL editing terminal features true character overstriking and instant replay by which a user can view the separate elements of previously overstruck characters. The model 16-APL's 385 displayable characters include 96 APL, 128 ASCII, 64 mosaic, 32 line-drawing and 32 subscript/superscript characters plus 33 special symbols and math notations. The terminal's standard four-page display memory can optionally be expanded to eight volatile or nonvolatile pages. The model 16-APL displays a standard 24-line x 80-column page, but its four- or eight-page memory can be organized by the user into any number of pages by redefining logical line lengths and page lengths. The 25th information line is used to display terminal status, feature selection and computer messages. The unit's built-in calculator and real-time clock also use the 25th line for displaying calculations and time of day/elapsed time. The model 16-APL has two fully buffered, bidirectional RS232 ports. It is available in four enclosure styles and three (9-, 12- or 15-in.) CRT sizes. The standard 12-in. version is priced at \$1695. **Teleray Division of Research Inc.**, Box 24064, Minneapolis, Minn. 55424. **Circle No 318**

Display station from IBM is low cost, lightweight

The IBM 3178 display station incorporates many of the features of the IBM 3278 model 2 display station in a compact, lightweight, low-cost unit. The 3178 includes a 12-in., non-glare screen and a choice of 75-key data-entry or 87-key typewriter keyboards. The screen displays as many as 1920 characters and swivels 90 degrees to the left or right. The detached, low-profile keyboard can be adjusted to a 6- or

12-degree slope to suit the operator. Among the standard 3278 model 2 features offered in the 3178 are an audible alarm, a numeric keyboard lock and a security key lock whose key can be removed with the power on. Prices are \$1660 or \$1720, depending on the keyboard selected, and volume discounts are available. **IBM Corp., Information Systems Group**, 900 King St., Rye Brook, N.Y. 10573.

Circle No 319

Ergonomic terminal is user friendly

The model Z-29 terminal features a menu-driven setup procedure, a detached keyboard, power-up diagnostics and a screen saver. It is compatible with ANSI protocol units and the DEC VT52. In addition, it emulates many of the DEC VT100's functions (in the 80-column mode), the Lear Siegler ADM-3A and the Hazeltine 1500. The keyboard has 77 typewriter-style keys, a separate 14-key numeric keypad, four LED



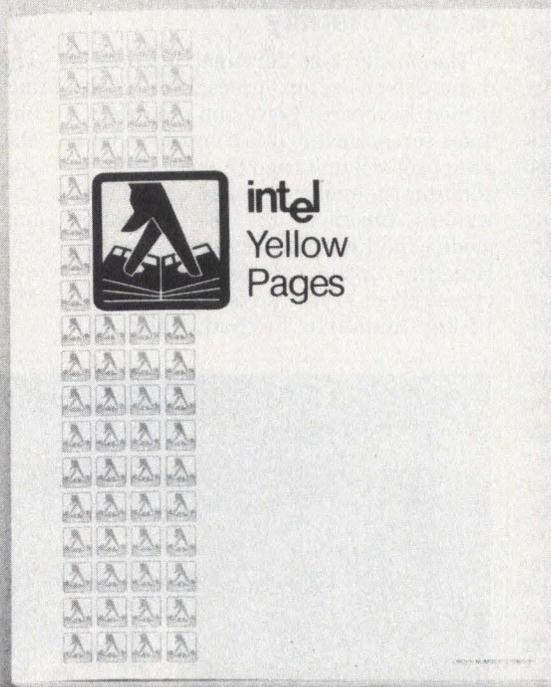
indicator lights, an optional palm-rest extension and user-selectable audible key click. The tiltable 12-in. green screen displays 25 rows of 80 characters. The terminal can display 256 characters including the 95 ASCII set, 33 graphics characters and an alternate 128-character set that includes subscripts, superscripts, VT100 graphics characters and special shapes. For OEMs, there is an expansion socket for 32K bytes of RAM or ROM. Price is \$849 in single-unit quantities. **Zenith Data Systems**, 100 Milwaukee Ave., Glenview, Ill. 60025.

Circle No 320

Fast, low-cost MBAs.

See our ad on Page 267.

INTRODUCING THE EASIEST WAY TO CALL UP YOUR SOFTWARE.



Introducing the Intel Yellow Pages. The first software directory of its kind. From the only company with enough software support to warrant it.

The Intel Yellow Pages lists 2,021 software products from independent vendors, consultants and ourselves. In both the U.S. and Europe.

There are 350 categories. Each category offering products completely compatible with Intel's entire iAPX 86 family. Including our new 80186 and 80286 microprocessors.

Our Yellow Pages is pure gold

when it comes to quickly finding the best applications software. Such as word processing, spreadsheets and project management. Even services like software development tools are covered for all of our 8 and 16-bit micros, boards or systems.

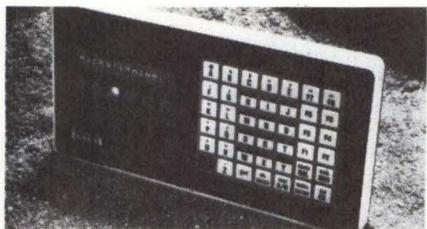
The book is priceless. It's free. Just send your name on company letterhead to: Intel, Lit. Dept. Z-15, 3065 Bowers Avenue, Santa Clara, CA 95051.

Then let your fingers do the programming.

intel® delivers
solutions

New Products

TERMINALS



Self-contained data-entry terminal meets MIL specs

The TM71M, a militarized model of the vendor's Microterminal control panel, conforms to MIL-E-16400, MIL-STD-454, MIL-S-901 (shock) and MIL-STD-167-1 (vibration) specifications. Measuring 8.5 × 4.5 × 0.85 in., the unit mounts on a flat surface. It has a 42-key, sealed keyboard with tactile feedback and contoured key tops that generates 80 alphanumeric characters. A 16-character LED alphanumeric display with scroll-left/scroll-right keyboard controls permits review and editing of data entered before transmission. Two 80-character buffers are provided for keyboard-generated data, and two 80-character buffers are available for CPU-generated messages. The TM71M's display includes CPU control of flashing, scrolling or blanking features. In addition to data-input and control keys, the TM71M keyboard includes 14 programmable function keys. Other features include RS232C and 20-mA serial communications at baud rates from 110 to 9.6K baud, remote reset and two TTL-compatible digital outputs to control external equipment. The TM71M sells for \$3000 in quantities of 100. **Burr-Brown, Industrial Systems Products Division**, P.O. Box 11400, Tucson, Ariz. 85734. **Circle No 321**

Color graphics terminal features anti-aliasing

The AED512 and AED767 are color graphics terminals designed for control of industrial processes, display of charts and other types of business graphs and CAD/CAM. The AED512 is a raster-refresh display that features 256 colors and a resolution of 512 × 512 pixels. The AED512 contains a small computer and a bit-map memory and emulates Tektronix 4010-4015 terminals. Standard interactive devices include a keyboard, function keys and a joystick. The terminal also features pixel-replication zoom, pan, polygon fill and Superoam. Superoam allows the display of a

software- or keyboard-selectable portion of an image that is larger than the full screen size. All video outputs drive external monitors and video tape equipment. The AED767 uses the same architecture as the AED512 but features a 1K × 1K × 8 virtual-address space with a 768- × 575-pixel viewing window. The AED767 also incorporates anti-aliasing. The AED512 and AED767 are priced at \$5995 and \$10,995, respectively, including eight memory planes and a 13-in., standard-persistence monitor. **Advanced Electronics Design Inc.**, 440 Potrero Ave., Sunnyvale, Calif. 94086. **Circle No 322**

Large-screen display uses gas-panel technology

The IBM 3290 gas-panel display station is designed for program development, report retrieval and database/data-communications applications. It can display as many as 9920 alphanumeric characters and a wide range of graphics including line draw-



ings, charts and sketches. The 10.7- × 13.4-in. flat screen can be divided into windows to provide an operator with access to as many as four applications or databases in one or more computers. The screen is a sealed sandwich of two glass plates less than 1/70 in. apart. The space between the plates is filled with neon/argon gas that glows as electrical charges are selectively applied onto 737,280 intersections of a wire grid to create high-resolution orange-on-black images. Single-unit price is \$7100, with quantity discounts available. **IBM Corp., Information Systems Group**, 900 King St., Rye Brook, N.Y. 10573. **Circle No 323**

MBA's for under \$2,000.

See our ad on Page 267.

New Products

CAD/CAM



CAD system permits automatic PC-board routing

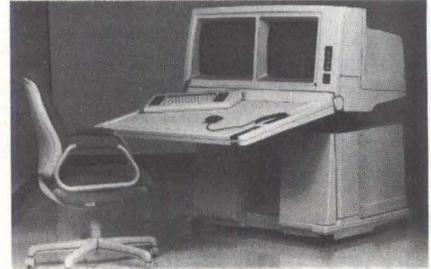
The Calay V03 CAD system features automatic routing of PC boards without a designer's presence or assistance. Hardware highlights of the system include a Digital Equipment Corp. LSI-11/23 computer with 256K bytes of RAM, a 512K-byte floppy disk drive, an 8M-byte Winchester disk drive, an alphanumeric terminal, a raster-scan screen with a graphics processor, a plotter interface and a digitizer. Calay V03 software includes an interactive multi-user graphic system with real-time data checking and user-friendly

input, a statistical program for analyzing PC-board data, the automatic routing program and a post processor for controlling output to various types of plotters. Price is \$169,000. **Calay Systems Inc.**, 3901 MacArthur Blvd., Suite 104, Newport Beach, Calif. 92660.

Circle No 324

Engineering workstation has local processing

The Interact graphics workstation includes three internal processors and more than 0.75M bytes of memory. Two 19-in. monochrome raster screens display drawings with 1280- × 1024-pixel addressability and resolution. The workstation performs dynamic panning, continuous zooming and real-time rotation of 3D elements without relying on the host data-processing system. Other display functions, including grid generation, cursor tracking, menu-command decoding, dynamic dragging and selective erasing, are also off-loaded. The host computer maintains and updates

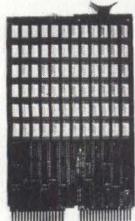


data files. The workstation incorporates an electronically active digitized surface large enough to accommodate a standard D-sized (22- × 34-in.) drawing. A movable keyboard for command input and text is also included. The workstation can communicate with a host data-processing system over a dedicated, polled access line using SDLC protocol. A second contention-access line enables the workstation to function as a node with Internet, the vendor's local-area communications network. Single-unit price is \$44,000. **Intergraph Corp.**, One Madison Industrial Park, Huntsville, Ala. 35807. Circle No 325

Q-Bus MEMORY from CLEARPOINT

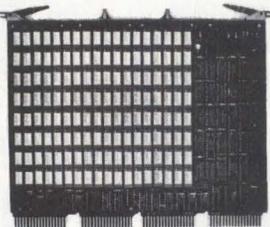
Our customers demand state-of-the-art technology. Shouldn't you?

- BLOCK MOVE on a full megabyte board — the first — available now!
- Up to 32 MB on a standard Q-Bus



◀ Q-RAM 11

Q-RAM 22B ▶



- 1/2 MB on a dual-height card
- All boards have on-board control and status registers (CSR) and LED to indicate parity errors.



CLEARPOINT INC.

Millbrook Park
327/D Boston Post Road
Sudbury, MA 01776
(617) 443-7121

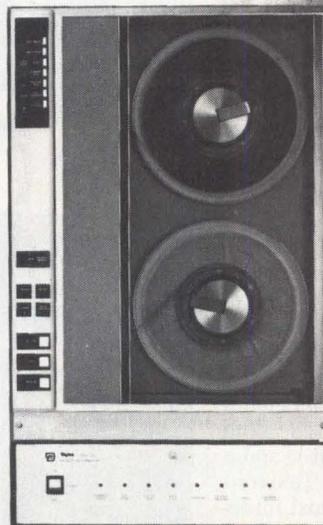
Q-Bus is a trademark of Digital Equipment Corp.

CIRCLE NO. 163 ON INQUIRY CARD

FAST 488!

IEEE-488 1/2-inch magnetic tape recording systems.

Recording solutions for users of H-P, Tektronix and other instrumentation and data logging systems.



- Dual density, speeds to 75 ips.
- World-wide computer data interchange.
- Data acquisition, ATE, CAD, disc backup and more.
- IBM and ANSI compatible formats.
- Transfer rates to 100,000 bytes/sec.
- Dual buffer to 24K bytes.
- Over 40M bytes of storage.

1/4" CARTRIDGE ALSO AVAILABLE

Dylon

9561 Ridgehaven Court, San Diego, CA 92123
(619) 292-5584 • TWX 910-335-1524

CIRCLE NO. 164 ON INQUIRY CARD

MINI-MICRO SYSTEMS/July 1983

CalComp introduces the MBA.

Every computer system has the business basics—accounting, finance, administration.

But when end users or OEMs add CalComp's M-84 plotter, their system becomes an MBA (Master of Business Art) that produces presentation-quality graphics for less than \$2,000.

The M-84 actually makes your system a little smarter. It's based on the Z80 microprocessor and has built-in firmware for five line styles, selectable character rotation, six different character sets and circle, arc and sector generation. It can also work as a printer and digitizer.

M-84 is fast, precise and quiet. It plots at speeds up to 177 inches per second with resolution of .004 inches on paper or film for overhead projection.

M-84 is analytical and easy to maintain. Diagnostics test and report on interface and plotting functions on your command.

The M-84 is versatile. There are three standard interface models—Centronics, IEEE and RS-232, and most popular applications software packages, including ISSCO's DISSPLA and TELL-A-GRAF, SAS/GRAF and Digital Research CP/M-based Graphic System Extension.

Our M-84 is colorful—8 pens, 8 colors. The high number of pens means faster plots and easier operation because users won't have to switch pens to get more colors.

Don't wait to get your M-84. Call your CalComp representative today.

California Computer Products, Inc., M/S3, 2411 West La Palma Ave., Anaheim, California 92801. In continental U.S. except California, call (800) 556-1234, ext. 156. In California (800) 441-2345, ext. 156.

CALCOMP
A Sanders Graphics Company
SANDERS



New Products

DATACOMM

Local-area network supports multiple microcomputers, operating systems

The ShareNet Networking System includes hardware and software for networking as many as 24 personal computers. In the ShareNet System, personal computers are connected via a local-area network to a Motorola MC68000-based network manager and file server. The MC68000 runs an operating system that administers shared resources, including 20M to 120M bytes of on-line disk storage, 256K bytes to 1M byte of RAM and as many as five printers.

The ShareNet operating system is vendor independent for both the microcomputer workstation and the microcomputer operating system. As a file server, the ShareNet operating system allows different operating systems running on networked microcomputers to share the same directory areas and data files concurrently. For example, an IBM Personal Computer running under PC-DOS and a Z80-based microcomputer running under CP/M-80 can view the same directories and access the same file structures. The ShareNet directories appear as logical drives under the respective operating systems. Security for the data on the network disk is imposed at the file, user, user group and directory levels. ShareNet software manages as many as five network printers in a spooled

fashion. Pipes are provided for direct station-to-station communications.

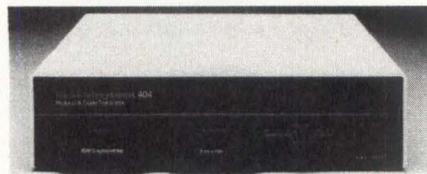
The basic topology of the ShareNet System is a Star network. Each workstation has its own cable connected to the network processor, with the network processor as the center. Personal computers connect to the network through a network interface card. Data-communications rate is 300K to 500K baud for each station. The Star topology allows each workstation to send and receive packets at its own rate without data path contention with other workstations.

A six-port network processor is priced at \$7995 in single-unit quantities. A node processor that converts a dumb CP/M terminal into an intelligent workstation and interfaces the terminal to the network processor is priced at \$1721. A network interface card for an IBM Personal Computer is priced at \$250. Network shared disk drives are priced from \$5000 to \$9000. **Novell Data Systems Inc.**, 1170 N. Industrial Park Dr., Orem, Utah 84057. **Circle No 326**

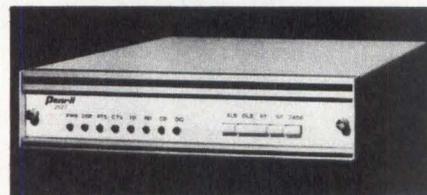
Protocol translators allow communications

The models 101, 202 and 404 protocol translators allow normally incompatible word-processing systems to communicate with each other, thus eliminating the need for physical transfer and manual rekeying of documents. The model 101 is designed for business applications in which text conversion is required between two word processors. Complete translation of text is handled internally by the fixed protocol software located in the model 101 EPROM. The user selects two protocols to match those of both end word processors when ordering the model 101. The model 202 provides on-line network capabilities among different word processors. A private communications network is formed by installing a model 202 at each site and connecting them over hard-wire circuits or voice-grade telephone lines. The model 202 uses a plug-in cartridge system offering a selection of 17 protocols. The model 404 protocol translator allows a wide variety of word

processors at separate locations to communicate with a central word-processing system. All protocol translation in receive or send operation is



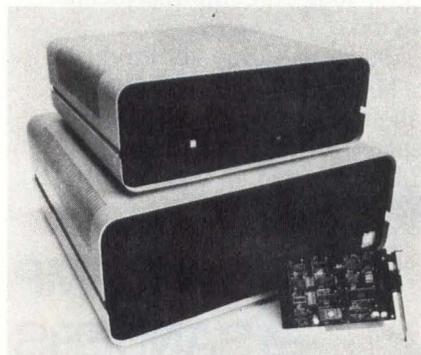
handled by the model 404 located at the central site. A dual, plug-in cartridge system for protocol translation eliminates the need for a protocol translator at both ends. All three models operate at data rates from 50 to 9.6K baud and feature built-in self-diagnostics, error reporting and inclusion of error codes on received documents. In addition, the models 202 and 404 feature a user-selectable direction of translation and automatic sequence initialization. Prices are \$3995, \$3195 and \$4995 for the models 101, 202 and 404, respectively, in single-unit quantities. **Racal-Telesystems Inc.**, 410 N. Michigan Ave., Chicago, Ill. 60611. **Circle No 327**



LSI modem features low error rate

Operating at 4800 or 2400 bits per sec., the model 2027 LSI modem can be used on two- or four-wire leased lines in point-to-point or multi-point applications. The CCITT V.27 bus-compatible modem includes an automatic adaptive equalizer that adjusts for variations in line properties. Other features include a selectable data quality alarm that alerts the operator if the error rate exceeds one error in 10^5 bits. The 2027 stand-alone model has a single-quantity price of \$1595. Rack-mount and single-card OEM versions are also available. **Penril Corp.**, 5520 Randolph Rd., Rockville, Md. 20852.

Circle No 328



Novell Data Systems' ShareNet networking system is built around an MC68000-based network processor, a central disk subsystem shared by all nodes on the network and individual network interface cards for each workstation. Software for electronic mail and database management is optional.

NEW...

from DATARAM

MOTOROLA
VERSAbus

1.0 MB
ADD-IN

Not just
more capacity;
more capability

Motorola's 68000 is a winner, and using this popular microprocessor in a VERSAbus/VERSAbord configuration is a smart move. Dataram's new single-board 1.0 MB DR-680 can make it even smarter. Increased single-board memory capacity means lower power, less space, higher reliability, and lower cost...and the DR-680 provides a lot more!

More speed: Ability to perform match cycles reduces access/cycle times by allowing immediate reading of data registers when adjacent words/bytes are accessed.

Advanced error handling: The DR-680 provides an on-board control and status register (CSR) which allows program control of ECC functions and contains the diagnostic information required for error analysis. The CSR can be read or written via the VERSAbus. Additionally, the DR-680 greatly increases reliability by performing error "sniffing" and error "scrubbing" during refresh operations.

Availability: Best of all, the 1.0 MB DR-680 is available now. And it comes with Dataram's standard one-year warranty.

For more information, send in the adjacent coupon or, for faster response, call Dataram today at (609) 799-0071.

VERSAbus and VERSAbord are registered trademarks of Motorola, Inc.

Dataram • Princeton Road • Cranbury, NJ 08512

MORE PERFORMANCE FROM MY VERSABUS!

- Sounds great. Please call me with more details.
- I'm interested. Send more information.

Name _____
Title _____
Company _____
Address _____ State _____ Zip _____
City _____
Telephone _____
MM783

DATARAM

DATARAM CORPORATION
Princeton Road,
Cranbury, NJ 08512

Before you buy a printer look at the fine print.

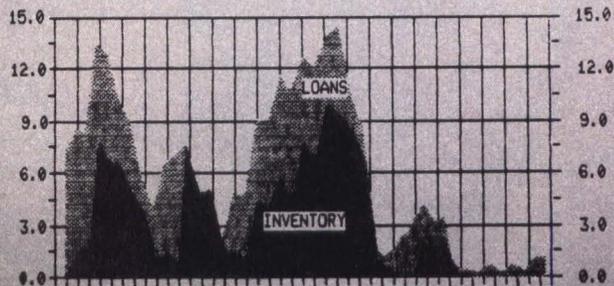
There's a big difference in printers, and the proof is right before your eyes.

This is an actual printout from Digital's Letterprinter 100. As you can see, it's good enough to send out to customers.

But that's not all the Letterprinter 100 can do. Suppose, for instance, you're in a hurry.

JUST PUSH A BUTTON AND YOU CAN PRINT OUT A WHOLE PAGE OF DRAFT COPY IN LESS THAN TEN SECONDS.

There are other fine points. You can see how the Letterprinter 100 can print multiple typefaces. It can also print in **BOLD**, **double-width** and **condensed**. And do all these styles automatically, without stopping. And with its wide range of graphics capabilities, you can even draw your own conclusions.



You simply can't find a more versatile printer than the Letterprinter 100. And it's just one of a family of printers we offer for Digital's personal computers and video terminals. Including a daisy-wheel printer, the LQP02, and a low-cost Personal Printer, the LA50, that still make you look good on paper.

So now that you've read the fine print, see our fine printers.

Call 1-800-DIGITAL, extension 700, for the distributor near you.

Or write Digital Equipment Corporation, Terminals Product Group, 2 Mt. Royal Avenue, UP01-5, Marlboro, Ma. 01752.

digital

CIRCLE NO. 151 ON INQUIRY CARD

New Products

SOFTWARE

KBASIC has file-management capabilities

KBASIC integrates Microsoft's MBASIC interpreter with keyed indexed-sequential search routines that provide multi-key indexed-sequential and direct-access record management using 14 file-handling verbs. The file managers maintain deleted-record buffer tools and space-allocation checkpoints, eliminating the need for user file-maintenance operations. A single program can have as many as four ISAM files and 16 DAFM files open simultaneously. Direct-access files accept record sizes from 64 to 512 bytes long. KBASIC runs on 8080/8085- and Z80-based microcomputers under the CP/M or TurboDOS operating system. Price is \$475. **Eidos Systems Corp.**, P.O. Box 3216, Nashville, Tenn. 37219.

Circle No 329

Performance analyzer measures data-processing

Series/1 Performance Analyzer runs on IBM Series/1 computers under the EDX operating system to measure data-processing activity. A single program can be analyzed iteratively to determine which source statements are using excessive computer resources. During successive iterations, the analyzer observes progressively narrower ranges of statements until the problem is pinpointed. The analyzer can also be used to examine system behavior when several programs are competing for resources. Disk-file and central-processor usage are tracked for each program to identify wait time and contention problems. A corporate license is priced at \$3500. **H&A Computer Systems Inc.**, 30 Hoteling Place, San Francisco, Calif. 94111.

Circle No 330

Program aids multidrop-network design

Optinet, running on Apple II microcomputers, is intended to design and predict line charges for intercity multidrop data networks. The package incorporates AT&T interstate tariffs and location information for 212 cities and uses the Esau-Williams algorithm in cost computation. A user can add tariffs and data for other cities. The analyst specifies the central site and other nodes of the planned network. Optional entries

include amount of traffic expected at each node and maximum number of drops and maximum traffic permitted in each network segment. Optinet then defines a network said to minimize monthly charges and satisfy the entered constraints. Price is \$599. **Le Roux International Inc.**, 3090 Acushnet Ave., New Bedford, Mass. 02745.

Circle No 331

Software simulators test application programs

A line of software simulators that runs on DEC PDP-11 computers helps programmers test application software for Intel 8080/8085 and 8086/8088 and Zilog Z80 microprocessors. Each simulator provides major functions and features of a microprocessor including instruction execution, hardware registers, input/output and interrupts. Intel hex files can be loaded into simulated memory. Programs execute under breakpoint control; trace mode provides execution history. Contents of registers and memory can be displayed and modified. Assembly, disassembly, symbolic debugging and relocatable values are provided. A count of executed cycles is kept. Prices start at \$1400. **Virtual Systems Inc.**, 1500 Newell Ave., Walnut Creek, Calif. 94596.

Circle No 332

Mainframe development supports Displaywriter, PC

VM-86, a multitasking, multi-user supervisor with virtual memory for both the IBM Displaywriter and the IBM Personal Computer, and V1.4, a virtual COBOL Host compiler for OS/VS, permit users of IBM's most popular small computers to develop and maintain interactive COBOL applications centrally using mainframe-development tools and communications. The Virtual COBOL Host compiler can be used in batch and interactive mainframe environments to develop and maintain interactive COBOL applications for VM-86. The output of the compiler can also be used with the IBM Virtual COBOL System Executive for the Series/1. VM-86 provides a multitasking, multi-user virtual-memory system equal to the IBM Virtual COBOL System Executive including dynamic JCL, logical resource sharing, device-independent I/O, indexed data files, sort, timer support and communications

facilities. The system features time-slicing, priority dispatching and paging support for Virtual COBOL applications developed using the Virtual COBOL System Executive on an IBM Series/1. Perpetual license fees for the Virtual COBOL Host compiler and VM-86 are priced at \$5000 and \$1000, respectively, per system. **Advanced Software Products Inc.**, 100 E. Linton Blvd., Tower B, Delray Beach, Fla. 33444.

Circle No 333

Cross-reference facility runs on 6809 computers

XRF, a cross-reference facility for Motorola 6809-based microcomputers using the OS9 operating system, simulates the abilities of a full database system without the related overhead in CPU time and disk usage. Using Boolean logic, XRF routines maintain a separate ISAM file containing the information to link logically associated records. The primary data ISAM file can be considered a multiple-key file when used with XRF. XRF must be used with the vendor's ISAM software. The ISAM software features sequential and random access in any combination for keyed and unkeyed records. XRF is priced at \$100 if purchased at the same time as ISAM (priced at \$350). If purchased separately, XRF is priced at \$200. **JBM Group Inc.**, Department 11C, 332 W. Church Rd., King of Prussia, Pa. 19406.

Circle No 334

Interface package links Displaywriter to IBM hosts

With this interface package, an IBM Displaywriter word-processing station can be used as an interactive terminal to communicate with an IBM System/34, System/38 or 370 host via the SDLC or BSC protocols. The package operates with the vendor's Gateway software, running in an IBM Series/1 computer that acts as a front end to the host. The Displaywriter connects to the Gateway computer via direct-connect, direct-dial, leased-line or X.25 packet networks and communicates with it at speeds as high as 9600 bps. The Displaywriter appears to the host as a 5251 or 3270 terminal on a multidrop line. The Displaywriter-resident software is priced at \$300. **Systar Corp.**, 1762 Technology Dr., San Jose, Calif. 95110.

Circle No 335

New Products

LITERATURE



Guidebook on using data-conversion products

The 32-page Designers' Guide and Handbook for data-conversion products details formulas, definitions and application considerations for building signal-processing systems that meet a user's real-world requirements. The book also includes condensed specifications and selection criteria for a broad range of A/D and D/A converters, sample-and-hold circuits and ancillary devices useful in creating precision signal-handling circuits and systems. **Analogic Corp.**, Audubon Rd., Wakefield, Mass. 01880. **Circle No 336**

Reference helps locate software for DEC computers

This 228-page software-referral catalog lists and describes more than 600 engineering-application software packages that are compatible with Digital Equipment Corp.'s computer systems. It covers chemical, civil/architectural, CAD/CAM, earth-resource, electronic, mechanical, optical, power-systems and structural engineering. General engineering tools and management and administration packages are also covered. A companion volume, the 69-page graphics-referral catalog, lists and describes more than 175 graphics hardware devices and software tools that are compatible with DEC computer systems. It covers display, hard-copy and input devices. **Digital Equipment Corp., Engineering Systems Group**, Two Iron Way, Box 1003, Marlboro, Mass. 01752. **Circle No 337**

Resale telephone networks described

A three-panel, color brochure describes the field of resale telephone networks with emphasis on required switching equipment. It details how deregulation in the telecommunications

industry permits entrepreneurs, inter-connect companies, hotels and others to resell the services of common carriers, satellite networks, AT&T and others. The publication explains how features of the vendor's tandem switching systems, such as automatic route selection and detailed station-message accounting, increase profits by routing calls through the optimal calling path and ensure accurate customer billing. **Harris Corp., Digital Telephone Systems Division**, Novato, Calif. 94948. **Circle No 338**

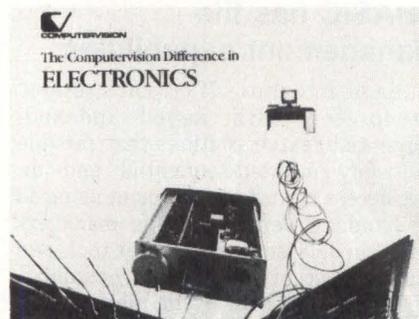


Power sources catalog explains power problems

A six-page product catalog describes the potential electric-power problems confronting users of high-technology equipment and details the vendor's line of motor-generator-based load-isolation computer power conditioners, rotary uninterruptible power supplies and frequency converters. The brochure also provides product warranty information and service provisions. **Computer Power Products**, 227 E. Compton Blvd., Gardena, Calif. 90248. **Circle No 339**

Magnetic-tape drives for DEC, DG computers

A family of magnetic tape drives for DEC and DG computers is described in an illustrated, color brochure. The brochure provides details, features and specifications of the company's DMT3000 series rack-mountable digital magnetic-tape drives. These drives connect directly to the DEC PDP-11, LSI-11, VAX-11 and DG Nova and Eclipse computers without program changes. **Unitronix Corp.**, 197 Meister Ave., Somerville, N.J. 08876. **Circle No 340**



Brochure describes use of CAD/CAM in electronics

A 12-page color brochure describes how the vendor's Designer CAD/CAM system can increase productivity in electronic design and manufacture. The brochure describes how the Designer system can be used for the design and manufacture of integrated circuits, hybrid circuits, PC boards, wiring diagrams and electromechanical packaging. **Computervision Corp., Marketing Communications Department**, 3 Oak Park, Bedford, Mass. 01730. **Circle No 341**

Card badge reader is used in industrial applications

The vendor's line of serial and static punched-card and badge readers for industrial applications in warehousing, assembly lines, process controls and security systems is described in an 18-page catalog. The illustrated catalog details the series HT manual badge-/card-reader terminals, motorized serial readers and microprocessor-controlled card readers. The catalog also includes information on static or parallel readers. **Taurus Corp.**, Box 278, Lambertville, N.J. 08530. **Circle No 342**

Computer-based instructional aids listed

Offerings in the vendor's Microcourse series in reading and language arts for grades three to eight are listed in a four-page brochure. These software-based curriculum materials cover more than 350 skills on 114 diskettes in reading and more than 440 skills on 136 diskettes in language arts. The brochure groups the diskettes into grade levels and lists the diskettes by title within each grade level. **Houghton Mifflin Co.**, One Beacon St., Boston, Mass. 02108. **Circle No 343**



Take your data places it's never been before.

Fiber optics technology can not only dramatically increase your data transmission capabilities, it can also simplify all the practical problems associated with linking computer systems and peripherals in local networks. It provides data security and freedom from interference unattainable with traditional wire-only systems.

As a major step towards making fiber optics available for every plant or office application, Hewlett-Packard is pleased to announce the HP 39301A multiplexer. It accommodates up to 16 peripherals and allows you to send data at distances up to one kilometre at speeds up to 19.2 kbps per channel simultaneously with a bit error rate of less than 10^{-9} . It is

completely compatible with your existing RS-232-C (V.24) I/O ports.

The information you need to evaluate the potential of fiber optics for your application has been put into a new brochure, "The Hewlett-Packard Fiber Optic Multiplexer," that is available free for the asking.

Show me! I'd like the facts on how HP's fiber optic technology can make my data communications more productive. Please send me my free copy of "The Hewlett-Packard Fiber Optic Multiplexer" immediately.

NAME	TITLE
COMPANY	ADDRESS
CITY/STATE/ZIP	PHONE
YOUR COMPUTER	INTENDED CONFIGURATION

In the U.S., mail coupon to: Hewlett-Packard Company • 640 Page Mill Road • Palo Alto, CA 94304.
In Europe: Hewlett-Packard, Nederland BV, Central Mailing Department • P.O. Box 529 • 1180 AM Amstelveen • The Netherlands.

When performance must
be measured by results.



**HEWLETT
PACKARD**

New Products

LITERATURE

Brochure explains architected software

A 12-page, color brochure describes the "architected" software approach used on the vendor's new family of array processors. The brochure contains an overall description of how the software is architected into strictly defined functional layers that are fine-tuned to corresponding system components and application needs. Sections are included on software tools for application development including AP Linker, Assembler and Interactive Debugging Tools. In addition, the run-time system software and AP function libraries are described as well as the software services available. **Analogic Corp.**, Audubon Rd., Wakefield, Mass. 01880. **Circle No 344**

Tektronix-compatible graphics featured

An updated, six-page brochure describes the second generation of

Retro-Graphics terminal enhancements. Called GEN.II Retro-Graphics, the low-cost, PCB kits convert standard alphanumeric displays into Tektronix-compatible, bit-map graphics terminals. The full-color brochure also details the company's history, product manuals, warranties, services and line of I/O interfaces used in interactive Retro-Graphics applications. **Digital Engineering Inc.**, 630 Bercut Dr., Sacramento, Calif. 95814. **Circle No 345**

Ada style manual illustrates program structuring

This six-page guide for Ada application programmers illustrates techniques for efficient program structuring. Numerous examples show preferred methods for in-house standardization of program syntax. The style recommendations are based on the examples in the *Reference Manual for the Ada Programming Language*, U.S. Department of Defense, July, 1982, with additions and changes made as a result of the

vendor's discoveries and usage experience. **Intellimac Inc.**, 6001 Montrose Rd., Rockville, Md. 20852.

Circle No 346

Basic industrial-control described in brochure

The vendor's BASIC industrial-control packages as well as its line of industrial-grade microcomputer modules are illustrated and described in a brochure. Featured are the RacPac 8 and RacPac 12 industrial rack-mount enclosures and 1872+ Industrial BASIC module. The products are intended for control, data acquisition and similar applications and are designed, manufactured and tested to operate reliably in industrial and other harsh environments. The brochure also lists the vendor's industrial-software offerings and its customer-service capabilities. **Xycom Inc.**, 750 N. Maple Rd., Saline, Mich. 48176. **Circle No 347**



Make the most of your hardware

SWITCH-IT

A Switch Box can add to the versatility of your equipment—permanent connections avoid the need to change cables manually to and from terminals, modems, CRT's, for example. A way to make CPU's or peripherals do extra duty. More than a dozen different kinds of ABC and ABCDE switch boxes, and Transfer Boxes in stock. Just for instance:

RS-232 ABC box \$99.50
RS-232 ABCDE box \$198.00
(Female connectors standard; male available on special order.)

Call or write for information and new catalog

ds cc The Company with a lot of Connections
Data Set Cable Company, Inc.

East 722 Danbury Road Ridgefield, Connecticut 06877 (203) 438-9684 TWX-710-467-0668	West 3001 Contract Avenue Las Vegas, Nevada 89101 (702) 382-6777
---	--

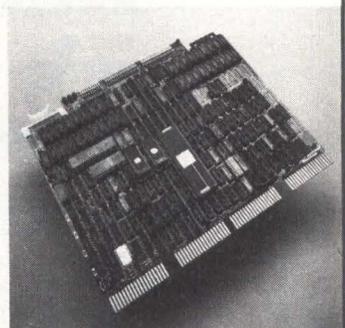
CIRCLE NO. 153 ON INQUIRY CARD

12MHz 68000 Based CPU On LSI-11* Bus • Runs UNIX*

You don't have to combine the high performance of a 12MHz 16/32 bit processor with the wide variety of peripherals available on the LSI-11 Q-bus and the versatility of the powerful UNIX operating system. We already have—with the IS-68K from Integrated Solutions.

CPU Features

- Single board, quad form factor
- 256Kb on-board, dual ported parity memory
- Dual bus design permits expansion of on-board memory to 4Mb with 1Mb array cards (available now)
- On-board and expansion memory runs with **no wait states**
- Hardware Q-bus arbitration logic allows 68000 to execute while DMA transfers occur
- 2 serial ports—programmable baud rates
- MMU: segmentation, paging system optimized for UNIX
- CPU can also use memory on Q-bus
- 8, 10, 12MHz versions (10MHz version exceeds performance of VAX 11/750*)



UNIX Features

- Full System III UNIX with enhancements
- Supports full range of Q-bus peripherals

CPU prices start at \$2395. Shipping **now** (delivery 30 days ARO). OEM, rep., distributor inquiries welcomed. For more information write or call:

(408) 374-2441



Integrated Solutions, Inc.
1350 Dell Avenue
Campbell, CA 95008

*LSI-11, Q-bus, VAX 11/750 are registered trademarks of Digital Equipment Corp. UNIX is a trademark of Bell Labs.

CIRCLE NO. 112 ON INQUIRY CARD

TOWER™ 1632.

A SHAPE YOU CAN WORK WITH. AT A PRICE YOU CAN LIVE WITH.

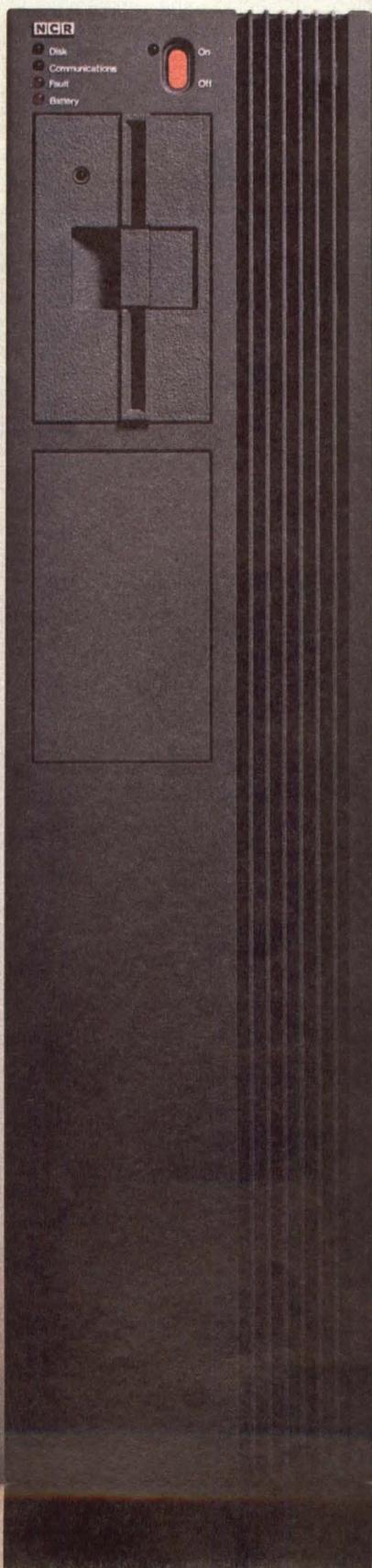
We call it "computer a la card."

Up to six microprocessor-based controller cards mounted into Tower™ 1632's Multibus* give system builders a range of hardware options until now available only to those with the resources to design, develop and manufacture a totally new system from the ground up.

You see, anyone could give you industry standard interfaces. Only Tower 1632 gives you the power to fully exploit all your options.

But it won't overpower your budget. Buy only what you need. Tower 1632 will arrive from the factory tailored for any application from one to sixteen users.

It's the system builder's ideal foundation. Mass storage



options, for example, range from a megabyte to a gigabyte. From networking to peripherals, it's as ready for the future as it is right for today. And the operating system, derived from UNIX**, delivers maximum software capability and portability.

So if your next computer isn't everything you want in a computer—no more and no less—you didn't call us. (The number is 1-800-222-1235.)

Tower's OEM price starts under \$10,000. And its performance never stops.

NCR Corporation, World Headquarters, OEM Marketing Division, Dayton, OH 45479.
Nationwide (800) 222-1235.
In Ohio (513) 445-2380.
In Canada (800) 268-3966.

**BUILT FOR SYSTEMS BUILDERS.
TOWER 1632.**

NCR
OEM Marketing Division

CIRCLE NO. 154 ON INQUIRY CARD

*Multibus is a trademark of Intel.
**UNIX is a trademark of Bell Laboratories.

Products for delivery in U.S.A. will comply with appropriate FCC rules.

New Products

LITERATURE

LITERATURE THAT COSTS

Reference discusses cryptographic systems

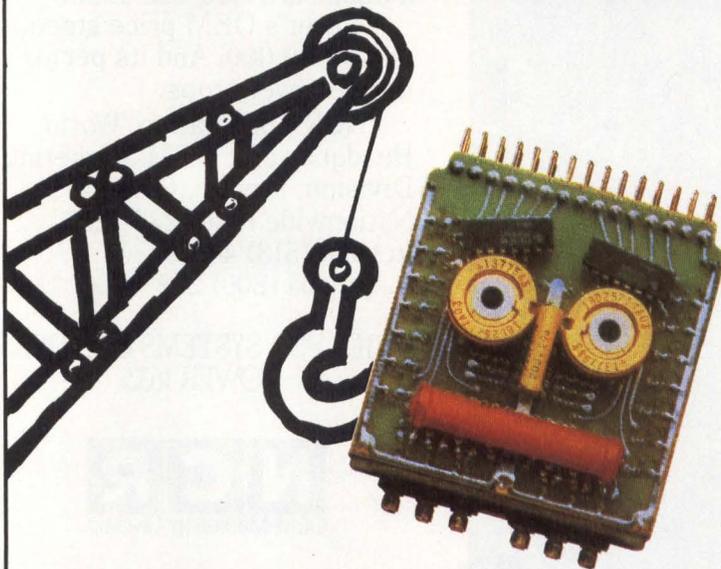
Cryptography: A New Dimension in Computer Data Security is an

application-oriented guide to planning, designing and implementing cryptographic systems for protecting information transmitted through large communications networks such as telephone lines, microwave or satellite. Written by Carl H. Meyer and

Stephen M. Matyas, the 755-page book is geared for non-experts confronted with problems of cryptographic design and implementation within a communications network or electronic data-processing system. The authors show what problems can be solved using cryptography, when cryptography is a solution to a data-security problem and when it is only a partial one. Single-copy price is \$39.95. **Wiley-Interscience**, 605 Third Ave., New York, N.Y. 10158.

Circle No 348

WHEN YOUR MODULE DRIVE RUNS OFF TRACK, WE'LL GET IT BACK ON THE ROAD. FAST.



CALL CONTROL DATA. 800/328-3980

IN MINNESOTA 612/931-3131

When your CMD (or any other drive in the storage module family) isn't running smoothly, call us. We repair and maintain dozens of makes and models. We're located nearby, in 50 cities throughout the United States.

 **CONTROL DATA**

*Addressing society's major unmet needs
as profitable business opportunities*

Research tool provides access to standards

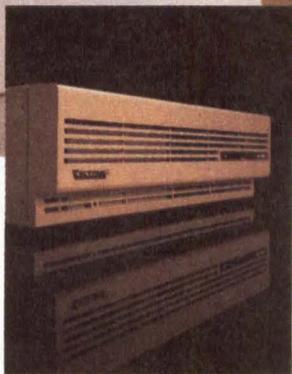
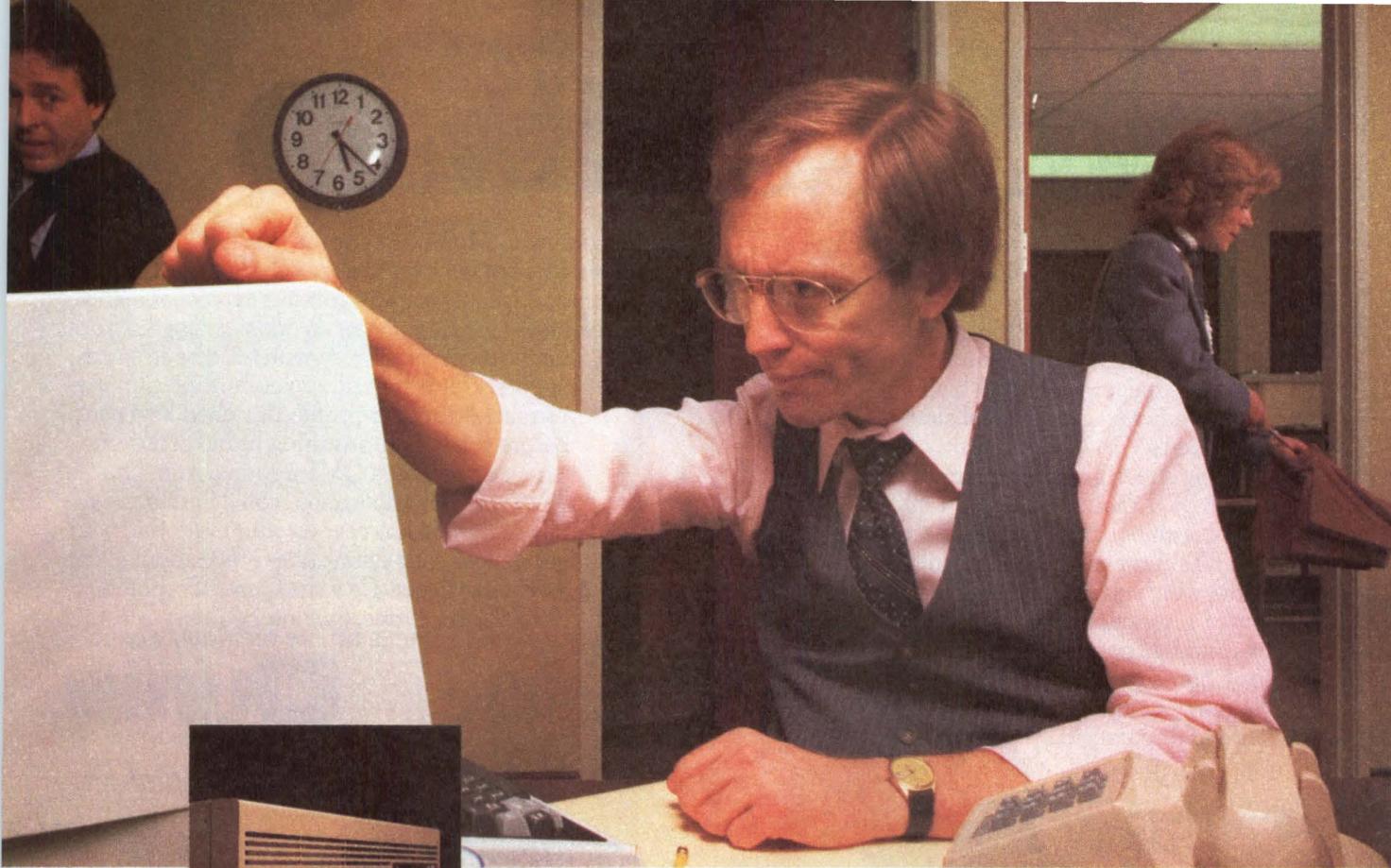
The 1983 edition of the *Catalog of American National Standards* lists all current ANSI-approved standards. The standards establish dimensions, ratings, terminology and symbols, test methods and performance and safety requirements for materials, equipment and products ranging from abrasives to zippers. The 192-page catalog is divided into two major sections. One section lists the titles of all standards under alphabetic subject headings. Each entry includes title, designation, price and discount information if applicable. The other section is a compilation of the designations of all standards listed. Each entry refers to the subject heading under which the complete listing appears and also gives price and discount information. Single-copy price is \$10. **American National Standards Institute Inc.**, 1430 Broadway, New York, N.Y. 10018.

Circle No 349

Telecommunications reference manual

The 350-page *Executive Telecommunications Planning Guide*, which is updated monthly, contains a glossary of terms, a directory of common carriers with rates and descriptions of all their service offerings, a list, by area code and exchange, of all the U.S. rate centers, a chart showing the availability (by city) of each of the full-period and measured-use services, traffic tables, carrier interconnection specifications, a tariff directory and an intercity mileage chart. The guide also contains cost-of-service estimating guides, frequently used telecommunications formulas and conversion tables, operator position planning data,

CIRCLE NO. 155 ON INQUIRY CARD



“What good is 9600 baud if your stat mux slows you down?”

Speed can be addictive, that's a fact. Once users get accustomed to fast feedback they just don't want to hear that your lines are overloaded or your mux just can't keep pace. They want their data and they want it now.

To help you avoid these baud rate bottlenecks, Telnet is happy to introduce our new M-860 Statistical Multiplexer.

You want speed? It's a thoroughbred at up to 78,600 bps, so you can take full advantage of 56K bps DDS circuits. You need flexibility? It's a chameleon that offers six different data link interfaces—two with integral modems.

Efficiency? It's an unparalleled performer that delivers multiplexing efficiencies of 800% and more. Friendliness? This is your mux—fully programmable from the local or remote end with an interactive menu system that also provides access to diagnostics and statistics. You'll never deal with DIP switches again. The M-860 is compatible with our own DCS-2 Data Carrier system and voice-grade lines, but it works equally well over microwave, coaxial cable and fiber-optic hookups.

Want more? How about local or remote echoplex, full field expansion, CRC error detection and ARQ retransmission, speed conversion—plus the same dependable service we've been giving the telecommunications industry for more than 15 years.

It's a combination that's really hard to beat, in a mux for people who'd rather be working than waiting. Call 1-800-227-3800 Ext. 2301 (in California 1-800-792-0990) or write Telnet Corp., PO Box 657, Kirkland, WA 98033. In Canada call (406) 475-0837 or write 91 Telson Road, Markham, Ontario L3R 1E4.

TELNET

CIRCLE NO. 156 ON INQUIRY CARD

Our 14" screen option won't strain your eyes. Or your budget.

With our new large-screen option, the advantages of Qume's QVT™ family of terminals are even easier to see.

In the ANSI X3.64 environment, our QVT 103™ can now give you one of the clearest, most readable 132-column data displays you've ever seen. As well as the low price and high flexibility that already make it the ideal alternative to Digital's VT100 terminals.

And the big screen gives extra eye appeal to our other QVT models—the QVT 102™, our low-cost terminal that emulates the most popular CRTs at the touch of a key, and the QVT 108™, which gives you the power and flexibility of 11 function keys, 12 editing functions and two pages of memory. Choose the 14-inch screen option for either, and you've added unparalleled

readability to what is already the best CRT in its class. Screen size is only one reason why QVT terminals have the clear edge for operator comfort and convenience. There's also Qume's superior ergonomic design: a non-glare green or amber display, with full tilt and swivel. A big 9x12 character cell to even further minimize eyestrain. And a low-profile, detached keyboard.

Before you choose any other brand of terminal, size it up against a QVT terminal from Qume. Whatever your application, you'll find the QVT family of terminals is easy on your eyes. And your budget. Talk to your Qume sales office about filling all your terminal needs. Or write Qume Corporation, 2350 Qume Drive, San Jose, California 95131. **CIRCLE NO. 157 ON INQUIRY CARD**

Qume
A Subsidiary of ITT

QUME CORPORATION

HEADQUARTERS
2350 Qume Drive, San Jose, CA 95131

CALIFORNIA
San Jose (408) 942-4111
Culver City (213) 410-1458
Santa Ana (714) 957-4040

COLORADO
Aurora (303) 752-3000

ILLINOIS
Palatine (312) 991-7250

OHIO
Dayton (513) 439-0469

TEXAS
Irving (214) 659-0745

NEW JERSEY
Edison (201) 225-5005

MASSACHUSETTS
Bedford (617) 275-3200

GEORGIA
Decatur (404) 284-8500

GERMANY
Düsseldorf
PH 0211743016

ENGLAND
Reading, Berkshire
PH: 734-584-646

FRANCE
Boulogne
PH: (1) 6082334

CANADA
Quebec PH:
(514) 695-3837



New Products

LITERATURE

modem interface specifications and strapping arrangements. Annual subscription fee is \$450. **Center for Communications Management Inc.**, P.O. Box 324, Ramsey, N.J. 07446.
Circle No 350

Book exposes TRSDOS 2.3 operating system

Authorized by the Tandy Corp., *TRSDOS 2.3 Decoded and Other Mysteries*, by James Favour, guides programmers through the internal operations of the TRSDOS operating systems of the Radio Shack model 1 computer. Although a knowledge of basic computer architecture and assembly language is assumed, the reader need not be familiar with the details of either on the model 1, as the significant features of both are presented in the text. The book details the components of the TRSDOS operating system including file-system modules, the command-line interpreter, the error-message processor and the debug module. The entire TRSDOS operating system code with detailed comments is included in an appendix. Single-copy price is \$29.95. **IJG Inc.**, 1953 W. 11th St., Upland, Calif. 91786.
Circle No 351

Standard specifies expanded keyboard

The ANSI X4.23-1982 standard provides recommendations on the arrangement of a 48-key, 96-character keyboard for typewriters, word processors and other alphanumeric-keyboard machines. The standard provides specifications for the keyboard arrangement of the 44 basic printing keys. It also provides for four additional keys and supplies users and manufacturers with recommended graphic characters and substitutions for extra keys. Graphics characters suggested for placement on the additional keys include the symbols for degree, plus/minus, left and right brackets, superscripts 2 and 3, paragraph, section, less than, greater than, the Greek μ and product dot. Copies of the standard are priced at \$5 each. **American National Standards Institute Inc.**, 1430 Broadway, New York, N.Y. 10018.
Circle No 352

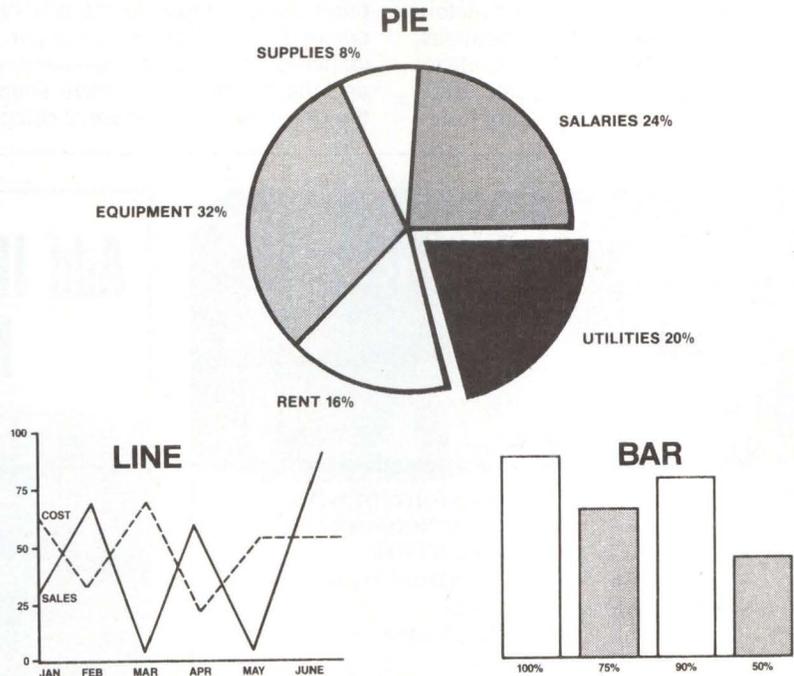
Second volume on database systems

A sequel to the author's previous book on the same subject, the 383-page *Introduction to Database Sys-*

tems, Volume II provides an in-depth tutorial on a variety of topics that were excluded from the earlier book. Author C.J. Date describes the principles underlying recovery, concurrency and security of database systems with examples from implemented systems.

Saturn-Graph™

PLOTS TO GIVE YOU
AFFORDABLE BUSINESS GRAPHICS



- Simple to use; interfaces with SATURN-CALC
- Runs under RT/TSX, RSX, RSTS, VMS
- Variety of type styles
- Many printers, plotters & CRT's supported

TOLL FREE 1-800-328-6145

SATURN®

SATURN SYSTEMS, INC.

6875 Washington Ave. So., Suite 218, Minneapolis, MN 55435 (612) 944-2452

CIRCLE NO. 158 ON INQUIRY CARD

New Products

LITERATURE

He also discusses semantic modeling, the treatment of missing information and distributed transaction management. Single-copy price is \$26.95. **Addison-Wesley Publishing Co.**, Reading, Mass. 01867.

Circle No 353

Directory describes computer publications

Designed for information specialists and others interested in industry publications, *Select: A Guide to Computer and Software Publications*, is a directory of serial publications serving the computer and software industries. Scheduled for shipment in September, the directory describes more than 500 publications. *Select* serves as a reference guide for identifying industry periodicals. Each entry in the directory includes

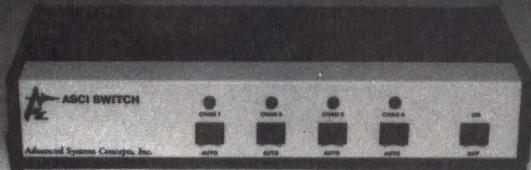
publication name, content description, cost, publisher and address, average number of pages, audience and advertising information. The directory also has an alphabetical list of publications and indexes to publishers and topics. The pre-publication price for *Select* is \$50. After Sept. 1, 1983, the directory will sell for \$65. **Data Courier Inc.**, 620 S. Fifth St., Louisville, Ky. 40202. Circle No 354

Report explores Japanese personal computers

Volume 52 of the JIPDEC report, *RUN Personal Computers*, contains four articles that explore the sale and use of personal computers in Japan. The first article, "Trends in Personal Computer Usage," presents the history of personal computer use in Japan. It identifies the major manufacturers and the machines that have shaped the development of personal comput-

ers in Japan. The second article, "Distribution of Personal Computer Hardware/Software," outlines the distribution systems established in Japan for personal computer products and the various sales strategies employed by retailers. The third article, "Personal Computer Schools," deals with the educational and training applications of personal computers in Japan. The final article, "OMRON Tateishi Electronics Co.—An Example of Personal Computer Utilization," relates the experiences of a major Japanese company in its efforts to introduce personal computers into all phases of its operations. The JIPDEC report is published quarterly and is available for an annual subscription fee of \$85. **Japan Information Processing Development Center**, Kikai Shinko Kaikan Building, 5-8, Shibakoen 3-chome, Minato-ku, Tokyo, 105, Japan. Circle No 355

Sell More Systems With ASCI Switches



Increase your sales to customers who can benefit from ASCI Peripheral Networks NOW — NOT Ethernet LATER.

Provide your customers with:

- Port expansion and sharing
- Low operating cost and high system reliability
- Easy installation
- Simple operation in software control mode
- Manual override for priority switching
- Extended capability with multivendor equipment
- RS-232 and parallel Centronic compatibility

ASCI Peripheral Networking devices are **compatible** with the OEM equipment you want to sell:

Apollo - Altos - Burroughs - Data General
DEC - HP - IBM - NCR - Northstar - Xerox
and other key manufacturers

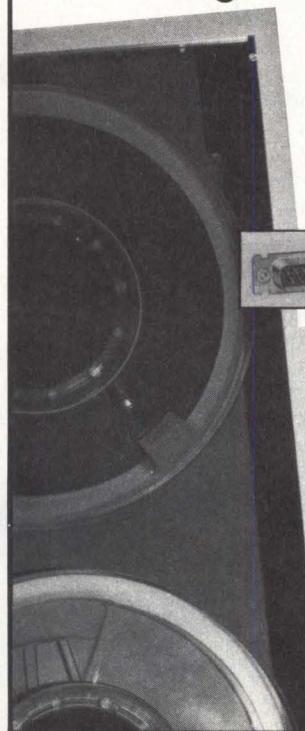
Call **213-793-8979** for the ASCI Systems Integrator Discount Schedule



Advanced Systems Concepts, Inc.
435 North Lake Avenue, Dept. W
Pasadena, California 91101
Telex: 701 215

CIRCLE NO. 162 ON INQUIRY CARD

Add IBM Format-Compatible Magnetic Tape To Any RS-232 Port With The IBEX STC-100



Plug-In 1/2" mag. tape drives to any mini or micro computer
Full read/write capability
Data logging
Call-detail recording

Write, phone or TWX for information



IBEX COMPUTER CORP.
20741 Marilla St.
Chatsworth, CA 91311
(213) 709-8100
TWX: 910-493-2071

CIRCLE NO. 159 ON INQUIRY CARD

MINI-MICRO SYSTEMS/July 1983

Here's Why You'll Be There, Too.

You want straight talk on what computer technology can do for you. And what it can do for your business. Minus the razzle-dazzle.

That's why you'll attend INFO 83, the world's largest exhibition of *business* computer systems. At INFO 83 you'll find the latest technology translated into the most effective information management applications. It's the only show broad enough to serve the complete computer system needs of 40,000 demanding executives. So you know it meets your needs, too.

Everything for Executive Decision Making. INFO 83 has more than 300 vendors of information management systems and equipment. All under one roof. All ready to demonstrate how computer systems can improve your control of information. And help you make the right decisions.

INFO 83 is your chance to run a word processor... or a dozen of them. Compare the personal computers designed specifically for professionals. Find the right PBX for your data network. And much more.*

INFO 83 has the world's largest software library — the Software Center, with over 75,000 packaged and custom programs.

Whether you're a corporate executive, MIS Director, DP Manager, or an independent entrepreneur, INFO 83 will help you put technology to work for your business.

**LAST YEAR
40,000
EXECUTIVES
CAME TO
THE WORLD'S
LARGEST
COMPUTER SHOW
FOR BUSINESS.
THIS
OCTOBER
EVEN MORE
WILL BE
THERE.**

Apply Yourself. At the Business Applications Conference.

Alongside the world's largest information management show is the largest, most comprehensive information management conference. Exclusively for business. Over 60 sessions designed to give you a better understanding of what the computer can do for your business. Whether you're a strategic planner or an implementer, an information manager or an information user.

Learn what you can and should expect from your decision support system. Chart the future of your office automation plan. Or make sure your personal computer is an effective business computer.

Attend a session on productivity improvement planning through manufacturing control. Discover what experts have learned about human resources and technology.

More than 200 authoritative speakers will focus on the specifics. Specific industries. Specific applications. Specifics that apply to *you*. And that you can apply to your business.

***Explore The Latest Business Applications For:**

- Personal Business Computers, Main frames, Minis & Micros/Data Communications/DataBases/Information Banks/Software Services/Peripherals & Accessories/Office Automation Equipment/Microfilm Equipment/Computer-Support Furniture/Information & Education.

**The Tenth International
INFORMATION
MANAGEMENT
EXPOSITION &
CONFERENCE**

New York Coliseum
October 10-13, 1983



MAIL TODAY FOR REDUCED-RATE TICKETS!

- Send _____ Reduced-Rate Tickets.
- Send _____ Conference Programs.

NAME _____
 TITLE _____
 COMPANY _____
 DIVISION _____
 STREET _____
 CITY _____ STATE _____ ZIP _____

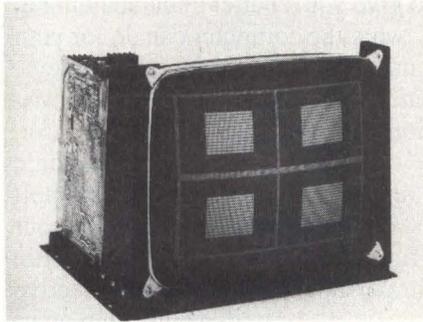
- I am interested in *exhibiting* in INFO 83.

Call me at (_____) _____

Mail to: Clapp & Poliak, Dept. I-83
708 Third Avenue, New York, NY 10017

New Products

SUBASSEMBLIES



Monitors feature long-term reliability

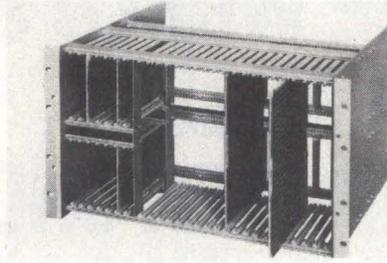
A family of high-resolution monochrome CRT monitors for graphics, workstation and composition system OEMs includes models with 15-, 17- or 19-in. diagonal CRTs. Monitors are available with as many as 1100 visible lines at a 60-Hz noninterlaced refresh rate and a choice of 70- or 120-MHz video amplifiers. The 70-MHz video amplifier accepts TTL, linear or ECL levels, while the 120-MHz video amplifier interfaces to differential ECL. Interlaced or noninterlaced 90-Hz vertical refresh rates and horizontal rates from 30 to 65 KHz are available. These CRT displays have been designed for long MTBF through conservative derating and low junction-temperature operation. Included on all monitors are a stator yoke, regulated high-voltage and dual-axis dynamic focus. For ease of maintenance, all electronics are on a single swing-out PC board. Diagnostic LEDs on all major circuit functions allow quick determination of status without test equipment. The monitors are available with any JEDEC phosphor, contrast-enhanced faceplates and anti-reflection coatings. Prices of the 70-MHz monitors range from \$685 to \$799 in OEM quantities. U.S. Pixel Corp., 125 Irving St., Framingham, Mass. 01701.

Circle No 356

Eurocard rack for double-sized VME boards

The model CKE2 high-capacity rack allows placing single- and double-sized VME-bus-compatible boards in one enclosure and has space in the rear for mounting large power supplies. The 19-in. EIA standard cage holds as many as 27 double-sized (6.3 × 9.19 in.) Eurocards or as many as 54 single-sized (6.3 × 3.94 in.) Eurocards. The CKE2 can also be configured to accommodate a

combination of Eurocard sizes. Bus interconnections are made with one 96-position connector on the single card and two connectors on the double card. Card-guide and connector-mounting holes are spaced on 0.2-in. centers, so that cards with varying components and



lead heights can be installed in any position. As the rear of the rack, a 10.5 × 16.8 × 5.5-in. space is available for power supplies with 1-in. clearance for backplane wiring. The rack measures 10.5 × 19 × 14.25 in. and weighs 5.7 lbs. Price is \$56.82 for the unassembled version, model CKE2U, and \$68.18 for the assembled version, model CKE2, in single-unit quantities. Vector Electronic Co., 12460 Gladstone Ave., Sylmar, Calif. 91342.

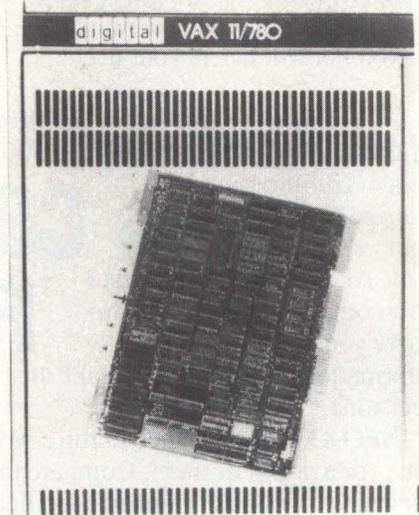
Circle No 357



Test instrument combines emulator, logic analyzer

The model 4009 emulator/logic analyzer for Motorola microprocessors combines a microprocessor emulator and an optional independently operated, 20-MHz, 32-channel logic analyzer into one instrument. It also features special digital-test-equipment functions such as clock operation and standby monitors, memory and bus testing, target system power monitor and voltage measurement. A separate 2-MHz, 6809E-based computer serves as the 4009's system supervisor. Measuring 17½ × 15 × 5¾ in., the model 4009 includes an emulator card set and pod assembly that supports the 6809 and 6809E processors, emulator trace, supervisory controller and an RS232C port. It is priced at \$6495 in single-unit quantities. The 32-channel

logic analyzer is priced at \$3995. Advanced Digital Technology Inc., 13400 Northrup Way, Building 27, Bellevue, Wash. 98005. Circle No 358

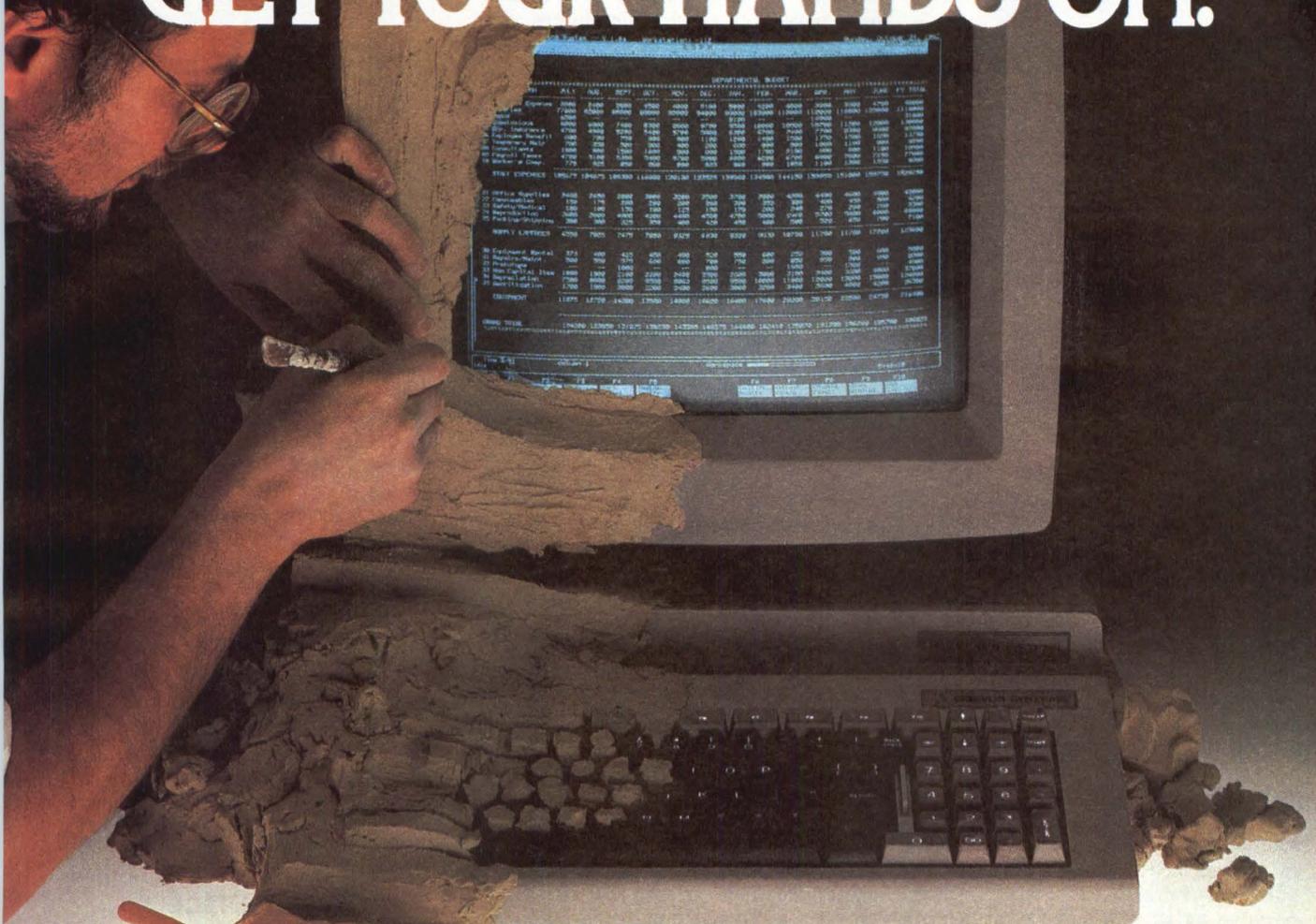


Coupler interfaces tape drives to DEC superminis

The model DU132 tape coupler interface board provides streaming- and start/stop-tape backup for Digital Equipment Corp. PDP-11/34 through PDP-11/70 minicomputers as well as VAX-11/750, VAX-11/780 and VAX-11/782 superminicomputers. The device interfaces with ½-in., start/stop, formatted nine-track tape transports from all major manufacturers or streaming-tape transports with embedded formatters from Cipher Data Products, Control Data Corp., Kennedy Co. and System Engineering Labs. The coupler permits data-transfer rates as high as 200K bytes per sec., with tape speeds as fast as 125 ips. When used in start/stop mode, it is software compatible with DEC VMS, RSTS/E, RSX-11M and RT-11 operating systems. A stand-alone utility software package accommodates the streaming-tape transports. A pair of 50-conductor ribbon cables links the DU132 with as many as four tape transports in a daisy-chain interconnection at distances as far as 25 ft. The DU132 is implemented on a standard DEC quad-width module measuring 10.44 × 8.42 in. Single-unit price is \$2850, with quantity discounts available. Distributed Logic Corp., 12800 Garden Grove Blvd., Garden Grove, Calif. 92643.

Circle No 359

THE SOFTEST PIECE OF HARDWARE YOU'LL EVER GET YOUR HANDS ON.



**PRESENTING
THE CORVUS CONCEPT™
THE 68000-BASED
PERSONAL WORKSTATION
THAT CAN BE QUICKLY
MOLDED TO FIT RIGHT
INTO YOUR APPLICATION.**

The Corvus Concept has a real soft spot in its heart for OEMs and systems integrators. That's why we offer so many software tools—ISO Pascal, FORTRAN 77, and many more. Plus plenty of internal

memory to use those tools: up to half a megabyte.

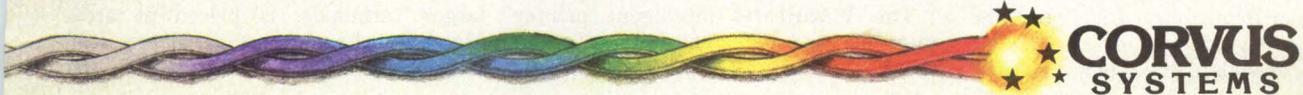
Our user interface is as soft a sell as you'll ever find, too. Take display formats, for example. With a fully bit-mapped screen—720 by 560 pixels—the Concept lets you mix any combination of graphics and text you want. Or create any character font your customer needs.

For display positions, the Concept is an equally soft touch. Horizontally, the screen can display 120 characters by 56 lines. Flip the screen vertically and you can display 80 characters by 72 lines. We've combined that flexibility with multiple

windows, finger-tip tilt and swivel adjustments, and 10 soft keys that define up to 40 displayed functions.

By the way, if you're wondering how hard it is to expand a Concept with peripheral add-ons, relax. It comes network ready via the Corvus OMNINET™ local area network. And its four expansion slots leave lots of room for growth.

So if you're trying to carve out a niche in the booming office automation market, start with a workstation that's like putty in your hands—the Corvus Concept. For full details, contact your Corvus Sales Representative today.

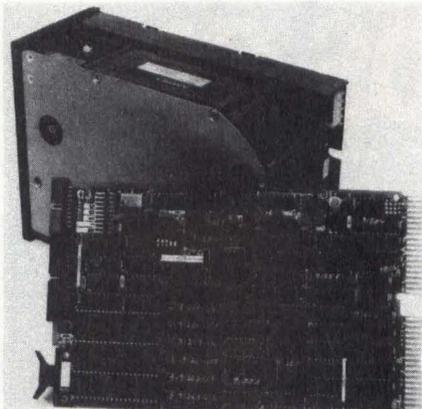


**CORVUS
SYSTEMS**

Tying it all together.

New Products

SUBASSEMBLIES



Controller matches LSI-11s with 5¼-in. Winchester

The model DQ614 disk controller interfaces one or two 5¼-in. Winchester disk drives with Digital Equipment Corp. LSI-11, LSI-11/2, LSI-11/23 and LSI-11/23 Plus microcomputers. The controller operates directly from the Q-bus without additional boards and emulates as many as four RL01 or RL02 disk drives giving formatted capacities as large as 41.6M bytes. Occupying a single dual-width slot in any LSI-11 backplane, the DQ614 is transparent to RT-11, RSX-11 and RSTS operating systems. The controller operates with drives that incorporate an ST-506 interface. A microprocessor-based universal formatting system compensates for drives with different characteristics such as number of heads, data-transfer rates, surfaces and capacities. The DQ614 measures 8.62 × 5.19 in. and requires 5V at 3.5A and 12V at 300 mA from the computer power supply. Single-unit price is \$1695, with quantity discounts available. **Distributed Logic Corp.**, 12800 Garden Grove Blvd., Garden Grove, Calif. 92643.

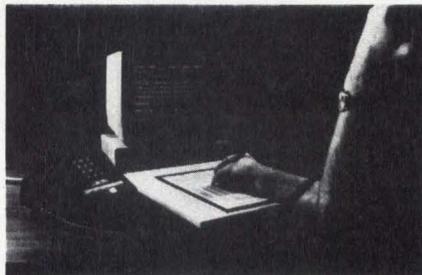
Circle No 360

Printer buffer interfaces popular computers, printers

The Microfazer hardware buffer/spooler can be used with almost any make of printer or computer and contains 8K bytes of RAM, user-expandable to 512K bytes. It has front-panel LEDs to give copy, ready and error status confirmation. A reset switch is provided to set the Microfazer and to clear its memory. Data rates and handshake signals are user-selectable on serial models. Single-unit prices of

the parallel-to-parallel Microfazer models range from \$169 for the 8K-byte version to \$1395 for the 512K-byte version. Serial-to-parallel Microfazers and parallel-to-serial Microfazers are priced from \$199 for the 8K-byte version to \$330 for the 64K-byte version. Serial-to-serial Microfazers include the required power supply and are priced from \$229 for the 8K-byte version to \$330 for the 64K-byte version. **Quadram Corp.**, 4357 Park Dr., Norcross, Ga. 30093.

Circle No 361



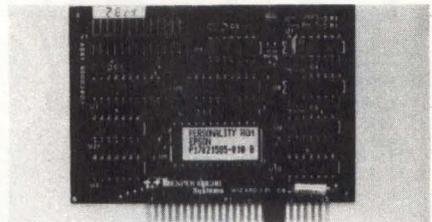
Writing tablet recognizes 51 characters

Penpad products allow users to communicate with a computer by hand writing. Each unit consists of a writing tablet, a control unit and an electronically activated ballpoint pen. They can recognize block capitals A through Z, numeric characters 0 through 9 and 15 other characters such as dollar signs and punctuation marks. The product analyzes character shapes to build memory images as they are written on the tablet. Each character shape is approximately 2000 bits of data that is reduced to 7-bit ASCII code and displayed on the screen. Data are transmitted to the computer by character, line or block as pre-defined or specified by an operator. The product is available in two versions. Personal Penpad, priced at \$3500, can be used with most personal computers and attaches via an RS232 interface to the computer's serial port. Penpad, priced at \$3950, is a complete terminal that includes a 12-in. green display screen and can be attached to various minicomputers. **Pencept Inc.**, 39 Green St., Waltham, Mass. 02154.

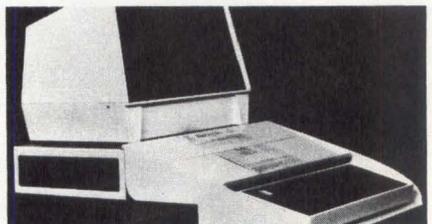
Circle No 362

Printer interface performs text-formatting functions

The Wizard IPI intelligent printer interface card mates parallel printers to the Apple II, Apple II Plus and Apple IIe



computers. It enables full implementation of a printer's text processing and graphics capabilities. By using control key commands, a user can set the left and right margins and line and page lengths, skip page perforations and select automatic or programmable line feeds. He can also print double-sized pictures, rotate pictures by 90 degrees, invert the video or do high-resolution screen dumps. The Wizard IPI can be run with most Apple II software including Applesoft BASIC, Apple Integer BASIC, the Apple Pascal system and CP/M. Graphics firmware for the unit is contained in an on-board personality ROM. Single-unit price is \$87.50. **Wesper Microsystems**, 14321 New Myford Rd., Tustin, Calif. 92680. Circle No 363



Video terminal workstation raises work surface

The Ergo-Mate models 1522 and 2022 convert 29- to 30-in.-high work surfaces into comfortable, ergonomically designed workstations. The Ergo-Mate includes a CRT platform that raises the video terminal 4¾ in. above the work surface to operator eye level. The CRT platform also tilts up at the rear, so that operators can adjust the screen angle for glare control. The Ergo-Mate accepts keyboards as wide as 22.125 in. and places them at the proper keying height. The Ergo-Mate places the document copy in line with the keyboard and the CRT and at a comfortable reading angle. The model 1522, which accepts terminals 15 in. deep, is priced at \$99; the model 2022, which holds larger terminals, is priced at \$109. **Mead-Hatcher Inc.**, 752 Military Rd., Buffalo, N.Y. 14216. Circle No 364

Mini-Micro MARKETPLACE

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

READERS: Please circle reader service numbers for additional information.

COMPLETE 68000 DEVELOPMENT TOOLS FOR VAX/VMS*

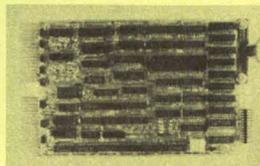
MOTOROLA PASCAL → 68000
optimizing cross-compiler.... \$2995
MOTOROLA 68000 relocatable
cross-assembler \$ 995
MOTOROLA cross-linker..... \$ 995
VMS ↔ VERSADOS†
file transfer..... \$ 395

All products run in VAX native mode.
Developed in cooperation with Motorola
for guaranteed EXORMACS/VERSADOS†
compatibility.

*tm Digital Equipment Corp. †tm Motorola

octal
INCORPORATED

1951 Colony Street, Mountain View, CA 94043
(415) 962-8080 Telex: 172933
CIRCLE NO. 201 ON INQUIRY CARD



CP/M® FOR YOUR LSI-11 AND PDP-11 RT-11 TSX+ RSX-11M Enter a New Software World

With our plug-in Z80 processor card you
can run CP/M, the popular personal and
business computer operating system. You
can run thousands of low cost software
packages available for CP/M. We include
a powerful word processing package
free! Everything you need is included
starting at \$1,250.00.

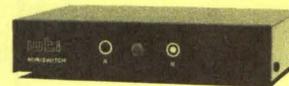


DECMATION
3375 Scott Blvd., Suite 422
Santa Clara, CA 95051 408/980-1678

*CP/M is a registered trademark of Digital Research, Inc.

CIRCLE NO. 202 ON INQUIRY CARD

Introducing the



\$89 MINI SWITCH

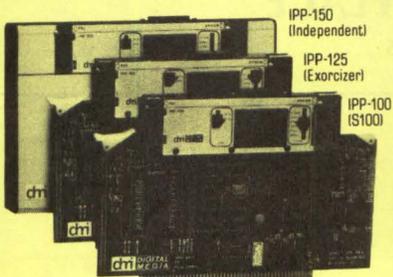
Now you can end the hassle of plugging and
unplugging data cables for just \$89. The WT1
Mini Switch lets you manually switch
between two RS232 devices and a common
device such as a Modem and a Printer
sharing a Mini Computer by simply pushing a
button. (Switches pins 2 thru 8 and pin 20,
plus one spare switch for custom wiring.)

Call toll free for more information today!

wte western
telematic inc.

2435 S. Anne St., Santa Ana, CA 92704 • (714) 979-0363
Outside California call toll free (800) 854-7226

CIRCLE NO. 203 ON INQUIRY CARD



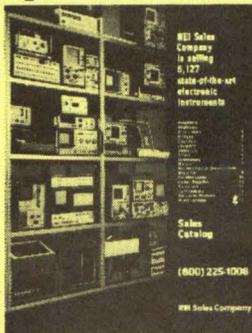
NEW GENERATION OF INTELLIGENT PAL/EPROM PROGRAMMERS - FOR THE NEW BREED OF ENGINEERS

• 20 AND 24 PIN PALs • 27 AND
25 EPROMs • ROM EMULATION

DIGITAL MEDIA
3178 GIBRALTAR AVENUE
COSTA MESA, CA 92626
(714) 751-1373

CIRCLE NO. 204 ON INQUIRY CARD

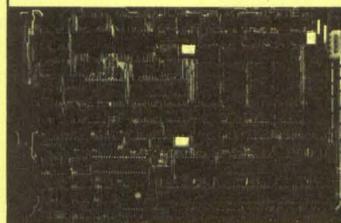
Like-new products



For free catalog,
phone toll-free (800) 225-1008
In Massachusetts (617) 938-0900
Genstar REI Sales Company

CIRCLE NO. 205 ON INQUIRY CARD

NEW PRODUCT!



CP/M Z80-A SINGLE BOARD COMPUTER

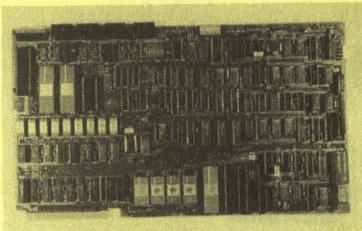
• On board video • Wide line and thin line graphics •
128K of RAM • Sasi interface • Floppy disk controller
for up to four 5-1/4 or 8 inch drives, single/double
density simultaneously • 4 serial ports • Full Centronics
printer port • Expansion bus • Extended track buffer •
16K printer buffer • DMA • Compact size

\$750.00 4-6 weeks delivery
\$10.00 shipping



INSIGHT ENTERPRISES, CORPORATION
373 N. Western Ave., Suite 12,
Los Angeles, CA 90004, (213) 461-3262
Dealer, OEM, International Inquiries Welcome.

CIRCLE NO. 206 ON INQUIRY CARD



DSTD-764 is a STD-Z80 BUS Single card microcomputer with built-in expansion and option video display controller daughter board. This board features full DMA support for on-board floppy disk controller, hard Disk Host Adaptor I/F, and RS-422 synchronous network port. Contains: 64K RAM, 3-RS-232C channels, 1-RS-422 channels, 2-8 bit parallel ports, 4-28 Pin Sockets, status switches, LED's and a fully supported edge card connector for STD BUS system expansion.



dy-4 SYSTEMS INC.

888 Lady Ellen Place
Ottawa, Ontario
Canada K1Z 5 M1
TWX: 610-562-8967
TEL: 613-728-3711

CIRCLE NO. 207 ON INQUIRY CARD

AUTOBOOT CP/M*

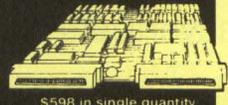
ID 80 SINGLE BOARD COMPUTER

IN EUROPE
"COMPUTERLE"



ID 80 IS A 64K, Z-80 BASED COMPUTER WITH ALL THE INTERFACES TO DRIVE YOUR SYSTEM WITH CP/M TO BOOT!

COMPLETE WITH ON-BOARD VIDEO TERMINAL FLOPPY DISK INTERFACE TWO SERIAL I/O PORTS THREE PARALLEL I/O PORTS EASY-TO-CONFIGURE BIOS

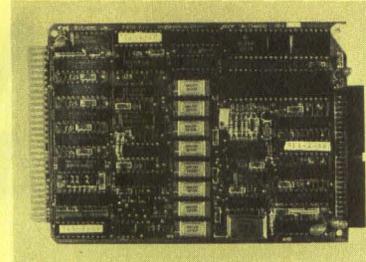


\$598 in single quantity

adps
1494 FIELDS DR
SAN JOSE, CA 95129
408-446-9332

*CP/M is a trademark of Digital Research

CIRCLE NO. 208 ON INQUIRY CARD



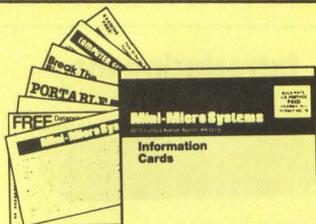
DSTD-711 is a STD-Z80 BUS Compatible board designed for OEM microcomputer-based applications and contains a floppy disk controller, DMA controller and 64K of dynamic RAM. The card supports both single-sided/double density and double sided/double density 5 1/4 and 8 inch drives.



dy-4 SYSTEMS INC.

888 Lady Ellen Place
Ottawa, Ontario
Canada K1Z 5 M1
TWX: 610-562-8967
TEL: 613-728-3711

CIRCLE NO. 209 ON INQUIRY CARD



HIGH INQUIRIES LOW COST

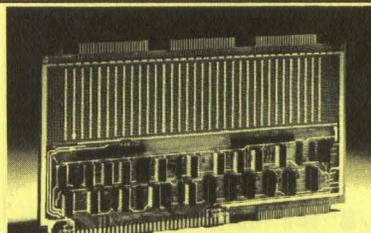
- Sell products and services directly
- Introduce new products
- Investigate new applications
- Develop new sales leads

MINI-MICRO SYSTEMS DIRECT RESPONSE POSTCARDS

SEPTEMBER MAILING CLOSES AUGUST 8

Call Carol Anderson 617-536-7780

CIRCLE NO. 210 ON INQUIRY CARD



MULTIBUS™ INTERFACE & PROTOTYPE

Prototype QUICKLY and EASILY. 100% of Multibus interfacing circuitry included. 20-bit Address, 8/16-bit Data. Delivery from stock.

Multibus™ Intel Corp. Model # PR 80A
Price: \$355 each

ELECTRONIC SOLUTIONS

5780 Chesapeake Ct.
San Diego, CA 92123
Toll Free (800) 854-7086

MULTIBUS PROTOTYPE WITH INTERFACE

CIRCLE NO. 211 ON INQUIRY CARD

PERSONAL ^{PRO} PROFESSIONAL

THE INDEPENDENT MAGAZINE
FOR DIGITAL PERSONAL
COMPUTER USERS

Now there is
a magazine
just for
DEC
personal computer
users.

Charter Subscription Offer
Now in Effect.

Personal and Professional
Box 114
Springhouse, PA 19477
(215) 542-7008

CIRCLE NO. 212 ON INQUIRY CARD

ORDER FORM

Advertise in the MINI-MICRO MARKETPLACE

Please run my advertisement in the following issues

Please specify category:

- Software Hardware
 Literature Services
 Other _____

1983 RATES

1x	3x	6x	12x	18x
\$560	\$540	\$520	\$500	\$480

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: 2 1/4" x 3 1/16"

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: Lorraine Marden, **MINI-MICRO SYSTEMS**
221 Columbus Ave.
Boston, MA 02116

15% Agency commission to accredited agencies. Please specify agency.

Classified Ads

hardware



**HEWLETT
PACKARD**
Desktop & Mini
Computer
Products

SAVINGS ALL MODELS

9845B/C	9000	Non-HP memory
9836A	9826A	and peripherals

CALL OR WRITE FOR FREE CATALOG

digital resources inc.
Box 23051 Portland, OR 97223 USA
503-246-0202
International Sales Telex 360-143

CIRCLE NO. 231 ON INQUIRY CARD

software

IBM-PC - PLOT-10

PC-PLOT-II is an intelligent emulation of the Tektronix Model 4010 graphics terminal which runs on the IBM-PC. The program allows display and creation of picture files when connected to a host computer running PLOT-10 (tm) or compatible software. The user may save picture data files on a local diskette as they are received from the host. The program also includes local printer control, and a serial line debug mode. Utility programs included allow the drawing of a local picture data file on the screen, plotting it on a HP Model 7470A pen plotter, printing on a local printer, and scaling. VISA, MasterCard, checks, PO's accepted. \$75.00

MicroPlot Systems Co.
1897 Red Fern Dr.
Columbus, Ohio 43229
614-882-4786 Telex 62186730

CIRCLE NO. 232 ON INQUIRY CARD

software

MicroPERT®
Project Management
for Tektronix, IBM PC, XT

For information, call or write
SHEPPARD SOFTWARE COMPANY
4750 Clough Creek Rd.
Redding, CA 96002
(916) 222-1553

CIRCLE NO. 234 ON INQUIRY CARD

publications

**Exclusively
UNIX*
and C
Information**

That's UNIQUE, the oldest and largest monthly newsletter covering the UNIX* and C marketplace.

- product reviews/listings/prices
- applications/tutorials/indexes
- industry inside information

Full year, \$54 (\$66 foreign) - write, call or circle reader service number for full brochure and FREE sample copy.

InfoPro Systems
Dept. MM • Box 33 • E. Hanover NJ 07936
(201) 625-2925
*UNIX is a trademark of Bell Laboratories
Formerly The UNIX Software List

CIRCLE NO. 236 ON INQUIRY CARD

This space should be working for you.
For details call:
Linda Lovett
(617)536-7780

STOCK PORTFOLIO Software. Use your APPLE or IBM PC to maintain your Stock Portfolio and produce the reports and information necessary to manage your stocks. Includes Portfolio Maintenance, Inquiry, Analysis, Graphs, Dividend and Sales reports.
MICRO-LOGIC DATA SYSTEMS, INC.
Box 37351, Omaha, NE 68137

CIRCLE NO. 233 ON INQUIRY CARD

Copy Deadline: Space reservations and advertising copy must be received by the 10th of the month preceding the issue date. Camera-ready mechanicals must be received by the 15th of the month preceding the issue date. For example, to appear in the February issue, copy must be received by January 10; mechanicals by January 15.

PLUG-INS
SUBROUTINES/FUNCTIONS

24 FORTRAN SUB-PROGRAMS NOW AVAILABLE FROM OUR LIBRARY FOR THE DATA GENERAL USER:

- STRING EDITING/MANIPULATION
- NUMBER CONVERSION
- SELECTIVE EDITING
- BIT MANIPULATION
- SEQUENCING

SNV SOFTWARE NORTH
3100 Glenn-Doh Drive
Anchorage, AK. 99504
(907) 333-4412

CIRCLE NO. 235 ON INQUIRY CARD

inventions wanted

**Inventors, Entrepreneurs,
Product Promoters**
wanted to display concepts at national technology trade show.
Call: 1-800-528-6050 X831

CIRCLE NO. 237 ON INQUIRY CARD

CLASSIFIED ADVERTISING ORDER FORM

Mini-Micro Systems classifieds reach more mini-micro people

Rates: \$80.00 per column inch

There is no charge for typesetting classified listings. Plan approximately 50 average words to a column inch, 8 lines of approximately 38 characters per line (3 inch maximum). Please send clean typewritten (double-spaced) copy.

Category: The following categories are available; be sure to specify the category you wish to be listed under: Business Opportunities, New Literature, Selling, Buying, Trading, Seminars, Services, Software, Supplies & Accessories. (Other categories may be employed at our discretion.)

Run this ad in _____ (number issues) Reader Inquiry No. YES NO
Ad size 1 col. wide by _____ inches deep Under _____ (category)
Check enclosed for \$ _____ (Pre-paid orders only)

Signature _____

Name _____ Title _____

Company _____ Telephone No. _____

Address _____

City _____ State _____ Zip _____

MAIL TO: Linda L. Lovett, Classified Advertising, Mini-Micro Systems,
221 Columbus Ave., Boston, MA 02116

Mini-Micro Systems

Career Opportunities/Recruitment Advertising

7-Day Closing

(Prior to Issue Mailing Date)

Rates

\$90 per column inch.
Column width 1 3/4" x 10" (4-column/page).
Full page: \$3,390 (1 x B&W).

Circulation

Over 95,000 technically sophisticated professionals in computer operations/systems management, data communications, engineering management, systems engineering/integrators, educators and systems programming specialists.

Recruitment
Hot Line

(203) 964-0664

Call your ad in—
we'll set the type
at no charge.

Mail Film to:

Stuart Tilt
Recruitment Manager
CAHNERS PUBLISHING CO.
999 Summer St.
P.O. Box 3809
Stamford, CT 06905

• ENGINEERS • PROGRAMMERS • ANALYSTS

MEET 35 EMPLOYERS

INTERVIEWING SOON IN THESE AREAS

New York, Chicago, Los Angeles, Washington, Baltimore, St. Louis, Detroit, Rochester, Buffalo, Cleveland, Atlanta, Cincinnati, Dayton, Philadelphia, San Francisco, Boston, Pittsburgh, Dallas, Houston, New Jersey, San Jose

SALARIES \$24,000 to \$75,000

Engineering:	Computers:
Microprocessor	Business EDP
Real-time control	Electronics
Peripherals	Electrical
Simulation	Mechanical
Systems	Manufacturing
	...and other related areas

UNIQUE BENEFITS FROM ATTENDING OPPORTUNITY CENTERS
PERSONAL INTERVIEW: You have an opportunity to meet representatives of top firms in a single day or evening in complete privacy.

FREE SALARY SURVEY: We will send you the Sanford Rose Associates' Salary Survey which reflects current salaries.

COMPANIES WHO HAVE ATTENDED

AT & T	GTE	NCR
Bausch & Lomb	Hewlett Packard	Raytheon Corp.
Burroughs Corp.	Honeywell, Inc.	RCA
Mead Digital Systems	IBM	Sperry Rand
Computer Sciences	ITT	Northrop Corp.
Fairchild Microprocessor	3M Company	Texas Instruments
Digital Equipment	Magnavox	TRW
Eastman Kodak	Martin Marietta	Westinghouse
Emerson Electric	McDonnell Douglas	Xerox Corporation
Exxon USA	Morse Borg Warner	Plus Local Firms
General Dynamics		And Many Others

Send resume or hand-written brief to:
Ed Rose
Opportunity Center
265 S. Main Street
Akron, OH 44311



CIRCLE NO. 238 ON INQUIRY CARD

EMPLOYMENT SERVICE FOR PROGRAMMERS AND ANALYSTS

National Openings With Client Companies
and Through Affiliated Agencies

Scientific and commercial applications • Software development and systems programming • Telecommunications • Control systems • Computer engineering • Computer marketing and support.

Call or send resume or rough notes of objectives, salary, location restrictions, education and experience (including computers, models, operating systems and languages) to either one of our locations. Our client companies pay all of our fees. We guide; you decide.

RSVP SERVICES, Dept. MM Suite 700, One Cherry Hill Mall Cherry Hill, New Jersey 08002 (609) 667-4488	RSVP SERVICES, Dept. MM Suite 211, Dublin Hall 1777 Walton Road Blue Bell, Penna. 19422 (215) 629-0595
--	---

From outside New Jersey, call toll-free 800-222-0153

RSVP SERVICES

Employment Agents for Computer Professionals

CIRCLE NO. 239 ON INQUIRY CARD

ENGINEERS/SOUTHEAST

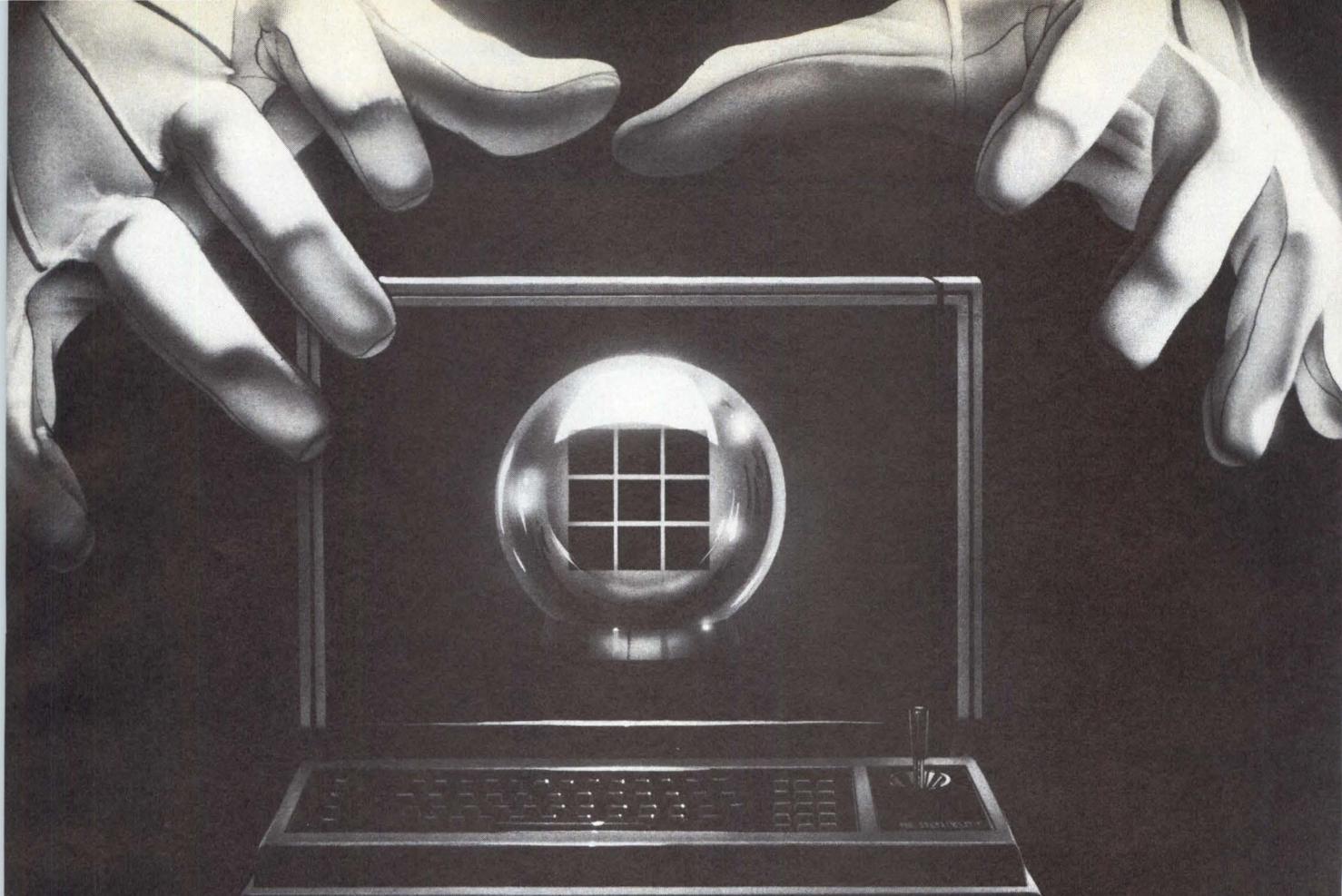
Affiliated offices throughout the Southeast. Positions in systems integration, systems analysis, software, mini-micro applications, programming. 25-60K. Aggressive, confidential. Fee paid service. Send resume to: Ted F. McCulloch.

McCULLOCH & CO.
P.O. Box 10211
Greenville, SC 29603

ENGINEERS...PROGRAMMERS

DES PROG • 6800/8080 • BIT SLICE • DATA/TELECOM • SIG PROC • ARCH VAX • UNIX • C • VMS • SYS-1 • DEC MODELING • CRYPTO • C² • ATE • E/M LSI/VLSI • CAD • RF/MW/ECM • DIAG
BUSINESS/SCIENTIFIC/MFGING APPS.

Forward Resume to: **IMR**
18582 Marion Way, Suite 504
Villa Park, CA 92667
Fees Assumed by NATIONAL Clients



**WE'RE PUTTING YOUR FUTURE ON DISPLAY.
Let's Talk About It At SIGGRAPH.**

MEGATEKNOLOGY™

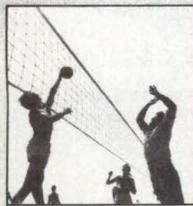
Megatek is continually discovering so many new CAD/CAM dimensions, we're turning "state-of-the-art" into history. That's Megateknoology™ — the only way adequately to describe our advanced computer graphics products, our device-intelligent software and our total work environment.

It's an environment that beckons the most talented and experienced hardware/software people in the industry.

One reason for Megatek's™ extraordinary success and growth — an average annual rate of 100% — is that we offer top computer talent an exceptional compensation package. Another is outstanding opportunities for rapid career advancement that only a growth company can offer. And then there's our location in San Diego — the best 70 miles on the Sunshine Coast of Southern California.

As if this weren't enough, our brand new facility offers you tennis courts, a swimming pool, a jogging track, jacuzzis, a supervised exercise facility, volleyball courts and shower/locker rooms.

If all these advantages sound like the ideal display for your future, consider these opportunities:



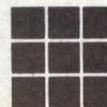
APPLICATIONS ENGINEERS
CUSTOMER SUPPORT SPECIALISTS
HARDWARE DESIGN ENGINEERS
SOFTWARE ENGINEERS
SYSTEMS ARCHITECTS
SYSTEMS PROGRAMMERS



We will be in Detroit July 25th through July 29th. To pre-arrange an interview, rush your resume to: CHARLES TEABERRY, Personnel Department, MEGATEK Corporation, United Telecom Computer Group, 3985 Sorrento Valley Blvd., San Diego, CA 92121. Between the above dates (only) you may call (313) 568-8487 to arrange an interview. We are an equal opportunity employer.

SEE OUR EXHIBIT AT BOOTH #527.

Making History out of
State-of-the-Art.



**MEGATEK
CORPORATION**

UNITED TELECOM COMPUTER GROUP

CIRCLE NO. 240 ON INQUIRY CARD

A Smarter, Easier Way to Check Out Computer Opportunities in Confidence...



Announcing the New, FREE National Digest of Computer Opportunities...\$18,000-\$100,000+.

Compare your current position with over 500 others in our free publication.

If you've ever tried, you know it's virtually impossible to monitor the computer job market by reading help wanted ads.

You'd have to subscribe to literally dozens of newspapers and other publications to even begin to know what's going on across the country. Yet, ads seldom give you a clear picture of what you'll really be doing on a job. And most importantly, one key aspect of any job—compensation—is almost always omitted. That's when it's good to know about the Source Edp Digest.

Simply call for your free copy of Source Edp's new *Digest of Computer Opportunities* and you'll be in touch with more than 500 exciting new opportunities. All in complete privacy.

It's more convenient and comprehensive.

The Digest gives you a timely and comprehensive report of our clients' current needs in programming, systems analysis, software development and support, management consulting, marketing and marketing support and all levels of computer and information systems management.

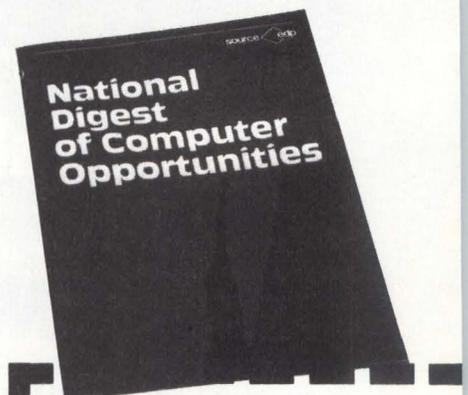
The Digest is organized geographically so you can evaluate openings in your hometown or city. Or anywhere else. Specific salaries, responsibilities, experience needed and more are covered for every career opening. In all, over 500 positions are reviewed in this 20-page report.

Best of all, it's free.

Call Source Edp for your free copy. As the world's largest recruiting firm that specializes exclusively in the computer field, we can provide expert assistance whenever you feel you would like to evaluate your career. Our professional staff is comprised *entirely* of people having extensive computer backgrounds. So you will always get sound advice in selecting the best career path alternatives. And, of course, there is never any obligation or expense to you since our client companies assume our charges.

If you're looking for a way to get the inside story on the latest computer career openings, you don't have to subscribe to hundreds of newspapers.

Just call us.



Call For Your FREE Copy Today.

Call the office nearest you that's listed to the right for your copy. If unable to call, write:

Source Edp, Dept. M-2
P.O. Box 7100
Mountain View, CA 94039

When writing, please be sure to indicate home address and current position title.

source  edp

The world's largest recruiting firm devoted exclusively to the computer profession.

Call Source Edp Today.

United States:

Arizona
Phoenix 602/279-1010

California
(Northern) Mountain View 415/969-4910
San Francisco 415/434-2410
Walnut Creek 415/945-1910
Century City 213/203-8111
(Southern) Fullerton 714/871-6500
Los Angeles 213/688-0041
Newport Beach 714/833-1730
San Diego 619/231-1900
Torrance 213/540-7500
Van Nuys 213/781-4800

Colorado
Denver 303/773-3700

Connecticut
Hartford 203/522-6590
Stratford 203/375-7240

District of Columbia
Washington D.C. 202/466-5890

Florida
Miami 305/624-3536

Georgia
Atlanta (Downtown) 404/588-9350
Atlanta (North) 404/953-0200

Illinois
Chicago 312/861-0770
Rolling Meadows 312/392-0244

Indiana
Indianapolis 317/631-2900

Kansas
Overland Park 913/888-8885

Kentucky
Louisville 502/581-9900

Louisiana
New Orleans 504/561-6000

Maryland
Baltimore 301/727-4050
Greenbelt 301/441-8700
Towson 301/321-7044

Massachusetts
Boston 617/482-7613
Burlington 617/273-5160
Wellesley 617/237-3120

Michigan
Detroit 313/259-7607
Southfield 313/352-6520
Troy 313/362-0070

Minnesota
Minneapolis (Downtown) 612/332-6460
Minneapolis (West) 612/544-3600
St. Paul 612/227-6100

Missouri
Clayton 314/862-3800
Kansas City 816/474-3393

New Hampshire
Nashua 603/880-4047

New Jersey
Cherry Hill 609/482-2600
Edison 201/494-2800
Morristown 201/267-3222
Paramus 201/845-3900
Princeton 609/452-7277

New York
New York City
(Grand Central) 212/557-8611
(Penn Station) 212/736-7445
(Wall Street) 212/962-8000

Rochester 716/263-2670
Syosset, L.I. 516/364-0900
White Plains 914/683-9300

Ohio
Akron 216/535-1150
Cincinnati 513/769-5080
Cleveland 216/771-2070
Columbus 614/224-0660
Dayton 513/461-4660

Oklahoma
Tulsa 918/599-7700

Oregon
Portland 503/223-6160

Pennsylvania
King of Prussia 215/265-7250
Philadelphia 215/665-1717
Pittsburgh 412/261-6540

Texas
Dallas (Central) 214/954-1100
Dallas (North) 214/387-1600
Fort Worth 817/338-9300

Houston (Downtown) 713/751-0100
Houston (W. Loop South) 713/439-0550
San Antonio 512/342-9898

Virginia
McLean 703/790-5610

Washington
Bellevue 206/454-6400

Wisconsin
Milwaukee 414/277-0345

Canada:

Ontario

Toronto

Downtown 416/865-1125
Don Mills 416/425-5730
Mississauga 416/272-3333

ENGINEERS

- Hardware
- Interface
- LAN
- Packaging
- Software
- Modem
- Communications
- Peripherals

\$25,000 to \$60,000

We place engineers with commercial and DOD companies and have electronics placement affiliates in literally every major city. 100% Fee Paid. Send confidential resume, job objective, geographic preference, salary/salary requirements to:

J. Robert Thompson
companies, inc.

Electronics Placement Specialists
2200 West Loop South, Suite 800
Dept. MM, Houston, TX 77027 (713) 627-1940

OPENINGS FOR ENGINEERS
& other degreed Specialists.
Send resume to:

Scientific Placement, Inc.
P.O. Box 19949 • Dept. 538
Houston, TX 77224
713/496-6100

PROFESSIONAL RESUME SERVICE

1125 S. Cedar Crest
Allentown, PA 18103

Complete resume preparation for design engineers and design managers in electronics. Call or write.

PROFESSIONAL RESUME SERVICE
(215) 433-4112

National Business Employment Weekly

Current Career Opportunities Look to Coast

Are you looking for a really good EDP position?

Start Your Job Hunt Right Here . . .
with the National Business Employment Weekly

Every week, it includes hundreds of the best executive, managerial and professional positions available across the country. Jobs in every field, including data processing and virtually every area of technical expertise. Jobs at salaries from \$25,000 to \$250,000.

PLUS . . . weekly editorial features covering every aspect of career advancement. Articles on writing resumes, interviewing, salary statistics, regional employment trends, and much more.

LOOK FOR OUR SPECIAL AUGUST 7TH "DATA PROCESSING" ISSUE WHICH WILL INCLUDE ADDITIONAL EDP OPPORTUNITIES AND RELATED EDITORIAL.

Pick up a copy of the National Business Employment Weekly at your newsstand today. Or we'll send you the next 8 issues by first class mail. Just send a check for \$32.00 to:

National Business Employment Weekly
Dept. MM 420 Lexington Ave. NY, NY 10170

An Exciting Software Development Environment

Perfect Software is adding exceptionally talented 'C' programmers to its software development team. Be part of a software science organization committed to developing the highest quality software. If you are extremely bright, creative and hard working, Perfect Software wants to hear from you.

Positions are available in our Berkeley, CA, Austin, TX and Eugene, OR software science facilities. Perfect Software offers opportunities in a 'C' and Unix environment. Software development tools include Unix on Vax 11/750 and related equipment.

- Porting software to foreign language versions and maintaining these
- Developing printer drivers and configuring to various personal computers
- Developing graphics capabilities
- Implementing mouse technology

Please send your resume and statement of interest in confidence to:

Perfect Software, Inc.
Product Science Center
66 Club Road, Suite 250, Eugene, OR 97401,
Attn: Gina Beyer

CIRCLE NO. 241 ON INQUIRY CARD

Computer Consultants Corner

6800/68000 Experts

- Microprocessor hardware and software design
- Industrial control specialists
- Hierarchical software design methodology
- Environmental testing
- Complete prototype facilities

CSA Computer System Associates
7562 Trade St., San Diego, CA 92121 (619) 566-3911

CIRCLE NO. 242 ON INQUIRY CARD

Applications of Microcomputers

- Hardware selection and installation
- Custom software development
- Data entry and verification
- Statistical survey analysis
- Mathematical modeling
- Training and technology transfer

Experience in Agriculture, Climatology and Remote Sensing. Projects in the United States and developing countries.

MICROsystems International, Inc.
P.O. Box 6206, Falls Church, VA 22046 • (703) 573-3849

CIRCLE NO. 243 ON INQUIRY CARD

ELECTRICAL NOISE PROBLEMS SOLVED in Electronic Data Processing and Microprocessor Based Control Systems **CALL (814) 466-6559**

Dr. E. Thomas Chesworth, P.E.
Seven Mountains Scientific Inc.
Boalsburg, PA 16827

CIRCLE NO. 244 ON INQUIRY CARD



BASS-SNEED
ASSOCIATES, INC.

Specialists in Microprogramming, Signal processor implementations, Image processing, Floating Point systems, Bit-slice machines, Real-time digital control systems design, Microprocessor applications

Integrated Hardware/Firmware/Software solutions
Lawrence P. Bass
Box 646, Ridgewood, NJ 07451
(201) 444-3411

CIRCLE NO. 245 ON INQUIRY CARD

Advertisers Index

Able Computer	92, 93, 95	Digi-Data Corp.	142	North Star Computer	216
Adaptec, Inc.	204-205	Digital Engineering	211	Northwest Digital Systems	212
Advanced Color Technology	229	Digital Equipment Corp.	195, 270	Okidata Corp.	213
Advanced Digital Corp.	17	Digital Graphic Systems	246	Onyx Systems	262
Advanced Systems Concepts	280	Digital Microsystems Inc.	254	Peripheral Technology	54
Alex. Brown & Sons	132	Direct Inc.	249	Persyst	245
Altos Computer Systems	89	Dual Systems	94	Pixel (Instrumentation Laboratory)	124
Amcodyne	83	Dylon Corp.	266	Plessey Microsystems	71
Amlyn Corp.	48-49	Dysan Corp.	16	Plessey Peripheral Systems	9, 221, 222
Anadex Inc.	217	Electronic Solutions	252	Plexus Computers	156-157
Andromeda Systems Inc.	79	Emulex Corp.	62, 150, 259	Priam	202-203
Apple Computer Inc.	136-137	Envision	167	Qume	278
Applied Circuit Technology	257	Epson America Inc.	78	Ramtek Corp.*	160-161
Archive Corp.	148-149	Esprit Systems, Hazeltine Terminals Div.	91	RCA	40-41
Axiom Corp.	247	Facit/Dataroyal	163	Rixon Inc.	80
Aydin Controls	32	Gavilan Computer Corp.	64	Rosscomp Corp.	158
Bridge Communications	67	General Electric Co.	261	Saturn Systems	279
Burr-Brown Corp.	225, 227	Glasgal Communications	248	Science & Communications Inc.	57
C. Itoh Electronics	13	Gould Inc., DeAnza Imaging Div.	193	Seagate Technology	144-145
CalComp	263, 265, 267	Gould Inc., S.E.L. Computer Systems Div.	5	Seiko Instruments USA	162
Cambridge Digital Systems (Div. of Compumart)	117	Heurikon Corp.	59	Shugart Corp.	24-25, 119
Carroll Touch Technology	260	Hewlett-Packard	73-75, 143, 191, 230, 241, 273	SofTech Microsystems	107
Centronics Data Computer Corp.	122	Houston Instrument Div. of Bausch & Lomb	169	Symbolics Inc.	209
Charles River Data Systems	237	Human Designed Systems Inc. (HDS)	103	Sydis	184-185
Chromatics Inc.	27	Ibex Computer Corp.	280	Tandon Corp.	14-15
CIE Systems	43	IBM Corp.	52-53, 253	TEAC Corp. of America	236
CIE Terminals	6, 250	ID Systems	188	Technical Systems Consultants	87
Clearpoint Inc.	266	INFO '83	281	TeleVideo Systems Inc.	60-61, 172-173
Codex Corp.	139, 141	Infoscrite	255	Teltone Corp.	277
COMDEX Europe	96	Intecolor Corp., an Intelligent Systems Co.	196	Termiflex Corp.	4
Compaq Computer Corp.	1	Integrated Solutions	274	Texas Instruments	97-100
Complexx Systems Inc.	47	Intel Corp.	127-129, 186-187, 264	3R Computers	154
Computer Technology Group	56	Intermec Inc.	134	Topaz Electronics Div.	90
Computerwise Inc.	51	Iomega	111	Trac Line Software	155
Comtal	199	Kennedy Co.	Cover 2	Ungermann-Bass	114
Conrac Corp.	76-77	Kierulff Electronics	58	Universal Data Systems, Inc.	238
Control Data Corp.—Engineering Services	276	Leading Edge Products	10	Versatec Inc., A Xerox Co.	164
Control Data Corp.—OEM	30-31	Lear Siegler Inc.	36-37	Visual Technology Inc.	201
Convergent Technologies	120-121	MAI/Basic Four	235	Watanabe Instruments Corp.	206
Corvus Systems Inc.	283	Maxtor Corp.	84-85	Western Digital	68-69
Cromemco Inc.	146	MDB Systems Inc.	233	Western Peripheral Div. of Wespercorp	Cover 3
Data I/O	194	Megatek Corp.	44-45	Wicat Systems Inc.	153
Datamedia	38	Memorex—OEM (A Burroughs Co.)	228	Xerox Computer Services	109
Dataram	269	Method Systems Inc.	194	Zilog Inc.	243
Data Set Cable Co.	274	Micom Systems Inc.	Cover 4	See pp. 288-291 for Career Opportunity Advertisers	
Data Sources	131	Micro Peripherals Inc. (MPI, Calif.)	218	See p. 291 for Computer Consultants Corner	
Datasouth Computer Corp.	29	Micro Products Corp. (MPC)	133	See pp. 285-286 for Mini-Micro Marketplace	
Data Systems Design Inc.	104-105	Micropolis Corp.	112-113		
Datavue, An Intelligent Systems Co.	170-171	Mini-Micro Systems	94, 152		
Davidge Corp.	4	NCR, OEM Marketing Div.	275		
Delta Airlines	63	NEC Information Systems Inc.	35		
		Nicolet Paratronics Corp.	18		

*USA Edition only

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

REGIONAL SALES OFFICES

BOSTON

John J. Fahey
Eastern Regional Manager
221 Columbus Ave.
Boston, MA 02116
(617) 536-7780

PHILADELPHIA

Richard W. Molden
Regional Manager
999 Old Eagle School Rd.
Wayne, PA 19087
(215) 293-1212

CHICAGO

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

DALLAS

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

DENVER

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

LOS ANGELES

Robert Billhimer
Regional Manager
12233 West Olympic Blvd.
Los Angeles, CA 90064
(213) 826-5818

ORANGE COUNTY

Debra Huisken, Regional Manager
2041 Business Center Drive
Suite 109 Irvine, CA 92715
(714) 851-9422

SAN FRANCISCO

Frank Barbagallo
Regional Manager
Rick Jamison, Regional Manager
Sherman Building, Suite 1000
3031 Tisch Way
San Jose, CA 95128
(408) 243-8838

AUSTRIA

Elan Marketing Group
Neutor g. 2
P.O. Box 84
1010 Vienna, Austria
Telephone: 43222-344466

ENGLAND

Ian Hardman Systems International
Quadrant House, The Quadrant
Sutton Surrey, SM2 5AS England
Tel: (01) 661-3022

GERMANY

Elan Marketing Group
7240 Horb/Neckar
Sudring, 53 Germany
Telephone: 497451-7828

ISRAEL

Igal A. Elan
Marketing Systems Development Co.,
Ltd.
13 Haifa St., P.O. Box 33439
Tel Aviv, Israel
Telephone: 25 29 67 Telex: 341667

JAPAN

Tomoyuki Inatsuki
General Manager
Trade Media Japan Inc.
R. 212 Azabu Heights
1-5-10 Roppongi Minato-ku,
Tokyo 106 Japan
Tel: (03) 585-0581

SWEDEN

Igal A. Elan
Elan Marketing Group
Humlegardsgatan Nr. 5
11446 Stockholm, Sweden
Telephone: (08) 676243

Career Opportunities

Stuart Tilt
Recruitment Advertising Manager
999 Summer Street P.O. Box 3809
Stamford, CT 06905
(203) 964-0664

From out of the West...Tape Dimension III



Brings a new dimension to Unibus efficiency for \$1983.

Tape Dimension III is the only buffered tri-density (GCR/PE/NRZI) TS-11™ emulating controller on the market. The combination of its unique asynchronous handshake design and 64K byte buffer enables it to take full advantage of bus speeds without the risk of causing data late conditions in other bus transfer operations. It makes Tape Dimension III particularly adaptable to systems with high speed disk drives.

And more. The 64K byte buffer provides total immunity to data late conditions, even at high-speed data rates on a highly populated peripheral bus. In fact, Tape Dimension III actually has greater capability than the TS-11!

Tape Dimension III is completely software-transparent to the VAX™ and PDP-11™ Unibus environment including diagnostics in VMS.

The Tape Dimension III controller supports up to four dual density (Percoc compatible) drives or four tri-density (STC or TELEX type) drives. It is a single embedded hex PC board that fits into any standard SPC slot.

This new dimension in tape transfer dramatically reduces the ratio of protocol to information data. And dramatically increases the efficiency of Unibus utilization. Find out how much it can improve your system throughput. Call or write today for complete information and the name of your nearest distributor (limited quantities) or regional sales representative (OEM quantities).



western peripherals

Division of WESPERCORP

14321 Myford Road, Tustin, CA 92680
(714) 730-6250 TWX: 910 595-1775 CABLE: WESPER

WESPER INTERNATIONAL UK
1st Floor The Parade, Frimley Camberley, Surrey, England GU16 5HJ • Tel: 0276 20934 TLX: 858306
WESPER INTERNATIONAL GMBH
Pixisstrasse 2, 8 Munich 80, West Germany • Tel: (089) 98 24 20 TLX: 5213718 Attn: WESPER INTERNATIONAL

©Registered Trademark of Digital Equipment Corporation

CIRCLE NO. 3 ON INQUIRY CARD

Are You a DEC PDP-11 or VAX-11 User?

Here's a connection you won't want to miss!

Now DEC users can interface remote terminal clusters directly to their Unibus without making *any* hardware or software changes. MICOM's Series 11 Bus Driver™, an all-in-one asynchronous interface for DEC PDP-11 and VAX-11 computers, provides simultaneous support for both statistically multiplexed remote terminals and local terminals through the same multiplexor — each remote cluster simply plugs in as if it were an individual local device.

Making a lot of connections? The Bus Driver allows for plugging as many as 32 terminals into a *single* Unibus slot — four times as many as can usually be supported. So DEC users can greatly increase their number of terminals without adding new

chassis, using up all of their Unibus slots, or upgrading to larger machines.

Compatible with DEC's own DZ11 or DH11 multiplexors and with MICOM's extremely popular Micro800/2 remote data concentrators, the Bus Driver also provides automatic retransmission on error for remote communications, automatic data rate recognition, and many other features, including a supervisory port for each communications link.

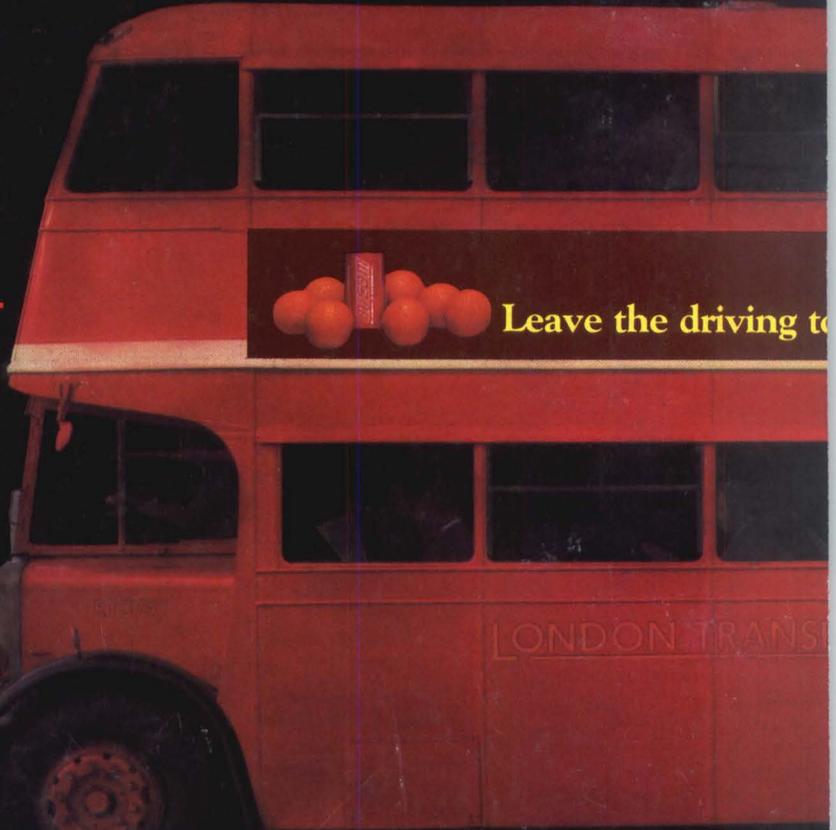
Prices start at \$6,300 for a system supporting a remote cluster of up to 16 terminals plus 15 more local devices. Call or send today for a brochure describing the Bus Driver and its applications.

Need a better way to get to your remote terminals?

MICOM's Bus Driver makes all the right connections.



Leave the driving to



DEC, PDP-11, VAX-11 and Unibus are trademarks of Digital Equipment Corp.

MICOM® *MicroComputers for DataCommunications*™

MICOM SYSTEMS, INC. • 20151 Nordhoff Street • Chatsworth, CA 91311 • Telephone (213) 998-8844 • TWX 910/494-4910
Regional Sales/Service • Atlanta, GA • (404) 435-2999 • Boston, MA • (617) 527-4010 • Chicago, IL • (312) 642-3603 • Dallas, TX
(214) 258-0774 • Philadelphia, PA • (609) 778-0133 • St. Louis, MO • (314) 576-7626 • Woodbridge, NJ • (201) 750-1120
MICOM-BORER LTD. • Bel Court • 15 Cradock Road • Reading, Berkshire RG20JT, England • (0734) 866801 • Telex 847135

Available now from these stocking reps...

AK: Anchorage (907) 276-5616 / Juneau (907) 789-4101 ● AL: (800) 327-6600 ● AR: (214) 620-1551 ● AZ: (602) 994-5400 ● CA: Anaheim (714) 635-7600 / Lodi (209) 334-1961 / San Diego (619) 565-1557 / San Jose (408) 298-7290 ● CO: Colorado Springs (303) 594-0880 / Denver (303) 777-8070 ● CT: (617) 235-5520 ● DE: (609) 779-0200
FL: (800) 432-4480 ● GA: (800) 327-6600 ● HI: (808) 537-9738 ● IA: (402) 895-5850 ● ID: (801) 466-6522 ● IL: (312) 255-4820 ● IN: (317) 846-2591 ● KS: (816) 252-3700
KY: (502) 228-5401 ● LA: (800) 327-6600 ● MA: (617) 235-5520 ● MD: (301) 261-4344 ● ME: (617) 235-5520 ● MI: (313) 588-2300 ● MN: (612) 425-4455 ● MO: Independence
(816) 252-3700 / St. Louis (314) 721-0401 ● MS: (800) 327-6600 ● MT: (801) 466-6522 ● NC: (800) 327-6600 ● ND: (612) 425-4455 ● NE: (402) 895-5850 ● NH: (617) 235-5520
NJ: North (201) 569-2353 / South (609) 779-0200 ● NM: Albuquerque (505) 292-1212 / Las Cruces (505) 524-9693 ● NV: (714) 635-7600 ● NY: Albany (518) 459-5891 / Buffalo (716) 662-4568 / New York City (201) 569-2353 / Rochester (716) 442-5631 / Syracuse (315) 638-2042 ● OH: Cleveland (216) 524-5930 / Dayton (513) 434-7500
OK: (405) 478-5000 ● OR: (503) 224-3145 ● PA: East (609) 779-0200 / West (412) 892-2953 ● RI: (617) 235-5520 ● SC: (800) 327-6600 ● SD: (612) 425-4455
TN: (800) 327-6600 ● TX: Dallas (214) 620-1551 / Austin (512) 327-8600 / El Paso (915) 542-1762 / Houston (713) 353-7728 ● UT: (801) 466-6522 ● VA: (301) 261-4344
VT: (617) 235-5520 ● WA: (206) 364-8830 ● WI: (414) 784-9379 ● WV: East (301) 261-4344 / West (412) 892-2953 ● WY: (303) 777-8070 ● Washington, DC: (301) 261-4344
Puerto Rico: (809) 723-9689

CIRCLE NO. 4 ON INQUIRY CARD